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Cyngor Gwynedd

Barmouth North Promenade FAS

Environmental Statement Volume 2 - Chapters

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Contents

ES Chapter 1 Introduction
ES Chapter 2 Project Description
ES Chapter 3 Need and Alternatives
ES Chapter 4 EIA Approach
ES Chapter 5 Air Quality
ES Chapter 6 Biodiversity and Protected Sites
ES Chapter 7 Climate Change
ES Chapter 8 Community Considerations
ES Chapter 9 Cultural Heritage
ES Chapter 10 Flooding and Water Quality
ES Chapter 11 Noise and Vibration
ES Chapter 12 Marine and Coastal Physical Processes
ES Chapter 13 Seascape and Landscape
ES Chapter 14 Cumulative and In-Combination Effects
ES Chapter 15 Summary

Cyngor Gwynedd

Barmouth North Promenade FAS

ES Chapter 1 Introduction

Reference: BMTH-ARP-EGN-ZZ-RP-OE-000003

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Contents

1. Introduction **3**
1.1 Purpose of this Report 3
1.2 Background 3
1.3 Overview of the Project 4
1.4 The Applicant 5
1.5 Determining Authorities 5
1.6 National Marine and Planning Policy 5
1.7 The need for EIA 6
1.8 Environmental Statement Structure 7
Abbreviations List **9**
References **10**

Graphics

Graphic 1-1 Illustrative photograph of existing principal defence structures 4

1. Introduction

1.1 Purpose of this Report

1.1.1 This Environmental Statement (ES) has been prepared by Ove Arup and Partners Ltd. (Arup) on behalf of Cyngor Gwynedd to accompany planning and marine licence applications for the Barmouth North Promenade Flood Alleviation Scheme (hereafter referred to as “the Proposed Development”).

1.1.2 The ES provides a description of the Proposed Development, and the alternatives considered, the likely significant environmental effects of the proposed development, alone and cumulatively with other plans or projects, along with measures to avoid, reduce or offset such effects. It has been prepared in accordance with the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 and the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) (hereafter referred to as the ‘EIA Regulations’).

1.2 Background

1.2.1 The town of Barmouth lies behind a long sandy and fine-shingle beach in Cardigan Bay. The promenade is a valued asset, providing access to the beach and the seafront provides the local population with leisure and recreational amenity. Tourism is important to the local economy; the small town attracts around 280,000 visitors annually [1]. The seafront forms an important part of the town’s visitor appeal.

1.2.2 The Proposed Development is located along a 1.2km length of the North Promenade within Barmouth. The existing defences run parallel with the promenade and adjacent to Marine Parade. The existing defences comprise sheet piles at beach level (plus concrete platform at some locations), with a primary wall at promenade level. Between the promenade and Marine Parade is a central wall, and between the road and hinterland a secondary wall, which serves as a de-facto defence (Refer to Graphic 1-1). Demountable defences are also used to fill gaps in the secondary wall when flooding is predicted. The beach itself includes timber groynes, although these are in poor condition.

Graphic 1-1 Illustrative photograph of existing principal defence structures

1.2.3 Existing beach levels decrease and defences deteriorate in condition towards the north of the Site. The Redline Boundary for the Proposed Development is shown in ES Volume 4, Figure 1.1.

1.2.4 Part of the promenade failed due to unsafe voiding beneath the promenade slab, requiring emergency stabilising repairs in 2020 and 2021. The repair works were emergency measures required to extend the life of the existing structures until the Proposed Development is implemented. Studies have concluded that overall foreshore bed levels along North Promenade are lowering, and this lowering is expected to continue. The area is therefore at risk of coastal flooding.

1.2.5 Overtopping currently occurs at the northern end of the promenade in 'benign' conditions i.e. median level tides, without surge, swell, low pressure or high winds. In addition to the promenade failure mentioned above, overtopping from this frontage has also caused extensive damage to the Cambrian coastal railway. There is also a risk from tide-locking of two ordinary watercourse outfalls, and blockage of culverts. Flap valves on the outfalls have also failed, risking tidal ingress. In the absence of investment, over 900 properties are predicted to have more than a 1 in 100 chance of flooding in any year. The rapid onset and depth of flooding presents a risk to life. Sea level rise due to climate change is predicted to accelerate, increasing the likelihood and severity of coastal flooding. By 2069, mean sea levels are predicted to have increased by 0.42m and by 2119, by 1.1m.

1.2.6 Cyngor Gwynedd, supported by YGC, is therefore seeking 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.

1.3 Overview of the Project

1.3.1 The Proposed Development would provide new and improved sea defences at Barmouth North Promenade and reduce the risk to life and flood risk to over 900 properties.

1.3.2 The Proposed Development comprises the following elements:

- Patch repairs of the primary sea wall over a length of approximately 1.2km.
- Secondary flood wall to be re-built and increased in height (to a maximum of 1.55m) over a length of approximately 1.1km.
- Existing sheet piles to be refurbished over approximately 950m length.
- Rock armour to be provided at beach level to protect the primary sea wall, revetment and part of the railway line North of the promenade.
- Refurbishment of culverted outfall and reinstatement of non-return valves.
- Provision of demountable flood defences where access is required.
- Placemaking and landscaping improvements.

1.3.3 The Redline Boundary for the Proposed Development is shown in ES Volume 4, Figure 1.1. Study areas in relation to the ES refer to spatial area considered in the environmental assessment for a given topic. This will vary by topic and will be defined in each ES topic chapter.

1.4 The Applicant

1.4.1 Cyngor Gwynedd are the Governing Body and Lead Local Flood Authority for the county of Gwynedd, which includes Barmouth. YGC are managing the project on behalf of Cyngor Gwynedd and have appointed contractor Alun Griffiths Contractors and designer Arup to complete the Full Business Case and Detailed Design.

1.5 Determining Authorities

1.5.1 The Proposed Development requires consent under the Town and Country Planning Act 1990 therefore must be assessed under the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017. The determining authority for the planning application is Cyngor Gwynedd Local Planning Authority. Under the Marine and Coastal Access Act 2009, the Proposed Development also requires a Marine Licence for works that fall below Mean High Water Springs (MHWS) and therefore must be assessed under the Marine Works EIA Regulations 2007 (as amended). The relevant regulator for Marine Licences in Wales is NRW.

1.5.2 This ES has been produced to meet the requirements of both the Town and Country Planning (EIA) (Wales) Regulations 2017 and the Marine Works EIA Regulations 2007 (as amended) to inform Town and Country Planning Act and Marine Licence applications.

1.5.3 Consultation has been undertaken with key statutory stakeholders and is detailed within relevant topic chapters - ES Volume 2, Chapters 5-13.

1.6 National Marine and Planning Policy

1.6.1 The Proposed Development supports the Planning Policy Wales (PPW) (Section 6.6.28) objective to carefully plan new or improved flood defences ensuring all potential environmental effects and relevant Shoreline Management Plan policies are considered.

1.6.2 Under Wales Marine Planning Policy, the Proposed Development aims to support the Wales National Marine Plan 2019, in particular policy SOC_02 considering the wellbeing of coastal communities, encouraging inclusion of opportunities that contribute positively to coastal communities and ensuring the development supports the future wellbeing of those communities.

1.6.3 The Proposed Development will deliver on the Shoreline Management Plan (SMP) 2, Policy Unit 11.15 – Barmouth North. The SMP is intended to provide a policy framework for the short medium and long terms. To achieve this, the policy is reviewed in three epochs: Epoch 1 runs from 2005 -2025, Epoch 2 is 2025-2055, Epoch 3 is 2055-2105.

1.6.4 In the short term (Epoch 1) the SMP specifies a policy of Hold the Line (HTL), maintaining and/or improving the existing defences. Due to the likelihood that this policy will become more difficult to sustain in the face of climate change, SMP2 notes that '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. As a result, in the medium and long term (Epoch's 2&3) it specifies a policy of managed realignment which may look to benefit from the headlands at Llanaber and South Barmouth.

1.6.5 Extensive options appraisal has been undertaken as part of the Outline Business Case for Barmouth North Promenade Flood Alleviation Scheme (refer to ES Volume 2, Chapter 3 Need and Alternatives). The preferred approach determined the need for existing defences to be improved as the most economical viable solution while safeguarding the community and recreational value of the promenade in the medium term. The Proposed Development therefore deviates slightly from the policy framework set out in SMP2 for the medium term. This is based on the understanding that the SMP2 timescales are subject to some flexibility, with policy change seen as a continual process. Engagement is being undertaken, led by the West Wales Coastal Group, to update the SMP2 policy to HTL for Epoch 2.

1.6.6 Further detail on the policy context of the Proposed Development is set out in ES Volume 3, Appendix 1.1.

1.7 The need for EIA

1.7.1 The requirement to undertake an EIA is prescribed by the Town and Country Planning (EIA) (Wales) Regulations 2017 and the Marine Works EIA Regulations 2007 (jointly to be referred to as the 'EIA Regulation'). The EIA Regulations set out the types of development which must always be subject to an EIA (Schedule 1 in the Town and Country Planning (EIA) Regulations, and Annex I in the Marine Works (EIA) Regulations). Developments which may require an EIA, if they trigger certain thresholds and are likely to give rise to significant environmental effects (referred to as Schedule 2 and Annex II of the Town and Country Planning (EIA) Regulations, and Annex I in the Marine Works (EIA) Regulations respectively).

1.7.2 The Proposed Development falls within Schedule 2(10)(m) and Annex II(69) of the respective EIA Regulations ('Coastal work to combat erosion and maritime works capable of altering the coast through the construction, for example, of dykes, moles, jetties and other sea defence works, excluding the maintenance and reconstruction of such works').

1.7.3 EIA is required for Schedule 2 / Annex II development where it has the potential to have a significant effect on the environment. An EIA Screening Opinion regarding whether the Proposed Development constitutes EIA development was sought from Cyngor Gwynedd and NRW on 8 September 2023 and 26 September 2023 respectively.

1.7.4 An EIA Screening Opinion was issued by Cyngor Gwynedd on the 27 October 2023 concluding that the Proposed Development constitutes EIA development under Schedule 3 of the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017. Please refer to ES Volume 3, Appendix 1.2 to view the EIA Screening Opinion.

1.7.5 An EIA Screening Opinion was issued by NRW on the 22 November 2023 (reference SC2304) confirming that the Proposed Development constitutes EIA development under the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended) and must be accompanied with the marine licence application. Please refer to ES Volume 3, Appendix 1.3 to view the EIA Screening Opinion.

1.7.6 As such, an Environmental Statement (ES) has been prepared to accompany the planning application and marine licence application.

1.7.7 An EIA Scoping Report was prepared by YGC and submitted to Cyngor Gwynedd and NRW on 06 February 2024 and 09 February 2024 respectively. Please refer to ES Volume 3, Appendix 1.4.

1.7.8 An EIA Scoping Opinion was issued by Cyngor Gwynedd and NRW on 30 April 2024 and 19 April 2024 respectively. Please refer to ES Volume 3, Appendix 1.5 and 1.6. As such the ES has been prepared based upon Cyngor Gwynedd and NRWs EIA Scoping Opinions, in accordance with the EIA Regulations. The ES presents the findings of the EIA undertaken for the Proposed Development.

1.8 Environmental Statement Structure

1.8.1 The ES contains the environmental information that is required by the EIA Regulations and comprises a number of volumes that are outlined in the section below:

1.8.2 Environmental Statement Volume 1: Non-Technical Summary (NTS) – a report which summarises the findings of the EIA written in non-technical language.

1.8.3 Environmental Statement Volume 2: Technical Assessments – (this volume) includes the introductory chapters and the EIA topic chapters (5 - 14), as follows:

- Chapter 1 – Introduction.
- Chapter 2 – Project Description.
- Chapter 3 – Needs and Alternatives.
- Chapter 4 – EIA Approach.
- Chapter 5 – Air Quality.
- Chapter 6 – Biodiversity and Protected Sites.
- Chapter 7 – Climate Change.

- Chapter 8 – Community Considerations.
- Chapter 9 – Cultural Heritage.
- Chapter 10 – Flooding and Water Quality.
- Chapter 11 – Noise and Vibration.
- Chapter 12 – Marine and Coastal Physical Processes.
- Chapter 13 – Seascape and Landscape and Visual.
- Chapter 14 – Cumulative and In-Combination Effects.
- Chapter 15 – Summary.

1.8.4 Environmental Statement Volume 3: Appendices – includes the technical reports and data that accompany the technical assessments in Volume 2.

1.8.5 Environmental Statement Volume 4: Figures – includes all the figures that are referenced within this ES, however some figures relating to the description of development are also integrated into the main text for ease of reference.

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

References

[1] Global Tourism Solutions (UK) Ltd, “Barmouth Tourism Estimate,” Global Tourism Solutions (UK) Ltd, October 2018. [Online]. Available: https://www.globaltourismsolutions.co.uk/.

Cyngor Gwynedd

Barmouth North Promenade FAS

ES Chapter 2 Project Description

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Contents

2. Project Description 1

2.1 Introduction 1
2.2 Site Location 1
2.3 Proposed Coastal Defence Works 2
2.4 Landscape and Public Realm 7
2.5 Surface Water Drainage 8
2.6 Materials 8
2.7 Environmental design measures and enhancements 9
2.8 Design Life 9
2.9 Operation, Maintenance and Inspection 11
2.10 Decommissioning 12
2.11 Construction Programme 12
2.12 Construction Phase 13

Tables

Table 2-1 Proposed coastal defence works 2
Table 2-2 Material quantities 9
Table 2-3 Extract from DMRB CD 350 table 7.1 10
Table 2-4 Proposed asset design life 11
Table 2-5 Proposed asset maintenance regime 12
Table 2-6 Construction programme for key assets. 12

Graphics

Graphic 2-1 Site Plan showing existing arrangement. 1
Graphic 2-2 Suggested location of Vessel A anchoring site and Vessel B route to site. 14
Graphic 2-4 Site compound location. 18
Graphic 2-5 Planned vehicle route to site. 19

2. Project Description

2.1 Introduction

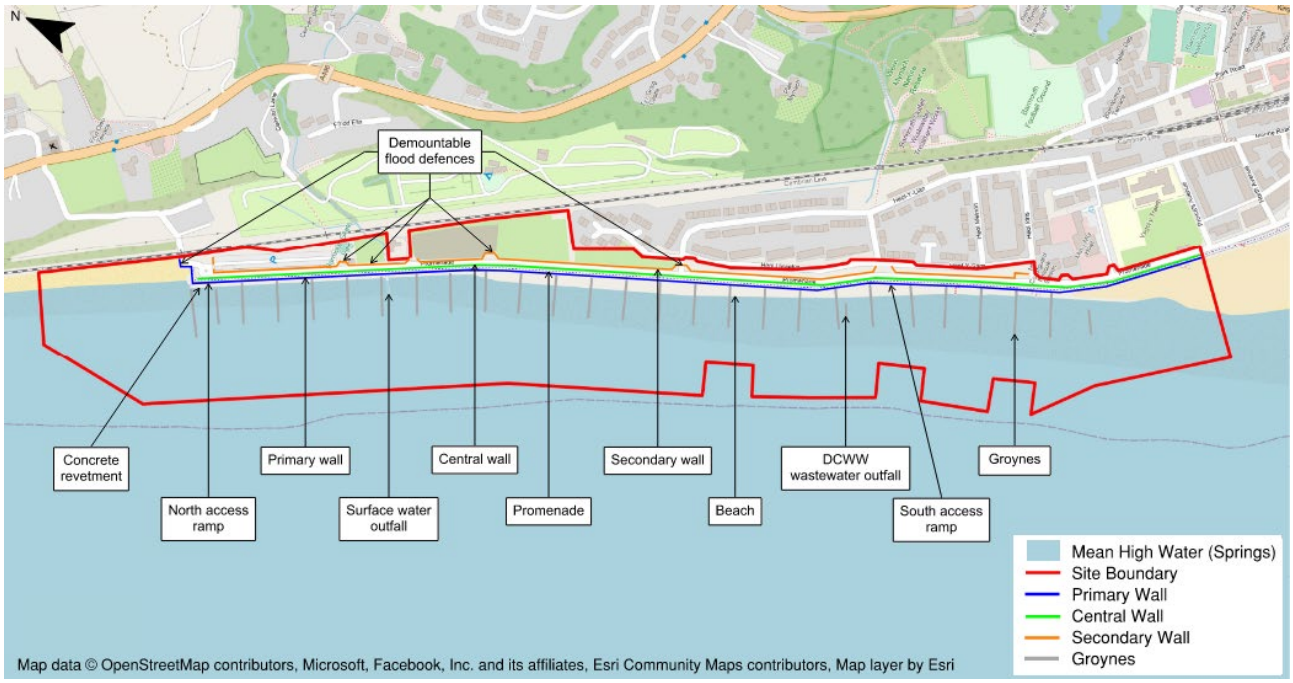
2.1.1 This chapter outlines the Proposed Development, and provides a description of its main components, including an outline of construction and operational requirements.

2.1.2 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). For each element of the design, the proposed construction methods and materials are provided with an overview of the duration of construction and considerations for programming.

2.1.3 Where measures to avoid, reduce or minimise environmental effects were incorporated within the final design and the relevant reference design drawings, these are identified within the relevant topic chapters under the heading of embedded environmental design measures and taken into account in the assessments.

2.2 Site Location

2.2.1 The Proposed Development is located within Barmouth North Promenade. A site plan presenting the existing arrangements and assets is shown below in Graphic 2-1.



Graphic 2-1 Site Plan showing existing arrangement.

2.3 Proposed Coastal Defence Works

2.3.1 An overview of the Proposed Development is presented in ES Volume 4, Figure 2.1- Outline Design Layout Site Plan.

2.3.2 Design General Arrangements and Cross Sections for the Proposed Development have been submitted with the planning application as below:

- BMTH-ARP-HGN-PROM-DR-Z-000003 - OUTLINE DESIGN LAYOUTS GENERAL ARRANGEMENT - SHEET 1 OF 5
- BMTH-ARP-HGN-PROM-DR-Z-000004 - OUTLINE DESIGN LAYOUTS GENERAL ARRANGEMENT - SHEET 2 OF 5
- BMTH-ARP-HGN-PROM-DR-Z-000005 - OUTLINE DESIGN LAYOUTS GENERAL ARRANGEMENT - SHEET 3 OF 5
- BMTH-ARP-HGN-PROM-DR-Z-000006 - OUTLINE DESIGN LAYOUTS GENERAL ARRANGEMENT - SHEET 4 OF 5
- BMTH-ARP-HGN-PROM-DR-Z-000007 - OUTLINE DESIGN LAYOUTS GENERAL ARRANGEMENT - SHEET 5 OF 5
- BMTH-ARP-HGN-ZZ-DR-Z-000001 - TYPICAL CROSS SECTIONS - SHEET 1 OF 5
- BMTH-ARP-HGN-ZZ-DR-Z-000002 - TYPICAL CROSS SECTIONS - SHEET 2 OF 5
- BMTH-ARP-HGN-ZZ-DR-Z-000003 - TYPICAL CROSS SECTIONS - SHEET 3 OF 5
- BMTH-ARP-HGN-ZZ-DR-Z-000004 - TYPICAL CROSS SECTIONS - SHEET 4 OF 5
- BMTH-ARP-HGN-ZZ-DR-Z-000005 - TYPICAL CROSS SECTIONS - SHEET 5 OF 5

2.3.3 Key assets are detailed in Table 2-1 with a brief description of the proposed works for each location in the Proposed Development.

Table 2-1 Proposed coastal defence works

Asset	Existing Description	Proposed Development
Beach	The Beach is primarily made up of sand with a shingle berm north of the promenade and dunes to the south. There is some coarse sediment (cobble/boulders) in the southern extent of the site and a coarse sediment fillet along northern half the frontage. To the south, the beach widens with sand dunes.	New rock revetment to be constructed at the top of the beach (950m in length) utilising rock armour (boulders) of a maximum grading of 3-6t. No other material is to be added to the beach. [Please note - at the time of preparing the Environmental Statement, additional areas of rock armour were included in some assessments to ensure a “conservative” scenario was considered. Through further physical modelling and flood modelling it has been determined that these areas are not required and has been subsequently removed from the Scheme, however some of the assessments still include it.] Coarse sediments will be redistributed along the beach front rather than being removed. The coordinates for the rock revetment include:

Asset	Existing Description	Proposed Development
		Northwest end of rock revetment: 260187, 317354 and southeast end of rock revetment: 260613, 316390
Groynes	Timber groynes situated in front of the northern promenade at roughly 45m intervals, the majority of which have damaged and/or missing boards.	The groynes are to be removed. Refurbishment is not proposed or required as part of the Proposed Development.
Concrete revetment	A concrete revetment runs at the top of the beach. A sheet pile cut-off toe has been installed running along its length, buried in the sand.	The existing concrete revetment is to remain. Existing sheet piles to be refurbished over a ~950m length to the north of the promenade, including a capping beam which will also be accessible to pedestrians for recreation. Existing buried concrete apron to the South of the Proposed Development to be covered by proposed rock armour.
Primary wall	Precast concrete wave recurve wall units.	The primary wall is to remain, with localised patch repairs to joints and sealant where required. The coordinates for the primary wall include: Northwest end of primary wall: 260282, 317263 and southeast end of primary wall: 260800, 316057.
Central wall	Separating the promenade and highway, an unreinforced stone wall with large sections of missing stones and many drainage holes. There are benches built into the wall and several access points enabling access between the beach and highway via the promenade.	The central wall is not required to provide a flood defence function. It will therefore be replaced with a new kerb and balustrade to provide separation between the promenade and highway.
Secondary wall	Unreinforced stone wall running parallel to the Central Wall on the opposite side of the Marine Parade highway, with demountable flood defences (stop logs) at multiple locations as below.	New reinforced concrete wall, generally on the alignment of the existing defective secondary wall. Max height of 1.55m, which may vary across length. Facing the promenade, the wall will include a concave recurve shape. Where feasible, the wall will have a textured concrete finish. The secondary wall runs from Heol Idris to and around the North Promenade Car Park, tying into the existing railway level crossing. The foundations of the wall will be designed to allow for future raising by up to 150mm. This is estimated to be required in 2055 but will be subject to further monitoring of storms and water

Asset	Existing Description	Proposed Development
		levels, and would require its own consenting process. The coordinates for the secondary wall include: Northwest end of secondary wall: 260364, 317114 and southeast end of secondary wall: 260800, 316057.
Demountable flood defences	Wooden boards slotted into stop logs bridging the gaps in the secondary wall at access points. Many demountable defences are in place as the default position.	Existing stoplogs will be replaced with either a continuation of the secondary wall, or flood gates. A total of nine number flood gates are to be installed
Promenade	A concrete walkway along the sea front from South to North Barmouth, running between the primary and central walls.	Raised planters, cycle stands, seating and other street furniture will be included. New street lighting is proposed.
Beach access ramps	Existing access ramps provided at the north and south of the promenade. Existing gradients (1:7 at North, 1:15 at South) pose accessibility challenges.	Existing ramp to the north of the Proposed Development to be rebuilt/extended at 1:21 gradient, extending up to 1.7m below beach level.
Beach access steps	Existing access steps, within the concrete revetment, are provided at regular intervals (100-150m) along the promenade. Due to erosion, many of these are in poor condition and provide access to the concrete revetment only, not beach level.	The access steps within the scheme extents (6 no.) will be rebuilt, complying with relevant standards to improve accessibility, and extended through the rock revetment to the beach, extending up to 1.7m below beach level.
Promenade access ramp	An existing landward ramp with a 1:6 slope connects Marine Parade, with the junction of Heol-Llywelyn, Heol-y-Sarn and Heol-y-Plas heading landward.	The existing landward ramp will be removed and replaced with both steps and a new ramp with a gradient of 1:21 or shallower.
Highway	The single carriageway Marine Parade runs the entire length of the promenade between the central and secondary walls. The seaward side is demarcated for parking, and there is a pavement on the landward side.	The carriageway will be resurfaced as part of the Proposed Development. Car parking demarcation is to be switched to the landward side of the road to reduce the risk of clash with the central balustrade, and improve access to the pavement. Crossing points are to be added to improve accessibility and safety for pedestrians.
Outfalls	One culverted watercourse discharges to the sea at the North of the site. Two DCWW outfalls extend under the promenade to discharge at the beach. There is also a pumped surface water drainage system.	The surface water pumping station and DCWW outfalls are not included as part of the scope of the Proposed Development. These will be protected during construction only. The outfall by the café is to be extended under the proposed rock

Asset	Existing Description	Proposed Development
		revetment and refurbished (including non-return valve.
Landscape and Public Realm	The existing north promenade is very limited in terms of amenity provision both for soft and hard landscape. Green areas and planting are absent along the promenade and road corridor. A number of moveable raise planters with palm trees are placed along the southern promenade and extend nearer the school Ysgol Y Traeth but do not encroach into the Proposed Development. The only areas of grass are located behind the secondary wall and adjacent to the residential areas. However, these are maintained as amenity grass, with limited aesthetic value. Seating areas are provided along the central wall and in limited locations along the secondary wall, however these have fallen into disrepair due to storm damage to the central wall and are not to current inclusivity standards. The promenade surface is showing its age and feels worn, with visible signs of cracking and patched up areas. Lighting columns are present along the secondary wall, however the light spill coverage appears insufficient, resulting in a non-uniform coverage and multiple dark areas along the promenade.	The following measures will be proposed as part of the public spaces design both in terms soft and hard landscape: - Improved and increased seating areas. - Raised planters with vegetation at key nodes and more significant amenity green areas around the northern car park. - Improved road crossing points for pedestrians. - Delineated areas for commercial activities (e.g. designated locations for food and beverage trucks) near the northern car park. - Cycle parking areas. - Improved signage/wayfinding. - Improved access to beach through the rock revetment. - Improved lighting provision.

2.3.4 A more detailed description of the Proposed Development is given below.

2.3.5 A 950m-long rock revetment will be the first formal line of defence against coastal flooding. The rock revetment arrangement is as follows for the majority of its extent, although levels vary and the rock revetment widens at the northern end. The rock revetment begins at beach level (approx. 0mAOD) and ramps up in two stages to meet the concrete revetment. The rock revetment initially ramps up at a 1 in 1.5 gradient over a distance of approximately 3.2m and levels off to form a 2.8m long landing. The second incline is at a 1 in 3 gradient over a distance of ~2.5m finishing with an 8m level section.

2.3.6 The rock revetment ramps up from beach level at a 1 in 1.5 gradient for 3.6m and levels out to create a 3.6m landing, then ramps up at a 1 in 3 gradient for ~4.5m and levels out at the crest for 4.8m. The rock revetment ramps down on the landward side creating a symmetrical section.

2.3.7 Approximately 48000t of primary rock and 15000t of smaller graded material is required for the entire rock revetment. The source of materials are discussed in section 2.12.

2.3.8 A concrete capping beam will be laid over the flat portion of the existing concrete revetment to allow limited amenity use. This will include an upstand to discourage access to the rock revetment.

2.3.9 The existing beach access steps in the concrete revetment will be refurbished and extended through the rock revetment to the beach. There will be six 2m-wide stepped access points consisting of flat landings in line with the rock revetment and steps where the rock revetment is sloped. The new steps are to be precast concrete elements, supported by sheet piles.

2.3.10 The north access ramps will be extended to provide access to maintenance vehicles and improve accessibility through the new rock revetment. Similar to the steps, these are to be precast concrete supported by sheet piles.

2.3.11 The primary wall separates the promenade from the beach. The existing wall will remain unchanged aside from localised repairs as needed. The promenade will typically be 5.3m wide and continue to provide the main active travel route along the seafront. Various low maintenance placemaking features such as benches and planting will be installed along the promenade.

2.3.12 The existing central wall will be demolished and replaced with a kerb and balustrade to provide separation between the promenade and highway. Several openings will be incorporated into the wall, including at formalised pedestrian crossing points along Marine Parade, which align with openings in the secondary wall.

2.3.13 The carriageway will be resurfaced as part of the Proposed Development. Car parking demarcation is to be switched to the landward side of the road, and crossing points are to be added to improve access.

2.3.14 The layout of the car park at the north of the site, and associated surrounding infrastructure, will be redesigned to rationalise vehicle movements and parking, while enhancing active travel provision, amenity spaces, and public realm features.

2.3.15 The secondary wall will be rebuilt in reinforced concrete and raised to a maximum height of 1.55m. The face of the wall facing the sea will include a concave recurve shape. The rear vertical face (and possibly the front face) will have a textured concrete finish. The wall will extend around the rear of the car park, between the car park and railway. In this section, it will be constructed entirely in concrete and will not include a recurve.

2.3.16 There are nine new flood gates in the Proposed Development, located along the primary and secondary walls. This includes across the Network Rail level crossings, and across access points to adjoining roads such as Heol Idris and Heol-y-Llan. Four of the flood gates will replace existing stop logs, the remaining five are located where there were previously gaps in the line of defence.

2.3.17 The existing lighting columns on the promenade will be removed and new columns will be installed along the promenade to increase illumination of the promenade and roadway, whilst reducing light spill which currently occurs with the existing arrangement. The lighting has been designed as:

- Tall asymmetric double lighting columns (8m-10m height) positioned at regular intervals.
- Well-shielded luminaires with asymmetric optics for precise light direction.
- Designed to light the road and the promenade.
- Warm white light sources (max 2700K) to reduce impacts on ecological receptors.

2.4 Landscape and Public Realm

2.4.1 The landscape design has been developed alongside the coastal defences from concept to outline design, before progressing to detail design. Each aspect has carefully considered the broader context of the area including the natural landscape, heritage, industrial and socio-economic characteristics to deliver a design that responds to the local identity and character.

2.4.2 The landscape design has been developed to suit the coastal environment and minimise maintenance requirements in order to reduce operational costs and ensure the elements of the design are robust and long lasting.

Hard landscape

2.4.3 Access to the beach, promenade and Marine Parade has been designed considering the views of the local community expressed through public consultation events. All footpaths included in the works will be at least 1.8m in width.

2.4.4 Any new signage shall be positioned at a height and of a size which allows wheelchair users and mobility scooters to read comfortably.

2.4.5 Wayfinding signage will be improved and rationalised to identify key assets of the area such as recreational routes, the Wales Coast Path and the national cycle network route.

2.4.6 Designated cycle parking locations will be dotted throughout the Proposed Development, and carefully located to minimise obstructions along circulation routes.

2.4.7 New walls will be designed to minimise visual intrusion in terms of height, profile and finishes. Textured concrete patterns will be used to improve the aesthetic value and mitigate the barren appearance of concrete structures.

2.4.8 A significant dwell area will be created at the northern end of the promenade, interfacing with the Carpark. This area will accommodate large seating areas, delineated spaces for kiosks and temporary commercial activities. Improvements to the car park will include a revised layout, integrated green spaces, improved accessibility and provision of disabled parking bays.

2.4.9 Smaller dwell areas will be provided at key nodes along the promenade and be comprised of raised planters and new seating installations. These nodes will also create safe and inclusive crossing points for pedestrians to cross the road. Surfacing finishes will be improved within these crossing points to help decrease vehicle speeds and create a safer environment for pedestrians.

2.4.10 Handrails will be installed on new steps and ramps throughout the Proposed Development.

2.4.11 New lighting columns will be installed with split luminaires for the road and promenade, positioned to avoid any detrimental impacts to wildlife or cause glare to residential properties.

2.4.12 Improved access to beach through the rock revetment will be provided at the existing access points.

2.4.13 A central balustrade will be provided between the road and the promenade to improve safety of pedestrian users. This will be in a durable marine grade

material. There will be openings every 100-150m for pedestrian access, which are in line with the current situation.

2.4.14 The existing ramp at Heol-Y-Plas juntion will be replaced by an accessibility compliant ramp and steps to provide access to the promenade from the adjacent residential areas.

Soft landscape

2.4.15 The Proposed Development will introduce raised planters with vegetation at key nodes and more significant amenity green areas around the northern car park. The proposed vegetation will be adapted to the saline and wind-swept environment and include those native to the UK and local area such as the sand dunes.

2.4.16 There is the potential to improve the biodiversity of the amenity grass verges along the back of the secondary wall and along the residential areas. This is being proposed as an enhancement which would improve the visual appearance of the area, the biodiversity value and would help to mitigate the visual impact of the secondary wall when looked at from the residential area.

2.5 Surface Water Drainage

2.5.1 A drainage strategy report has been developed to demonstrate that there will be no adverse impacts to the existing surface water regime caused by the Proposed Development.

2.5.2 It is proposed that the existing surface water drainage is to be retained. The level of the site falls from the base of the secondary wall towards the primary wall. Surface water runs from the back of the existing footway, across the carriageway and adjacent parking bays, towards the existing central wall. Water is then conveyed through the central wall via drainage holes and gaps in the wall for pedestrian access. From there, runoff continues toward the primary wall, where it is discharged through uniformly spaced outlet holes in the wall, and via the slipways adjacent to Heol-Y-Plas and Princes Avenue, directly onto the concrete apron seaward of the primary wall and ultimately discharging into the sea.

2.5.3 The Proposed Development proposes to retain the existing holes in the primary wall, providing drainage through the proposed kerb and balustrade, and retaining the outfall regime into the sea. No measures are proposed to change the existing hydraulic control or water quality provisions of the site.

2.5.4 The surface water culvert by the café is to be extended through the proposed rock revetment by approximately 15m with scour protection to be considered at the outfall. A non-return valve will be added to the existing surface water culvert through the promenade adjacent to the promenade café.

2.6 Materials

2.6.1 The largest volume of materials to be sourced comprises the rock armour (of various grades). The rock is to be a high-quality, sufficiently dense rock such as granite or basalt.

2.6.2 At this stage, it is possible that this will be delivered either by road from local quarries or via marine transport, sourced from overseas. The preferred method

is for sourcing by road, however given the uncertainty around availability, price and other impacts at this stage, the possibility of marine deliveries is also included in the assessment. See section 2.12 for further details on the delivery methodology.

2.6.3 There will be a requirement for further imported materials i.e. reinforcement, masonry and concrete for the works, but these will be of lower quantities and transport movements. These materials are to be sourced locally and brought in by road to reduce transportation cost, reduce embodied carbon and support local economies. Quantities of materials are shown in Table 2-2.

Table 2-2 Material quantities

Material	Quantity
Rock armour	63,000 t
Sheet piles	950 t
Concrete	5000 m^3
Aggregate	14600 t
Rebar	200 t
Road surfacing	2200 t

2.7 Environmental design measures and enhancements

2.7.1 Throughout the development of the design, measures have been embedded to avoid and mitigate impacts. These measures are included below.

2.7.2 The existing groynes are known to be partially colonised by blue mussels (a priority species designated under the Environment Act) (see ES Volume 2, Chapter 6 Biodiversity and Protected Sites for more information). The groynes are not required as part of the Proposed Development and are to be removed.

2.7.3 Enhancement and mitigation measures have been identified (as described further within ES Volume 2, Chapter 6 Biodiversity and Protected Sites) to include:

- Removal of Japanese knotweed (an Invasive Non-Native Species, (INNS)) to improve underlying habitat conditions
- Sand dune enhancement (off-site)
- Expansion of the Sabellaria alveolata reef (off-site) by providing suitable substrate
- Installation of rock armour lower in the intertidal zone to increase habitat availability for blue mussels and other species

2.8 Design Life

2.8.1 The Proposed Development has been designed in accordance with the Design Manual for Roads and Bridges (DMRB). Design working life for new structures is in line with Table 2-3. Structures including flood walls and sheet piles will be designed to a working life category 5, with any departures to be agreed.

2.8.2 The proposed design life for each asset is summarised in Table 2-4.

Table 2-3 Extract from DMRB CD 350 table 7.1

Design working life category 1 (temporary structures, typically 10 years design working life)	
Temporary structures (1)	
Design working life category 2 (replaceable structure parts, typically 50 years design working life)	
Expansion joints	Waterproofing systems
Safety barriers	Parapets
Design working life category 3 (Short term structures, typically 50 years design working life)	
Lighting columns	Environmental barriers
CCTV masts, high mast lighting	Sign and signal gantries
Columns for traffic signs/signals	Bridge gantries, access systems
M&E installations	
Design working life category 4 (typically 51-120 years design working life)	
No examples given	
Design working life category 5 (typically >120 years design working life)	
Bridges	Retaining walls
Tunnels	Buried structures
Bridge bearings (2)	

(1) Structures or parts of structures that can be dismantled with a view to being re-used are not be considered as temporary.

(2) The design working life of bridge bearings can be reduced to 50 years subject to agreement with the technical approval authority (TAA)

2.8.3 The existing structure comprises numerous elements which have been modified, strengthened and repaired throughout its life to date. As-built and condition records of the original structure and any modifications are limited. A risk-based approach will estimate residual design life of retained existing elements with associated assumed requirements for monitoring and maintenance.

2.8.4 Continued maintenance, inspection and repair of the structure will be crucial in ensuring the ongoing performance of the structure and the performance of individual elements. Therefore, a supporting management plan to monitor and maintain the rate of deterioration, hence reducing the likelihood of a catastrophic failure will also be developed by Arup post planning application.

Table 2-4 Proposed asset design life

Asset	Proposed design life
Concrete revetment – new sheet pile cut-off	100 years
Rock revetment	50 years (overtopping) 200 years (start of damage)
Primary wall	As existing
Secondary wall	Walls and bases 120 years Joint sealants 10 years
Flood gates	Flood gate itself 60 years Seals and other parts 15 years
Culvert non-return valves	25 years
Public realm hard landscape	Will vary for different products and materials, but will aim for robust materials to maximise design life and maintenance requirements
Public realm soft landscape	
Highway and drainage	40 years
Handrails	25 years

2.9 Operation, Maintenance and Inspection

2.9.1 An operation and maintenance plan is to be produced. Given the need to provide coastal flood protection up to 2075, maintenance provisions will be made up until this date. To reflect the planned change to managed realignment after this date, maintenance will be subject to monitoring.

2.9.2 Flood gates will be manually operated when a sufficiently large storm event (caused by high water levels, wave action or climatic conditions) is predicted (generally via flood warnings from NRW) and reopened once the event is complete and any flooding has receded.

2.9.3 The flood gates will allow for safe operation of the gate by a single operator in windy weather, avoiding use of complex systems such as hydraulics where possible. They will be operable from the 'wet' side given the plan for their operation. It is expected that gates will be closed for a matter of hours, giving time for the promenade to be cleared in advance of a storm, and then to drain down (expected to take a maximum of three hours).

2.9.4 Maintenance access will be provided for the flood gates through adjacent on street parking.

2.9.5 The frequency of operation will increase over time with climate change.

2.9.6 All coastal flood defence assets will be inspected annually. Where maintenance of the rock revetment is required, this is likely to involve similar land-based plant to construction (described in section 2.12.2), to reshape individual elements of the proposed rock revetment to match the construction details where they have been knocked out of place from severe storm events. Access would be via the access ramps located to the north and south of the beach, with any materials likely to be delivered through the routes described in section 2.12.32.

Maintenance is more likely to occur after large storm events. The proposed maintenance regime is summarised in Table 2-5.

2.9.7 The hardstanding landscape assets materials and products will be robust against vandalism. The products selected will have varying design life and maintenance requirements, as outlined by manufacturers. The period for establishment of soft landscape vegetation by the landscape contractor prior to handover to the council is to be agreed.

Table 2-5 Proposed asset maintenance regime

Asset	Maintenance by Asset Owner
All coastal flood defence assets	Inspected annually, maintenance where required from unexpected damage
Primary wall	Periodic replacement of sealant.
Secondary wall	Periodic replacement of sealant.
Flood gates	Annual testing Periodic replacement of seals.
Culvert non-return valves	Annual maintenance.

2.10 Decommissioning

2.10.1 The Proposed Development is being designed to provide a standard of protection to 2075, in line with the Shoreline Management Plan. However, structural elements will be designed with a design life as set out in section 2.8. Given the health and safety risks that would be created should they be removed, it is that the defences will remain in place past 2075 and not decommissioned.

2.10.2 Potential decommissioning effects of the Proposed Development have therefore been scoped out of the ES and not considered within the assessments as the coastal defence will remain in place past the design life.

2.11 Construction Programme

2.11.1 Works are scheduled to commence in April 2027 and due to be completed in spring 2029, taking approximately 24 months. The estimated timescale for each asset's construction is detailed in Table 2-6.

Table 2-6 Construction programme for key assets.

Asset	Programme
Beach and rock revetment	12 months
Primary wall, central balustrade and secondary wall	12 months
Public realm works (hard and soft landscape)	12 months

2.11.2 Barmouth is a popular holiday destination; to minimise negative impacts of the Proposed Development on the community and tourism, the construction programme will be dependent on the tourism season. Programming of activities will take into account impact on local businesses and tourism, aiming to reduce disruption during the summer holiday season. Construction durations, estimated in Table 2-6, are weather dependent. Due to the tidal nature of the site and

frequent overtopping experienced it is likely that construction will be disrupted during named storms in the Barmouth locality.

Working hours

2.11.3 Regular working hours are scheduled to be between 07:00 and 19:00, although much of the construction work subject to beach access will require variations around tidal patterns. There will be no work over Christmas, New Year, Easter and Bank Holidays. The outline construction methodology estimates that 50 full-time staff will be on site for the duration of the construction: 15 office staff and 35 construction workers. No nighttime working will take place however in the winter months, work will likely start and finish in the dark due to shorter daylight hours.

2.11.4 Works will not be carried out during the school summer holidays to reduce impacts on the community and tourism. This has been the case with other construction projects in Barmouth.

2.12 Construction Phase

2.12.1 The construction approach to each asset of the Proposed Development is described within this section.

Rock Revetment

2.12.2 Stockpiles will be used to store excavated material and imported rock, their location is dependent on the delivery method. There are two options for delivery – Option 1 by road and Option 2 by sea - detailed below, including different stockpile locations to be utilised for each option.

2.12.3 For both options, temporary stockpiles located on the beach below MHWS will be used to store rocks for the rock revetment prior to placement. All sand/shingle excavated from the beach will be stored on the beach above MHWS to be later reinstated along the beach and used for beach recharge.

2.12.4 The rock revetment will be constructed with one working front, starting in the north and moving south.

2.12.5 To construct the rock revetment existing shingle and sand in the footprint of the proposed rock revetment (estimated 9,500m^3) will be excavated using a 35t-40t excavator. Shingle and sand will be moved to an on-site stockpile location using a dump truck. Any non-indigenous material or non-natural debris will be removed and disposed of at a nearby tip. A geotextile separation membrane will be placed on the excavated surface. Rocks will be individually placed from the temporary stockpiles on the beach with a 50t excavator with a grab. This work will be undertaken at low tides.

Option 1 - Delivery by Road

2.12.6 For option 1, the main stockpile area will be located within the site compound area (see paragraph 2.12.31) to store 7000t-10,000t of rock for the rock revetment. Rock will be moved from the main stockpile to temporary stockpiles below MHWS prior to placement using dump trucks and a 50t excavator with a grab.

2.12.7 For option 1, delivery by road, the rock would be supplied by a Welsh quarry. The approximate volume of rock required for the Proposed Development is

63,000t, which if delivered by road would equate to around 20 round trips per day over a period of 10 months using heavy goods vehicles (HGVs).

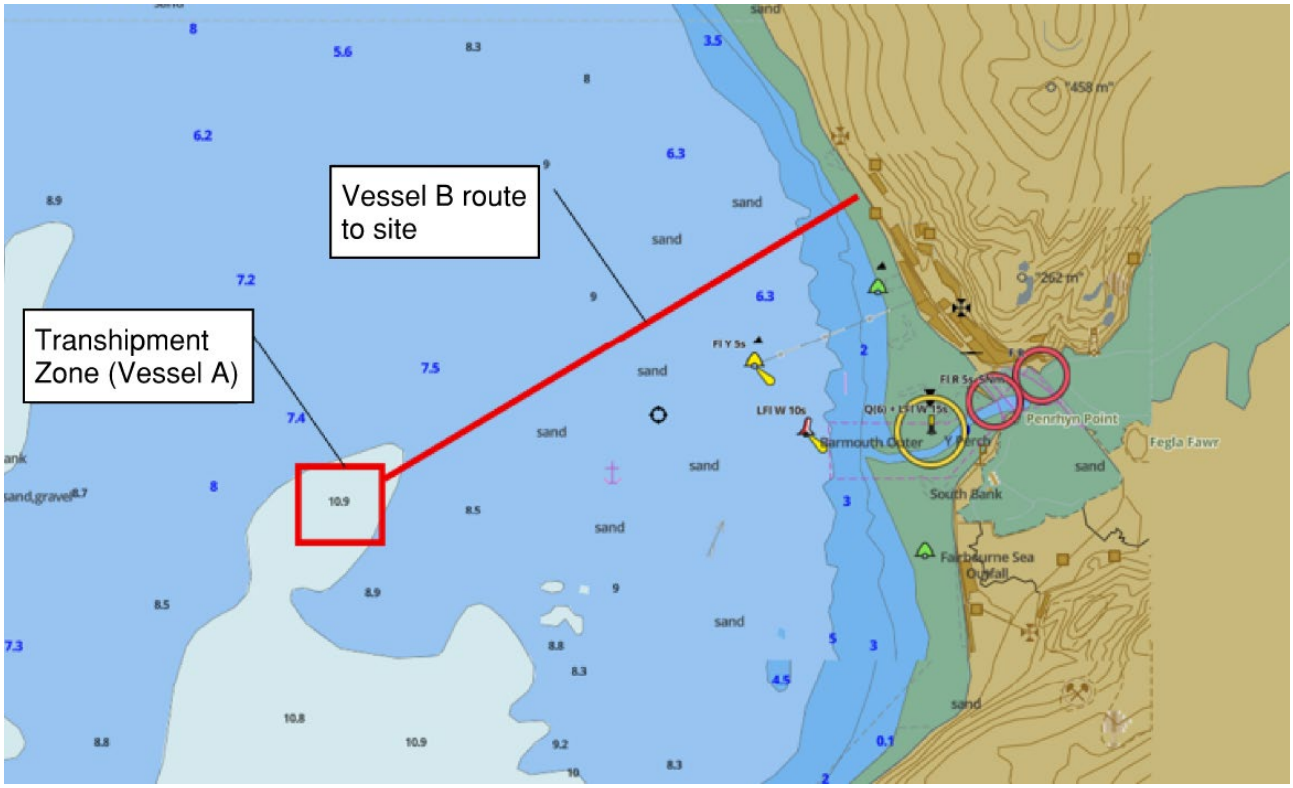
2.12.8 Graphic 2-5 indicates the site compound area and construction access routes. Temporary stockpile areas will be adjacent to the beach access ramps (below MHWS). All other material will be stored above MHWS in the site compound area.

Option 2 - Delivery by Sea

2.12.9 For option 2, delivery by sea, the rock will be tipped onto the shore below MHWS level as a temporary stockpile, rock will be placed directly from here to the rock revetment footprint.

2.12.10 The rock is likely to be sourced from a European quarry. The rock supplied will be transported to the quayside where approximately 25,000t of rock will be loaded onto a Self-Discharging Excavator Vessel (SDEV) (Vessel A). Vessel A will set sail to the site where it will anchor approximately 6km offshore of Barmouth for around 1 to 2 weeks before setting sail for another load.

2.12.11 A shallow draught tipper boat or smaller barge (Vessel B) of capacity 1,000-3,000t will travel with Vessel A and the rock armour will be transferred individually from Vessel A onto Vessel B using an on-board excavator equipped with a hydraulically operated grab. Vessel B will transport the rock to the site of the proposed rock revetment at high tide and tip the rock onto the seabed. At low tide this will be sorted into sizes and placed in the rock revetment footprint using the excavator and grab. See Graphic 2-2 for suggested anchoring site and route of Vessel B between Vessel A and the site of the Proposed Development.



Graphic 2-2 Suggested location of Vessel A anchoring site and Vessel B route to site.

2.12.12 Vessel B will shuttle to and from the main ship transferring rock to the breakwater site. It is estimated that 10-20 journeys to and from the main ship will

be required per load. Once Vessel A has been unloaded, it will return to collect more rock from the quarry. A total of up to 4 return trips for Vessel A are estimated to be required to transport the rock.

2.12.13 Navigational safety and lighting will be required for some of the works below high water. The proposed works to the rock revetment will be limited to daylight hours 'in the dry' i.e. during low tides only. This will prevent interference with harbour navigation access. Vessels will be lit and marked appropriately conforming to relevant navigational code, including the Maritime and Coastguard Agency (MCA) requirements. The harbourmaster will be notified of the dates of works, in advance. There would be one or two tugs on site for barge handling and control of Vessel B. Upon delivery, Vessel B will approach the shoreline shortly before the following high tide. Some vessels will be running their engines when offloading is taking place. Marine Gas Oil (MGO) will be used as fuel. At no time will there be any beaching of boats on the beach.

2.12.14 In the unlikely event of an emergency the Harbourmaster will be contacted so that a Notice to Mariners can be raised and / or lighting or buoying installed if required to limit further damage, nuisance or incidents occurring. In the unlikely event that plant becomes trapped and has to be abandoned, the harbourmaster will be alerted, so that a notice to mariners can be raised. Depending on location and if deemed necessary, requirements to mark or light the obstacle until it is removed can be agreed with the harbourmaster. Conditions of contract will be placed to ensure that the contractor is responsible for the removal of any obstructions to navigation caused by abandoned plant.

Beach Access Steps

2.12.15 Sheet piles will be placed either side of the area where the steps will be constructed reaching a height above MHWS, this will be carried out using a 70t piling rig. Shingle/sand will be excavated using a 35t-40t excavator and moved to a stockpile area on the beach above MHWS with dump trucks. Rubble will be placed between the two sheet pile walls and steel framework constructed to support the steps. Precast concrete slabs and steps will be placed on top of the steel frame to form the steps and landings using a 70t crane with a maximum lifting height of 55m. The sheet piling will be cut down to follow the line of the concrete steps and a concrete capping beam cast in situ. A 30m concrete pump will be used to pour concrete from a concrete mixer truck parked on Marine Parade.

Beach Access Ramp

2.12.16 The construction methodology of the ramp is similar to the access steps. The existing ramp will remain in place and the proposed ramp constructed on top and around the existing concrete structure. Sheet piles will be placed on either side of the proposed ramp footprint with bedding rock and loose rock infill between the sheet piles. A geotextile layer with concrete blinding layer will be poured over the fill material to create a smooth surface at the correct gradient. A precast concrete base slab is to be placed on top of this and form a connection with the sheet piles. Bulk concrete pour anchored into the existing ramp will raise the level of the top section of the existing ramp to join the new ramp. The top level of concrete parapets is to remain above the top of the rock revetment and a balustrade railing on top. The concrete parapet is designed to prevent the public from walking along the top of the wall. Rock revetment will be placed

around the ramp and over the existing ramps, partially embedded in mass concrete to reduce risk of units shifting.

Concrete Revetment - Sheet piling

2.12.17 New sheet piling will be installed using 70t piling rig and a crane with a maximum lifting height of 55m.

Primary wall

2.12.18 Localised concrete repairs and filling of joints will be carried out using hand tools where required – isolated sections of the promenade would need to be cordoned off while this is carried out.

Central Balustrade

2.12.19 The central balustrade will be constructed by demolishing the existing masonry wall, excavating the promenade surface and reconstructing the kerb and balustrade. Two gangs will begin in the south separated by a small gap and move north to increase efficiency. The balustrade will be built in sections of up to 5m to reduce disruption and traffic management required. Street furniture such as signage and benches will be removed and stored to be replaced following construction. Traffic management measures will be required as work will take place on and adjacent to the west lane of Marine Parade (see section 2.12.33).

2.12.20 The existing wall will be demolished using an angle grinder, pneumatic breaker, excavator and dump trucks. The waste material will be transported offsite for disposal. Kerb and balustrade units would be transported from the compound, along the promenade, using lightweight tractor and trailer units. Lifting equipment will be used to lift the units into place and connection details will be completed by hand.

Secondary Wall

2.12.21 Construction of the secondary wall will involve demolition and reconstruction of the existing wall. Two gangs will begin in the south separated by a small gap and move north to increase efficiency of the crane and other equipment. The wall will be built in 5m sections to reduce disruption and traffic management required. Street furniture such as signage will be removed and stored to be replaced following construction of the secondary wall. Traffic management measures will be required as work will take place adjacent to the east lane of Marine Parade.

2.12.22 The existing wall will be demolished using an angle grinder, pneumatic breaker, excavator and dump trucks. The waste material will be transported offsite for disposal. Excavation of the existing wall foundations is not required due to the use of sheet piles. Sheet piles will be lifted using a crane and driven using a piling rig to construct the wall's foundations.

2.12.23 The concrete recurve wall will be constructed on top and connected to the sheet piles. This is likely to be constructed in-situ with concrete brought onto site and poured into formwork, although the use of precast units may be possible. On the landward side the wall will be clad with stone masonry to match the existing secondary wall.

Groyne Removal

2.12.24 The timber groynes will be removed using hand cutting tools and machinery. Groyne piles will be removed using an excavator with a grab or chain attachment. Concrete steps attached to the existing concrete revetment at the end of each groyne will be broken out with an excavator and a breaker. Waste material from the groynes and steps will be removed from site using dump trucks. Groyne removal will take approximately two weeks.

Outfall Extension

2.12.25 The existing surface water outfall will be extended through the rock armour to provide a new outfall. The outfall is likely to be extended in the same pipe material, with concrete surround for protection. The pipes will be lifted into position with an excavator, and shutters placed around the pipes prior to pouring concrete using a mobile concrete pump. A proprietary flap valve will be fixed to the end of the encased pipe.

Demountable Defences

2.12.26 Temporary demountable flood defences would be installed where existing flood defence features are temporarily removed as part of construction, prior to the construction of the permanent works.

Construction Lighting

2.12.27 Throughout the duration of the project, temporary lighting will be required to allow works to continue outside of daylight hours, this will mainly occur during the winter months. This includes work lighting which will be temporary lighting installed in the same place throughout the project and task specific lighting which will be in place for specific sections of the works for a shorter length of time. All temporary lighting will be directed away from the sensitive areas identified by the Ecological Clerk of Works (ECoW).

2.12.28 Flood lighting, security lights, and any other obtrusive external lighting shall be sensitively located to avoid nuisance to neighbouring properties and should only provide the necessary luminance for the relevant tasks. Site compound lighting will be installed to light up compound walkways and access, and directed into the site compound causing no disturbance to the local environment outside of the compound.

2.12.29 Work lighting locations:

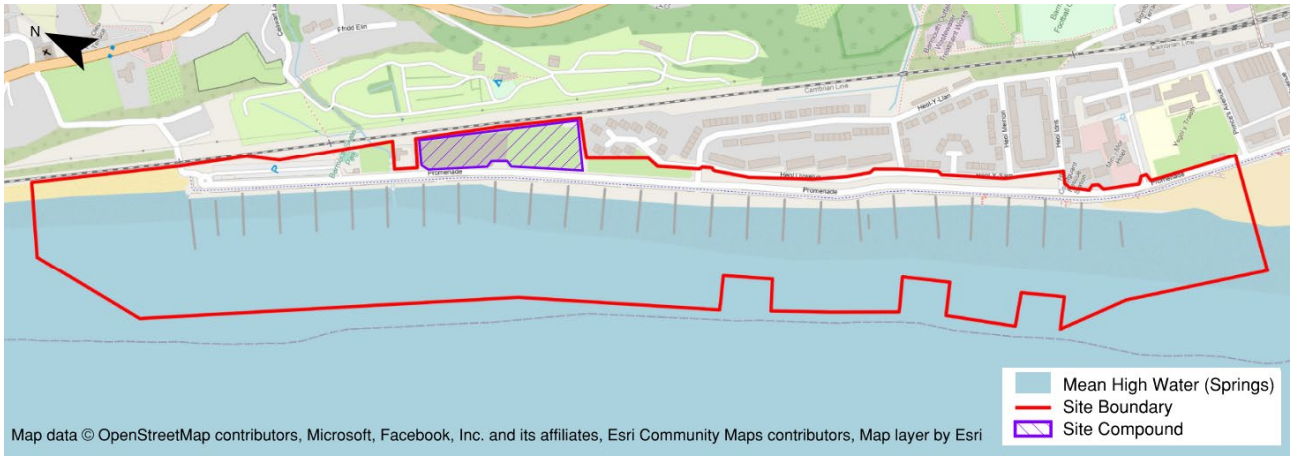
- All cabins in the site compound.
- Stockpile area in yard.
- On ramps for unloading/turning around for deliveries.
- Along any working area (on the beach or top of the promenade).

2.12.30 Types of task specific lighting:

- Mobile Tower lights.
- Hand held lighting & Head torches.
- Vehicle and Plant lighting.

Site Compound and Access

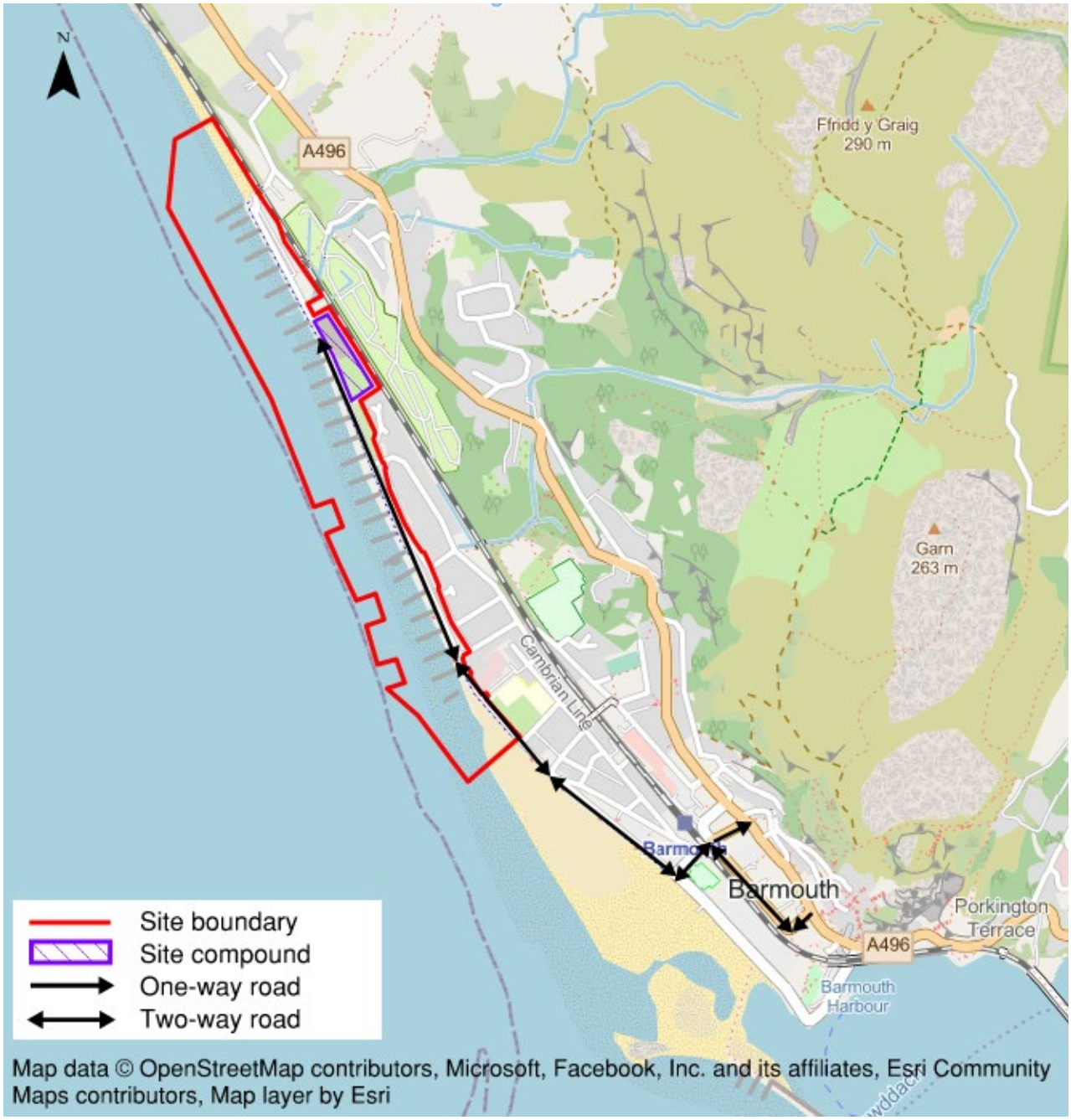
2.12.31 The construction compound will be located on privately owned land to the east of Marine Parade as shown in Graphic 2-3. Arrangements have been made with the landowner for use of the land during the construction period. The compound will accommodate welfare, office and parking facilities.



Graphic 2-3 Site compound location.

Vehicle routes to site

2.12.32 Vehicles will access the site from the south following the route marked in Graphic 2-4. Due to height restrictions at other railway crossing points this is the most suitable route for HGVs and it is therefore necessary to pass through the town centre.



Graphic 2-4 Planned vehicle route to site.

Traffic management & access

2.12.33 Access from the compound to the beach will be via existing ramps or via a purpose-built ramp. Existing ramps will require strengthening or minor improvements (widening, edge protection, pedestrian access) to facilitate access and they will eventually be rebuilt to access the beach through the new revetment works.

2.12.34 The works will be carried out under a combination of two traffic signals and priority works installed along Marine Parade to maintain access to all properties at all times.

2.12.35 It has been assumed that all staff will arrive and depart from the site during the typical highway peak hours of 08:00-09:00 and 17:00-18:00.

2.12.36 Based on the assessment of the lack of existing public transport provision, it has been assumed that 50% of staff will drive to work in their own cars, and 50% will be passengers in a company van.

2.12.37 Innovative traffic monitoring (Tactical Road User Surveillance Technology) and management (Dynamic Roadspace Utilisation Management) systems will be used to optimise traffic management by adapting to traffic conditions in real time.

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

Cyngor Gwynedd

Barmouth North Promenade FAS

ES Chapter 3 Need and Alternatives

Reference: BMTH-ARP-EGN-ZZ-RP-OE-000005

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3. Need and Alternatives

3.1 Introduction

3.1.1 This chapter details the need for and aims of the Proposed Development. It sets out the history of the project, how the Proposed Development has emerged as the preferred option, and which reasonable alternatives were considered throughout the design process.

3.2 Scheme Need

3.2.1 Barmouth North Promenade is instrumental in protecting the coastline and hinterland from flooding and erosion, as well as providing amenity benefits to the local area. The beach and primary wall are the primary coastal flood defences along this stretch of coastline, in conjunction with the various 'de-facto' defences behind it.

Flood Risk

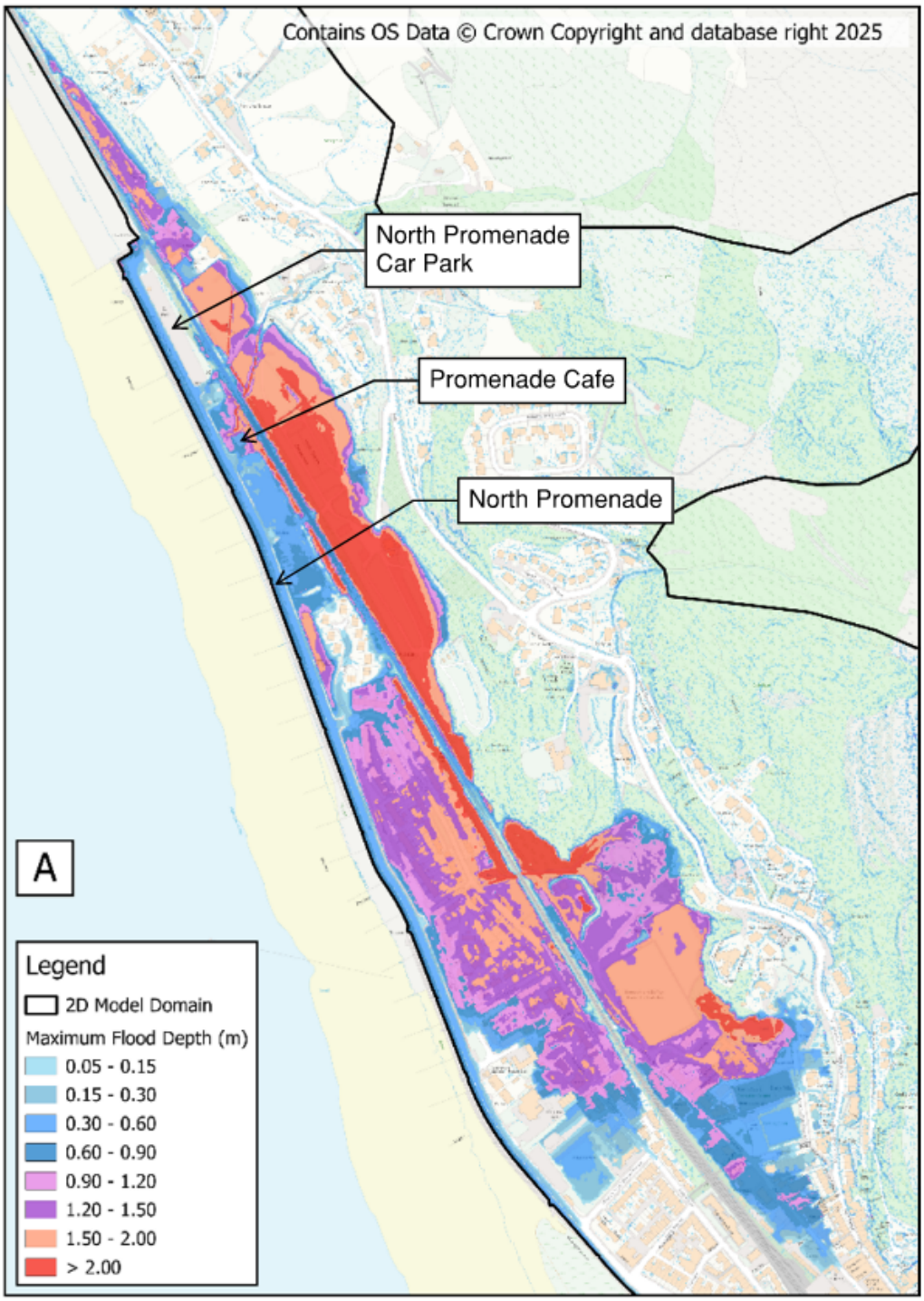
3.2.2 In the absence of any improvements to flood defences in the area, over 900 properties are predicted to have more than a 1 in 100 chance of flooding in any given year [1]. This figure is expected to increase over time due to climate change, and also assumes no structural failure of the existing coastal flood defences. The rapid onset, depth and flow rates of predicted flooding present a risk to life. In 2014, there was a severe flooding event which forced the emergency evacuation of the Promenade Café and other properties, flooding of streets in the town centre as well as extensive damage to the Cambrian coastal railway.

3.2.3 Overtopping of the primary wall regularly occurs in relatively benign conditions towards the North of the site, for instance high tide conditions outside spring tides without the presence of swell, surge, low pressure or strong winds.

Flood modelling for the combined coastal and surface water 1 in 100-year event, (refer to Graphic 3-1) shows flood depths of over 2m impacting a large area of Barmouth, as well as significant flooding of properties.

3.2.4 The NRW sea flood risk map [2] shows there is a greater than 1 in 30 annual chance of flooding in some areas. The Proposed Development wwould reduce flood risk to properties to a minimum standard of a 1 in 50 annual chance in 2075.

3.2.5 In line with the latest Welsh Government (2022) guidance on climate change allowances, a sea level rise of 0.44 m by 2075 and 1.01m by 2125 is predicted at Barmouth. This will increase the frequency of the existing coastal defences being overtopped and increase the severity of overtopping. This will worsen the risk of flooding from the sea and is likely to exacerbate the rate of deterioration of the existing primary wall and secondary defences. Works are therefore required to prevent deterioration of existing defences and increase protection of properties and infrastructure from wave overtopping.



Graphic 3-1 Baseline Flood Depths (2025) Combined 1 in 100-year event [3]

Structural Condition

3.2.6 The structural condition of the sea defence and other structures is described in the OBC [1], which discusses conditions at the site, the risk of structural failure as summarised below.

3.2.7 Generally, beach levels decrease and the condition of sea defences deteriorate towards the north of the Site. Coastal process studies have concluded that overall foreshore bed levels with the Site are lowering and that this lowering is expected to continue. Should foreshore bed levels continue to lower, this would

increase the risk of structural failure and global instability of the existing sea defence structure from sheet pile toe exposure and wash-out of fines.

3.2.8 During a storm in 2020, part of the promenade failed due to unsafe voiding beneath the promenade slab, requiring emergency stabilising repairs. Repairs implemented were intended as interim measures, to temporarily extend the life of the existing structures until the Proposed Development is implemented.

3.2.9 As a result of beach drawdown and erosion, many of the beach access points are unsafe to use. In the north of the Site there are numerous sets of steps which have a large drop (>1m) to the beach level due to lowering of the foreshore, presenting a significant public safety risk. This reduces the number of access points to the north section of Barmouth beach, where movement along the beach is already restricted by the presence of groynes. The limited beach access increases the risk of entrapment for people on the beach.

3.2.10 Understanding of coastal processes and the significantly deteriorated condition of the groynes demonstrate that they have limited effect on beach material movement. The groynes in the north have been subject to substantial degradation, with the loss of timber panels from exposed sections. The groynes in the south are almost completely covered in sediment. Poor access on the beach and north promenade increases the risk of entrapment at high tide and limits the amenity potential of the north promenade.

3.2.11 The secondary wall (with associated demountable stop logs) is a non-structural masonry wall with minimal resistance to impacts. Sections of this wall were knocked down during the 2014 and 2015 storm events among others. While these have been temporarily rebuilt, they remain in a state of disrepair.

3.2.12 The primary wall includes surface water drainage outlets with no provision of non-return or flap valves, providing further entry points for coastal flooding to get onto the promenade.

3.2.13 There are two culverted watercourses which discharge to the sea at Barmouth North Promenade. The culverts are partially blocked with shingle from the beach which causes surface water drainage issues. Flap valves installed within these outfalls have failed, increasing risk of tidal ingress. Although the primary driver of the Proposed Development is to reduce coastal flood risk, work is required to improve conveyance of surface water to the sea and prevent tidal ingress via these routes.

Direct benefits

3.2.14 The Proposed Development would directly contribute to flood risk alleviation for the town of Barmouth, together with a corresponding reduction in the financial, human and socio-economic impacts associated with urban flooding. Without intervention, the direct cost of flood-related damage has been estimated at over £170 million (present value 2026) over 100 years.

Wider benefits

3.2.15 Tourism makes an important contribution to the economy of Barmouth, and provides local employment in the tourism sector together with retail, hospitality and accommodation sectors. The majority of tourist footfall is concentrated around South Barmouth due to the lack of amenities and beach access in North Barmouth. While North Barmouth is less frequented, the promenade beach still

provides valuable leisure and recreation amenity to local residents and tourists. The promenade forms part of the Wales Coastal Path between Llanaber and South Barmouth, provides access to the beach, and has views across Cardigan Bay.

3.2.16 Ongoing degradation of sea defences is likely to ultimately result in failure of the sea defence and damage to the North Promenade and car-parking. This is likely to result in a reduction in tourism visitor footfall due to unsightly damage and loss of parking and access facilities. Improved connectivity and wayfinding have the potential to leverage the less used North Promenade, broadening the appeal of Barmouth and reducing pressure on the popular South Promenade.

3.2.17 The sea defence supports the amenity value of the full promenade, whilst providing coastal protection to the adjacent road, the low-lying Heol y Llan housing estate, the Cambrian Coast Railway Line, a skate-park, restaurant/café, the Hendre Mynach Caravan & Camping Park and the outfalls of two ordinary watercourses.

3.2.18 The Cambrian Coast Railway provides a strategic public transport link to coastal towns in west Wales, including Barmouth. Disruption to this asset would have heavy economic and social implications to the wider county of Gwynedd. Loss of railway service beyond Barmouth would affect 17 stations with considerable social well-being, health and community cohesion implications, particularly affecting those without access to cars.

3.3 Scheme Development

3.3.1 The need for improvement of the coastal defences at Barmouth North Promenade has been investigated over the last decade and in particular since the flood events in 2014.

3.3.2 The Outline Business Case (OBC) [1] describes evolution of the features of the Proposed Development. In 2014, a Project Appraisal Report (PAR) proposed a new highway wall and drainage improvements. The PAR acknowledged that this would not address the issue of overtopping at the source nor would it protect the promenade from flooding. The PAR was later updated in 2017, with a new preferred solution recommending a water retaining bund with control structure and sea outfall. Neither the 2014 nor 2017 PAR received approval from the Welsh Government. A 2018 review of these reports proposed production of an Outline Business Case (OBC), which was produced in 2019, and defined five objectives to guide the project through the subsequent design stages:

- To reduce the threat of coastal flood and erosion risk to people and property with due consideration of The West of Wales Shoreline Management Plan 2 (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.
- Ensure an affordable and deliverable whole life option through a partnership approach and contributions.

3.3.3 A long list of options was developed and then refined to a short list and combined to form adaptive pathways, see Section 3.4. These adaptive pathways were appraised and a preferred option taken forward to the detailed design stage. The OBC was approved and received funding in 2021.

3.3.4 In 2024, YGC appointed Alun Griffiths (Contractors) Ltd., with Arup (the 'AGC Team') to refine the Proposed Development from the OBC and progress the Full Business Case (FBC). The flood defences and placemaking design have been presented to the local community as the option has progressed, through concept (January 2025) to detail design (2026). The community has been consulted on the design and their feedback taken into consideration to refine the Proposed Development.

3.4 Design Evolution

Outline Business Case Stage

3.4.1 At OBC stage, a long list of options was developed and then refined to a short list. The short-listed options were combined to form adaptive pathways to allow the implemented solution to respond to the uncertainty of climate change and the change in SMP2 policy between epochs, from a hold the line policy to managed realignment.

3.4.2 The short-listed options at OBC stage, selected within a workshop (January 2019), are listed in Table 3-1. These options were transformed into adaptive pathways considering the short, medium and long-term over the next 100 years to best respond to evolving future challenges. The eight adaptive pathway options are presented in Table 3-2.

Table 3-1 Overview of OBC short-listed options [1]

Option		Description
1	Baseline (Do-Nothing and Do-Minimum)	Business As Usual. Cyngor Gwynedd reactive maintenance is not able to address the significant defects with the existing defences. Walkaway residual life is estimated at ~10 years. Erosion at defence toe, loss of pile section and voids from loss of fines risks revetment failure and defence breach inundating the wider flood cell (Heol-Y-Llan housing estate and central Barmouth). Measures to protect or replace the sheet pile section and arrest the abrasion/ corrosion are likely to be significant and are not a Business As Usual intervention.
2	Betterment of existing defences	Works to extend the life-span and improve the standard of protection of the existing defences: • Extend the life of the existing sheet piles with refurbishment works. • Raise or replace the primary seawall (depending on structural condition and hydraulic performance) and flood wall. • Add protection to the structure toe in the form of a rock-toe or shingle beach profile (where stability allows). • Improve demountable barriers and drainage improvements
3	Beach Management and Associated Structures (i.e., groynes/ breakwaters)	Combination of rock breakwaters offshore and/or shore-linked groynes to hold the placement of beach material and dissipate wave energy offshore. For an offshore breakwater to be effective in reducing the risk to Barmouth, it would have to be constructed relatively close to shore (within a few hundred metres). An effective offshore breakwater would require

Option		Description
		considerably more rock armour to construct than a rock armour structure adjacent to the promenade.. It would also: - Be close enough to shore that people can access it (either walking or swimming), with a residual risk of entrapment. - Present a major navigational hazard - Have a major visual impact, especially at low tide - Have a detrimental effect on the Special Area of Conservation - Be more expensive to construct and maintain. Coarser shingle beach re-charge material would be introduced to promote and encourage a sustainable beach level. Works to extend the life of the existing sheet piles required.
4	New line of defence set back at the railway (i.e., Managed Realignment)	New line of defence to protect the railway line, allowing the area directly behind the seawall to be subject to erosion. Options include: • **Option 4a:** Defence line set back along full length of promenade (as per 2011 SMP2) • **Option 4b:** Defence line set back along northern end of promenade only (protecting residential properties). Beach management (similar to Option 3) protecting properties to south.

Table 3-2 OBC Adaptive pathway scenarios [1]

	Epoch 1 0-20 years	Epoch 2 20-50 years	Epoch 3 50-10 years
Pathway A	Option 2: Betterment of defences *Precautionary SOP reducing to 1 in 50 by 2069*		Option 4: Managed realignment (SMP2) *Adaptive SOP 1 in 200*
Pathway B	Option 2: Betterment of defences *SOP 1in 200 in 2019*	Option 4: Managed realignment (SMP2) *Adaptive SOP 1 in 200*	
Pathway C	Option 2: Betterment of defences *Precautionary SOP reducing to 1 in 50 by 2069*		Option 3: Beach Management *Adaptive SOP in 200*
Pathway D	Option 2: Betterment of defences *SOP 1in 200 in 2019*	Option 3: Beach Management *Adaptive SOP in 200*	
Pathway E	Option 3: Beach Management *Adaptive SOP in 200*		
Pathway F	Option 3: Beach Management *Adaptive SOP in 200*		
Pathway G	Option 2: Betterment of defences *Precautionary SOP reducing to 1 in 50 by 2069*		Option 4b: Managed realignment (North Only) *Adaptive SOP 1 in 200*
Pathway H	Option 2: Betterment of defences *SOP 1in 200 in 2019*	Option 4b: Managed realignment (North Only) *Adaptive SOP 1 in 200*	

Note: SOP – Standard of Protection

3.4.3 At the OBC stage, Pathway G was chosen as the preferred option on the basis that it was the most economically favourable option that would achieve a 1 in 50 2069 Standard of Protection (SOP). This provides flood protection in the medium term, later transitioning to a policy of managed realignment, in line with

the SMP2. *Option 2: Betterment of Existing Defences* was further developed to reduce uncertainties associated with the Epoch 1 works, details of Option 2 are provided in Table 3-3.

Table 3-3 Summary of OBC Preferred Option features

Area/Structure	OBC Preferred Option
Beach	300m of rock armour revetment to be provided to protect the primary sea wall to the north of the frontage. 560m of shingle beach profile to be built out to better protect the primary sea wall. Extents to be defined during detailed design, dependant on stability of shingle material due to coastal processes.
Groynes	No reliance on existing or installation of new groynes.
Sea wall revetment	Voids in substructure to be repaired. Sheet piles to be replaced over approximately 515m length.
Primary wave wall	No reliance on existing wave wall.
Central wall	Wall to be replaced to act as primary wave wall with crest level increased by +0.6m (from 5.65mOD to 6.25mOD) over a length of approximately 1.2km.
Secondary wall	Wall to be re-built structurally and increased by +0.45m (from 6.4mOD to 6.85mOD) over a length of approximately 1.1km to act a flood wall to contain coastal flooding and overtopping.
Demountable flood defences	Allowance for 2no. flood gates.
Promenade	Remediating voiding to promenade. Budget allowance for landscaping to 5no. dwell areas.
Highway	Excluded
Outfalls	Refurbishment of existing culverted outfall flap values.

Full Business Case Stage

3.4.4 During the Full Business Case (FBC) Stage, the OBC preferred option has been refined based on further testing and analysis. This section covers the key design decisions made as part of this process.

Coastal Defence

Standard of protection and design life

3.4.5 The Proposed Development has been designed to provide a standard of protection to 2075. Providing a standard of protection further than this (for example to the end of epoch 3) would not be in line with the SMP policy. It would also increase the negative impacts of the Proposed Development, in particular seascape and landscape; carbon and community considerations given the need for considerably larger defences with a higher standard of protection.

Groynes & Coastal Processes

3.4.6 The existing groynes on the beach are known to be in poor condition.

3.4.7 Movement of beach material via wave action (longshore drift) is minimal, and therefore the groynes do not provide significant performance benefits to the scheme. They also reduce the amenity value of the beach and ability to traverse

it from north to south and vice versa. Some wind-blown transport of beach material does occur, but is not generally affected by the groynes.

3.4.8 The groynes also pose a risk to public safety given their poor condition, which is likely to deteriorate further and increase the likelihood of structural collapse. It was therefore decided to remove the groynes from the beach, with suitable mitigation measures installed to replace the habitat for blue mussels (as described in ES Volume 2-Chapter 6 Biodiversity and Protected Sites).

Rock Revetment

3.4.9 The OBC preferred option included sections of both beach recharge and a rock revetment in front of the promenade. These options were reviewed at FBC stage:

- Beach recharge only.
- Rock revetment only.
- A combination of rock revetment and beach recharge.

3.4.10 It was agreed that a solution that only utilises a rock revetment was preferred, on the basis of technical performance, environmental impact and cost. In particular the reduced quantities of material (and subsequent impact on traffic volumes), impact on protected species and impact on the beach's recreational value.

3.4.11 The size of the rock revetment has been refined extensively utilising physical model testing to confirm the width of revetment and size of rock armour are appropriate in reducing the volumes of overtopping in line with the Proposed Development's aims.

3.4.12 In particular, an option to raise the top level of the rock armour by an extra layer which would then sit on the existing concrete promenade was considered, but discounted due to the limited benefit in comparison with the additional material and associated carbon, traffic and cost impacts.

The design of the Proposed Development at PAC showed the Southern extents of the rock armour extending to a point adjacent to Heol Idris. Subsequent coastal and hydraulic modelling has shown that the Southern extent can be further north (adjacent to Heol-y-Plas) without adversely affecting flood risk. This reduces the amount of rock armour required, with positive impacts on cost, carbon and environmental impact, as well as reducing the impact on the visual and amenity value of the beach. This extents of the rock armour was raised as a concern in public consultations.

Rock Revetment - Northern Extension

3.4.13 At OBC stage, a defence was proposed extending to the North of the promenade adjacent to the Cambrian Coastal railway. This design has been developed to prevent water overtopping the railway and subsequently outflanking the secondary wall to cause flooding. A number of options were considered to address this, including:

- Raised defences (a wall or bund) on the landward side of the railway. Through inundation modelling it was shown that this would cause detriment to a number of properties, and so was not developed further, as well as being difficult to construct.

- A wall immediately adjacent to the railway. This would introduce considerable risk to the railway line in the temporary (and possibly permanent) case, as well as having a much-increased impact on coastal processes in the area. The performance of such a solution would also not be guaranteed.
- Extending the new rock revetment as symmetrical section beyond the north promenade for 125m, in front of the existing shingle berm.

3.4.14 Through further inundation flood modelling and physical modelling of the shingle embankment, the need for this element of the defence has been shown not to be required, therefore the Proposed Development would not include any works beyond the end of the existing Northern Promenade, except for a tie-in detail of the Rock Revetment to the promenade wall (as it returns inland) and to the existing shingle embankment.

Primary Wall

3.4.15 The OBC preferred option showed that the central wall would be replaced with a new 'alternative primary' wave wall, with no reliance on the existing primary wall given uncertainty over its condition.

3.4.16 During FBC, possible options for the primary wave wall were explored, including:

- Constructing a new, higher primary wave wall on the existing alignment.
- Constructing a new, higher 'alternative primary' wave wall on the alignment of the current central wall, as the OBC preferred option.
- Remediation of the existing primary wall, relying further on the rock revetment solution for the protection of the base of the revetment, reduction of overtopping, and limited reliance on the central wall.

3.4.17 It was agreed that a new higher primary wave wall would not be developed, based on the significant costs of investigations into the primary wall, the cost of construction and the negative impact on landscape and seascape.

3.4.18 Investigations into the primary wave wall were carried out to determine the extent of likely repairs required to achieve the agreed design life. These determined that the primary wall was in relatively good condition, requiring localised repairs only (for instance new joints).

3.4.19 Additionally, the decision to utilise a rock revetment only (without beach recharge) was identified to reduce loading on the primary wall, reducing the risk of structural failure.

3.4.20 Due to these findings, the decision was made to retain the existing primary wall without raising it.

Central Wall

3.4.21 Raising the central wall to act in a similar manner to the primary wall to reduce overtopping was considered (similar to the 'alternative primary' option considered at OBC). However, analysis showed that to meaningfully reduce overtopping, the central wall would need to be prohibitively high (>2m), with a significant negative impact on visual amenity, embodied carbon and construction cost. For this reason, it was decided the central wall would provide a traffic separation role between the highway and promenade only.

3.4.22 A concrete wall with dimensions similar to the existing (0.5m x 0.5m) was investigated, with the purpose of providing a more robust structure with reduced maintenance requirements. However, the foundation size was found to be prohibitively large (>3m) in order to withstand sufficient wave loading. This would significantly reduce the structural integrity of the overall promenade, and would result in unacceptable levels of structural risk.

3.4.23 Instead, the central wall would be replaced by a kerb and balustrade to provide separation.

Secondary Wall

3.4.24 The height of the secondary wall, and need for a recurve shape, was tested extensively via physical and inundation modelling to arrive at the final design. This balances the need to limit overtopping to protect properties from flooding with the visual impact of the increased height of the secondary wall.

3.4.25 The modelling demonstrated that a 1.55m recurve wall would provide the required standard of protection until approximately 2055. At this point, the section of wall in front of properties (starting 52.7307N, -4.0677E) would need to be raised 150mm to a height of 1.7m to continue providing this standard of protection.

3.4.26 The sheetpile foundation and floodgate pillars would be designed to allow for this future change. However, the change wouldl be subject to a separate business case and consenting process.

3.4.27 A sheet pile foundation is required for stability and to prevent seepage.

<u>Northern Extent</u>

3.4.28 At the northern end of the Site, the alignment of the secondary wall has considered flood risk performance alongside visual impact, cost and carbon.

3.4.29 This has resulted in the secondary wall being set back behind the car park (instead of on the seaward side) for multiple reasons, including:

- Height of the wall can be reduced, given the increased distance from the primary wall and reduced overtopping volumes.
- Similarly, removed need for recurve and sheet-pile cut-off.
- Creates accessible and cohesive use of the space, increasing amenity value.
- Allows inclusion of additional green space to enhance the amenity and biodiversity value of the area.

Flood Gates

3.4.30 Flood gates have been positioned where access is required (either to entry to buildings or to other roads) through the secondary wall during normal conditions, but flood defence is required during a storm event. The number of flood gates has been minimised to reduce operational risk. ‘Up-and-over’ ramps have been excluded given the restrictions on space on either side of the wall and the height of the wall.

3.4.31 Gates have been chosen as opposed to stop logs or other ‘drop in’ barriers to reduce operational risks. The only exception to this is where the Proposed

Development is to retain the existing Network Rail stoplogs through the primary wall to the shingle beach to the north of the promenade.

3.4.32 Flood gates were considered in the primary wall alignment at the top of the northern and southern ramps. Feasibility concerns were raised due to wave impact loading as well as the impact their closure would have on promenade drainage, potentially increasing flood risk. For these reasons, the Proposed Development does not include flood gates in these locations.

Drainage

3.4.33 The addition of a non-return valve to the surface water culvert under the promenade by the café was shown to reduce flood risk through inundation modelling, and has therefore been included in the scheme.

3.4.34 Further survey identified the surface water culvert by the café outfalled under the proposed rock revetment. To retain functionality, this wouldl be extended as part of the proposed development.

3.4.35 Existing drainage routes on the promenade would be retained, outfalling through drainage holes and ramp access through the primary wall.

Promenade

Parking

3.4.36 The layout of the promenade has been designed to maintain, and where possible increase, the number of available parking spaces. This includes in the North car park as well as on-street parking on the promenade itself.

3.4.37 On-street parking has been moved from the seaward side of the carriageway (adjacent to the central wall) to the landside (adjacent to the pavement). This reduces the risk of people exiting the car conflicting with traffic on the highway and providing immediate access to the pavement.

Access

3.4.38 A key aim of the approach to the design of the scheme has been to improve access both around the promenade and between the promenade and the beach. This includes the provision of new drop kerbs, stairs and ramps.

3.4.39 New stairs wouldl be constructed at the locations of the existing, heavily damaged, steps to the beach. This is to reduce the impact on the primary wall (existing gaps would need to be filled in and new ones created to incorporate new locations). The height of the parapet and handrail have been designed to balance the need for edge protection and support with reducing the risk of damage of a full-height handrail.

3.4.40 Ramps are at a minimum gradient of 1:21 in line with BS 8300-1:2018 and CD353, and include landings at changes of direction. This makes them considerably more accessible than the current landings (1:12 gradient and steeper) while reducing the size of revetment and subsequent impacts on cost, carbon and construction programme.

3.4.41 The location of formalised crossings along the promenade has been combined with parking design and analysis of pedestrian movement routes. The crossing points have been designed to improve accessibility across the promenade, as well as reducing the risk of vehicle collisions and slowing down traffic.

Lighting

3.4.42 Lighting on the promenade has been proposed to increase safety of pedestrians and vehicles, whilst reducing light spill to sensitive habitats, as described in ES Volume 2-Chapter 2 Project Description.

3.4.43 Alternatives considered include low-level lighting (via bollards or similar) or separate lighting columns for the promenade and Marine Parade. However, both would increase light spill to sensitive habitats, and so were discounted.

Summary

3.4.44 Throughout the design of the Proposed Development, alternatives have been considered in relation to appropriate adaptive pathways and how best to achieve betterment of the existing defences within the constraints of the Site. The Proposed Development presents the optimal balance of providing flood protection to Barmouth, while increasing the amenity and recreational value of the local area and enhancing the natural and historic environment.

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
NRW	Natural Resources Wales
OBC	Outline Business Case
SMP	Shoreline Management Plan
YGC	Ymgynghoriaeth Gwynedd Consultancy

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Cyngor Gwynedd

Barmouth North Promenade FAS

ES Chapter 4 EIA Approach

Reference: BMTH-ARP-EGN-ZZ-RP-OE-000006

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Contents

4. EIA Approach **2**
4.1 Introduction 2
4.2 Need for EIA 2
4.3 EIA Scoping 4
4.4 Stakeholder Engagement 6
4.5 Assessment, Mitigation and Residual Effects 6
4.6 Cumulative and In-combination Effects 14
4.7 Assumptions and Limitations 15
4.8 Other environmental assessments 15
4.9 Competent Experts 16
Abbreviations List **17**
References **18**

Tables

Table 4-1 Summary of ES Requirements (EIA Regulations) 3
Table 4-2 Summary of EIA topics scoped in and out 5
Table 4-3 Definitions of sensitivity 11
Table 4-4 Definition of Magnitude 11
Table 4-5 Significance Matrix 12
Table 4-6 Indicative significance criteria for use within the EIA 12

4. EIA Approach

4.1 Introduction

4.1.1 This chapter sets out the purpose of the Environmental Impact Assessment (EIA) process and the approach taken to identify and assess the likely significant effects of the Proposed Development.

4.1.2 The chapter describes the scope and methodology and the overall approach being undertaken for the EIA, as well as details of engagement undertaken to date. Further details of topic specific methodologies, such as survey methods, are detailed within ES Volume 2- Chapters 5 to 13.

4.1.3 EIA involves a process of drawing together, in a systematic way, an assessment of a project's likely significant environmental effects, and presenting this information within an Environmental Statement (ES) for consideration by the determining authority when determining a planning application.

4.1.4 The EIA process includes the following key characteristics:

- Systematic – the EIA is comprised of a series of tasks that are defined by regulation, guidance and accepted industry practice.
- Analytical – the EIA must be used to inform the decision making rather than promote the project itself.
- Consultative – the EIA process must allow for and provide opportunity for interested parties and statutory consultees to provide feedback on the project and assessments undertaken.
- Iterative – the EIA process should allow for environmental concerns to be addressed during the planning and design stages of the project.

4.2 Need for EIA

4.2.1 The requirement to undertake an EIA is prescribed in the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 as amended (the TCPA EIA Regulations) and in the Marine Works (Environmental Impact Assessment) Regulations 2007 as amended (the Marine EIA Regulations), collectively referred to throughout as the EIA Regulations.

4.2.2 An EIA Screening Opinion regarding whether the Proposed Development constitutes EIA development was sought from Cyngor Gwynedd and NRW on 8 September 2023 and 26 September 2023 respectively.

4.2.3 A Screening Opinion was issued by Cyngor Gwynedd on the 27 October 2023 concluding that the Proposed Development constitutes EIA development under Schedule 3 of the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017. Refer to ES Volume 3, Appendix 1.2.

4.2.4 A Screening Opinion was issued by NRW on the 22 November 2023 (reference SC2304) confirming that the Proposed Development constitutes EIA development under the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended). This opinion also confirms the application required for the proposed works for a marine licence under Part 4 of the Marine and Coastal Access Act 2009 must be accompanied by an ES. Refer ES

Volume 3, Appendix 1.3. As such, an Environmental Statement (ES) has been prepared to accompany the planning application and marine licence application.

4.2.5 A Scoping Report was prepared by YGC and submitted to Cyngor Gwynedd and NRW on 06 February 2024 and 09 February 2024 respectively. A Scoping Opinion was issued by Cyngor Gwynedd and NRW on 30 April 2024 and 19 April 2024 respectively. As such the ES has been prepared based upon Cyngor Gwynedd and NRWs Scoping Opinions, in accordance with the EIA Regulations. The ES presents the findings of the EIA undertaken for the Proposed Development. Refer to ES Volume 3, Appendix 1.4 to 1.6.

4.2.6 Part 5, regulation 17 (3) of the TCPA EIA Regulations and Regulation 12 (2) (b) of the Marine EIA Regulations list the information that should be included in an ES. This is outlined in Table 4-1~~Table 4-1~~ below together with details of where this information can be found in the ES.

Table 4-1 Summary of ES Requirements (EIA Regulations)

Part 5, regulation 17 (3) Requirement	Regulation 12 (2) (b)	Where assessed/included in the ES
A description of the proposed development comprising information on the site, design, size and other relevant features of the development	A description of the project and the regulated activity, comprising information on the site, design, size and other relevant features of the project and the regulated activity;	ES Volume 2, Chapter 2 Project Description
A description of the likely significant effects of the proposed development on the environment	A description of the likely significant effects of the project and the regulated activity on the environment;	ES Volume 2, Chapters 5 to 14 (topic chapters)
A description of any features of the proposed development, or measures envisaged in order to avoid, prevent or reduce and, if possible, mitigate likely significant adverse effects on the environment	A description of the features of the project and the regulated activity or the measures envisaged in order to avoid, prevent or reduce and, if possible, mitigate likely significant adverse effects on the environment;	ES Volume 2, Chapters 5 to 14 (topic chapters)
a description of the reasonable alternatives studied by the applicant or appellant, which are relevant to the proposed development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the significant effects of the development on the environment	A description of the reasonable alternatives studied by the applicant which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment;	ES Volume 2, Chapter 3 Need and Alternatives
a non-technical summary of the information referred to in sub-paragraphs (a) to (d); and	A non-technical summary of the information referred to in paragraphs (i) to (iv)	ES Volume 1 – Non-Technical Summary
Any additional information specified in Schedule 4 relevant to the specific characteristics of the particular development or type of development and to the environmental features likely to be significantly affected	Any additional information specified in Schedule 3 relevant to the specific characteristics of a particular project or type of project and to the environmental features likely to be affected	ES Volume 2, Chapters 5 to 14 (topic chapters)

4.3 EIA Scoping

4.3.1 Scoping is the process of identification, at the early stages of a project, of the likely potential significant environmental effects that may arise as a result of a proposed development. Scoping establishes what assessments will be carried out for the EIA and for what phases of the development they would apply to. As part of this process, a request for an EIA Scoping Opinion is submitted to the planning authority (in this case Cyngor Gwynedd and NRW Marine Licencing Team). Scoping helps to ensure that environmental issues and potential effects are assessed at the appropriate level of detail within the EIA. Where a scoping opinion has been issued, the ES must be based on the most recent scoping opinion so far as the Proposed Development remains materially the same as the Proposed Development which was subject to the opinion.

4.3.2 As part of the scoping opinion process, Cyngor Gwynedd and NRW consulted with a number of statutory consultees to inform their Scoping Opinion. These included:

- Biodiversity Unit/Biodiversity Officer Cyngor Gwynedd.
- Cadw.
- Chamber of Shipping.
- Dwr Cymru Welsh Water.
- Gwynedd Archaeological Planning Service (GAPS).
- Marine Enforcement - Marine & Fisheries Division.
- Maritime and Coastguard Agency (MCA).
- Ministry of Defence (MoD).
- National Air Traffic Services (NATS).
- Natural Resources Wales.
- Natural Resources Wales Advisory (NRW A).
- Public Health Wales.
- Public Protection Unit Cyngor Gwynedd.
- The Crown Estate (TCE).
- Trinity House (TH).
- Welsh Archaeological Trusts (now Heneb).

4.3.3 The EIA Scoping Opinion comments and consultation responses that informed the EIA Scoping Opinion have been taken into account in relation to each relevant ES topic chapter. Each topic chapter provides a summary of how the Scoping Opinion responses have been addressed within the assessments and the design development (refer to ES Volume 2, Chapters 5 to 13).

4.3.4 The EIA Scoping Opinions confirmed its broad agreement with the scoping report and provided further information to be provided for individual topics, which are outlined and addressed within the topic chapters.

4.3.5 As part of the Scoping Opinion from NRW Marine Licensing Team it was also confirmed that the EIA should consider potential impacts on shipping and navigation in response to comments provided by the MCA *'the MCA have stated that it would be useful to confirm what (if any) construction works will be undertaken in the marine environment and whether the proposed scheme introduces any new potential hazards to other marine users.'*

4.3.6 As described in ES Volume 2, Chapter 2 Project Description, two options are being considered for delivery of rock armour, by road or by sea. The methodology for the delivery of rock armour by sea has been set out in Chapter 2. No further assessment has been undertaken in regard to shipping and navigation due to the nature of the method of delivery and consideration that this would not introduce new hazards to other marine users. Engagement has been undertaken by YGC with MCA and NRW to confirm the approach to assessment of the rock armour delivery by sea. It was confirmed by the MCA from correspondence on 11 July 2025 that shipping and navigation may be scoped out of the assessment and a description of the ship movement methodology is provided within the project description. This is supported by NRW that a separate assessment on shipping and navigation would not be required if agreed by the MCA on this approach. Refer to ES Volume 3, appendix 4.1, MCA and NRW correspondence regarding shipping and navigation.

4.3.7 The scoping process is a beneficial stage in the EIA process which is best undertaken early in the development design process to inform the EIA and allow for embedded ~~mitigation~~ environmental design features early in the design development. As described, EIA is an iterative process, therefore as the design has evolved the scope of the EIA has been reviewed and discussions have been held with Statutory Stakeholders to ensure that the scope of the assessment remains appropriate.

4.3.8 A summary of topics scoped in and out of this ES is presented in Table 4-2~~Table 4-2~~.

Table 4-2 Summary of EIA topics scoped in and out

Topic	Scoped in	Scoped out
Air Quality	Yes	-
Community Considerations (including traffic and transport)	Yes	-
Noise and Vibration	Yes	-
Biodiversity, including protected species and habitats	Yes	-
Geology and Soils	-	Yes
Marine and coastal physical process	Yes	-
Seascape and Landscape and Visual	Yes	-
Flooding and Water Quality	Yes	-
Climate Change	Yes	-
Cultural Heritage	Yes	-
Shipping and Navigation	-	Yes
Cumulative and In-Combination Effects	Yes	-

4.4 Stakeholder Engagement

4.4.1 Non-Statutory Consultation with Cynor Gwynedd and other key statutory stakeholders has been undertaken throughout the pre-application process in order to agree and refine the scope of the EIA and any baseline surveys or investigations required to inform the assessment, agree approaches to assessment, and the need for embedded ~~mitigation~~ environmental design measures through the design or by other means.

4.4.2 Key consultees and consultation undertaken to date for each of the environmental topics are discussed in ES Volume 2, Chapters 5 to 13.

4.5 Assessment, Mitigation and Residual Effects

4.5.1 EIA is a staged, iterative process. The assessment of the proposed development has been undertaken in accordance with the EIA Regulations.

4.5.2 Once the scope of the EIA had been established, individual environmental topics were subject to survey and investigation to establish the baseline conditions. This was followed by an assessment to identify and predict the significance of the likely environmental effects of the proposed development. The assessment methodologies applied are based on recognised best practice and topic specific guidance; relevant details of assessment methodologies are provided within the appropriate topic assessment chapters of this ES.

4.5.3 The technical studies that have been undertaken for each topic have generally followed the same approach, as follows:

- Scope of assessment – describing the considerations taken when determining the scope of the assessment, including impacts and effects that have been scoped out.
- Determining the assessment methodology – defining the methods used to define the environmental baseline, and the prediction and assessment of likely significant effects on identified receptors and setting out any assumptions and limitations applicable to the assessment.
- Collection and collation of existing baseline information of the study area in addition to any supplementary survey work required to fill any data gaps or to update any outdated information. The study area for each topic is determined at the scoping stage and agreed through the EIA Scoping Opinion.
- Frequent consultation with both internal specialists within the team and relevant external consultees. This has been both within and across topic areas.
- Consideration of the potential impacts and effects of the proposed development on the existing baseline, followed by identification of possible design changes that would lead to the avoidance or reduction of predicted adverse effects (and likewise the enhancement of any positive effects).
- Assessment of the final design and evaluation of the significance, identification of any further mitigation requirements, and an assessment of any residual and cumulative effects.
- Compilation of the relevant ES chapter.

4.5.4 The approach to each of these key stages is discussed in more detail below.

4.5.5 A cumulative assessment has also been undertaken across the topic areas and is presented within ES Volume 2, Chapter 14 Cumulative Effects, including the approach to the assessment. In-combination effects have been assessed within the topic chapters as part of their assessment.

Baseline

4.5.6 To identify the effects of the Proposed Development on the environment, it is important to understand the existing environment (the 'baseline conditions'). Understanding the baseline allows any changes that would be caused by the Proposed Development to be predicted and assessed.

4.5.7 Baseline data on the existing environmental conditions within and around the site has been obtained based on data sources that include:

- survey information as defined within each topic section.
- aerial photographs and maps of the site and surroundings.
- published documentary information on environmental conditions in the vicinity of the site.
- online environmental data.

4.5.8 Each topic chapter includes a description of the current environmental conditions. This is based on the study area(s) identified for each topic, and the information available.

4.5.9 The ES presents baseline information representing the conditions of the environment at the time of writing. The baseline year is topic specific depending on when the majority of baseline information has been obtained or modelled. For each topic, the most up-to-date data have been used and where this is not possible, justification is provided within the topic chapters.

Future baseline

4.5.10 Paragraph 3 of Schedule 4 of the TCPA EIA Regulations and Paragraph 3 of Schedule 3 of the Marine EIA Regulations establishes the information to be included within the ES, which includes

" A description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge".

4.5.11 This paragraph refers to the need to define the current environmental baseline and, where relevant and technically feasible, the future baseline for a proposed development.

4.5.12 For the purposes of the EIA, the future baseline conditions are identified for all assessment years considered by topics. Assessment years are stated in the assessment methodology section of each topic chapter. The identification of the future baseline conditions involves predicting changes that are likely to happen between now and the relevant future baseline year, for reasons unrelated to the Proposed Development. This entails taking current conditions and committed

development into consideration and using experience and professional judgment to predict what the future baseline conditions might look like prior to start of construction and operation.

4.5.13 The future baseline is defined by considering the changes to the baseline that may result from factors, such as the likely effects of climate change, as predicted at the time of writing.

4.5.14 The future baseline is also defined by considering the changes to the baseline that may result from factors, such as other plans, programmes and developments, that would occur over time in the absence of the Proposed Development. This includes policy-driven changes such as more renewable energy feeding the electricity grid and cleaner vehicles emitting less air pollution. Where there is an expected change in baseline for a topic over time, this change is predicted and reported to enable robust identification of the effects of the Proposed Development against a future baseline.

Spatial and temporal scope

4.5.15 For each environmental topic assessed in this ES, the issues to be addressed are considered within study area(s) (i.e., the spatial scope) within which significant effects may occur, and the periods in time when the issues are assessed (i.e., the temporal scope) are set out in topic chapters. Consideration is given to effects that would arise during construction, and operation (including maintenance). This includes the identification of temporary, permanent, direct, indirect, cumulative and in-combination effects.

4.5.16 The design life of the Proposed Development is discussed in ES Volume 2, Chapter 2 Project Description. The Proposed Development has been developed to provide a standard of protection of a 2% annual exceedance probability event in 2075. From 2075 the Proposed Development will not be decommissioned after this ~~point,but~~point but is expected to cease to be maintained. This will be in line with anticipated updates to the SMP2 policy to Hold The Line for Epoch 2.

Spatial scope

4.5.17 The redline boundary presented on ES Volume 4, Figure 1.1 presents the site area and extent of land expected to construct the Proposed Development and the land required for the Proposed Development. Based on the redline boundary, each topic identifies appropriate study areas taking into account specific receptors or resources under consideration for that topic. Each topic chapter provides a description of the approach taken to define the study area, including ensuring it is of sufficient size to encompass the spatial extent over which impacts relevant to that topic and the related receptors and resources might occur.

4.5.18 The approach to the spatial scope (study area) for each topic assessment takes into account the following factors:

- The physical extent of the Proposed Development.
- The nature of the baseline environment.
- The anticipated type, extent and characteristics of the environmental and social effects.

- Relevant guidance, standards, best practice and legislation.

Temporal scope

4.5.19 The EIA predicts the likely significant effects of the current and future baseline during the construction and operation phases of the Proposed Development.

4.5.20 The construction and operation phases considered within the EIA presented are described as:

- Construction effects, i.e. temporary effects likely to arise from construction activities (e.g. effects of noise and dust on nearby communities) and temporary and permanent existence effects as a result of the physical presence of the Proposed Development (e.g. effects of the use of land on habitats). This would include effects resulting from the activities associated with the construction and installation of the Proposed Development, effects associated with the temporary works such as construction compound areas and work activities, as well as permanent land take.
- Operational effects, i.e. those likely to occur as a result of the operation and maintenance of the Proposed Development.

4.5.21 Effects may extend for a longer period than the phase in which the effects originally occur. For example, effects as a result of vegetation clearance during construction may be experienced for a number of years after construction has been completed, until any replanted habitats have matured. For the purposes of the EIA, the effects are described under the phase within which the impact arises (i.e. in the above example, vegetation loss assessed for the construction phase).

4.5.22 The environmental assessments use defined temporal scales to characterise the duration of potential effects. For the purposes of assessment, the following definitions are applied unless otherwise defined in topic chapters. These are based on professional judgement and the characteristics of the Proposed Development:

- Short-term: This is assumed to be temporary effects during the construction phase. Up to 2 years.
- Medium-term: This is used to describe effects with a duration of 5 years, which are typically post construction.
- Long-term: This is used to describe effects with a duration that extends longer than 15 years post construction.

Parameter approach

4.5.23 In assessing the effects of the Proposed Development from an environmental perspective, the principle of the ‘Rochdale Envelope’ is applied. This approach involves establishing a maximum design envelope within which the final detailed design of the Proposed Development will sit.

4.5.24 The Rochdale envelope provides flexibility in design options where details of the whole project are not available when the application is submitted, while ensuring the impacts of the final development are fully assessed during the EIA. This approach has been adopted from case law primarily from R. v Rochdale MBC ex

parte Milne (No. 1) and R. v Rochdale MBC ex parte Tew [1999] and R. v Rochdale MBC ex parte Milne (No. 2) [2000]. These cases dealt with outline planning applications for a proposed business park in Rochdale.

4.5.25 This approach is based on a precautionary, realistic worst-case scenario(s) which then feeds through into any necessary mitigation measures identified. Guidance on the Rochdale Envelope for the EIA has been based on the Planning Inspectorate Advice Note Nine: Rochdale Envelope [1] which sets out the approach, and case law which sets a precedent that outline planning permission should be based on a realistic worst-case approach, and that ES assessments should be consistent with the defined parameters in the application to ensure a robust assessment of the likely significant effects.

4.5.26 These parameters are defined in ES Volume 2, Chapter 2 Project Description. This provides clear parameters for environmental assessment, whilst allowing for flexibility of ongoing design evolution. Each topic assessment therefore establishes those parameters likely to result in the maximum adverse effect (the likely worst-case scenario) and an assessment is undertaken on this basis. For example, impacts resulting from road traffic are assessed taking into account the use that will have the greatest adverse impact on the road system, whereas the landscape and visual assessment takes account of the land use which will have the greatest impact on views (e.g. the height of any materials or structures).

Assessment of significance

4.5.27 The EIA Regulations require the identification of the likely significant effects of the Proposed Development. This includes consideration of the likely significant effects during the construction and operation phases of the Proposed Development. The assessment of the significance of effects for the majority of topics is based on a three-step process:

- Assigning value (or sensitivity) to receptors or resources.
- Assigning magnitude of impact.
- Assigning significance.

4.5.28 Professional judgement, along with relevant and accepted guidance is used within each assessment chapter to assess the interaction between receptor value (i.e. its importance or sensitivity) and the predicted magnitude of change to identify whether an effect is significant and what level of significance should be assigned (e.g. high, medium, low or negligible significance). In some cases, this is based on quantitative assessment whereas in others, it is only possible to use professional judgement and qualitative assessment. In all cases, clear justification for the assessment approach has been set out along with all assumptions and limitations.

4.5.29 Where there are no topic specific standards/guidance for assessing significance, the criteria set out in Table 4-3~~Table 4-3~~ for sensitivity of receptor, and Table 4-4~~Table 4-4~~ for magnitude of effect, have been combined to provide an assessment of significance as defined in Table 4-5~~Table 4-5~~ below.

Table 4-3 Definitions of sensitivity

Level of sensitivity	Definition of sensitivity examples
High	Environment is subject to major change(s) due to impacts: e.g. species present in nationally important numbers, or globally threatened; Special Area of Conservation; National Park; World Heritage Site; a panoramic viewpoint
Medium	Environment clearly responds to effect(s) in a quantifiable and/or qualifiable way: e.g. species present in locally important numbers; people travelling on roads; lowland agricultural landscape; an archaeological feature that is not unusual but cannot be considered common.
Low	Environment responds in a minimal way, or not at all, to effect(s) such that only minor, or no, changes are detectable: views from softwood commercial plantation; an archaeological feature that is common, or has been mostly destroyed; common, widespread species,

4.5.30 The magnitude of the effect on the baseline can then be assessed considering the scale, extent of change, nature and duration of effect.

Table 4-4 Definition of Magnitude

Level of Magnitude	Definition of magnitude
High	Total loss or major alteration to key elements/ features/ characteristics of the baseline (pre-development) conditions such that post development character/composition/attributes of baseline will be fundamentally changed.
Medium	Partial loss or alteration to one or more key elements/ features/ characteristics of the baseline (pre-development) conditions such that post development character/ composition/ attributes of baseline will be partially changed.
Low	Minor loss of or alteration of the baseline. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of the baseline condition will be similar to pre-development circumstances/patterns.
Negligible	Very minor loss or alteration to one or more key elements/features/characteristics of the baseline (pre-development) conditions. Change barely distinguishable, approximating to the “no change” situation.

4.5.31 Using these definitions, a combined assessment of sensitivity and magnitude can then be undertaken to determine how significant an effect is, as demonstrated in Table 4-5~~Table 4-5~~. Where the table presents two potential conclusions, professional judgement has been applied.

4.5.32 Where effects are classified as being of moderate and/or major significance (either beneficial or detrimental), the effect is considered significant in EIA terms. Table 4-6~~Table 4-6~~ provides a description for each of these criteria definitions.

4.5.33 The majority of assessments have used these criteria; however where there is deviation, this is explained and justified within each of the topic assessment chapters.

Table 4-5 Significance Matrix

Significance Matrix				
		Sensitivity		
		Low	**Medium**	**High**
Magnitude	**High**	Moderate	Major or Medium	Major
	Medium	Minor or Moderate	Moderate	Major or Moderate
	Low	Minor	Minor or moderate	Moderate
	Negligible	Negligible	Negligible	Negligible

Table 4-6 Indicative significance criteria for use within the EIA

Significance	Criteria
Major	These effects are likely to be important considerations at an international/national, regional or district scale and, if adverse, are likely to constitute key considerations for the project, depending upon the relative importance attached to the issue during the decision-making process. Mitigation measures and detailed design work are unlikely to remove all of the effects upon the affected receptors, communities or interests.
Moderate	These effects, if adverse, while important at a local scale, are not likely to be key decision-making issues. Nevertheless, the cumulative effect of such issues may lead to an increase in the overall effects on a particular area or on a particular resource. They represent issues where effects will be experienced but mitigation measures and detailed design work may ameliorate/enhance some of the consequences upon affected receptors, communities or interests. Some residual effects may still arise.
Minor	These effects may be raised as local issues but are unlikely to be of importance in the decision-making process. Nevertheless, they are of relevance in the detailed design of the project and in the consideration of mitigation or compensation measures.
Negligible	No effects or those which are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

Mitigation

~~4.5.33~~4.5.34 The EIA Regulations require the ES to include a description of the measures envisaged to avoid, prevent, or reduce and, if possible offset likely significant adverse effects on the environment. In broad terms, the EIA and design incorporate mitigation measures following a hierarchical system (i.e., mitigation hierarchy) as follows:

- Avoidance and prevention: design and mitigation measures to prevent the effect (e.g., alternative design options or avoidance of environmentally sensitive sites).
- Reduction: where avoidance is not possible, then mitigation is used to lessen the magnitude of impact or significance of effects.
- Remediation: where it is not possible to mitigate (i.e. avoid or reduce) a significant adverse effect, these are measures incorporated within the Proposed Development to offset the adverse effect (e.g. new habitat to compensate for habitat loss elsewhere).

~~4.5.34~~4.5.35 Mitigation is defined below, falling into three categories:

- Embedded ~~mitigation~~environmental design measures: modifications to the location or design of the Proposed Development which are an inherent part of the design for the purpose of avoiding, preventing or minimising likely significant adverse environmental effects. For example, reducing the height of a development to reduce visual impact; or identifying a key habitat that should remain unaffected and therefore avoiding the habitat.

- Additional mitigation: further measures or actions required to reduce likely significant adverse environmental effects over and above that embedded within the design. For example, replacement of a feature that would be lost such as intertidal features that cannot be avoided. These measures are identified during the EIA process to further prevent, reduce and, where possible, offset any adverse effects on the environment and are described in the relevant topic chapters within the Mitigation and Enhancement sub sections.

- Construction good practice measures: measures to reduce reasonably foreseeable impacts that are undertaken to meet existing legislative requirements, or actions that are considered to be standard best practices used to manage commonly occurring environmental effects~~. Measures to be implemented in construction and operation are presented in the outline EMP (document reference BMTH-ARP-EGN-ZZ-RP-OE-000011) provided as part of the planning application and marine licence submission documents~~. ~~F~~An Outline Construction Environmental Management Plan (CEMP) which sets out considerate contractors' practices for managing activities which have potential nuisance and environmental effects, such as the spillage of fuels, oils or other chemicals is provided as part of the submission documents ~~(document reference: XXX)~~ that includes all identified topic construction measures set out in the ~~EMP~~ ES to be adopted during construction to avoid and reduce environmental effects, such as pollution control measures. ~~**[AGC TO CONFIRM DOCUMENT REFERENCE].**~~

~~4.5.35~~4.5.36 This ES reports on the likely significant effects of the Proposed Development following the implementation of embedded ~~mitigation~~ environmental design measures and construction good practice measures (as described within ES Volume 2- Chapters 5 - 13, Embedded Environmental Design Measures section). It then reports on the likely significant effects of the Proposed Development following the implementation of any additional mitigation (as described in ES Volume 2- Chapters 5 - 13, Mitigation and Enhancement section), which are known as 'residual effects'. Where additional mitigation is required, mitigation measures are described in the Mitigation and Enhancement subsection of each topic chapter of this ES.

~~4.5.36~~4.5.37 Where appropriate, proposed monitoring measures are set out within the topic chapters.

Enhancement

~~4.5.37~~4.5.38 Enhancement is defined as measures taken to achieve a net benefit, which are unrelated to an adverse impact, or which go beyond that required to mitigate/compensate for an impact. For example, restoration of a degraded habitat to leave it in a measurably better state than it was before the Proposed Development, or other interventions to leave a positive legacy for the environment and community. Planning Policy Wales (PPW) requires

development to implement enhancement measures to contribute to Biodiversity Net Benefit. This is described further in Section 4.8.

4.5.384.5.39 Enhancement measures that have been identified as part of the design process on a topic-by-topic basis. Those enhancement measures which have been identified and adopted as part of the proposed development are described within the topic chapters and also documented in the Green Infrastructure Statement (document reference: BMTH-ARP-ELS-ZZ-RP-L-000003) submitted alongside the Planning Application.

4.6 Cumulative and In-combination Effects

4.6.1 The EIA Regulations require that the ES includes a description of the cumulation of effects with other existing or approved projects. Cumulative effects are effects that, in combination with each other, may be more (or less) than the sum of the individual effects. These may result from incremental changes caused by other existing or approved projects together with the proposed development.

4.6.2 The purpose of undertaking a cumulative assessment is to identify whether other developments, plans or projects may lead to an elevated effect on the environment during construction, or once a development is built and in use. Other developments need to be of a sufficient scale and/or proximity to the proposed development for potential cumulative effects to be likely. Other developments may also precede the development being assessed thereby changing future baseline conditions, or in some cases introducing new sensitive receptors. Each topic has considered cumulative effects from construction activities as well as operational with other development. Each topic has considered developments that are within their assessment study area which vary on a topic-by-topic basis.

4.6.3 A review of consented and planned developments within a radius of 10km (based on the maximum extent of the study areas of each topic). The study areas are based on the extent for each topic assessment which are explained within the topic Chapters (ES Volume 4, Chapter 5 to 13 and Chapter 14 Cumulative effects). Chapter 14 sets out the approach to and assessment of cumulative effects for each topic that has been undertaken, along with a long list of relevant cumulative developments within the study area. The list has been developed through review of the Cyngor Gwynedd planning portal, NRW Marine licences register, the Local Plan designated sites, Welsh Government Planning Casework Developments of National Significance Applications list and National Infrastructure Planning Register of Applications in Wales.

4.6.4 The EIA regulations also requires that the ES considers interaction of the likely significant effects identified in the assessments of the effects to population and human health, biodiversity, land, soil, water, air and climate, material assets, cultural heritage and the landscape associated with a Proposed Development. In-combination effects are those that result from the interaction between the individual effects of the Proposed Development (i.e., interaction of environmental topics such as air quality, noise and health), combined together on a single receptor or resource at a single point in time.

4.6.5 Where the in-combination effects for topics are inherently assessed within topic assessments (for example, the outcomes of noise effects have been assessed within the ecology assessment to assess the in-combination of effects on the adjacent national designated sites), these are reported within the assessment

section of the individual topic chapters of the ES for effects during construction, and operation.

4.7 Assumptions and Limitations

4.7.1 In accordance with EIA Regulations, difficulties encountered during assessment work and limitations and assumptions used for individual assessment areas are set out in each individual topic chapter.

4.8 Other environmental assessments

4.8.1 The EIA takes into account other relevant environmental assessments:

Habitat Regulations Assessment (HRA)

4.8.2 The Conservation of Habitats and Species Regulations 2017 as amended (known as the Habitats Regulations) are used to implement the EU Habitats Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora). The HRA is included with this Planning Application and Marine Licence Application, document number BMTH-ARP-EBD-ZZ-RP-OE-000003.

Water Framework Directive (WFD)

4.8.3 A Water Framework Directive (WFD) compliance assessment has been undertaken in accordance with The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. This is provided within ES Volume 4, Appendix 10.1 Water Framework Directive Assessment.

Net Benefit for Biodiversity (NBB)

4.8.4 Planning Policy Wales (paragraph 6.4.12) requires that proposed development must provide net benefit for biodiversity through biodiversity enhancements on site or immediately adjacent to the site, over and above that required to mitigate or compensate for any negative impact. A step-wise approach must be applied to ensure a scheme of enhancements is provided to achieve NBB. Enhancement measures could include on-site, locally relevant, habitat creation and/or could be part of the development itself favouring the use of native species using biodiverse nature-based solutions.

4.8.5 A NBB assessment has been undertaken and set out within ES Volume 2, Chapter 6, Biodiversity and Protected Sites and also documented within a Green Infrastructure Statement included with this Planning Application, document number BMTH-ARP-ELS-ZZ-RP-L-000003.

Flood Consequence Assessment (FCA)

4.8.6 A FCA is required for planning applications in a flood risk area as set out within Planning Policy Wales. A FCA is included with this Planning Application which has been informed by flood modelling to demonstrate how the Proposed Development will manage flood risk. The FCA has been produced in compliance with Technical Advice Note (TAN) 15. The FCA has also informed ES Volume 4, Chapter 10 Flooding and Water Quality assessment. The document number is BMTH-ARP-XGN-ZZ-RP-W-000003.

4.9 Competent Experts

4.9.1 Arup has led the preparation of this ES and has undertaken the topic assessments.

4.9.2 Arup is a registrant of the Institute of Sustainability and Environmental Professionals (ISEP) (previously called the Institute of Environmental Management and Assessment (IEMA))~~Institute of Environmental Management and Assessment's~~ EIA Quality Mark scheme. Arup is committed to excellence in EIA activities and has agreed to have this commitment independently reviewed through review of ESs prepared by the company.

4.9.3 Regulation 17(4) of the TCPA EIA Regulations and Regulation 12(2) (c) of the Marine Works EIA Regulations, states that the developer must ensure that the environmental statement is prepared by competent experts and the environmental statement must be accompanied by a statement from the developer outlining the relevant expertise or qualifications of such experts.

4.9.4 This ES has been prepared by a team of competent experts. The team comprises technical specialists who have extensive experience in the field of EIA. The details (including their experience and qualifications) of these competent experts are presented in ES Volume 3,Appendix 4.1 Competent Experts. The individual experts can demonstrate their competence through a mix of academic qualifications, membership of relevant professional institutions and practical experience in undertaking EIAs.

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

References

[1] Planning Inspectorate, “Nationally Significant Infrastructure Projects - Advice Note Nine: Rochdale Envelope,” Planning Inspectorate, 1 July 2018. [Online]. Available: https://www.gov.uk/government/publications/nationally-significant-infrastructure-projects-advice-note-nine-rochdale-envelope. [Accessed 18 July 2025].

Cyngor Gwynedd

Barmouth North Promenade FAS

ES Chapter 5 Air Quality

Reference: BMTH-ARP-EAQ-ZZ-RP-OE-000001

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Contents

5. Air Quality **1**

5.1 Introduction 1

5.2 Legislation, Policy and Guidance 2

5.3 Standards and Guidance 5

5.4 Stakeholder Engagement 6

5.5 Methodology 7

5.6 Baseline 9

5.7 Embedded Environmental Design Measures 11

5.8 Assessment of Likely Significant Effects 15

5.9 Mitigation and Enhancement 17

5.10 Residual Effects 17

5.11 Assessment Summary 17

Abbreviations List **18**

Glossary **18**

References **19**

Tables

Table 5-1 List of relevant legislation 2

Table 5-2 List of relevant national policy 3

Table 5-3 Welsh air quality standards for human health 5

Table 5-4 Critical levels for the protection of ecosystems 6

Table 5-5 Cyngor Gwynedd Council comments on scope of the air quality assessment and the response 6

Table 5-6 Estimated background mean annual pollutant concentrations for 2023 11

Table 5-7 Dust emission magnitude for construction activities 15

Table 5-8 Summary dust risk table prior to mitigation 16

Table 5-9 Summary of effects matrix 17

5. Air Quality

5.1 Introduction

5.1.1 This chapter provides an assessment of the likely significant effects on air quality that may arise from the construction, operation and maintenance of Barmouth North Promenade Flood Defence Scheme (hereafter referred to as the 'Proposed Development'). The approach undertaken for this chapter has been supported by a scoping report submitted by Cyngor Gwynedd (Ymgynghoriaeth Gwynedd Consultancy (YGC)), engagement with statutory consultees, and scoping opinions received from Cyngor Gwynedd and Natural Resources Wales (NRW) on 30 April 2024 and 19 April 2024 respectively.

5.1.2 This chapter details the legislation, policy and guidance that is relevant to air quality, a summary of engagement undertaken and the methodology of assessment. This is followed by an assessment of likely significant effects of the Proposed Development on air quality, taking account of the embedded environmental design measures. Any additional mitigation is then considered along with any proposals for enhancement design measures. This chapter concludes with a summary of likely significant residual effects.

5.1.3 The air quality elements considered with this chapter for the Proposed Development include:

- A review of existing air quality conditions at, and in the vicinity of, the Proposed Development.
- An assessment of the potential changes in air quality arising from the construction of the Proposed Development.
- Formulation of mitigation measures, where appropriate, to ensure any adverse effects on air quality are minimised.

5.1.4 Construction impacts can arise from dust associated with the works, equipment emissions and vehicle emissions. Impacts from dust and equipment emissions have been scoped into this assessment. The transport team have reviewed traffic volumes associated with the construction phase and confirmed they are well below the IAQM/EPUK screening criteria and have been scoped out of further assessment in this chapter. Emissions from shipping have been reviewed and are also scoped out of requiring further assessment in this chapter. Further details of screening and justification for scoping out traffic and shipping emissions are provided in ES Volume 3, Appendix 5.1 Air Quality Assessment Scope.

5.1.5 Operational phase and maintenance effects from the Proposed Development have been scoped out as set out in the EIA Scoping Report and agreed with relevant stakeholders. No changes have been identified since scoping, therefore no further assessment of operational effects are included in this chapter.

5.1.6 This chapter is supported by the following appendices, contained in Volume 3:

- 5.1 Air Quality Assessment Scope.
- 5.2 Construction Dust Assessment Methodology.

5.1.7 This chapter is supported by the following figures, contained in Volume 4:

- 5.1 Construction Dust Buffers.

5.1.8 This chapter should be read in conjunction with:

- ES Chapter 6 Biodiversity and Protected Sites.
- ES Chapter 8 Community Considerations.

5.2 Legislation, Policy and Guidance

5.2.1 This section identifies the legislation, policy, guidance and other documentation that has informed the assessment of likely significant effects on air quality.

Legislation

5.2.2 This section is supported by the ES Volume 3, Appendix 1.1 Policy Context, which outlines overarching legislation and policy relevant to the Proposed Development. Table 5-1 lists the legislation relevant to air quality and the assessment of the likely significant effects.

Table 5-1 List of relevant legislation

Legislation	Relevance to Assessment
The Environment (Air Quality and Soundscapes) (Wales) Act 2024 [1]	The Environment (Air Quality and Soundscapes) (Wales) Act 2024, effective from 14 February 2024, provides a comprehensive legal framework to improve air quality and reduce the impacts of airborne pollution on health, nature and the economy. It introduces statutory air quality targets, strengthens local air quality management duties, and requires Welsh Ministers to promote public awareness and pollution reduction. The Act also supports active travel as a pollution mitigation measure and allows this duty to be extended to other public bodies. These provisions are directly relevant to the Proposed Development, which considers construction phase impacts from dust associated with the works, equipment emissions and vehicle emissions. The Act reinforces the need to evaluate and mitigate such emissions to ensure compliance with national air quality objectives and to minimise harm to local communities and the environment.
Environment Act 2021 [2]	The Environment Act 2021, enacted in November 2021, amends the Environment Act 1995 [3] and Clean Air Act 1993 [4] to strengthen local authorities' powers in reducing pollution and improving air quality. It mandates the creation and review of an Air Quality Strategy, establishes the Office for Environmental Protection, and includes new powers for vehicle recalls to comply with environmental standards. The Act is a key part of the UK government's Clean Air Strategy [5], aiming to reduce public exposure to air pollution. The Act reinforces the importance of evaluating construction phase emissions in line with national strategies and ensuring mitigation measures are in place to protect public health and comply with evolving regulatory expectations.
Air Quality Objectives and Limit Values [6]	The air quality standards [6] define acceptable levels of pollutants to protect health and the environment. Some pollutants have long-term standards due to prolonged exposure effects, while others have short-term standards for immediate impacts. These standards, referred to as Air Quality Standards (AQS), guide assessments for human health (see below in Table 5-3 for the pollutants of most relevance to this assessment). The AQS provide a benchmark against which predicted pollutant concentrations are compared to determine the potential for significant effects on human health and ecological receptors.
European Council Directive 92/43/EEC (Habitats Directive) [7]	The Habitats Regulations [7] requires the Local Authority first to evaluate whether operation of the Proposed Development is likely to give rise to a significant effect on the European site (such as Special Areas of Conservation (SAC), Special Protection Areas (SPA) and Ramsar sites.)

Legislation	Relevance to Assessment
	(Habitats Regulation Assessment screening). Emissions of oxides of nitrogen (NO_x) and sulphur dioxide (SO_2) from construction activities can affect sensitive habitats. There are specific pollutant objectives for vegetation called 'critical levels', these are outlined below in Table 5-4.
Non-Road Mobile Machinery Regulations (NRMM) (Emission of Gaseous and Particulate Pollutants) (Amended) Regulations 2014 [8]	The NRMM Regulations 2014, which implemented European Union (EU) Directive 2012/46/EU [8], have since been superseded by provisions in the Environment Act 2021. However, the 2014 Regulations and associated EU directives remain relevant to this assessment as they set specific emission standards for NRMM engines, particularly for construction equipment. These standards aim to reduce emissions of pollutants such as nitrogen oxides (NOx) and particulate matter through the adoption of cleaner engine technologies (e.g. Stage IV engines). This is directly relevant to the assessment of construction-phase impacts, where NRMM is a key source of localised air pollution

National Policy and Strategies

5.2.3 Table 5-2 lists the relevant planning policy and strategies, with paragraphs of relevance to the air quality assessment.

Table 5-2 List of relevant national policy

National Policy & Paragraph Number	Summary of Policy Requirement and Relevance
Clean Air Strategy 2019 [5]	The UK's Clean Air Strategy outlines a comprehensive plan to tackle air pollution and improve air quality, aiming to protect public health, the environment, and the economy. It sets ambitious targets to reduce emissions of five key pollutants, including ammonia, nitrogen oxides, particulate matter, sulphur dioxide, and volatile organic compounds by 2030. The strategy emphasises reducing emissions from agriculture, industry, transport, and domestic sources through measures like tighter regulations, improved monitoring, and promoting cleaner technologies. It also focuses on raising public awareness, supporting local action, and ensuring alignment with international commitments. By prioritising air quality, the strategy seeks to prevent thousands of premature deaths annually and foster a healthier environment for future generations. The Strategy specifically highlights the need to reduce emissions from Non-Road Mobile Machinery (NRMM) used on construction sites by promoting cleaner technologies, tightening emission standards, and encouraging the use of low-emission equipment. These principles align with the focus on managing dust and exhaust emissions during the construction phase of the Proposed Development.
UK Marine Policy Statement [9]: Paragraph 2.6.2.1 – 2.6.2.2	The UK Marine Policy Statement emphasises the importance of air quality in the marine environment. It highlights the need to manage air pollutants from marine activities to protect marine ecosystems and human health. The Statement aims to integrate air quality considerations into marine planning and decision-making processes to ensure a sustainable and healthy marine environment. The Proposed Development includes the potential use of marine vessels for transporting construction materials. While shipping emissions have been scoped out of the assessment, the Statement reinforces the need to consider and minimise air quality impacts from marine operations as part of sustainable and marine planning.
Planning Policy Wales Edition 12 [10]:	The 12th edition of Planning Policy Wales (PPW12), published in July 2024, outlines land-use and planning policy for Wales and

National Policy & Paragraph Number	Summary of Policy Requirement and Relevance
Paragraphs 6.7.1 – 6.7.25	incorporates principles from the Well-being of Future Generations (Wales) Act 2015. The policy emphasises air quality, particularly in the Distinctive and Natural Places theme, highlighting its importance for public health and well-being. It stresses the planning system's role in reducing air pollution exposure, addressing high pollution areas, and preventing the worsening of air quality issues. PPW12 reinforces the need to consider air quality impacts during the planning and design changes, particularly in relation to construction activities.
Welsh National Marine Plan [11]: Paragraphs 199 – 201, 205 – 207	The policy outlines policies for the sustainable use of Welsh seas. Regarding air quality, the plan focuses on reducing emissions from marine activities and promoting sustainable practices. It includes measures to control air pollutants from shipping and fishing, aiming to improve air quality and protect marine ecosystems. Although scoped out of the assessment, the potential use of marine vessels for transporting construction materials could contribute to localised emissions. The Plan reinforces the importance of considering marine-based air quality impacts and supports the adoption of clearer practices in like with sustainable development opportunities.
Future Wales – the National Plan 2040 [12]	The framework provides clear direction related to air quality and how that should be managed and improved through existing policy (e.g. Planning Policy Wales [10]) and sets out how air quality should be improved within the regional plans. The Plan reinforces the need for consistency with national and regional air quality objectives. This assessment supports the Plan by identifying potential air quality impacts during construction and ensuring that appropriate mitigation is proposed in line with the strategic aims of improving air quality across Wales.
Well-Being of Future Generations (Wales) Act 2015 [13]	The Act promotes sustainable development with well-being goals like creating '*a resilient Wales'* and '*a healthier Wales'*, recognising the impact of air quality on both ecological habitats and human health. National indicators, including nitrogen dioxide (NO_2) levels, are established to track progress. The Act aims to reduce pollution exposure by assessing an annual weighted population average of NO_2. This assessment contributes to the well-being goals by identifying potential impacts on human and ecological receptors and recommending mitigation, where appropriate, to minimise pollution exposure, during the construction phase.
Clean Air Plan for Wales, Healthy Air, Healthy Wales [14]	The Clean Air Plan for Wales, first published in August 2020, outlines measures to improve air quality by reducing emissions from various sources, aiming to meet the World Health Organisation's (WHO) very fine particulate matter ($PM_{2.5}$) target of 10µg/m^3 annually. It also commits to developing a Clean Air Act to enhance existing legislation, reduce the health and environmental impacts of poor air quality, and support climate emergency actions. The Clean Air Plan for Wales reinforces the importance of minimising emissions during construction, particularly from sources such as dust and NRMM.

Local Policy and Strategies

5.2.4 There are no specific policies relating to air quality in the Anglesey and Gwynedd Joint Local Development Plan 2011 – 2026 [15]. However, the Plan states that proposed developments may be refused if they are likely to result in unacceptable levels of pollution. It also highlights the importance of promoting

sustainable transport across the local authority area, which can contribute indirectly to improved air quality.

5.3 Standards and Guidance

5.3.1 The guidance and standards which relate to this topic are listed below.

- Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction (v 2.2) [16]; used to assess the risk of construction dust impacts and to inform the identification of sensitive. receptors, dust emission magnitudes, and appropriate mitigation measures.
- Environmental Protection UK (EPUK)/IAQM Land-Use Planning & Development Control: Planning for Air Quality[1] [17]; Applied to screen out construction traffic and shipping emissions, and to support planning decisions in line with air quality considerations.
- Defra, Local Air Quality Management Technical Guidance (LAQM TG(22)) [18]; considered for its relevance to local authority air quality duties and the planning system, helping to ensure the assessment aligns with national air quality standards and reporting practices.
- Dust Nuisance; Dust is defined in BS 6069 (Part Two) as particulate matter sized 1-75µm in diameter and is considered a statutory nuisance under the Environmental Protection Act 1990 [19]. The UK lacks specific standards for dust nuisance due to uncertainties in monitoring technology and the subjective nature of dust deposition perception. Instead, dust management relies on on-site practices and mitigation rather than formal standards or enforcement actions. In the absence of enforceable thresholds, the assessment relies on best practice guidance [16] to identify potential dust impacts and recommend mitigation to minimise nuisance and protect local amenity.

Air Quality Standards

5.3.2 The main pollutants of concern for local air quality are oxides of nitrogen (NO_x, nitrogen dioxide (NO_2), and particulate matter (PM_{10} and $PM_{2.5}$). Sulphur dioxide (SO_2) is not considered to be a human health concern in the area. However, it has been considered in relation to potential emissions from shipping and the possible implications for ecological receptors.

5.3.3 Table 5-3 sets out the national air quality standards for NO_2, PM_{10}, $PM_{2.5}$ and SO_2, with regards to human health [6].

Table 5-3 Welsh air quality standards for human health

Pollutant	Averaging Period	Environmental Standard
Nitrogen dioxide (NO_2)	Annual mean	40 µg/m^3
	1-hour mean	200µg/m^3 not to be exceeded more than 18 times a year (99.79th percentile)
Fine particulate matter (PM_{10})	Annual mean	40µg/m^3

[1] It is noted that the EPUK and IAQM planning guidance (Ref 19) is under review for an update, the updated version is expected to be published in October 2025. This updated guidance will have a focus on emissions reduction, with consideration on screening thresholds, and method of defining impact descriptors.

Pollutant	Averaging Period	Environmental Standard
	24-hour mean	50µg/m^3, not to be exceeded more than 35 times a year (90.41st percentile)
Fine particulate matter ($PM_{2.5}$)	Annual mean	20µg/m^3*
Sulphur Dioxide (SO_2)	24-hour mean	125µg/m^3, not to be exceeded more than 3 times a year (99.18th percentile)
	1-hour mean	350µg/m^3, not to be exceeded more than 24 times a year (99.73rd percentile)
	15-minute mean	266µg/m^3, not to be exceeded more than 36 times a year (99.9th percentile)
Note: *The Environmental Targets (Fine Particulate Matter) (England) Regulations 2023 [20] state that *"the annual mean level of $PM_{2.5}$ in ambient air must be equal to or less than 10µg/m^3 ("the target level") by 31st December 2040"*. The Environmental Improvement Plan 2023 [21] sets out an interim target of 12µg/m^3, to be achieved by 31 January 2028. However, this interim target is not applicable to Wales although there is a clear intention to reduce $PM_{2.5}$ in Wales outlined in the Clean Air Plan for Wales [14].		

Ecological Legislation

5.3.4 Table 5-4 outlines the critical levels that are used to assess the potential impacts upon any sensitive ecosystems [7].

Table 5-4 Critical levels for the protection of ecosystems

Pollutant	Averaging Period	Critical Level
Oxide of nitrogen (NO_x)	1-hour mean	30µg/m^3
	Daily mean	75µg/m^3
SO_2	Annual mean	20µg/m^3

5.4 Stakeholder Engagement

EIA Scoping Opinion

5.4.1 An EIA Scoping Opinion was received by Cyngor Gwynedd Council (supported by Ymgynghoriaeth Gwynedd Consultancy (YGC)) and Natural Resources Wales (NRW) on 30 April 2024 and 19 April 2024 respectively. The comments received in relation to air quality are presented in Table 5-5 and how these have been addressed. NRW did not provide and specific comments regarding air quality.

Table 5-5 Cyngor Gwynedd Council comments on scope of the air quality assessment and the response

Scoping Opinion Comment	Response
The Public Protection Service, Cyngor Gwynedd Council have advised that as part of the EIA, an environmental management plan (EMP) should be incorporated. This should consist of the set of mitigation, monitoring, and institutional measures to be taken during implementation and operation to eliminate adverse environmental and social	A construction dust assessment has been carried out as part of the ES, to inform appropriate control measures to be deployed during the construction works. The construction phase assessment has been carried out following the IAQM guidance [16] and is outlined in ES Volume 3, Appendix 5.2, Construction Dust Methodology. Mitigation measures have been outlined in Section 5.9 and are from the IAQM Guidance.

Scoping Opinion Comment	Response
impacts, offset them, or reduce them [dust] to acceptable levels.	An outline CEMP has been produced and is provided as part of the planning application and marine licence.

Non-Statutory Engagement

5.4.2 Non-Statutory stakeholder engagement was carried out with the Local Planning Authority (LPA) Environmental Health Department on 27th February 2025 to present the air quality methodology. No feedback or comments were received.

5.5 Methodology

Study area

Baseline

5.5.1 The baseline study area has included a review of sources and available monitoring data within 2km of the Proposed Development boundary. The 2km area reflects industry standard and is considered appropriate in order to understand the effects from local sources such as roads and industrial processes and to gather a suitably representative baseline monitoring data set.

Dust and Construction Equipment

5.5.2 Construction is defined as all the works undertaken to build a proposed development and all the impacts on air quality will occur during this phase. The study area for construction dust is in accordance with the IAQM dust guidance. The study area's sensitivity to dust soiling, human and ecological effects has been determined through assessing the number of receptors and their sensitivity to dust soiling and health effects within 20m, 50m, 100m and 250m from the Proposed Development boundary. This study area is presented in ES Volume 4, Figure 5.1.

Baseline Methodology

5.5.3 Existing or baseline ambient air quality refers to the concentration of relevant substances that are already present in the environment. These are present from various sources, such as industrial processes, commercial and domestic activities, traffic and natural sources.

5.5.4 A desk-based review of the following data sources has been undertaken to determine air quality conditions around the Proposed Development:

- North Wales Combined Authorities Collaborative Project[2] 2023 air quality Progress Report (APR) [22].
- The Environment Agency website [23].
- Natural Resources Wales website [24].
- The Defra website [25].
- .Air Pollution Information System (APIS) [26].

[2] Includes Gwynedd County Council, Isle of Anglesey County Council, Denbighshire County Council, Wrexham County Borough Council, Conwy County Borough Council and Flintshire County Council.

5.5.5 The review identified the main sources of air pollution, local air quality monitoring data and local background pollutant concentrations.

Assessment Methodology

5.5.6 The assessment has considered two options for transporting construction materials to the Proposed Development: by road and by vessel. The assessment scenarios are outlined below.

Assessment Scenarios

- **Option 1:** All materials, employees access the site by road .
- **Option 2:** Rock armour material only transported by vessels, and all other materials and employees by road.

5.5.7 Both options have been assessed in accordance with the guidance [17], [18].

Dust and Construction Equipment Assessment

5.5.8 The effects from demolition and construction of the Proposed Development have been assessed using the qualitative approach described in the latest guidance by the IAQM [16]. The guidance considers the potential for dust and equipment emissions arising from activities such as demolition, earthworks, construction and trackout, and the effects these may have on human health, dust soiling and ecological harm.

5.5.9 An impact is described as a change in pollutant concentrations or dust deposition, while an ‘effect’ is described as the consequence of an impact. The main impacts that may arise during construction of the Proposed Development are:

- Dust deposition, resulting in the soiling of surfaces.
- Visible dust plumes.
- Elevated PM_{10} concentrations as a result of dust generating activities on-site.
- An increase in NO_2 and PM_{10} concentrations due to exhaust emissions from NRMMs and vehicles accessing the site.

5.5.10 The IAQM guidance [16] considers the potential for dust emissions from dust generating activities, such as demolition of existing structures, earthworks, construction of new buildings and trackout. Earthworks refer to the processes of soil stripping, ground levelling, excavation and land capping, while trackout is the transport of dust and dirt from the site onto the public road network where it may be deposited and then re-suspended by vehicles using the network. This arises when vehicles leave the site with dusty materials, which may then spill onto the road, or when they travel over muddy ground on-site and then transfer dust and dirt onto the public road network.

5.5.11 For each of these dust generating activities, the guidance considers three separate effects:

- Annoyance due to dust soiling.
- Harm to receptors.
- The risk of health effects due to a significant increase in PM_{10} exposure.

5.5.12 The receptors can be human or ecological and are selected based on their sensitivity to dust soiling and PM_{10} exposure. Sensitive receptors are defined as

those properties/schools/hospitals that are likely to experience a change in pollutant concentrations and/or dust nuisance due to the construction and operation of the Proposed Development.

5.5.13 The methodology takes into account the scale at which the above effects are likely to be generated (classed as small, medium or large), the levels of background PM_{10} concentrations and the distance to the closest receptor, in order to determine the sensitivity of the area. This is then taken into consideration when deriving the overall risk for the Proposed Development. Suitable mitigation measures are also proposed to reduce the risk of the potential impacts on local air quality as a result of the demolition and construction works.

5.5.14 Further information for the method of approach is presented in ES Volume 3, Appendix 5.2, Construction Dust Methodology.

Construction Traffic Assessment

5.5.15 The transport team have reviewed traffic volumes associated with the transport of construction material to the Proposed Development.

5.5.16 A screening assessment has been undertaken using the indicative criteria in the EPUK/IAQM land-use guidance [17]. Further details of the screening assessment and justification for scoping out a construction traffic assessment is provided in ES Volume 3, Appendix 5.1 Air Quality Assessment Scope.

Assessment of Shipping Emissions

5.5.17 Should rock amour material be transported by vessels, (Option 2), ship movements could lead to increasing NO_x, NO_2, Sulphur Dioxide (SO_2) and Particulate Matter emissions [18]. The assessment of shipping emissions has been scoped out of the assessment, with further details and justification provided in ES Volume 3, Appendix 5.1 Air Quality Assessment Scope.

Limitations and Assumptions

5.5.18 Where there is uncertainty on volumes of earthworks/construction a ‘large’ magnitude has been assumed to provide a worst-case assessment.

5.6 Baseline

Current Baseline

5.6.1 This section presents information on the baseline air quality conditions around the Proposed Development. This baseline assessment uses a study area of 2km as this is considered to be sufficient to provide an overview of local ambient air quality conditions.

Sources of Air Pollution

Industrial Processes

5.6.2 Industrial air pollution sources are regulated through a system of operating permits or authorisations, requiring stringent emission limits to be met and ensuring that any releases to the environment are minimised or rendered harmless. Regulated (or prescribed) industrial processes are classified as Part

A(1), A(2), Part B or Medium Combustion Plant (MCP) processes, and are regulated through the Pollution Prevention and Control (PPC) system [27] [28]. The larger more polluting processes are regulated by the National Resources Wales (NRW), and the smaller less polluting ones by the local authorities. Local authorities regulate only for emissions to air, whereas the NRW regulates emissions to air, water and land.

5.6.3 According to NRW [24], there are no Part A(1) industrial processes with emissions to air within 2km of the Proposed Development.

Road Traffic

5.6.4 In recent decades, atmospheric emissions from transport on a national basis have grown to match or exceed other sources in respect to many pollutants, particularly in urban areas. The local air quality around the Proposed Development is mainly influenced by the A496, which is located approximately 200m northeast of the Proposed Development.

Local Air Quality

5.6.5 The Environment Act 2021 [2] requires local authorities to review and assess air quality with respect to the objectives for the pollutants specified in the National Air Quality Strategy. Although this Strategy is developed for England, its objectives are also advocated and applied in Wales. Where objectives are not predicted to be met, local authorities must declare the area as an AQMA. In addition, local authorities are required to produce an Air Quality Action Plan (AQAP) which includes measures to improve air quality within the AQMA.

5.6.6 According to the Defra website [29], there are no designated AQMAs within the Cyngor Gwynedd Council authority area.

Local Monitoring

5.6.7 A review of existing air quality conditions in the area surrounding the Proposed Development has been undertaken using the 2023 North Wales Authorities Collaborative Project Annual Progress Report (APR) [22].

5.6.8 Following a review of the most recent APR, Cyngor Gwynedd Council does not undertake diffusion tube monitoring or automatic monitoring within 2km of the Proposed Development. All monitoring sites in Cyngor Gwynedd Council report air quality levels below the AQS, indicating no significant air quality concerns in the area.

Defra Estimated Background Concentrations

5.6.9 Background concentrations refer to the existing levels of pollution in the atmosphere, produced by a variety of stationary and non-stationary sources, such as roads and industrial processes. The Defra website [25] includes estimated background pollutant concentrations for NO_2, PM_{10} and $PM_{2.5}$ for each 1km-by-1km OS grid square in the UK.

5.6.10 The Defra background pollutant concentrations for the OS grid squares containing the Proposed Development (260500, 317500 and 260500, 316500) are shown below in Table 5-6. Concentrations are well below the annual mean air quality objectives for NO_2 (40µg/m^3), PM_{10} (40µg/m^3) and $PM_{2.5}$ (20µg/m^3).

Table 5-6 Estimated background mean annual pollutant concentrations for 2023

OS Grid Square		Annual Mean Concentration (µg/m^3)			
X	Y	NO_2	NO_x	PM_{10}	$PM_{2.5}$
260500	317500	3.0	3.6	8.38	5.4
260500	316500	3.0	3.7	8.58	5.5
Average		**3.0**	**3.7**	**8.5**	**5.5**

Receptors – Sensitive to Construction Dust

5.6.11 For the assessment of construction dust, the identification of receptors and their sensitivity to dust effects followed IAQM guidance [16].

5.6.12 There are between 10 – 100 high sensitivity receptors including residential properties and schools within 20m of the Proposed Development.

5.6.13 There is one ecological site (Pen Llyn a'r Sarnau / Lleyn Peninsula and the Sarnau SAC) within 50m of the Proposed Development study area.

Future Baseline

5.6.14 The future baseline related to known or anticipated changes to the current baseline in the future is considered.

5.6.15 Even if the Proposed Development were not to come forward, there is likely to be a change to the future baseline conditions because of other factors and developments in proximity. The future baseline represents the conditions that would prevail 'Without Development' in place.

5.6.16 Background air pollutant concentrations are currently available using 2021 base year for projections [25]. These are predicted to improve over time due to reductions in emissions resulting from:

- Reductions in transport emissions resulting from improvements in fuel efficiency and uptake in low emission vehicles.
- General reduction in the use of fossil fuels.
- Reductions in pollutant emissions from agricultural sources due to improvements in management envisaged in the 2019 Clean Air Strategy [5].
- Improved emissions standards for Non-Road Mobile Machinery and static generators.

5.7 Embedded Environmental Design Measures

5.7.1 The design includes a range of measures that been embedded into the Proposed Development design to avoid or minimise environmental effects. The design measures related to air quality include construction best practice measures.

Construction Good Practice Measures

5.7.2 Construction dust mitigation measures are identified in line with best practice. These measures have been provided for the construction activity according to the IAQM guidance [16]. These mitigation measures are outlined below The contractor's Outline Construction Environmental Management Plan (CEMP) (document reference- EN.F.15) includes these measures.

5.7.3 Overall, high risk mitigation measures will be considered for the Proposed Development with high-risk demolition, medium risk earthworks, high risk construction and high risk trackout specific measures.

Communications

- Develop and implement a stakeholder communication plan that includes communing engagement before work commences on site.
- Display the name and contact details of person(s) accountable for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
- Display the head or regional office contact information.
- Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions, approved by the Local Authority. The level of detail will depend on the risk and should include as a minimum the highly recommended measures in this document. The desirable measures should be included as appropriate for the site. The DMP may include monitoring of dust deposition, dust flux, realtime PM_{10} continuous monitoring and/or visual inspections.

Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
- Make the complaints log available to the local authority when asked.
- Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.
- Hold regular liaison meetings with other high risk construction sites within 250m of the site boundary, to ensure plans are co-ordinated and dust and particulate matter emissions are minimised. It is important to understand the interactions of the off-site transport/deliveries which might be using the same strategic road network routes.

Monitoring

- Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results, and make the log available to the local authority when asked. This should include regular dust soiling checks of surfaces such as street furniture, cars and window sills within 100m of site boundary, with cleaning to be provided if necessary.
- Carry out regular site inspections to monitor compliance with the DMP, record inspection results, and make an inspection log available to the local authority when asked.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.
- Agree dust deposition, dust flux, or real-time PM_{10} continuous monitoring locations with the Local Authority. Where possible commence baseline monitoring at least three months before work commences on site or, if it a

large site, before work on a phase commences. Further guidance is provided by IAQM on monitoring during demolition, earthworks and construction.

Preparing and Maintaining the Site

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
- Fully enclose site or specific operations where there is a high potential for dust production and the site is actives for an extensive period.
- Avoid site runoff of water or mud.
- Keep site fencing, barriers and scaffolding clean using wet methods.
- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.
- Cover, seed or fence stockpiles to prevent wind whipping.

Operating Vehicle/Machinery and Sustainable Travel

- Ensure all vehicles switch off engines when stationary - no idling vehicles.
- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.
- Impose and signpost a maximum-speed-limit of 15 mph on surfaced and 10 mph on unsurfaced haul roads and work areas (if long haul routes are required these speeds may be increased with suitable additional control measures provided, subject to the approval of the nominated undertaker and with the agreement of the local authority, where appropriate).
- Produce a Construction Logistics Plan to manage the sustainable delivery of goods and materials.
- Implement a Travel Plan that supports and encourages sustainable travel (public transport, cycling, walking, and car-sharing).

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.
- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
- Use enclosed chutes and conveyors and covered skips.
- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
- Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste Management

- No bonfires and burning of waste materials.

Demolition

- Ensure effective water suppression is used during demolition operations. Hand held sprays are more effective than hoses attached to equipment as the water can be directed to where it is needed. In addition high volume water suppression systems, manually controlled, can produce fine water droplets that effectively bring the dust particles to the ground.
- Bag and remove any biological debris or damp down such material before demolition.

Earthworks

- Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable.
- Use Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable.
- Only remove the cover in small areas during work and not all at once.

Construction

- Avoid scabbling (roughening of concrete surfaces) if possible.
- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.
- Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery.
- For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.

Trackout

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.
- Avoid dry sweeping of large areas.
- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.
- Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
- Record all inspections of haul routes and any subsequent action in a site log book.
- Install hard surfaced haul routes, which are regularly damped down with fixed or mobile sprinkler systems, or mobile water bowsers and regularly cleaned.
- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonable).

- Ensure there is an adequate area of hard surfaced road between the wheel wash facility and the site exit, wherever site size and layout permits.
- Access gates to be located at least 10 m from receptors where possible.

5.8 Assessment of Likely Significant Effects

5.8.1 This section presents the assessment of likely significant effects on air quality resulting from the construction of the Proposed Development. The likely significant effects of the Proposed Development have been identified taking into account the embedded environmental design measures outlined in Section 5.1. Further mitigation may be proposed as a result which is presented in Section 5.9.

Construction Effects

5.8.2 This section presents the assessment of potential effects on air quality impacts resulting from the construction of the Proposed Development. The potential construction effects are assessed based on detailed design presented in ES Volume 2, Chapter 2 Project Description.

5.8.3 The Proposed Development will include demolition, earthworks, construction and trackout, which are likely to cause the generation and mobilisation of dust, as well as emissions from Non-Road Mobile Machinery (NRMM).

Sensitive receptors

5.8.4 Sensitive receptors are defined as those properties, schools, hospitals that are likely to experience a change in pollutant concentrations and/or dust nuisance due to the construction of the Proposed Development.

5.8.5 There are between 10-100 sensitive human receptors within 20m of the Proposed Development and are considered *'high sensitivity receptors'* in accordance with the IAQM guidance [16].

5.8.6 There is one ecological designated site within 50m of the Proposed Development (Pen Llyn a'r Sarnau / Lleyn Peninsula and the Sarnau SAC). This site is an internationally designated site and is therefore considered a *'high sensitivity receptor'* in line with IAQM guidance [16].

5.8.7 The construction dust buffers around the Proposed Development are presented in ES Volume 4, Figure 5.1.

Dust emission magnitude

5.8.8 Based on the IAQM guidance [16] and the data provided by the project team, the dust emission magnitudes for the Proposed Development are considered to be large for demolition, construction and trackout and medium for earthworks. The dust emission magnitude for each activity is shown in Table 5-7.

Table 5-7 Dust emission magnitude for construction activities

Activity	Dust emission magnitude	Reasoning
Demolition	Large	Potentially dusty construction material, <12,000m^3, demolition activities <6m above ground level
Earthworks	Medium	Total site area 18,000m^3-110,000m^3, bunds created 3-6m high, sandy soil type, <10,000 tonnes of material to be moved

Activity	Dust emission magnitude	Reasoning
Construction	Large	Construction material with high potential of dust (concrete), 12,000m^3-75,000m^3
Trackout	Large	>100m unpaved road length, 20-50 HGVs outward movements per day

Sensitivity of the area

5.8.9 The sensitivity of the area to dust soiling has been assigned as *high*, due to the presence of between 10-100 high sensitivity receptors within 20m of the Proposed Development.

5.8.10 Annual average PM_{10} concentrations for the OS grid squares containing the Proposed Development is 8.5µg/m^3 for 2023, which is less than the threshold of 24µg/m^3 stated in the IAQM guidance [16]. The sensitivity of the area for human health can therefore be assigned as *low*, as there are between 10-100 high-sensitivity receptors within 20m of the Proposed Development.

5.8.11 The sensitivity of the area to ecological impacts has been assigned as *medium*, due to the presence of one ecological receptor within 50m of the Proposed Development.

Risk of impacts

5.8.12 Taking into consideration the dust emission magnitude and the sensitivity of the area, the Proposed Development has been classified as low risk to human health impacts for earthworks, construction and trackout; and high risk of dust soiling for earthworks, construction and trackout. For ecological impacts, the Proposed Development has been classified as high risk for demolition, and medium risk for earthworks, construction and trackout. Table 5-8 summarises the risk of dust soiling, human health and ecological impacts for demolition, earthworks, construction and trackout.

5.8.13 Specific good practice mitigation to minimise risk of dust soiling, human health impacts and ecological impacts are described above in Section 5.7. Overall, high risk mitigation measures will be considered for the Proposed Development with high risk demolition, medium risk earthworks, high risk construction and high risk trackout specific measures.

5.8.14 The dust emitted by the activities discussed can be greatly reduced or eliminated by applying the mitigation measures, according to IAQM Guidance [16]. With the mitigation measures in place, air quality impacts resulting from the construction of the Proposed Development can be considered **not significant**.

Table 5-8 Summary dust risk table prior to mitigation

Activity	Risk of Dust Soiling	Human Health Risk	Ecological
Demolition	High risk	Medium risk	High risk
Earthworks	Medium risk	Low risk	Medium risk
Construction	High risk	Low risk	Medium risk
Trackout	High risk	Low risk	Medium risk

5.9 Mitigation and Enhancement

Additional Mitigation of Construction Effects

5.9.1 No additional mitigation measures are required for construction dust as all required high risk measures are included as embedded environmental design measures.

5.10 Residual Effects

5.10.1 Since no additional mitigation measures are required for the construction phase, residual effects arising from construction dust remain as reported in Section 5.8.

5.11 Assessment Summary

Table 5-9 Summary of effects matrix

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual effect
Human receptors and Ecological Receptors	Construction dust impacts	There would be **no significant** effects arising from construction dust after the implementation of best practice mitigation in line with IAQM guidance.	Mitigation measures are outlined in Section 5.7, and the accompanying outline EMP. No additional mitigation is required.	Effect unchanged – **not significant**

Abbreviations List

AAFT	Annual Average Daily Flow
APR	Annual Progress Report
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
CEMP	Construction Environmental Management Plan
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPUK	Environmental Protection UK
ES	Environmental Statement
HDV	Heavy Duty Vehicle (>3.5 tonnes)
IAQM	Institute of Air Quality Management
LDV	Light Duty Vehicle (<3.5 tonnes)
MCP	Medium Combustion Plant
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NRMM	Non-Road Mobile Machinery
NRW	Natural Resource Wales
PM_{10}	Particulate Matter ≤10 micrometres
$PM_{2.5}$	Particulate Matter ≤2.5 micrometres
PPC	Pollution Prevention and Control
SAC	Special Area of Conservation
SPA	Special Protection Area
YGC	Ymgynghoriaeth Gwynedd Consultancy

Glossary

Air Quality Objectives	Standards to protect human health and the environment from harmful air pollutants
Baseline	The existing environmental conditions before the implementation of the Proposed Development
Construction Dust	Particulate matter generated from construction activities such construction, earthworks and trackout
Critical Levels	Threshold pollutant concentrations used to assess potential impacts on sensitive ecosystems
Residual Effects	Environmental effects that remain after mitigation measures have been implemented

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Cyngor Gwynedd

Barmouth North Promenade FAS

ES Chapter 6 Biodiversity and Protected Sites

Reference: BMTH-ARP-EBD-ZZ-RP-OE-000002

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Contents

6. Biodiversity and Protected Sites 1

6.1 Introduction 1

6.2 Legislation, Policy and Guidance 2

6.3 Stakeholder Engagement 5

6.4 Methodology 9

6.5 Baseline 16

6.6 Embedded Environmental Design Measures 35

6.7 Assessment of Likely Significant Effects 38

6.9 Mitigation and Enhancement 56

6.10 Residual Effects 62

6.11 Assessment Summary 63

Tables

Table 6-1 List of relevant legislation 2

Table 6-2 List of relevant national policies 3

Table 6-3 List of relevant local policy, plans and strategies 4

Table 6-4 NRW comments on scope of the Proposed Development and the response 5

Table 6-5 Gwynedd Council comments on scope of the Proposed Development and the response 6

Table 6-6 NRW comments relevant to the ES Chapter 6 on the Proposed Development post PAC 7

Table 6-7 Assumed zone of Influence for ecological receptors 10

Table 6-8 Summary of methods for field surveys 11

Table 6-9 Statutory Designated Sites and Non-Statutory (local) Sites. 16

Table 6-10 Phase 1 Habitat field survey results 21

Table 6-11 Intertidal Biotope field survey results 24

Table 6-12 Protected and notable species survey results 24

Table 6-13 Nature conservation evaluation of ecological receptors 29

Table 6-14. Resilience Assessment of the Existing Ecosystems along with Indication of how the Scheme may change this Resilience (Increase +/ Decrease -). 53

Table 6-15 Summary of effects matrix 63

6. Biodiversity and Protected Sites

6.1 Introduction

6.1.1 This chapter provides an assessment of the likely significant effects that may arise from the construction, operation and maintenance of Barmouth North Promenade Flood Defence Scheme (hereafter referred to as the 'Proposed Development'), on ecological receptors within the study area. The approach undertaken for this chapter has been supported by a Scoping Report submitted by Cyngor Gwynedd (Ymgynghoriaeth Gwynedd Consultancy (YGC)), engagement with statutory consultees, and Scoping Opinions received from Cyngor Gwynedd and Natural Resources Wales (NRW) in April 2024 and July 2025 respectively.

6.1.2 This chapter details the legislation, policy and guidance that is relevant to biodiversity and the Proposed Development, a summary of consultation undertaken, the methodology of assessment, and the embedded environmental design measures. This is followed by an assessment of likely significant effects of the Proposed Development on the ecological receptors within the study area, taking account of the embedded environmental design measures, and the need for any additional mitigation is then considered along with any proposals for enhancement. This chapter concludes with a summary of likely significant residual effects.

6.1.3 This chapter is supported by the following baseline report appendices, all contained in Volume 3:

- Appendix 6.1 – Arup (2025) Barmouth North Promenade, Intertidal Biotope Survey Report. Document Reference
- Appendix 6.2 – Arup (2024) Barmouth North Promenade, Preliminary Ecological Appraisal Report.
- Appendix 6.3 – Arup (2025) Barmouth North Promenade, Blue Mussel *Mytilus edulis* Assessment.
- Appendix 6.4 – Arup (2024) Barmouth North Promenade, Otter and Water Vole Report.
- Appendix 6.5 – Arup (2025) Barmouth North Promenade, Habitats Regulations Assessment Screening for Ground Investigation.
- Appendix 6.6 – Castell Ecology (2025) Barmouth North Promenade, Wintering Bird Report (CE0289.01WeBS(0).
- Appendix 6.7 – Arup (2025) Barmouth North Promenade, *Sabellaria alveolata* Survey Report.
- Appendix 6.8 YGC (2025) Bat Survey Report (CPF8718)
- Appendix 6.9 – Castell Ecology (2024) Breeding Bird Habitat Appraisal (CE0287.01bbha(0))
- Appendix 6.10 – Arup (2025) Indicative Underwater Noise Modelling.

6.1.4 This chapter should be read in conjunction with:

- ES Chapter 5 Air Quality
- ES Chapter 7 Climate Change
- ES Chapter 10 Flooding and Water Quality
- ES Chapter 11 Noise and Vibration
- ES Chapter 12 Marine and Coastal Physical Processes
- ES Chapter 13 Seascape and Landscape and Visual
- ES Chapter 15 Cumulative and In-Combination Effects
- Green Infrastructure Statement (GIS) (Doc Ref. BMTH-ARP-ELS-ZZ-RP-L-00003)
- Habitat Regulations Assessment Coastal Squeeze Addendum (Doc Ref BMTH-ARP-EBD-OFFSH-TN-OE-000003)

6.2 Legislation, Policy and Guidance

6.2.1 This section identifies the legislation, policy, guidance and other documentation that has informed the assessment of likely significant effects on the ecological receptors within the study area. This section is supported by the ES Volume 3, Appendix 1.1 Policy Context, which outlines overarching legislation and policy relevant to the Proposed Development.

Legislation

6.2.2 Table 6-1 lists the legislation relevant to this topic and the assessment of the likely significant effects.

Table 6-1 List of relevant legislation

Legislation	Relevance to Assessment
The Environment (Wales) Act 2016 [1]	Central to the Act is the aim to safeguard and build resilience of natural systems to continue to provide long-term benefits for the environment, economy, people and communities. Section 6 under Part 1 of the Act requires that "public authorities must seek to maintain and enhance biodiversity so far as consistent with the proper exercise of their functions and in so doing promote resilience of ecosystems". Section 7 requires Welsh Ministers to publish, review and revise lists ('S7 Lists') of living organisms and habitats that are of principle importance in Wales. The Welsh Government have updated their lists on the 20th March 2026, to include 69 Section 7 Habitats and 1322 Section 7 Species.
The Conservation of Offshore Marine Habitats and Species Regulations (2017) [2]	The regulations aim to protect and conserve offshore marine habitats and species by implementing measures to promote sustainable management of habitats and species in offshore waters and safeguard important habitats from disturbance or harm.
Well-being of Future Generation (Wales) Act 2015 [3]	The Act places legal duty on public organisation to maintain and enhance biodiversity, by thinking about the long-term impact of their decisions. This includes a well-being goal of resilience, promoting a nation which maintains and enhances a biodiverse natural environment with healthy functioning ecosystems.
Wildlife and Countryside Act 1981 (as amended) (WCA) [4]	Underpins nature legislation in Wales covering the conservation and protection of wild animals, plants and habitats. The WCA protects a range of wildlife, including the protection of wild birds and their eggs whilst nests

Legislation	Relevance to Assessment
	are in use (implementing the Birds Directive), making it an offence to injure or kill a number of species listed in Schedule 5, protecting wild plants listed under Schedule 8, and making it unlawful to plant or otherwise cause to spread in the wild any plant which is listed under Part II of Schedule 9.
Conservation of Habitats and Species Regulations 2017 (as amended) (The Habitats Regulations) [5]	Transposes Council Directive 92/43/EEC on the Habitats Directive into law within England and Wales and provide for the designation and protection of sites of International importance, referred to as Protected Sites under the National Site Network within the assessments. The Habitat Regulations also convey special protection measures to a number of species (listed in Schedule 2) referred to as a European Protected Species (EPS).

National Policy and Strategies

6.2.3 Table 6-2 lists the relevant planning policy and strategies, with paragraphs of relevance to the assessment.

Table 6-2 List of relevant national policies

National Policy & Paragraph Number	Summary of Policy Requirement and Relevance
Planning Policy Wales (PPW) Edition 12 [6]	PPW sets out that planning authorities must seek to maintain and enhance biodiversity in the exercise of their functions, by ensuring development does not cause any significant loss in habitats or populations of species. The policy ensures any scheme applying for planning permission must demonstrate achievement of a net benefit for biodiversity and enhance ecosystem resilience (through applying a stepwise approach[1]). A Green Infrastructure Statement is required with all planning applications to demonstrate compliance with this approach.
DECCA Framework [7]	A framework for evaluating ecosystem resilience based on five attributes and properties specified in the Environment Wales Act and can be applied across different habitats and land uses and for a range of different scales: Diversity, Extent, Condition, Connectivity and Aspects of ecosystem resilience (“DECCA”).
Welsh National Marine Plan [8]	The vision of the Marine Plan supports the shared UK vision of clean, healthy, safe, productive and biologically diverse oceans and seas and Welsh Government’s commitments to supporting the Well-being of current and future generations. Objective 10 of the Plan concerns the protection, conservation and enhancement of marine biodiversity to halt/reverse decline. This includes the supporting of a well-managed and ecologically coherent network of Marine Protected Areas (MPAs) and resilient populations of representative, rare and vulnerable species. This includes Policy ENV_01, which requires proposals to safeguard, maintain and, where appropriate, enhance marine ecosystems and biodiversity, and to avoid, minimise and/or mitigate adverse effects on the marine environment.
UK Marine Policy Statement [9]	The framework for preparing Marine Plans and taking decisions affecting the marine environment, contributing to the achievement

[1] The stepwise approach refers to the application of the mitigation hierarchy whereby the first principle is to avoid impacts and adverse effects on biodiversity features. Where it is not possible to avoid an impact, the second principle is to seek appropriate mitigation and restoration, followed by compensation and enhancement. Enhancement measures to provide net benefits for biodiversity should be undertaken at each stage of this stepwise approach.

National Policy & Paragraph Number	Summary of Policy Requirement and Relevance
	of sustainable development in the United Kingdom marine area. 'Living within environmental limits' is one of the high-level marine objectives promoting conserving, protecting and recovering biodiversity, and healthy, resilient and adaptable marine ecosystems.
Future Wales – The National Plan 2040 [10]	Provides the National Development Framework for Wales, setting out the direction for development in Wales until 2040. It addresses national priorities through the planning system, including how biodiversity needs to be safeguarded, and how actions should secure the maintenance and enhancement (net gain) of biodiversity, ecosystem resilience and green infrastructure, and part of development proposals. The principles of the Well-being of Future Generations (Wales) Act 2015 are embedded within the plan, to facilitate sustainable development.
Marine Area Statements	The Marine Area Statement covers all inshore waters in Wales, extending out to 12 nautical miles. The key themes are building resilience of marine ecosystems, promoting nature-based solutions and adaptation at the coast, and maximising marine planning. Marine habitats present in north-west Wales are covered under the wider Marine Area Statements and are not listed separately within the north-west Wales Area Statement which primarily covers terrestrial habitats.

Local Policy and Strategies

6.2.4 The relevant local planning policy plans and strategies to the assessment are listed in Table 6-3.

Table 6-3 List of relevant local policy, plans and strategies

Local Policy, Plan & Strategy	Relevant policy	Relevance to Assessment
Anglesey and Gwynedd Joint Local Development Plan 2011 - 2026 (2017) [11]	Strategic Policy PS 5 [12, pp. 60-61]	Sustainable development – includes reference to protecting and improving biodiversity and ensuring all new development is resilient to the effects of climate change.
	Strategic Policy PS 19 [12, pp. 165-166]	Conserving and enhancing (where appropriate) the natural environment – consideration given to several factors when determining a planning application, including protecting, enhancing and/or restoring biodiversity and networks of natural habitats (in accordance with Local Biodiversity Action Plans / Policy AMG 5).
	General Policy and Policy AMG 5 [12, pp. 174-175]	Local biodiversity conservation – Proposals must protect and enhance biodiversity (where appropriate) that is identified as important to the local area by avoiding harmful impacts through sensitive location of the development and considering opportunities to create/improve/manage habitats and landscapes. Proposals can be refused if they do not conform with the criteria set out in this policy, such as 'the need for the development outweighs the importance of the site for local nature conservation'.
	Policy AMG 4 [12, pp. 173-174]	Coastal protection – ensuring that proposals do not cause unacceptable harm to the area's biodiversity interests (i.e., European Protected Areas) due to, for example, materials, noise or emissions.

Local Policy, Plan & Strategy	Relevant policy	Relevance to Assessment
Natur Gwynedd Local Biodiversity Action Plan (LBAP) [13]		Natur Gwynedd is the Local Biodiversity Action Plan (LBAP) for Gwynedd outside the Snowdonia National Park, also extending out to sea covering a range of marine habitats and species. The working document has several aims including contributing to the conservation and enhancement of biodiversity locally (in Wales) and at both a UK and global level. The document will be adopted as supplementary planning guidance by Gwynedd Council and unpin various strategies and research / monitoring.

Standards and Guidance

6.2.5 Guidance and standards for specific species, groups and other ecological receptors is discussed in individual relevant sections or is provided in the ecological baseline reports. The principal assessment source used for this topic is the following:

- The Guidelines for Ecological Impact Assessment in the United Kingdom and Ireland: Terrestrial, Freshwater Coastal and Marine (2018) CIEEM [14].

6.3 Stakeholder Engagement

EIA Scoping Opinion

6.3.1 An EIA Scoping Opinion was received by Cyngor Gwynedd Council (supported by Ymgynghoriaeth Gwynedd Consultancy (YGC)) and Natural Resources Wales (NRW) on 30th April 2024 and 19th April 2024 respectively. The comments received in relation to Biodiversity and Protected Sites are presented in Table 6-4 and Table 6-5, including how these have been addressed in the Environmental Statement and this chapter.

Table 6-4 NRW comments on scope of the Proposed Development and the response

Scoping Opinion Comment	Response
NRW have advised that marine mammals of the Pen Llyn a'r Sarnau Special Area of Conservation (SAC) would need to be considered due to possible noise disturbance from the piling activity.	Marine mammals have been scoped into the assessment as receptors. This is covered in the statutory sites and species sections.
NRW have highlighted that the potential for the piling activity to impact on migratory fish from underwater noise and vibration and should be considered for the Afon Eden – Cors Goch Trawsfynydd SAC which has Atlantic salmon as a feature and would migrate up the Mawddach estuary.	Afon Eden - Cors Goch Trawsfynydd SAC has been scoped into the assessment as a receptor. This is covered in the statutory sites and species sections.
NRW have advised that The Aber Mawddach / Mawddach Estuary Site of Special Scientific Interest (SSSI) should be scoped in.	The Aber Mawddach / Mawddach Estuary SSSI has been scoped into the assessment as a receptor. This is covered in the statutory sites section.
NRW welcome a survey for Invasive Non-Native Species (INNS) to identify the range and location of any species in the vicinity. However, they suggest that this includes all species of medium	Marine INNS were recorded during the Intertidal Biotope survey in October 2024. An invasive species of barnacle was identified amongst the timber groynes. This species is listed as low risk

Scoping Opinion Comment	Response
and high concern on the Marine Invasive Non-native Species Priority Monitoring and Surveillance list for Wales.	on the Marine Invasive Non-native Species Priority Monitoring and Surveillance list for Wales. No further INNS surveys were deemed necessary as no additional INNS were identified.
NRW advise that such an assessment should include surveys for otters (*Lutra lutra*) (also a feature of the Pen Llyn a'r Sarnau SAC) and bats so that suitable mitigation may be considered.	An otter habitat suitability and field sign survey were undertaken in November 2024. In addition, a Preliminary Roost Assessment (PRA) and presence/likely absence survey was undertaken for bats in 2025. These receptors are covered in the corresponding species section.
With regards to physical processes a spatial maximum zone of influence for potential impacts of the proposed works has not been presented. A suitable spatial maximum zone of influence should be confirmed.	The addition of transport Option 2 (delivery of rock armour by sea) has resulted in an increase to the study area. This study area covering the Zone of Influence (ZoI) has been reflected throughout the assessment. Further details on the spatial maximum ZoI can be found in Chapter 12 Marine and Physical Coastal Processes.
NRW have noted the Scoping Report submitted provides insufficient detail regarding potential direct and indirect impacts of the Construction, Operation and Decommissioning phases of the proposed works to Physical Processes.	Please see ES Chapter 12 Marine and Coastal Physical Processes for full details on potential direct and indirect impacts of the Construction and Operation phases of the Proposed Development on physical processes. Decommissioning has not been assessed due to the assumption that the defences will remain in place past 2075.

Table 6-5 Gwynedd Council comments on scope of the Proposed Development and the response

Scoping Opinion Comment	Response
The applicants should follow the relevant guidance for benthic habitat assessments for marine development.	The following NRW Guidance Notes have been used during surveys to inform the assessment of likely significant effects within this Chapter: • Benthic habitat assessment guidance for marine developments and activities (2021) [15]. • Benthic habitat assessment guidance (intertidal sediments, horse mussel (*Modiolus modiolus)* reefs, *Sabellaria* reefs, subtidal habitats, subtidal sediments) (2021) [16]. Environmental Impact Assessment (EIA) for marine development (2021) [17]
As highlighted by the Gwynedd Biodiversity Officer the project should look to incorporate biodiversity enhancements into the design of the scheme where possible.	Terrestrial and marine enhancements for a range of receptors have been incorporated into the assessment. This is covered in the mitigation and enhancement section.
The Biodiversity Unit have advised that there is the possibility that piddocks could be present within old wooden groynes or intertidal clays.	Piddock were not recorded during the Intertidal Biotope survey in October 2024 or during the detailed *Sabellaria* survey in May 2025. However, their potential presence has been considered within the intertidal habitat assessment section.

Scoping Opinion Comment	Response
The above information will also be needed for your Authority to undertake a HRA as the competent authority under the Conservation of Habitats and Species Regulations 2017 (as amended).	A Habitat Regulation Assessment (HRA) Report (Stage 1 and Stage 2 screening) has been produced for the Proposed Development. Please see BMTH-ARP-EBD-ZZ-RP-OE-000003 for reference.

Table 6-6 NRW comments relevant to the ES Chapter 6 on the Proposed Development post PAC

Scoping Opinion Comment	Response
NRW welcome the inclusion of a Marine Vessel Management Plan (MVMP) to avoid potential impact on subtidal blue mussel habitat. Should Option 2 (transportation of rock armour by sea) be the preferred development option, NRW would welcome further discussion to select the most appropriate locations for vessel management and rock storage. NRW further encourage implementation of overall speed restrictions for vessels operating both within and outside the SAC, as precautionary measure to minimise potential disturbance to marine mammals that may be present in the area.	Measures have been included within the ES and HRA to address habitat disturbance for subtidal blue mussel habitat under the Option 2 development option. Commitments to slow vessel speeds are included within the assessment and will be secured through the MVMP as a precautionary measure to minimise disturbance to marine mammals and other receptors. An MVMP has been included within the assessment framework and will be secured should Option 2 (sea delivery of rock armour) be taken forward. The MVMP will set out vessel management, routing, anchoring and operational controls to minimise potential impacts on marine receptors and habitats.
NRW advised that allis and twaite shad, mobile features of the Aber Mawddach / Mawddach Estuary SSSI, may be present near the works and, as hearing-specialist fish, could be sensitive to vessel noise under Option 2. Whilst modelling indicates that source noise from the large transport vessel could theoretically affect hearing-specialist fish under prolonged exposure, predicted noise levels at the SAC boundary and vessel stopping points are below TTS thresholds, and sustained exposure is unlikely given offshore anchoring and fish mobility. With implementation of the MVMP, residual risk is considered low.	Potential effects on hearing-specialist fish have been considered using available modelling outputs and outlined under construction effects for clarity. The intermittent nature of vessel activity, anchoring location offshore, and implementation of vessel management measures are expected to reduce the likelihood of significant effects. The assessment concludes no significant residual effects on fish, supported by construction timing at low water and the application of embedded mitigation measures/MVMP.
Updated auditory injury criteria for marine mammals have recently been published and NRW advise that these revised thresholds are to be reflected in future assessments to ensure current best practice.	Thresholds from updated guidance has been integrated into the ES and HRA reports. Underwater noise has been assessed using modelling outputs and embedded mitigation measures. Noise levels have been interpreted in the context of construction timing, activity type and distance from receptors, with conclusions based on modelled noise levels rather than source levels alone.
Regarding Chapter 12 – Marine and Coastal Physical Processes, NRW state that the main driver for dune formation is wind driven (aeolian) sand transport from the west to north-west, with the construction of the causeway blocking the northern estuary channel, providing space for the	The ES Chapter 6 has incorporated the impact on dunes and proposed dune mitigation/enhancement within the updated ES Chapter 6. The assessment has been informed by existing coastal process evidence. The potential influence of revetment works and groyne removal on aeolian

Scoping Opinion Comment	Response
dunes to develop and the construction also trapping aeolian transport. NRW advise amending this section of the report and that the impact of the revetment on dunes is assessed. It should be noted that it is NRW's initial opinion that the change to the revetment (slight loss of upper intertidal beach) is unlikely to cause a material reduction in sand supply to the dunes. The removal of the groynes impact on aeolian transport should also be considered: this could lead to increased sand supply if the groynes are currently trapping wind driven sand.	sand transport and dune dynamics has been considered, with conclusions reflecting the limited scale of change anticipated.
NRW advise that indirect effects and disruption to hydrology and sand supply have not been considered as part of the current HRA and Appropriate Assessment in relation to potential impact on biogenic reef *Sabellaria alveolata* habitat. NRW advise that this element is included as part of the HRA with information included in the Appropriate Assessment to rule out a potential impact pathway.	Potential indirect effects on biogenic reef habitat have been considered within the assessment framework and ruled out due to the localised impact.
NRW advise that the location of the *Sabellaria alveolata* habitat recorded as part of the Phase 1 intertidal survey should be confirmed in Appendix 6.1 Intertidal Biotope Survey Report, Figure 4 Intertidal Biotope Survey.	Habitat extents and locations are confirmed within the relevant appendices.
NRW have proposed amendments to the coastal squeeze assessment.	A Habitats Regulations Assessment Coastal Squeeze Addendum has been produced to consider coastal squeeze impacts (doc ref BMTH-ARP-EBD-OFFSH-TN-OE-000003)
Regarding otters, NRW advise that to reduce any potential impact on otters during the operational phase as a result of lighting impacts, the planning authority should include the following condition on any planning permission granted: **Condition:** Prior to its installation, full details of lighting shall be submitted to and agreed in writing by the Local Planning Authority. The Lighting Plan should include: - Details of the siting and type of external lighting to be used - Drawings setting out light spillage in key sensitive areas - Details of lighting to be used both during construction and/or operation - Measures to monitor light spillage once development is operation. - The lighting shall be installed and retained as approved during construction and operation. **Justification:** A lighting plan should be submitted to ensure lighting details are agreed prior to	Otter mitigation measures are to be included within the CEMP, and a lighting strategy will be secured to control light spill during construction and operation, reducing potential effects on otters and other sensitive receptors.

Scoping Opinion Comment	Response
installation and to reduce the impacts of lighting in the interest of protected species, protected sites, habitats, commuting corridors, dark skies, visual amenity and nighttime tranquillity of designated landscapes.	
Regarding removal of groynes, NRW advise that details on groyne removal and any environmental impact from this activity is to be considered, including water quality. Detail the method on how the groynes will be removed and possible sediment suspension from the works. With approximately 27 rows of groynes to be removed, the cumulative impact of disturbing sediment that may contain pollutants should be considered further. NRW would encourage the work to remove the groynes should be done at low water, reducing the risk of sediment resuspension.	Groyne removal will be undertaken at low water where practicable and controlled through method statements within the CEMP. Measures will be implemented to manage sediment disturbance, machinery positioning and pollution risk. Groyne removal has been considered within the assessment and will be controlled through the Construction Environmental Management Plan (CEMP). Measures will be implemented to minimise sediment disturbance, pollution risk and effects on water quality during removal works.

Non-Statutory Engagement

6.3.2 Non-Statutory Stakeholder consultation has not been undertaken in relation to the Proposed Development.

6.4 Methodology

Study area

6.4.1 This section describes the spatial scope (the area which may be impacted) for the assessment. It applies to the potential impacts on statutory and non-statutory nature conservation sites, and habitats and species of conservation importance (ecological receptors).

6.4.2 In this chapter the study area includes all land directly affected by the Proposed Development. For certain ecological receptors, such as those that are hydrologically connected or considered to represent Functionally Linked Land (FLL), the study area has been extended to also include land or sea beyond the Site to adequately capture any impacts to “off-site” receptors.

6.4.3 Due to the coastal location of the Proposed Development, the study area used for this assessment covers both terrestrial and marine habitats. The terrestrial extent of the study area includes the existing primary and secondary sea walls along 1.6km of the Barmouth Promenade, in addition to the North Promenade Car Park. The marine extent covers the intertidal zone, from the primary sea wall along the Barmouth Promenade down to the MLWS (approximately 125m from primary sea wall to the seaward edge of the Site boundary).

6.4.4 The study area also includes an assessment of offshore designations, habitats and species, as a result of material transportation optionality:

- Option 1 – delivery of rock armour by road.
- Option 2 - delivery of rock armour by sea.

6.4.5 Should the rock armour be transported by sea, the study area includes an assessment of potential vessel routes, anchorage locations, and beach landing

points, to account for potential impacts from vessel traffic, sedimentation, turbidity, reduced water quality and disturbance via noise and vibration.

6.4.6 The methodologies for establishing the baseline conditions are set out in the following sections along with the assessment methods for evaluating ecological receptors, characterising impacts and determining significance of effects. The distances for each ecological receptor and the assumed Zone of Influence (ZoI) from the Proposed Development are listed in Table 6-7 below. The ZoI correlates with the study area used for this chapter of the impact assessment.

Table 6-7 Assumed zone of Influence for ecological receptors

Ecological Receptors	Assumed Zone of Influence
Internationally Designated Sites notified for their population of marine mammals, fish or otter (*Lutra lutra*) where a direct hydrological connection is present	15km buffer around the Proposed Development
Other Internationally Designated Sites	10km buffer around the Proposed Development
Nationally Designated Sites	2km buffer around the Proposed Development
Locally Designated Sites	2km buffer around the Proposed Development
Priority Habitats, main rivers, Priority Ecological Networks and NRW priority areas	2km buffer around the Proposed Development
Irreplaceable habitat ((Ancient woodland, Ancient/veteran trees)	2km buffer around the Proposed Development
Relevant habitats and species records (including protected and invasive species)	2km around the Proposed Development
Standing waterbodies	0.5km around the Proposed Development

Baseline Methodology

6.4.7 The environmental baseline data for the Site has been obtained from desktop study and baseline surveys. The following sources have been used to complete the baseline assessments:

- Multi-Agency Geographical Information for the Countryside (MAGIC) website [18] for locations of statutory designated sites.
- Joint Nature Conservation Committee (JNCC) website [19] for citations of statutory designated sites.
- NRW Protected Areas of Land and Sea [20] website for information on statutory designated sites.
- Welsh Government DataMapWales [21] for notable habitats including ancient woodlands and main rivers.
- Welsh Government DataMapWales for priority ecological networks.
- Woodland Trusts Ancient Tree Inventory [22] for ancient and veteran trees.
- Welsh Marine Planning Portal [23] for information on marine protected and priority species.
- OS Open Maps [24] for locations of any ponds potentially suitable for great crested newts (*Triturus cristatus)* within 500m of the Site.
- Shoreline Management Plan [25].

- Wales Environmental Information Portal [26].
- Wales Invasive Non-Native Species (INNS) Portal [27].

6.4.8 Field surveys have been conducted to establish the ecological baseline of the Site and study area. The surveys undertaken and methodology for establishing baseline conditions regarding habitats and protected and notable species is summarised in Table 6-8, together with details including dates and survey extents. For details on the individual survey methodologies, locations of surveys, equipment used, and survey limitations, refer to the associated baseline reports provided in Appendix 6.1 – 6.9.

Table 6-8 Summary of methods for field surveys

Survey	Date	Summary of Method	Survey Area	Report & Appendix
Intertidal Biotope Survey	30 September 2024 and 01 October 2024	Surveys were undertaken in accordance with the Marine Nature Conservation Review (MNCR) Intermediate Level survey for rapid biotope assessment, comprising broad biotope appraisal and identification of conspicuous flora and fauna [28]. Identification of the soft sediment biotopes in situ was undertaken in accordance with the Marine Monitoring Handbook Procedural Guideline No. 3-1 [29].	The Site plus extended to OS grid reference SH 60750 15923 (south) and SH 59957 17750 (north)	Intertidal Biotope Survey Report – ES Volume 3, appendix 6.1
Extended Phase 1 Habitat Survey	25 September 2024	Following JNCC's Extended Phase 1 Habitat Survey methodology [30] which included an assessment of habitats on site, and the potential for habitats to support protected/notable species and INNS.	The Site plus 30m outside the boundary (where accessible)	Preliminary Ecological Appraisal (PEA) Report– – ES Volume 3, appendix 6.2.
Blue mussel Assessment	06 May 2025	Desk based assessment following the Intertidal Biotope Survey to quantify the extent of blue mussel across the Proposed Development and adjacent designated sites using online sources (DataMap Wales).	The Site plus up to 800m offshore	Blue Mussel Assessment File Note – – ES Volume 3, appendix 6.3
Otter and Water Vole Survey	06 November 2024	Survey of all watercourses and suitable habitat for signs of otter and water vole (*Arvicola amphibius*), using 'Monitoring the	All suitable habitat within and up to 500m of the Site	Otter and Water Vole Survey Report – –ES Volume

Survey	Date	Summary of Method	Survey Area	Report & Appendix
		Otter' [31] and 'Water Vole Field Signs and Habitat Assessment' [32].		3, appendix 6.4
Wintering Bird Surveys	Monthly from September 2024 to March 2025	Surveys followed the Wetland Bird Survey (WeBS) methodologies [33], employing monthly core counts at high tides (September 2024 to March 2024), and at low tides (November 2024 to February 2025).	The Site plus 500m outside the boundary	Wintering Bird Survey Report – ES Volume 3,Appendix 6.6
Sabellaria alveolata Survey	01 – 02 May 2025	Survey methods were aligned with the NRW Guidance Note 030d [15] and informed by the results of the previous Intertidal survey report covering the Proposed Development.	Approximately 200m north of the Site where *Sabellaria alveolata* was previously recorded during the Intertidal Biotope Survey	*Sabellaria alveolata* Report — ES Volume 3, Appendix 6.7
Bat Surveys	25 February and May 2025	Preliminary Roost Assessment (PRA) of buildings and presence/likely absence survey of the substation (via dusk emergence survey). .	The Site plus 30m outside the boundary (where accessible)	Bat Survey Report – ES Volume 3, appendix 6.8
Breeding Bird Habitat Appraisal Survey	08 July 2024	A walkover survey was carried out by an experienced ornithologist to record both the species present, and to examine the types and extents of potential breeding bird habitats within and adjacent to the Proposed Development.	The Site and immediately adjacent habitats	Breeding Bird Habitat Appraisal Report– ES volume 3, appendix 6.9
Indicative underwater noise modelling	July 2025	Desk-based assessment of underwater noise levels from source to receiver (sensitive ecological receptors)	Study area based on transhipment zones and routing locations provided by Keynvor Morlift Limited (KML).	Indicative underwater noise modelling – ES volume 3 Appendix 6.10

Assessment Methodology

6.4.9 The assessment of impacts from the construction and operational phases of the Proposed Development has followed the methodology set out in CIEEM guidance [14]. In line with this guidance, the following definitions are used for impacts and effects:

- Impact – actions resulting in changes to an ecological receptor. For example, the construction activities of a development removing a hedgerow.

- Effect – outcome to an ecological receptor from an impact. For example, the effects on a dormouse (*Muscardinus avellanarius*) population from the loss of a hedgerow.

6.4.10 The assessment of impacts considers the ecological baseline within the study area at the time of survey. Methods of valuing or determining the importance of the ecological receptors within a geographic context are detailed below.

Valuing Habitat and Species

6.4.11 The CIEEM guidelines [14] recommend that the value of ecological receptors is determined based on a geographic frame of reference. For this assessment, the following geographic frame of reference is used:

- International.
- National (i.e. UK).
- Regional (i.e. northwest Wales).
- County (Gwynedd).
- Local (i.e. within circa 5km of the Site).

6.4.12 In accordance with the CIEEM guidelines [14], in assigning a level of value to each ecological receptor considered in the assessment, it is necessary to consider its distribution and status, including a consideration of trends based on available historic records. Rarity (including inclusion of lists of species of conservation importance, such as Red Data Lists, Birds of Conservation Concern, Biodiversity Action Plans and Lists of Habitats and Species of Principal Importance for the Conservation of Biodiversity: Section 7 Species and Habitats (also referred to as priority species and habitats) is an important consideration because of its relationship with threat and vulnerability; although since some species and habitats are inherently rare, it is necessary to consider rarity in the context of status. A habitat or species that is rare and declining should be assigned a greater level of importance than one that is rare but known to have a stable distribution or population.

6.4.13 Those ecological receptors which have been identified as being of sufficient value to be material to decision-making (e.g. those considered to be of 'Local' importance or above), and which it is considered could experience significant effects as a result of the Proposed Development (i.e. effects that could adversely affect the habitat or the favourable conservation status of a species' local population), have been classified as 'Important Ecological Features' ("IEF") (as outlined in CIEEM Guidelines [14]), and thus are considered in the detailed assessment.

6.4.14 Other ecological receptors (i.e. those which are of less than 'Local' importance) are scoped out, and not subject to any further assessment within this document (unless there are legal obligations such as for invasive non-native species ("INNS")).

Predicting and Characterising Ecological Impacts

6.4.15 In accordance with CIEEM guidelines [14] when describing impacts on receptors of at least local importance, reference is made to the following:

- Positive or negative – i.e. an impact that either increases or reduces quality of the environment or factor being assessed.

- Magnitude – i.e. the size of an impact in quantitative terms where possible.
- Extent – i.e. the area over which an impact occurs.
- Duration – i.e. the time for which an impact is expected to last.
- Reversibility – i.e. a permanent impact is one that is irreversible within a reasonable timescale or for which there is no reasonable chance of action [34] being taken to reverse it. A temporary impact is one from which a spontaneous recovery is possible.
- Timing and frequency – i.e. whether impacts occur during critical life phases or seasons and how often impacts occur.

6.4.16 Both direct and indirect impacts are considered: direct impacts are changes that are directly attributable to a defined action, e.g. the physical loss of habitat occupied by a species during the construction process. Indirect ecological impacts are attributable to an action, but which affect ecological resources through impacts on an intermediary ecosystem, process or receptor, e.g. a pollution event reducing the food source for a receptor such as otter or water vole.

6.4.17 The integrity of a site is also assessed and defined within TAN 5 [15] as:

'…the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and / or the levels of populations of the species for which it was classified.'

Significance Criteria

6.4.18 In accordance with the CIEEM guidelines [14] a significant ecological effect, in broad terms:

'encompass impacts on structure and function of defined sites, habitats or ecosystems and the conservation status of habitats and species (including extent, abundance and distribution)'.

6.4.19 Furthermore, a significant effect:

'is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general.'

6.4.20 It is important to note however that the actual determination of whether an impact is ecologically significant is made irrespective of the value of the receptor in question. In this respect the CIEEM methodology differs from some other approaches to EIA.

6.4.21 The assessment relies on professional judgement and guidance as provided within CIEEM guidelines [14].

6.4.22 Any significant effects remaining after mitigation (the residual effects), together with an assessment of the likelihood of success of the mitigation, are the factors to be considered against legislation, policy and development management in determining the Proposed Development.

Mitigation, Compensation and Enhancement

6.4.23 It is important as part of any environmental impact assessment, wherever possible, to clearly differentiate between mitigation, compensation and enhancement. These terms are used in this assessment as follows:

- **Avoidance** of impacts is sought at design stage where possible to avoid harm to identified ecological receptor (for example changing the construction footprint or avoiding lighting).
- **Mitigation** is used to refer to measures to avoid, reduce or remedy a specific negative impact in situ for the same receptor.
- **Compensation** is where there are significant residual negative ecological effects despite the mitigation proposed, these should be offset by appropriate compensatory measures.
- **Enhancement** is used to refer to measures that seek to provide net benefits for biodiversity over and above requirements for avoidance, mitigation or compensation.

Green Infrastructure Statement

6.4.24 A Green Infrastructure Statement (GIS) has been produced (following compliance with PPW 12 and the Environment (Wales) Act) which demonstrates how the stepwise approach has been followed throughout the Proposed Development design. The Building with Nature Standards Framework v2.0 [35] have been used to inform the Green Infrastructure Statement in the absence of any formal guidance.

Limitations and Assumptions

Blue mussel

6.4.25 A review of aerial imagery indicated that there is a sub-tidal reef feature within <100m of the Site. This feature can be seen extending from the intertidal zone off Barmouth beach, stretching towards the SAC boundary and further offshore. Given the presence of known blue mussel beds and subtidal biogenic reef features locally, it has been assumed that this visible feature may be a blue mussel bed – this is supported by prior mapping of this habitat as blue mussel bed by NRW [20]. For the purposes of this assessment, a precautionary approach has been applied whereby the presence of blue mussels has been assumed, to ensure sufficient consideration has been given to the Proposed Development and any associated impacts.

6.4.26 The review of aerial mapping is caveated as it was not possible to derive subtidal features past approximately 800m offshore as the aerial mapping resolution declined significantly past this point.

6.4.27 No subtidal surveys have been undertaken to inform this assessment.

Intertidal biotope

6.4.28 The intertidal biotope survey was undertaken within the recommended months of April to October. Monday 30 September experienced strong winds and heavy rain, whilst 1 October was fine with moderate winds and occasional showers. The strong onshore wind may have influenced the low tide level such that access to the full low tide was restricted by the low pressure and strong onshore winds. This may have limited access to the lowest available tides. However, the survey was timed to take advantage of spring tides with the biotopes in the vicinity of MLWS assessed at each low tide. It is therefore considered that the biotopes and species identified are representative.

Sabellaria alveolata

6.4.29 The guidance states that surveys are undertaken in late summer to early autumn following the main spring/summer settlement period, to ensure *Sabellaria* reefs are sampled during optimal periods of peak biomass. Programme constraints necessitated survey in early May; however, results are considered representative of conditions.

6.4.30 Habitat characterisation of *S.alveolata* provides a snapshot of the condition of the reefs at the time of survey. Intertidal and shallow subtidal reefs in particular can suffer significant damage from increased wave action during winter storms.

6.4.31 No coring or destructive sampling was undertaken.

Bats

6.4.32 Good practice guidance recommends that bat activity surveys begin at least 15 minutes before sunset and continue for 1.5 to 2 hours afterwards. The survey of the substation building was completed 1 hour after sunset, which is shorter than recommended. The building is in an exposed location adjacent to the promenade, with limited surrounding vegetation and likely lightspill from nearby streetlights and properties. The Site was assessed as having low suitability for foraging and commuting bats, with pipistrelles (known to emerge earlier) being the only species identified in the desk study.

6.4.33 The structure did not present typical features of a horseshoe bat roost and was considered suitable only for crevice-dwelling species, though it is unclear whether internal access was gained for the PRA survey. However, as the building is being retained, the risk of an impact as a result of any missed roosting features is considered to be low.

6.5 Baseline

6.5.1 This section sets out existing conditions and identifies potential ecological receptors and their value, as per the methodology listed in Section 6.4.

Designated Sites

6.5.2 Nine International designated sites are present within 15km of the Site (see Table 6-7 for details on the ZoI applied). This included both terrestrial and marine-based SACs and SPAs. Two nationally designated sites are present within 2km of the Site, both being SSSIs, and seven non-statutory (local) sites, consisting of Candidate Wildlife Sites (CWSs) were recorded within 2km.

6.5.3 Details of these sites can be found in Table 6-9 and their locations are shown in ES Volume 3, Appendix 6.2 – Arup (2024) Barmouth North Promenade, Preliminary Ecological Appraisal Report .

Table 6-9 Statutory Designated Sites and Non-Statutory (local) Sites.

Designated Site	Description	Minimum distance & direction from the Site
International Designated Sites		
Pen Llŷn a'r Sarnau SAC	Annex I habitats (primary reason for site selection):	31m west

Designated Site	Description	Minimum distance & direction from the Site
	• 1110 Sandbanks which are slightly covered by sea water all the time • 1130 Estuaries • 1150 Coastal lagoons *Priority feature • 1160 Large shallow inlets and bays • 1170 Reefs Annex I habitats (qualifying feature, but not a primary reason for site selection): • 1140 Mudflats and sandflats not covered by seawater at low tide • 1310 *Salicornia* and other annuals colonizing mud and sand • 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) • 8330 Submerged or partially submerged sea caves Annex II species (present as a qualifying feature, but not a primary reason for site selection): • 1349 Bottlenose dolphin (*Tursiops truncatus)* • 1355 Otter (*Lutra lutra)* • 1364 Grey seal (*Halichoerus grypus)*	
Coedydd Derw a Safleoedd Ystlumod Meirion/ Meirionnydd Oakwoods and Bat Sites SAC	Annex I habitats (primary reason for site selection): • 91A0 Old sessile oak woods and *Ilex* and *Blechnum* in the British Isles • 91E0 Alluvial forests with black alder (*Alnus glutinosa)* and ash (*Fraxinus excelsior)* (Aldno-Padio, *Alnion incanae, Salicion albae*) Annex I habitats (qualifying feature, but not a primary reason for site selection): • 3260 Water courses of plain to montane levels with the *Ranunculion fluitantis* and Callitricho-Batrachion vegetation • 4010 Northern Atlantic wet heaths with *Erica tetralix* • 4030 European dry heaths • 9180 *Tilio-Acerion* forests of slopes, screes and ravines * Priority feature • 91D0 Bog woodland * Priority feature Annex II species (primary reason for site selection): • 1303 Lesser horseshoe bat (*Rhinolophus hipposideros)*	350m east
West Wales Marine SAC	Annex II species (primary reason for site selection): • 1351 Harbour porpoise (*Phocoena phocoena*)	13.18km southwest
Morpha Harlech / a Morpha Dyffryn SAC	Annex I habitats (primary reason for site selection): • 2110 Embryonic shifting dunes • 2120 Shifting dunes along the shoreline with *Ammophila arenaria* (white dunes) • 2130 Fixed coastal dunes with herbaceous vegetation (grey dunes) * Priority feature • 2170 Dunes with *Salix repens* ssp. *argentea* (*Salicion arenariae*)	4.76km northwest

Designated Site	Description	Minimum distance & direction from the Site
	• 2190 Humid dune slacks Annex II species (primary reason for site selection): • 1395 Petalwort (*Petalophyllum ralfsii*)	
Cadair Idris SAC	Annex I habitats (primary reason for site selection): • 3130 Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea* • 8110 Siliceous scree of the montane to snow levels (*Androsacetalia alpinae* and *Galeopsietalia ladani*) • 8210 Calcareous rocky slopes with chasmophytic vegetation • 8220 Siliceous rocky slopes with chasmophytic vegetation Annex I habitats (qualifying feature, but not a primary reason for site selection): • 4010 Northern Atlantic wet heaths with *Erica tetralix* • 4030 European dry heaths • 6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) • 6430 Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels • 7130 Blanket bogs (* if active bog) * Priority feature • 7230 Alkaline fens • 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles Annex II species (primary reason for site selection): • 1065 Marsh fritillary butterfly (*Eurodryas, Hypodryas*) • 1393 Slender green feather-moss *Drepanocladus vernicosus*	5.20km southeast
Rhinog SAC	Annex I habitats (primary reason for site selection): • 4030 European dry heaths • 91A0 Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles Annex I habitats (qualifying feature, but not a primary reason for site selection): • 3130 Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea* • 4010 Northern Atlantic wet heaths with *Erica tetralix* • 4060 Alpine and Boreal heaths • 7130 Blanket bogs (* if active bog) * Priority feature • 7150 Depressions on peat substrates of the Rhynchosporion Annex II species (primary reason for site selection): • 1831 Floating water-plantain (*Luronium natans)*	8.45km northeast
Afon Eden – Cors Goch Trawsfynydd SAC	Annex I habitats (qualifying feature, but not a primary reason for site selection): • 7110 Active raised bogs *Priority feature Annex II species (primary reason for site selection):	11.41km east

Designated Site	Description	Minimum distance & direction from the Site
	• 1029 Freshwater pearl mussel (*Margaritifera margaritifera)* • 1831 Floating water-plantain (*Luronium natans)* Annex II species (present as a qualifying feature, but not a primary reason for site selection): • 1106 Atlantic salmon (*Salmo salar)* • 1355 Otter (*Lutra lutra)*	
Northern Cardigan Bay Special Protection Area (SPA)	Annex II species (primary reason for site selection): A001 Red-throated diver (*Gavia stellata*)	2.14km west
Bird's Rock SPA	Annex II species (primary reason for site selection): A346 Red-billed chough (*Pyrrhocorax pyrrhocorax*)	9.37km south
National Statutory Sites		
Barmouth Hillside SSSI	Nationally important geological site, woodland and botanical interest. The woodland supports a varied mammal and bird population.	350m east
Aber Mawddach/ Mawddach Estuary SSSI[2]	The special features of the site are the estuarine habitats, particularly muddy sediments and saltmarshes, reed beds and raised mire. There is also a substantial species interest, including breeding wading birds, scarce vascular and invertebrates. Otter (*Lutra lutra*) and migratory fish species allis shad (*Alosa alosa*) (non-spawning populations), twaite shad (*Alosa fallax*), sea lamprey (*Petromyzon marinus*) and Atlantic salmon (*Salmo salar*) are also features of interest.	302m south
Non-Statutory Sites		
Wern Mynach/Gwynedd CWS	Wet woodland and marshy grassland.	157m east
Ceilwart-ganol/ Gwynedd CWS	Acid grassland and bracken (*Pteridium aquilinum*).	468m east
Garn/ Gwynedd CWS	Dry heath/acid grassland mosaic.	799m east
Dinas Oleu/ Gwynedd CWS	Dry dwarf shrub heath.	807m southeast
Ffridd y Graig & South to Garn/ Gwynedd CWS	Acid grassland and dry dwarf shrub heath.	819m east
Orielton Wood/ Gwynedd CWS	Broadleaved woodland and dry dwarf shrub heath.	1.53km south

[2] Mawddach Estuary is also a Shellfish Waters Protected Area (SWPA).

Designated Site	Description	Minimum distance & direction from the Site
Tyddyn-y-nant/ Gwynedd CWS	Acid grassland and marshy grassland.	1.66km north

Irreplaceable Habitats

6.5.4 There are no irreplaceable habitats located within the study area. The desk study identified eleven areas of ancient woodland (either unknown category, plantation on ancient woodland site or restored ancient woodland site) within 2km of the Site. The closest lies 145m to the east. The locations of ancient woodland in relation to the Site are shown in ES Volume 3, Appendix 6.2 – Arup (2024) Barmouth North Promenade, Preliminary Ecological Appraisal Report. No ancient trees were recorded within 2km of the Site. Given the distance between the Proposed Development and these features and lack of impact pathway and connective features, no effects on these receptors are foreseeable and as such they are not further considered within this chapter.

Priority Habitats

6.5.5 An area to the north of the Site is classified as a Priority Ecological Network owing to its 'semi-natural grassland'. Most of this area includes the grassland associated with residential properties, caravan parks and further afield. The entire Barmouth coastline is categorised as a Marine Priority Ecological Network.

6.5.6 Several priority and notable habitats are present within 2km of the study area as summarised below:

- Section 7 and OSPAR: Marine Habitats:
  - Mussel Beds (within study area).
  - Estuarine Rocky Habitats (approximately 1km southeast).
  - Intertidal Mudflats (approximately 1km southeast).
  - Atlantic Salt Meadow (approximately 1.5km southeast).
- Marine Article 17 Habitats:
  - Intertidal Reef (Rocky) (within study area).
  - Mudflats and Sandflats (within study area).
  - Estuaries (immediately south, associated with Mawddach Estuary).
  - Estuaries Associated Sediment (approximately 200m south).
- Water Framework Directive (WFD) Higher Sensitivity Habitats [36]:
  - Mussel Beds (*Modiolus modiolus*, *Mytilus edulis* & others) (A1.22, A2.72, A5.62, A4.24, A3.361) (within study area).
  - Saltmarsh (A2.5) (approximately 1.5km southeast).
- WFD Lower Sensitivity Habitats:
  - Gravel & Cobbles (intertidal & subtidal coarse sediment A2.1, A5.1) (within study area).

- Intertidal Soft Sediment (Sand, Mud & Mixed A2.2, A2.3, A2.4) (within study area).
- Rocky shore (Intertidal rock A1) (within study area).
- Subtidal Soft Sediment (Sand, Mud & Mixed A5.2, A5.3, A5.4) (within study area).

Waterbodies

6.5.7 There are no major watercourses (main rivers) or waterbodies within the Site, with the closest 'river' being Afon Mawddach (1km southeast) and the Melin Plas Drain (1.5km north). A small watercourse/ditch feature (unnamed) is located just north of the Promenade Café and measures approximately 46m in length within the Site, before flowing off-site. This watercourse culverts under the railway track (to the northeast).

6.5.8 The search on MAGIC highlighted six waterbodies within 500m of the Site: the closest being 80m east (a small pond at the end of a watercourse and culvert just off Heol-Y-Llan). All other waterbodies were located on the east side of the railway track.

Habitat Surveys

Extended Phase 1 Habitat Surveys

6.5.9 An Extended Phase 1 Habitat Surveys identified 14 habitat types within the Site. These are shown in ES Volume 3, Appendix 6.2 – Arup (2024) Barmouth North Promenade, Preliminary Ecological Appraisal Report and described in detail below in Table 6-10, along with corresponding habitat descriptions.

Table 6-10 Phase 1 Habitat field survey results

Phase 1 Habitat Type	Area coverage	Habitat Description
Dense scrub (A2.1) and scattered scrub (A2.2)	0.06ha	Dense scrub and bracken (*Pteridium aquilinum*) occur adjacent to a small lane to the north of the Site, off-site and on the hillside. Scattered scrub is infrequent within the Site, with a small area which bounds the former compound area. Species noted include bramble (*Rubus fruticosus*), gorse (*Ulex europaeus*) and willow (*Salix* sp).
Tall ruderal herb (C3.1)	0.20ha	This habitat was associated with areas around the formerly used compound site, to the south of the Site and areas adjacent to the watercourses and railway line. Throughout most of the tall ruderal vegetation were stands of Japanese knotweed (*Reynoutria japonica*). Other species noted included bracken, willow, common reed (*Phragmites australis*) and bramble.
Introduced shrub (J1.4)	n/a	This habitat is associated with the ornamental planting within gardens which were not directly accessible for survey.
Running water (G2)	46m	Two watercourses were recorded off-site during the survey, with a small section (approx. 46m) falling within the Site. The larger of the two off-site watercourses is densely choked with vegetation with Japanese knotweed present. Other species noted include willow scrub, common reed, bindweed (*Convolvulus arvensis*)

Phase 1 Habitat Type	Area coverage	Habitat Description
		and bramble. The watercourse flows through the wooded Wern Mynach CWS prior to being culverted under the railway line, it is open for a small section and fenced off, prior to it being culverted under the road. The section inspected had a gravel substrate and slow flow. The watercourse furthest north (by the Promenade Café) is culverted under the railway line and is routed through grassland. This section of the watercourse surveyed is dominated by common reed and Japanese knotweed. The watercourse is approximately 1m wide and 0.5 – 1m deep with clear water and slow flow.
Intertidal mud/sand (H1.1)	17.75ha	This habitat forms the larger part of the intertidal habitats. Wooden groynes dissect the intertidal habitat which are home to blue mussels, barnacles and brown algae (*Fucus* sp).
Intertidal cobbles / shingle (H1.2)	1.65ha	An area of intertidal cobbles and shingle occurs within the other intertidal habitats, adjacent to the existing sea wall and extends seaward. Isolated patches also occur along the existing sea wall. A wider expanse occurs to the north and forms a long stretch, extending north.
Coastal grassland (H8.4), formerly classified as Dune grassland (H6.5)	0.10ha	This area, previously recorded as dune grassland (H6.5), has been reclassified as coastal grassland (H8.4). The habitat extent is considered too limited to constitute a dune system; however, dune associated species are present within the grassland. There was a very small patch of coastal grassland to the north of the Promenade Café, with plant species of a similar composition to the other coastal grassland areas on site, but with less diversity, and a few clumps of marram grass (*Ammophila arenaria*) within the area cleared and formerly used as a compound site. The area extent is limited and has become encroached with bramble scrub and INNS including Japanese knotweed and Montbretia. A small ditch runs through this habitat.
Coastal grassland (H8.4)	1.21ha	Coastal grassland occurs in small strips on the verges located adjacent to the residential flats and properties. This area is managed as a short sward. Some areas where the substrate of the adjacent walls and masonry are showing have become colonised by stonecrop (*Sedum* sp.), common restharrow (*Ononis repens*), yarrow (*Achillea millefolium*) common birds-foot-trefoil (*Lotus corniculatus*), mouse-ear hawkweed (*Hieracium pilosella*), sea plantain (*Plantago maritima*) and lady's bedstraw (*Galium verum*). Other species noted include red fescue (*Festuca rubra*), creeping bent (*Agrostis stolonifera*) and white clover (*Trifolium repens*). A small area of coastal grassland occurs adjacent to the formerly used compound site. Species noted here include small patches of marram grass, red fescue, cocksfoot (*Dactylis glomerata*), dock (*Rumex* sp.), yarrow, sea plantain, gorse (*Ulex europaeus*) and bramble scrub.
Bare ground (J.4)	0.65ha	Bare ground/gravel substrate is associated with the formerly used compound site.

Phase 1 Habitat Type	Area coverage	Habitat Description
Buildings (J3.6)	0.005ha	There are numerous residential, commercial and leisure facilities and buildings to the east of Marine Parade.
Wall (J2.5)	2,403m	A masonry walls run the entire length of Marine Parade, both sides, with gaps associated with entrances to roads and or buildings.
Artificial sea wall (J3.5)	1.52ha	The seawall is present along the entire length of Marine Parade, bordering where the land meets the coast. It is of masonry composite and is enhanced by areas of sheet metal piling in sections.
Hardstanding (J5)	2.15ha	Hardstanding within the Site includes the Marine Parade, residential roads, footpaths and carparking.
Dunes (H6)	Off site, to the south of site	Sand dunes to the south of the Site, not within the Site. The dunes are proposed for mitigation/enhancement as part of the mitigation for the scheme but have not been subject to survey.

Intertidal Biotope Surveys

6.5.10 An intertidal biotope survey was conducted across the intertidal zone of the study area, with the results shown in Table 6-10 and in ES Volume 3, Appendix 6.1 – Arup (2025) Barmouth North Promenade, Intertidal Biotope Survey Report. The upper shore was characterised either by *barren littoral shingle* (LS.LCS.Sh.BarSh) or *barren littoral coarse sand* (LS.LSa.MoSa.BarSa) with the lower shore dominated by the impoverished fine sand biotope LS.LSa.MoSa.AmSco.Sco - *Scolelepis spp. in littoral mobile sand* – a community defined by very low macroinfaunal biodiversity and very low abundance / biomass. This community dominates the proposed policy change area due to the high exposure presented by the westerly aspect of the site creating constant natural disturbance to the substrate. Consequently, all three main intertidal biotopes are either devoid of conspicuous fauna or defined by their lack of diversity and biomass.

6.5.11 Twenty-eight timber groynes situated along the beach hosted the most biodiverse communities recorded within the Site, and were colonised by a range of algae, crustaceans and molluscs. Blue mussels were observed growing in relatively high densities on approximately two thirds of the timber groynes, and on an outfall pipe. The outfall pipe will be retained and incorporated into the proposed revetment, whilst removal of the groynes is proposed.

6.5.12 In addition, honeycomb worm reefs comprising of *Sabellaria alveolata* were observed in the rocky intertidal area approximately 270m north/northwest of the Site. Noting the importance of the ‘reefs’ as supportive of wider biodiversity, *Sabellaria* reefs are listed as ‘Biogenic Reefs’, a sub-category of the ‘Reefs’ feature under Annex I of the Habitats Directive. *Sabellaria alveolata and Sabellaria spinulosa* reefs are Section 7 Habitats. The extent of the area identified during the survey meets the minimum requirements (20 metres squared) to be defined as a distinct biotope (approximately 1,553m^2 squared).

6.5.13 An invasive barnacle (*Austrominius modestus*) was widespread across the study area, predominantly associated with the timber groynes. This species is considered lower risk for Wales according to the Marine Invasive Non-Native Species Priority Monitoring and Surveillance List for Wales [37].

Table 6-11 Intertidal Biotope field survey results

Zonation	Biotope Code	Biotope	Locality	Comment / Status
Supralittoral Upper Littoral Fringe Lower Littoral Fringe	LS.LCS.Sh.BarSh	Barren littoral shingle	Cobble ridge – variable width, throughout the study area	No conspicuous flora or fauna - barren
Supralittoral Upper Littoral Fringe Lower Littoral Fringe	LS.LSa.MoSa.BarSa	Barren littoral coarse sand	Upper beach with larger expanses to south of the Site	No conspicuous flora or fauna - barren
Upper Eulittoral	LR.MLR.BF.FvesB [summer-variant; reduced exposure]	*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock	North of the Site, located shoreward of *S. alveolata* reef	Seasonal variation linked to exposure. LR.HLR.MusB.Sem.FvesR [winter variant] *Semibalanus balanoides, Fucus vesiculosus* and red seaweeds on exposed to moderately exposed eulittoral rock
Mid Eulittoral	LS.LBR.Sab.Salv	*Sabellaria alveolata* reefs on sand-abraded eulittoral rock	North of the Site	**Priority habitat**
Upper Eulittoral	LR.HLR.MusB.Sem.LitX	*Semibalanus balanoides* and *Littorina* spp. on exposed to moderately exposed eulittoral boulders and cobbles	Centre of the Site	Stable embedded cobbles in sediment
Upper Eulittoral Mid Eulittoral	LR.FLR.Eph.UlvPor	*Porphyra purpurea* and *Ulva* spp. on sand-scoured mid or lower eulittoral rock	Central and south of the Site	Stable embedded cobbles in sediment
Mid Eulittoral Lower Eulittoral	LS.LSa.MoSa.AmSco.Sco	*Scolelepis* spp. in littoral mobile sand	Majority of sandy beach	Potential muddy sand biotope at MLWS – as per NRW mapping – no conclusive evidence

Protected and notable species survey results

6.5.14 Table 6-12 details the desk study and field survey results for protected and notable species assessed within the study area. Full details are provided within the PEA report at Appendix 6.2.

Table 6-12 Protected and notable species survey results

Species	Summary Description of Results
Otter	<u>Desk Study Results</u> Two records of otter were returned within 2km of the Site. One record was for a dead otter recorded 500m south within the marine habitat, and the other, a live sighting, was noted foraging and feeding on Barmouth Breakwater 1.5km south.

Species	Summary Description of Results
	Otter and Water Vole Survey (November 2024) No evidence of otter was recorded during the survey. All waterbodies within 500m of the Site were assessed as having low to negligible potential for otter, owning to their fragmented nature, lack of food supply and poor condition. The habitat within the Site is also modified by existing coastal defences and increased human use, in addition to a lack of concealment which would limit the ease of access and movement for otters in this area. The off-site Mawddach Estuary provides more optimal habitat in terms of foraging and refugia for this species. The off-site woodland associated with Wern Mynach CWS does offer suitable habitat for refuge and laying up, though no evidence was noted.
Water vole	Desk Study Results No records of water vole were returned within 2km of the Site. Otter and Water Vole Survey (November 2024) The watercourses surveyed were of low to negligible suitability for water vole owing to limited open areas, dense overshading, limited suitable bank substrate for burrowing, and flow regime. All watercourses are fragmented and unlikely to support viable populations, and as such this species is not further considered within this chapter.
Bats	Desk Study Results A single record of a pipistrelle bat (*Pipistrellus pipistrellus*) was returned within 2km of the Site, foraging southeast close to the Lion Hotel. PEA Walkover (September 2024) No trees which offer bat roosting potential occur within the Site. There are several properties to the east of Marine Parade which offer low – moderate roosting potential, as follows: • Moderate roosting potential: – Min Y Mor Hotel (approximately 25m east of the Site) – Substation building (within the Site boundary) • Low roosting potential: – Residential properties / apartments associated with Hoel Y Sarn (approximately 10m from the Site) – Residential properties / apartments associated Hoel Llywelyn (approximately 15m from the Site) – Garages along Hoel Y Plas (approximately 10m from the Site) – Promenade Café and Wine Bar (directly adjacent to the Site boundary) The seawall and culverts do not have the potential to support bats as these are frequently inundated with sea water. The Site in general is exposed, with low to negligible potential for foraging and/or commuting along the coast and Marine Parade. There is some lighting along the highway, though this is limited. The main foraging and commuting habitat are associated with the off-site vegetated railway corridor, and the woodland beyond this located to the east. A presence/likely absence survey of the substation (conducted via a dusk emergence survey) confirmed no bats emerged from the substation and a roost is therefore considered unlikely to be present.
Hazel dormouse	Desk Study Results No records of hazel dormouse were returned within 2km of the Site. Dormice populations in North Wales are small, scattered and isolated from each other [38].

Species	Summary Description of Results
	PEA Walkover (September 2024) The coastal environments and habitats within the Site are considered unsuitable for dormice based on a lack of suitable habitat and as such this species is not further considered within this Chapter.
Badger	Desk Study Results Two records of badger (*Meles meles*) were returned within 2km of the Site The closest record was 400m east recorded near the A496 and was noted going into adjacent woodland at dusk. PEA Walkover (September 2024) No badger setts or badger activity was noted during the survey. Off-site woodland habitat to the east associated with the CWS (located 150m from the Site, beyond the railway track) provides the most optimal habitat for the construction of setts. The habitat corridor along the railway network provides some suitable foraging and dispersal habitat.
Other notable mammals	Desk Study Results Eight records of hedgehog (*Erinaceus europaeus*) were returned within 2km of the Site. These were all live sightings, located in and around residential areas. PEA Walkover (September 2024) Small mammals such as hedgehog could use the grassland habitat, boundary vegetation and railway line for foraging and dispersal into the wider landscape. Most of this habitat occurs outside the Site. The coastal habitats and Marine Parade offer no suitable habitat.
Birds (breeding and wintering)	Desk Study Results Sixteen records of bird were returned within 2km of the Site and were largely waterbirds. Records included black headed gull (*Chroicocephalus ridibundus*), common scoter (*Melanitta nigra*), oystercatcher (*Haematopus ostralegus*) and common sandpiper (*Actitis hypoleucos*). PEA Walkover (September 2024) The tall ruderal habitat and scattered trees / scrub may provide suitable nesting and foraging habitat for birds. During the walkover survey approximately 90 gulls were present including herring gull (*Larus argentatus)*, lesser black-backed gull (*Larus fuscus)* and black headed gulls which were noted loafing/resting/feeding on the sand, with an additional 30 foraging over water. Cormorants (*Phalacrocorax carbo)* and oystercatchers were recorded flying along the shoreline and a suspected rock pipit (*Anthus petrosus*) was recorded on the beach. Other birds recorded or heard in the scrub included stonechat (*Saxicola rubicola*), robin (*Erithacus rubecula*), blackbird (*Turdus merula*), wren (*Troglodytes troglodytes*), magpie (*Pica pica*) and house sparrows (*Passer domesticus*). Birds flying overhead included barn swallow (*Hirundo rustica*), carrion crow (*Corvus corone*) and jackdaws (*Coloeus monedula*). Breeding Bird Habitat Appraisal (July 2024) No species typically associated with coastal breeding habitats were recorded during the survey. The absence of reedbeds and saltmarsh within or in proximity to the Site removes the potential for the presence of the Mawddach Estuary SSSI species. Marram grass growing in the dunes south of the works area provides some opportunity for nesting grasshopper warbler (*Locustella naevia)* (noted in the SSSI citation) but the suitability of the habitat diminishes towards the northern extent of the dune system and is largely non-existent within the Site. It is, therefore, extremely unlikely that this species would be impacted by the Proposed Development.

Species	Summary Description of Results
	With the exception of the very southern portion of the Site, the majority of the beach is inundated at high tide making it unsuitable for ground-nesting species such as ringed plover (*Charadrius hiaticula*) and oystercatcher. Areas where shoreline remains exposed during high tide experience such a high volume of pedestrian activity or, in the case of pebble beach to the north of the promenade, is also unsuitable due to its steep profile, that any ground-nesting along the beach is considered highly improbable. Small, walled areas of hardstanding between the promenade and the railway line do, however, offer limited potential for nesting oystercatcher and ringed plover, but again, this is considered improbable due to high recreational use. Intertidal Biotope Surveys (September and October 2024) The following species were recorded during the survey; twelve oystercatchers, one curlew (*Numenius arquata)*, three carrion crow, five jackdaw, and twelve herring gull – all observed feeding on the lower areas of the shore and in the vicinity of the mussel-laden outfall pipe. Wintering Birds Surveys (2024 - 2025) A total of 11 species were recorded within the study area between September 2024 to March 2025. This included eider (*Somateria mollissima*), common scoter, goosander (*Mergus merganser*), oystercatcher, turnstone (*Arenaria interpres*), black-headed gull, herring gull, guillemot (*Uria aalge*), red-throated diver, and cormorant (*Phalacrocorax carbo*). In all surveys, feeding was the predominant behaviour observed; no roosting sites were encountered. Counts were generally low across each survey, with a peak observed in September 2024. Gull species represented 72% of all registrations of the high tide surveys, wildfowl 11%, waders 8%, and other species that fall outside these groups, 9%.
Amphibians	Desk Study Results No records of amphibians were returned within 2km of the Site. Great crested newt are considered absent from this region of Wales[3] and as such, this species is not further considered within this chapter. PEA Walkover (September 2024) The habitats within the Site have poor suitability for amphibians, and no ponds are present. There are some suitable areas of terrestrial habitat for amphibians which offer more habitat structure and diversity such as the ditch and fringing habitats, however generally within the Site, these are isolated.
Reptiles	Desk Study Results Five records of reptiles were returned within 2km of the Site. Species noted included adder (*Vipera berus*), slow worm (*Anguis fragilis*) and common lizard (*Zootoca vivipara*). The closest record was that of an adder 500m to the north located within a private garden, not directly connected to the Site and to the north of the A496. PEA Walkover (September 2024) The habitats within the Site have poor suitability for reptiles. However, there are some sub-optimal areas which offer more habitat structure and diversity such as the coastal grassland. The off-site railway line running parallel to the Site and ruderal habitats associated may acts as a dispersal corridor.

[3] Review of the Current Conservation Status (CCS) of the Great Crested Newt in Wales, with specific references to its long-term prospects and within its stronghold in NorthEast Wales. 2018. NRW and Amphibian and Reptile Conservation Trust, Report No. 259. https://cdn.naturalresources.wales/media/687859/eng-evidence-report-259-review-of-the-current-conservation-status-ccs-of-the-great-crested-newt-in-wales.pdf

Species	Summary Description of Results
Fish	Desk Study Results No records of fish were returned within 2km of the Site. Additional searches of the offshore areas adjacent to the Site recorded nursery grounds for anglerfish (*Lophius piscatorius*), whiting (*Merlangius merlangus*), spotted ray (*Raja montagui*), thornback ray (*Raja clavata*) and forage fish, and spawning grounds for cod (*Gadus morhua*), plaice (*Pleuronectes platessa*), sole (*Solea solea*), and sand eel (*Ammodytes* spp.). Migratory fish species allis shad (non-spawning populations), twaite shad, sea lamprey and Atlantic salmon are also features of interest of the Mawddach Estuary SSSI 302m south of the site. PEA Walkover (September 2024) The tidal areas just outside the Site may support a wide range of marine species, including migratory species in passage. The watercourse/ditch may provide suitable habitat for a limited range of common freshwater species, however, are suboptimal due to dispersal barriers.
Marine mammals	Desk Study Results No records of marine mammals were returned within 2km of the Site. Additional searches returned records adjacent to the Site including a grey seal pupping and haul out site approximately 1km south of the Site (approximate grid reference - SH 60940 15019), in addition to bottlenose dolphin and harbour porpoise. PEA Walkover (September 2024) The tidal areas immediately adjacent to the Site are suitable to support foraging and commuting marine mammals.
Invertebrates (Terrestrial and Marine)	Desk Study Five records of terrestrial invertebrates were returned within 2km of the Site. The closest records of notable species included wall (*Lasiommata megera*) 274m east, coastal silver-stiletto (*Acrosathe annulata*) 581m north and cinnabar (*Tyria jacobaeae*) 793m east. PEA Walkover (September 2024) The majority of the Site is unsuitable for terrestrial invertebrates owing to the extent of hard standing and tidal influences. The only suitable habitat is associated with the unmanaged areas including the tall ruderal habitat, railway line and gardens which provides habitat for some coastal species and or common species, dependent upon habitat type. Intertidal Biotope Surveys (September and October 2024) Blue mussels were observed growing on approximately two thirds of the existing timber groynes and on the outfall pipe in relatively high densities and were observed to be a key forage resource to local waders (oystercatcher, etc.). *Sabellaria alveolata* was also identified to the north of the Site (off-site).
Notable plants	Desk Study No plant records were provided as part of the desk study. PEA Walkover (September 2024) No species of note were recorded during the field survey. The off-site dunes to the south-east of the Site may provide suitable habitat to support a range of notable flora.
INNS (Flora and fauna)	Desk Study Results Eleven species were recorded within 2km of the Site. The nearest record was of Japanese knotweed which was recorded to the rear of the formerly used compound site. Other species recorded within 500m include Montbretia (*Crocosmia pottsii x aurea = C. x*

Species	Summary Description of Results
	crocosmiiflora) and Japanese rose (*Rosa rugosa*). No marine INNS records were identified within or immediately surrounding the Site on the Wales INNS Portal. PEA Walkover (September 2024) Dense stands of Japanese knotweed occur frequently within the study area, mainly associated with disturbed habitat adjacent to the formerly used compound and along the off-site railway embankment and the watercourse. Montbretia was recorded in the coastal grassland adjacent to a small ditch. Intertidal Biotope Surveys (September and October 2024) One Marine INNS, an invasive barnacle (*Austrominius modestus*), was identified and found to be widespread across the Site, predominantly associated with the timber groynes. However, this species is deemed to be of low risk in Wales according to the Marine Invasive Non-native Species Priority Monitoring and Surveillance List for Wales [37].

Evaluation of Ecological Receptors

6.5.15 This section evaluates the nature conservation importance of the habitats and species (receptors) known to be present, or considered to be present, within the study area. The receptors are valued in terms of their importance at an international, national, regional, county, local context and less than local (or site) context. The values are shown in Table 6-13 below.

Table 6-13 Nature conservation evaluation of ecological receptors

Ecological Receptors	Evaluation	Conservation Value in the Context of the Proposed Development
Designated Sites		
Pen Llŷn a'r Sarnau SAC	International[4]	Annex I habitats and species listed as qualifying features that are relevant to the assessment include sandbanks which are slightly covered by sea water all the time, estuaries, reefs, sandflats not covered by seawater at low tide, bottlenose dolphin, otter and grey seal.
Coedydd Derw a Safleoedd Ystlumod Meirion/ Meirionnydd Oakwoods and Bat Sites SAC	International	Annex I species listed as qualifying features that are relevant to the assessment include lesser horseshoe bats.
Northern Cardigan Bay SPA	International	Annex I species listed as qualifying features that are relevant to the assessment includes red-throated diver.
West Wales Marine SAC	International	Annex I species listed as qualifying features that are relevant to the assessment includes harbour porpoise.
Morpha Harlech / a Morpha Dyffryn SAC	International	Annex I habitats and species listed as qualifying features that are relevant to the assessment include embryonic shifting dunes, shifting dunes along the shoreline, fixed coastal dunes with herbaceous vegetation, humid dune slacks and petalwort.
Cadair Idris SAC	International	None of the Annex I habitats and species listed as qualifying features are relevant to the assessment based on a lack of potential impact pathways.

[4] International Sites are designated at an international level and are therefore of international value.

Ecological Receptors	Evaluation	Conservation Value in the Context of the Proposed Development
Craiyr Aderyn (Bird's Rock) SPA	International	Annex I species listed as qualifying features that are relevant to the assessment include the red-billed chough.
Rhinog SAC	International	None of the Annex I habitats and species listed as qualifying features are relevant to the assessment based on a lack of potential impact pathways.
Afon Eden – Cors Goch Trawsfynydd SAC	International	Annex I species listed as qualifying features that are relevant to the assessment include the freshwater pearl mussel, floating water-plantain and Atlantic salmon.
Barmouth Hillside SSSI	National[5]	None of the habitats listed as features are relevant to the assessment based on a lack of potential impact pathways.
Aber Mawddach/ Mawddach Estuary SSSI	National	The habitats and species listed as features that are relevant to the assessment include estuarine habitats, muddy sediments, saltmarshes, reed beds, raised mire, breeding wading birds, scarce vascular and invertebrates, otter and migratory fish species (such as allis shad, twaite shad, sea lamprey and Atlantic salmon.
CWS's (seven sites, see Table 6-9).	County[6]	None of the habitats listed as features are relevant to the assessment based on a lack of potential impact pathways.
Intertidal Biotopes		
Intertidal cobbles/ shingle (H1.2) LS.LCS.Sh.BarSh (Barren littoral shingle)	Less than local	This habitat was defined as a species-poor community, lacking macrofaunal diversity (during intertidal biotope field surveys). These habitats are common and widespread within the wider geographical context and are not notable in terms of extent or botanical diversity and are therefore valued at less than local (site) value.
Intertidal mud/ sand (H1.1) LS.LSa.MoSa.BarSa (Barren littoral coarse sand)	Less than local	This habitat was defined as a species-poor community, lacking macrofaunal diversity (during intertidal biotope field surveys). These habitats are common and widespread within the wider geographical context and are not notable in terms of extent or botanical diversity and are therefore valued at less than local (site) value.
LR.MLR.BF.FvesB (*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock)	Local	This habitat is located outside the Site and shoreward of a *S.alveolata* reef (Annex I habitat). Due to the connectivity and proximity to the *S.alveolata* reef, this habitat is valued at a local level as it may support other species associated with the reef.
LS.LBR.Sab.Salv (*Sabellaria alveolata* reefs on sand-abraded eulittoral rock)	International	Areas of honeycomb worm reefs were identified in the rocky intertidal area north of the Site. Noting the importance of the 'reefs' as supportive of wider biodiversity, *Sabellaria spp*. reefs are listed as 'Biogenic Reefs', a sub-category of the 'Reefs' feature under Annex I of the Habitats Directive. *S.alveolata* reef is also listed as a Priority Habitat under Section 7 of the Environment (Wales) Act 2016 and is also part of the Annex I reef feature of the Pen Llŷn a'r Sarnau SAC, adjacent to the Site. The extent of the area identified during the survey meets the minimum requirements to be defined as a

[5] SSSIs are designated at a national level and are therefore of national value.

[6] CWS's are designated for their presence of habitats or species of local or regional importance by local authorities and are therefore of county value

Ecological Receptors	Evaluation	Conservation Value in the Context of the Proposed Development
		distinct biotope. Therefore, this habitat is valued at an international level.
LR.HLR.MusB.Sem.LitX (*Semibalanus balanoides* and *Littorina spp*. on exposed to moderately exposed eulittoral boulders and cobbles)	Local	Small distinct areas of this habitat type are recorded within the Site and extend seaward into the SAC and are valued at a local level.
LR.FLR.Eph.UlvPor (*Porphyra purpurea* and *Ulva spp*. on sand-scoured mid or lower eulittoral rock)	Local	Small distinct areas of this habitat type are recorded within the Site and extend seaward into the SAC and are valued at a local level.
Intertidal mud/ sand (H1.1) LS.LSa.MoSa.AmSco.Sco (*Scolelepsis* spp. in littoral sand)	Less than local	This habitat was defined as a species-poor community, lacking macrofaunal diversity (during intertidal biotope field surveys). These habitats are common and widespread within the wider geographical context and are not notable in terms of extent or botanical diversity and are therefore valued at less than local (site) level.
Other Marine Habitats		
Blue mussel habitat (non-S7 mussel bed Habitat)	County	Blue mussels were observed growing on approximately two thirds of the existing timber groynes – 22 of 28 groynes, with 11 groynes comprising densities of Abundant or Common. This habitat is valued at a County level.
Phase 1 Habitats		
Coastal grassland (H8.4)	Less than local	These habitats are common and widespread in the wider geographical area. They are not notable in terms of extent or botanical diversity, and the majority of these areas have a short sward subject to regular maintenance. This habitat is found in small strips across the Site and is largely managed as a short sward, therefore supporting less species than more diverse areas of off-site grassland. Therefore, this habitat is valued at a less than local (site) level. The patch of coastal grassland, formerly classed as dune grassland; although there are dune species throughout, it is limited in extent and in poor condition, due to the presence of multiple INNS. Therefore, this habitat is valued at less than local (site) level.
Running water (G2)	Local	A small section (approximately 46m) of watercourse/ditch falls within the Site. The ditch is largely culverted running through the urban areas and will not be impacted by the Proposed Development. This habitat is valued at a local level.
Dense scrub (A2.1) and Scattered scrub (A2.2)	Less than local	Scrub is not considered to form part of any Priority Habitat. Due to the small infrequent areas of scrub within the Site it will support less species than the denser/ more biodiverse areas of off-site scrub which is more widespread. Therefore, this habitat is valued at a less than local (site) level.

Ecological Receptors	Evaluation	Conservation Value in the Context of the Proposed Development
Tall ruderal herb (C3.1)	Less than local	Tall ruderal habitat is not considered to form part of any Priority Habitat. Due to the small areas of ruderal growth within the Site and the presence of INNS within this habitat, it is valued at a less than local (site) level.
Amenity grassland (J1.2)	Less than local	This grassland type is within the Priority Ecological Network for 'Semi-Natural Grassland'. However, due to the regular management and disturbance they will support less species than more biodiverse areas further north. This habitat also falls outside the Site and is won't be impacted by works. Given these habitats are common and widespread within the wider geographical context and are not notable in terms of extent or botanical diversity they are therefore valued at less than local (site) level.
Artificial sea wall (J3.5)	Less than local	The sea wall on the seaward side (including existing sheet piles) has been colonised by barnacles and algae, with no notable communities present. Due to the low diversity present this habitat is valued at a less than local (site) level.
Dunes (H6)	International	Sand dunes located south of the Site (outside the Site boundary) are proposed for mitigation/enhancement but have not been surveyed. They are a Section 7 Priority Habitat and potentially likely fixed coastal dunes (Annex I 2130) and are therefore precautionarily classed as international.
Bare ground (J.4) Buildings (J3.6) Wall (J2.5) Hardstanding (J5)	Negligible	Minimal biodiversity value provided by these habitat types (excluding buildings and their roosting potential for bats, which is assessed under 'species'). Therefore, they are valued as negligible.
Species		
Bats	Local	The Meirionnydd Oakwoods and Bat Sites SAC is located 350m east of the Site and supports lesser horseshoe bat (Annex I species). However, no records of bats were returned for within the Site, with a single record of a common pipistrelle recorded foraging close to the Lion Hotel (off-site). No suitable roosting structures are present within the Site, with six properties / structures outside the Site offering low to moderate roosting potential to crevice dwelling bat species, but not lesser horseshoe bats for which the SAC is designated. The area in general is very exposed, with low to negligible potential for foraging and/or commuting along the coast and Marine Parade. Bat surveys (PRA and presence/likely absence) undertaken in 2025 confirmed no bat roosts were identified within a small substation situated alone the Marine Parade. Therefore, bats are valued at a local level.
Badger	Less than local	No records of badger were returned during the desk study, with no signs recorded during the field survey. Minimal sett building habitat is present within the Site. More suitable habitat for badgers is present off-site to the north of the railway line (within woodland). Therefore, badgers are valued at a less than local level.

Ecological Receptors	Evaluation	Conservation Value in the Context of the Proposed Development
Otter	International (non-breeding)	The potential of the waterbody/ditch adjacent to the Site to support otter is limited. Surveys for otter found no field signs, including possible resting spots within the Site. Otters are likely to use the more optimal intertidal areas for foraging and movement and are a qualifying feature of the Pen Llŷn a'r Sarnau SAC and the Afon Eden – Cors Goch Trawsfynydd SAC, as well as being a feature of interest of the Mawddach Estuary SSSI. They are also a Gwynedd BAP species. Therefore, otters are considered important in an international context.
Notable mammals	Local	Records for hedgehog were returned within 2km of the Site. Notable mammals such as hedgehogs could use grassland and scrub habitats within the Site for foraging, however it is unlikely to support significant populations of notable mammal species. Therefore, notable mammals, specifically hedgehog, are valued at a local level.
Marine mammals	International	The tidal areas within or adjacent to the Site are suitable to support foraging and commuting marine mammals. A seal pupping and haul site was recorded 1km south of the Site near the mouth of the Mawddach Estuary. Grey seal and other marine mammals such as bottlenose dolphin and harbour porpoise are all features of the adjacent Pen Llŷn a'r Sarnau SAC and West Wales Marine SAC which is hydrologically connected to the Site. Therefore, marine mammals are valued at an international level.
Birds	Breeding (Local) Wintering (international)	Breeding: No species typically associated with coastal breeding habitats or cited for the adjacent Mawddach Estuary SSSI were recorded during the breeding bird habitat appraisal. Vegetation present onsite was generally fragmented and species poor offering minimal breeding habitat for locally common and widespread species. As such, are valued at local level. Winter: A number of notable bird species have been recorded during winter bird surveys using the nearshore marine habitat, including red-throated diver which is a qualifying feature of the Northern Cardigan Bay SPA located 2.1km from the Site. Due to the association with designated Sites nearby, the wintering bird assemblage has been valued at an international level.
Amphibians	Less than local	No records of amphibians were returned within the Site, with an absence of ponds and suitable terrestrial habitat to support viable populations of amphibians. There is potential for dispersal and foraging within the adjacent habitats (via the off-site railway and ditches). Therefore, amphibians are valued at less than local (site) level.
Reptiles	Local	Record of adder, slow worm and common lizard were returned within 2km of the Site, with adder listed is a Gwynedd BAP species. Small areas of sub-optimal habitat present include grassland, scrub and tall ruderals. There is potential for dispersal and foraging within the adjacent habitats (via the off-site railway and ditches). Given the records of a BAP species locally, reptiles are valued at local level.

Ecological Receptors	Evaluation	Conservation Value in the Context of the Proposed Development
Invertebrates (Terrestrial)	Less than local	The majority of the Site is unsuitable for terrestrial invertebrates owing to the extent of hard standing and tidal influences, with small pockets of suitable habitat located off-site. Therefore, terrestrial invertebrates are valued at less than local (site) level.
Invertebrates (Marine)	National (blue mussels) International (*Sabellaria alveolata*)	See assessment for blue mussels and biotope code LS.LBR.Sab.Salv above.
Fish	International	The marine areas intertidal and subtidal zones may support a wide range of marine fish species, including migratory species in passage. The freshwater watercourse/ditch may provide suitable habitat for a limited range of common freshwater species, however, are not considered optimal to support migratory species due to dispersal barriers. Although no records were returned during the desk study, Atlantic salmon are a qualifying feature of the Afon Eden – Cors Goch Trawsfynydd SAC, with migratory fish species such as allis shad and twaite shad, and sea lamprey being features of interest for the Mawddach Estuary SSSI. Therefore, fish are considered important within the marine environment in an international context.
INNS (flora and fauna)	Not applicable	INNS (flora) were recorded within the Site, which included Schedule 9 species Japanese knotweed and Montbretia. Marine INNS, an invasive barnacle (*Austrominius modestus*), was identified and found to be widespread across the intertidal study area, predominantly associated with the timber groynes. However, this species is deemed to be of low risk in Wales [39]. Therefore, INNS are considered to have less than local (site) value.

6.5.16 Those receptors with negligible or less than local value are not assessed any further within the Ecological Impact Assessment (EcIA) context unless there are related legal compliances and/or positive outcomes and enhancements to be assessed such as INNS (and the habitats where INNS are).

6.5.17 Receptors not taken forward for further assessment are as follows.

- Intertidal mud and sand (LS.LCS.Sh.BarSh - Barren littoral shingle).
- Intertidal mud and sand (LS.LSa.MoSa.AmSco.Sco - *Scolelepsis spp*. in littoral sand).
- Intertidal cobbles/shingle (LS.LSa.MoSa.BarSa - Barren littoral coarse sand).
- Coastal grassland (H8.4).
- Dense scrub (A2.1) and scattered scrub (A2.2).
- Amenity grassland (J1.2).
- Artificial sea wall (J3.5).
- Bare ground (J4).
- Buildings (J3.6).

- Wall (J2.5).
- Hardstanding (J5).
- Hazel dormouse.
- Water vole.
- Notable mammals.
- Amphibians.
- Terrestrial invertebrates.

6.6 Embedded Environmental Design Measures

6.6.1 The Proposed Development includes a series of integral measures that have been embedded from the early design stage to avoid or minimise impacts on ecological receptors during both the construction and operational phases.

6.6.2 This section summarises the integral embedded measures that will be implemented as construction good practice measures. The mitigation hierarchy aligns with the stepwise approach which must be followed in Wales to comply with the achievement of Net Benefit for Biodiversity (NBB) and comply with the requirements of PPW.

Embedded environmental design measures

6.6.3 Principle 1 of the stepwise approach is to avoid or eliminate potential impacts and adverse effects on biodiversity receptors throughout the design process. The project design team consulted with ecologists regarding sensitive receptors early in the design process. Sensitive ecological receptors were identified and avoided (where possible). Where it was not possible to avoid an impact entirely, the design next sought to minimise the impact, or to then mitigate and restore where possible or provide compensation for the impact on the receptor. The embedded measures include:

- Construction activity within Internationally designated sites such as the adjacent SACs will be prohibited. Only transportation of rock armour is permitted through the SACs, as per Option 2 (delivering rock armour by sea), if selected. No rock armour will be stored in the adjacent SAC.
- Piling activity during construction will take place during dry conditions either side of low tide. This will prohibit noise and vibration travelling through the water column to the intertidal and offshore zones, including the Pen Llyn a'r Sarnau SAC located 31m west of the Site.
- Internationally important habitats (Annex I) such as the *Sabellaria alveolata* reef to the north of the Site will be avoided, and no construction activity including storage, compounds or access would be permitted in proximity to this habitat.
- A Landscape and Environmental Masterplan (LEMP) will be developed to form part of the overall Environmental Masterplan required to secure commitments for ecological mitigation. The LEMP will include the maintenance and monitoring required to ensure that mitigation and compensatory measures are achieved.

Embedded good practice measures

6.6.4 A range of measures relevant to the Proposed Development are set out for the construction phase within the Construction Environmental Management Plan (CEMP) EN.F.15 Barmouth North Promenade FAS – CEMP.

6.6.5 The following measures are of particular importance that will be put in place during construction to prevent direct and indirect impacts on ecological receptors arising from pollution, disturbance and entrapment:

- Ensuring that all construction activities are controlled and are in accordance with relevant legislation and undertaken in compliance with the relevant Guidance for Pollution Prevention (e.g. GPP5) and industry best practice (CIRIA).
- Constant monitoring of dust levels and effective methods of work should be adopted to prevent dust becoming airborne at the source for example; using wet sweeping methods to prevent accumulation of dust and mud and using effective exhaust ventilation and filtering to minimise potential dust pollution.
- Plant will be regularly serviced and maintained.
- Plant will be located as far as reasonably practicable away from ecologically sensitive receptors and will be shut down when not in use.
- Trenches and holes will be covered when not being worked on to prevent entry by mobile species such as otters, and where this is not possible exits and escape routes such as ramps or mammal ladders will be provided.
- Use of noise control equipment such as jackets, hoods and shrouds on equipment such as generators.
- Temporary fencing will be installed prior to construction works to exclude fauna from working areas, including compounds.
- To minimise potential effects on light-sensitive receptors, including otter, a Lighting Strategy will be prepared and secured prior to installation of any permanent lighting. The Lighting Strategy will apply to both construction and operational phases and will set out the siting, specification and directional control of external lighting, supported by drawings illustrating predicted light spill in sensitive areas. Measures to monitor and manage light spill post-installation will be included.
- All construction works, especially those emitting high levels of noise and vibration, will be limited to daylight hours taken to be from 30 minutes after dawn and 30 minutes before dusk. Work to typically take place during daylight hours. Any work during hours of darkness (taken as the period 30 minutes before sunset to 30 minutes after sunrise) will be avoided as far as practicable and where unavoidable, the Contractor will agree any exceptions with the ECoW in advance of construction activities. Should night working be required, these will be discussed with the ECoW and appropriate mitigation put in place as determined by the ECoW (particularly concerning lighting). These could include:
    - Temporary lighting used for construction will be switched off when not in use and positioned so as not to spill on to adjacent land,

watercourses, sensitive receptors within the area surrounding the works.

- Directed lighting will be used to minimise light pollution for construction compounds and to ensure no light spill over 0.5 Lux (where possible) on any watercourses.
- Lighting levels around construction compounds will be kept to the minimum necessary for security and safety by the contractor.

- Vegetation clearance will be supervised by an Ecological Clerk of Work (ECoW), with appropriate consideration given to protected and/or notable species with potential for harm or disturbance based on the location and/or timing of clearance. This will include avoidance of sensitive periods altogether wherever feasible (e.g. avoiding clearance within the breeding bird season).
- Any vegetation clearance that may be required between March and September (the nesting bird season) should be subject to a thorough nesting bird check by an ECoW no more than 24 hours prior to clearance. If a nest is identified within or close to vegetation to be removed then it must be left in-situ and protected from the works, with no further works in the area until the young birds have fledged from the nest. The suitable buffer of works to prevent disturbance and length of time for birds to fledge is dependent upon species identified.
- If any protected species or signs of protected species such as an otter holt, or other ecological receptors including new occurrences or increase in extent of INNS are encountered during the works, all work in the vicinity is to stop immediately and a suitably qualified ecologist contacted as soon as possible.
- Appropriate measures for the treatment and control of invasive non-native species will be implemented. Any plant or machinery that has been used in areas with invasive species such as Japanese knotweed (7 metre buffer around Japanese knotweed recommended), will be thoroughly cleaned, checked and dried. Water used to clean vehicles will be controlled to prevent the spread of the plant (through seeds, rhizomes, fragments, etc.). INNS areas will be cordoned off to prevent any inadvertent spreading. Construction staff and visitors will undergo the appropriate INNS training and best practice biosecurity measures during construction to prevent the spread of INNS.

6.6.6 The CEMP will also detail the requirement and timing required for pre-construction surveys for protected species and an ECoW to oversee management of ecological issues as they arise, to educate site personnel in ecological issues where needed, and ensure any method statements are implemented, mitigating potential impacts during construction.

6.6.7 The CEMP will include Toolbox Talks provided by a suitably qualified ecologist to all site personnel to inform them of ecological receptors including INNS, sensitive habitats, and protected and notable species prior to the commencement of construction. An associated register of attendance will be signed and kept as a record; and a copy of the toolbox talk left at the site office for reference. Should any new INNS be noted, a suitably experienced and competent ecologist would be contacted immediately for further advice.

Embedded pollution control

6.6.8 Best practice will be adopted in line with GPP 5 to minimise the risk of pollution during the Proposed Development and all construction activities will be carried out in accordance with guidance outlined within CIRIA best practice guidance.

6.6.9 The following groups of measures are of particular importance that will be put in place during construction:

- The Contractor would be required to develop and implement the CEMP detailing the practical and necessary measures required during construction to prevent the pollution of the surrounding environment.
- The CEMP will include a fuel spillage procedure, requirements for fuel storage locations, including 110% bunding requirements and refuelling only in bunded areas, restrictions on use of fuel when working in the intertidal (use of biodegradable hydraulic oils and hydrogenated vegetable oil (HVO) only), restrictions to tidal working times and general protocols to reduce adverse impacts on water quality.
- The CEMP will include a materials storage procedure to prevent loose sediment stored on site from being mobilised and dispersed into receiving watercourses. The CEMP will include methods to manage unintended mobilisation of materials stored on site.
- Regular on-the-spot visual monitoring would be undertaken during the construction phase to determine any visible changes to water quality in the marine environment.
- The Biosecurity Risk Assessment covers the measures required to safely manage the import of materials from other sites into the intertidal area with respect to INNS and the recommendations would be incorporated into the CEMP.

6.6.10 Removal of the existing timber groynes will be undertaken during low water conditions where practicable to minimise sediment disturbance and reduce the risk of sediment resuspension. Works will be controlled through method statements within the Construction Environmental Management Plan (CEMP), including measures to manage sediment mobilisation, sediment contaminant testing, machinery positioning and pollution risk. Given the temporary and localised nature of the works, and the application of embedded mitigation, no significant effects on water quality are anticipated.

6.7 Assessment of Likely Significant Effects

6.7.1 This section presents the assessment of likely significant effects on the ecological receptors valued in Table 6-13 (at local level and above) resulting from the construction and operational phases of the Proposed Development. Potential effects have also been assessed against each of the transportation options during construction, as follows:

- Option 1 – delivery of rock armour by road.
- Option 2 – delivery of rock armour by sea.

6.7.2 The likely significant effects of the Proposed Development have been identified taking into account the embedded measures outlined above in Section 6.6.

Further mitigation may be proposed if the embedded measures are insufficient, and if required these measures are presented in Section 6.8. Refer to ES Chapter 4 EIA Approach, for assumptions and limitations.

6.7.3 Legally protected species will be assessed regardless of their nature conservation value.

6.7.4 Ecological receptors of negligible or less than local level have been scoped out of further ecological impact assessment unless further legal considerations apply. However, general mitigation and best practice measures as detailed in Section 6.6, will be applied during construction of the Proposed Development to ensure individual species are not harmed and no offence is committed under the relevant legislation.

6.7.5 On this basis, the following receptors have been taken forward for detailed assessment (those above less than local value, or where legislative requirements apply such as with INNS):

- Designated sites.
- Intertidal ecology.
- Subtidal ecology.
- Running water (G.2).
- Dunes (H6)
- Bats.
- Badger.
- Otter.
- Marine mammals.
- Birds.
- Reptiles.
- Invertebrates (Marine).
- Fish.
- INNS

Construction Effects

6.7.6 This section presents the assessment of potential effects on the ecological receptors listed above resulting from the construction of the Proposed Development.

6.7.7 Construction is defined as all the works undertaken to build the Proposed Development and typically the majority of the impacts on the ecological receptors will occur during this phase as this is when physical changes occur. The potential effects are assessed based on detailed design presented in ES volume 2, Chapter 2 Project Description,.

Designated sites

6.7.8 The following statutory and non-statutory designated sites are included within the assessment:

- Pen Llŷn a'r Sarnau SAC (international value).
- Coedydd Derw a Safleoedd Ystlumod Meirion/ Meirionnydd Oakwoods and Bat Sites SAC (international value).
- West Wales Marine SAC (international value).
- Afon Eden – Cors Goch Trawsfynydd SAC (international value).
- Rhinog SAC (international value).
- Cadair Idris SAC (international value).
- Morpha Harlech / a Morpha Dyffryn SAC (international value).
- Northern Cardigan Bay SPA (international value).
- Craiyr Aderyn (Bird's Rock) SPA (international value).
- Barmouth Hillside SSSI (national value).
- Aber Mawddach/ Mawddach Estuary SSSI (national value).
- CWS's (county value).

6.7.9 Potential impacts upon designated sites and their qualifying features include impacts upon the sites themselves, but also any areas considered to qualify as Functionally Linked Land (FLL) which may support the designation and associated qualifying features.

6.7.10 Potential impacts upon designated sites include:

- With regards to Option 1 (delivering rock armour by road), direct damage to habitats and species from the movement and storage of machinery and plant during construction.
- With regards to Option 2 (delivering rock armour by sea), damage to habitats and species from increased turbidity via sediment disturbance from activities including rock dumping, presence of multiple vessels (tugboats and transport barge) engine scour, mooring and anchor/chain scour, and underwater noise disturbance in absence of mitigation. This includes direct mortality and injury.
- Indirect damage or degradation of habitats and species from reduced water quality as a result of a pollution event(s).
- Disturbance to species listed as qualifying features of the designated sites from noise, vibration and visual disturbance from physical presence / movement of vessels.

Effects from direct habitat loss

6.7.11 The HRA Report concluded **no likely significant effects** arising from direct habitat loss on any designated sites. No designated sites are located within the Site and therefore no direct losses are reasonably foreseen.

6.7.12 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, which will reduce any impacts to mobile species associated with the SAC which may otherwise be present in proximity to the active works areas during high tide.

6.7.13 The proposed intertidal mitigation includes 0.5ha of Sabellaria reef creation adjacent to existing Sabellaria to the north of the site, along with 0.063ha of blue mussel bed creation adjacent to existing SAC mussel beds. The placement of scattered substrate would create a localised loss of intertidal sand within the working area. The placement of substrate would be confined to carefully selected locations embedded within the habitat management plan, on intertidal sand surrounding the habitats, avoiding sensitive habitats and any key areas of ecological interest, and would not materially alter sediment supply. There is ample intertidal sand habitat within the site and surroundings, any loss is anticipated to be minimal in extent and highly localised when considered in the context of the wider area. Further, the mitigation would be creating a high value habitat that, through the HMMP, would be required to be maintained in favourable/target condition, protected from future disturbance and with embedded design and monitoring measures to protect adjacent habitat.

6.7.14 Construction activity associated with Option 1 (delivering rock armour by road) will not result in direct habitat loss within any designated site. It has been assumed that the major road networks will be used to transport rock armour, none of which run through any designated sites in proximity to the Site.

6.7.15 Transportation activity associated with Option 2 (delivering rock armour by sea) will not result in direct habitat loss within any designated site. It is anticipated that all vessels will moor offshore. The smaller vessel, Vessel B, will make a limited number of journeys to the Site at high tide, to deposit materials on the upper sections of the beach, before returning to moor offshore. No materials will be deposited within any designated sites causing habitat loss.

Effects from damage or degradation

6.7.16 The HRA Report concluded a likely significant effect upon the Pen Llŷn a'r Sarnau SAC due to potential indirect damage or degradation if Option 2 (delivering rock armour by sea) was selected.

6.7.17 Embedded pollution prevention measures will avoid any indirect impacts such as pollution events during construction in both the terrestrial and marine environments. This also includes the mitigation works in proximity to the blue mussel beds and Sabellaria reef, where embedded pollution prevention would be secured within the CEMP.

6.7.18 Whilst embedded measures would negate any direct damage or degradation to qualifying features during the transportation of materials, these measures will only safeguard against pollution events and would not prohibit indirect impacts through increased sedimentation in sensitive marine habitats caused by vessel and propellor scour, or from mechanical damage from anchor and chain scour if vessels are inappropriately moored. The presence of multiple vessels with engines producing a scour effect on sand-based substrate will temporarily increase turbidity. Increased turbidity may negatively affect the qualifying features (habitats supporting sessile filter feeding species) associated with Pen Llŷn a'r Sarnau SAC approximately 31m west of the Site.

6.7.19 All other designated sites are considered to be located at a sufficient distance from the Proposed Development that they would not be subject to any direct or indirect impacts arising from damage or degradation.

6.7.20 The Proposed Development has been assessed as having **no likely significant effects** on designated sites due to damage or degradation, with the exception of Pen Llŷn a'r Sarnau SAC.

Effects from disturbance

6.7.21 The HRA Report concluded a **likely significant effect** upon the Pen Llŷn a'r Sarnau SAC, Northern Cardigan Bay SPA and West Wales Marine SAC due to potential noise disturbance, physical presence of vessels causing visual disturbance and vessel transit on marine mammals and red-throated diver if Option 2 (delivering rock armour by sea) was selected. Fish within the Mawddach Estuary SSSI are also considered for disturbance from the likely significant effects of noise if Option 2 is chosen.

6.7.22 In the event Option 1 is selected, no disturbance impacts are anticipated due to a lack of impact pathways to designated sites. In the event Option 2 is selected, the embedded measures will be sufficient to prohibit qualifying features from non-physical disturbance such as a pollution event, but they will not be adequate to protect marine mammals and red-threated diver from disruptive noise levels underwater and vessel presence and movements.

6.7.23 Worst-case marine activity assumes Option 2 (sea delivery) with Vessel A anchoring approximately 6 km offshore for approximately 2 weeks per load and a 3,000t shuttle barge (Vessel B) making 20 trips per load (up to four Vessel A return trips total), with works constrained to daylight/low-tide “in the dry” operations and appropriate navigation marking/Harbourmaster notification.

6.7.24 The presence of a large transport vessel entering and mooring within the SAC, in addition to the smaller vessel to transport rock armour at high tide, may result in noise disturbance to sensitive marine mammals (e.g. bottlenose dolphin, harbour porpoise and grey seal) and disturbance from vessel presence and movements to red-throated diver. Noise sources may include the engines of the vessels during transport, engine noise if left running whilst moored, and mechanical sounds whilst rock armour is transferred between vessels. Without mitigation, the decibel (dB) levels could cause behavioural shifts. Red-throated diver is known to be highly sensitive to vessel presence and disturbance [40, 41].

6.7.25 Auditory injury to marine mammals is not classed under noise disturbance. Noise disturbance refers to behavioural responses (such as avoidance or displacement) without physical harm. The noise thresholds for disturbance are lower than those for auditory injury, marine mammals will typically disperse or move away when exposed to noise levels below the injury threshold, making it unlikely they would remain close enough to experience noise disturbance. Noise disturbance arising from vessel movements would be spatially limited to a localised area around the vessel transit route/working area and would therefore affect only a small proportion of the overall designated site area. However, as there is a risk of disturbance in absence of mitigation within the MVMP, a likely significant effect is anticipated from the Proposed Development on the Pen Llyn a’r Sarnau SAC and West Wales Marine SAC as a result of noise disturbance to qualifying features

6.7.26 As vessel physical presence and movements, comprising anchoring and repeat transits within the SPA could result in disturbance and displacement of the qualifying feature red throated diver, a likely significant effect cannot be ruled out.

6.7.27 The HRA Report also concluded that Atlantic salmon (a qualifying feature of the Afon Eden SAC) would not be impacted by the Proposed Development due construction works being undertaken in dry conditions either side of low tide, avoiding any noise or vibration disturbance entering the water column. In the event Option 2 is selected; the presence of transport vessels could produce noise that may cause short-term disturbance (avoidance behaviour) to Atlantic salmon, however, the duration and exposure are considered to be *de minimis* and would not cause any physiological impacts and are therefore **not significant**. If noise is generated outside of the peak migration period for the Atlantic salmon, the impacts would be negligible.

6.7.28 All other designated sites are considered to be located at a sufficient distance from the Proposed Development that they would not be subject to any disturbing noise levels. The Proposed Development has been assessed as having **no likely significant effects** on designated sites, with the exception of Pen Llŷn a'r Sarnau SAC, Northern Cardigan Bay SPA and West Wales Marine SAC with effects limited to the immediate vicinity of the source (large transport vessel).

Direct mortality or injury

6.7.29 The HRA Report concluded that in absence of mitigation, a **likely significant effect** upon the Pen Llŷn a'r Sarnau SAC and West Wales Marine SAC due to potential direct mortality or auditory injury on marine mammals if Option 2 (delivering rock armour by sea) was selected.

6.7.30 Direct mortality or physical injury (non-auditory)[7] risk on bottlenose dolphin, harbour porpoise and grey seal present locally was assessed. The risk of killing or injuring any of the Annex II qualifying features via boat collision is considered negligible as the vessels will be moving slowly (secured within the MVMP), and spending most of their time being moored with engines turned off. Marine mammals typically disperse or move away when they detect an approaching vessel, making it unlikely they would remain close enough for direct physical injury to occur. However, mitigation of speed restrictions for vessels operating both within and outside the SAC will be included in the MVMP as a precautionary measure to minimise potential disturbance to marine mammals that may be present in the area.

6.7.1 Regarding marine mammal auditory injury[8] it was concluded that without mitigation, the decibel (dB) levels from shipping vessels could cause auditory

[7] As defined in the HRA, direct mortality or physical injury (non-auditory) refers to death or harm resulting from direct physical interaction with project activities or equipment, rather than effects mediated through sound, assessed separately. This may occur through mechanisms such as vessel collision or propeller strike (causing blunt trauma, lacerations, or fatal injury), crushing or entrapment (e.g. between a vessel and structure or within equipment), and physical abrasion or grounding-related contact (including close-range interaction with hulls or propeller wash where animals are in immediate proximity). The key distinguishing feature is that injury requires direct contact, or near contact, with a physical hazard and is not dependent on acoustic thresholds.

[8] Auditory injury for this assessment is defined as injury to the hearing system of a marine mammal caused by exposure to underwater sound, not physical contact, potentially resulting in either temporary (TTS) or permanent changes in hearing sensitivity. Permanent auditory injury causes physiological damage and they rely on their hearing for essential functions, including navigation, communication, and foraging.

injury to qualifying features. If Option 2 is selected, the presence of a large transport vessel entering and mooring within the SAC, in addition to the smaller barge to transport rock armour at high tide, may result in underwater noise that may result in auditory injury to sensitive marine mammals (e.g. bottlenose dolphin, harbour porpoise and grey seal) and disturbance from vessel presence and movements to red-throated diver. Noise sources may include the engines of the vessels during transport, engine noise if left running whilst moored, and mechanical sounds whilst rock armour is transferred between vessels. Without mitigation, the decibel (dB) levels could cause physical damage to qualifying features or cause significant behavioural shifts. Red-throated diver is known to be highly sensitive to vessel presence and disturbance [40, 41].

6.7.2 Indicative desk-top noise modelling was undertaken via calculations using cylindrical and spherical sound, taking into account depth, sound absorption and weighted results (based on hearing sensitivity of receptors such as marine mammals and fish) [42] [43] [44]. Weighted auditory injury (INJ) thresholds [30] resulting in permanent and physical auditory damage to a bottlenose dolphin can occur from 201dB SEL_{24}, with weighted Temporary Threshold Shift (TTS) experienced from 181dB SEL_{24} (vessel are non-impulsive sound). For grey seal INJ can occur from 195dB SEL_{24} and TTS from 175dB SEL_{24}.

6.7.3 Estimated modelled unweighted noise levels at the SAC boundary and edge of the Site at MLWS are 122dB (below both TTS and INJ thresholds for bottlenose dolphin and grey seal). At various stopping points along the transport route from the large vessel to the Site, the noise levels range from 125dB to 142dB (below both TTS and INJ thresholds for the three marine mammal species). Worst case anticipated unweighted noise levels for the large transport vessel are 191dB at source, and smaller vessels precautionarily are assessed as 200dB at source (worst case scenario). Noise levels at source are given unweighted, as such, are precautionary figures, which may overestimate the risk of auditory injury compared to using weighted values.

6.7.4 It is considered that the construction phase of the Proposed Development would not result in a LSE on the Pen Llyn a'r Sarnau SAC as a result of auditory injury to grey seals, harbour porpoise or bottlenose dolphin. However, unweighted noise levels at source for the vessels are above the threshold, and, although deemed unlikely, if a marine mammal would be present in close proximity to the source vessels, auditory injury may occur in absence of mitigation within the MVMP.

6.7.5 Piling activity for the placement of the sheet piles during construction that is not undertaken in the dry may also generate underwater noise and vibration disturbance impacts upon marine mammals. However, the construction works themselves will be undertaken at low tide only, which reduces piling noise travelling into the SAC during construction. No pathway for effect for marine noise impact is anticipated for piling undertaken in the dry.

6.7.6 Fish within the Mawddach Estuary SSSI, allis and twaite shad (*Alosa spp*.), are hearing-specialist species for which Temporary Threshold Shift (TTS) onset is dependent on both sound level and duration of exposure. This group is assigned a TTS onset threshold of 186 dB SEL_{24}, equivalent continuous level of 158 dB assumes a 12-hour exposure duration. Indicative modelling shows that predicted underwater noise levels at the SAC boundary and vessel stopping points are well below thresholds associated with TTS. Given the intermittent nature of vessel activity, offshore anchoring, and the mobility of shad, sustained exposure

sufficient to cause auditory injury is unlikely. With implementation of measures within the Marine Vessel Management Plan, any residual effects are expected to be limited to short-term behavioural responses and are not considered significant.

6.7.7 Mitigation of speed restrictions for vessels operating both within and outside the SAC should be included as a precautionary measure to minimise potential disturbance to the qualifying features that may be present in the area. As such, in absence of mitigation, the Proposed Development may cause direct mortality/ auditory injury to marine mammals.

6.7.8 It is therefore considered that in absence of mitigation the Proposed Development will result in a LSE on the West Wales Marine SAC and the Pen Llyn a'r Sarnau SAC as a result of killing/ auditory injury of qualifying marine mammal features.

Habitats

6.7.9 The Proposed Development would require the permanent loss of terrestrial and intertidal habitats valued at or above local level and which potentially support protected and notable species. The following impacts have been identified and are assessed for each receptor (habitats and species):

- Habitat loss and fragmentation.
- Habitat damage or degradation.
- Disturbance.
- Species mortality and injury.

6.7.10 Groyne removal will be undertaken at low water where practicable and managed through CEMP method statements to minimise sediment disturbance, sediment resuspension and potential effects on habitats and the species they support. A watching brief for any olfactory or visual clues to potential contamination will be implemented.

Intertidal ecology

6.7.11 The following intertidal biotopes assessed as being of local value or higher are included within this section:

- LR.MLR.BF.FvesB (*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock).
- LS.LBR.Sab.Salv (*Sabellaria alveolata* reefs on sand-abraded eulittoral rock).
- LR.HLR.MusB.Sem.LitX (*Semibalanus balanoides* and *Littorina spp*. on exposed to moderately exposed eulittoral boulders and cobbles).
- LR.FLR.Eph.UlvPor (*Porphyra purpurea* and *Ulva spp*. on sand-scoured mid or lower eulittoral rock).

6.7.12 Local or higher value intertidal biotopes identified within the Site are limited to LR.HLR.MusB.Sem.LitX and LR.FLR.Eph.UlvPor. Both LS.LBR.Sab.Salv and LR.MLR.BF.FvesB are situated approximately 120m north of the Site and are

therefore within the study area but will not be subject to direct or indirect impacts including loss or fragmentation, damage or degradation, disturbance, or mortality and injury of associated species. Please refer to Chapter 12 Marine and Coastal Physical Processes which confirms no changes to the coastal regimes or processes are anticipated within the study area).

6.7.13 Overall, the intertidal zone was considered to be species poor, with LR.HLR.MusB.Sem.LitX and LR.FLR.Eph.UlvPor representing the higher value biodiversity features within the Site. Both biotopes are present in two discreet patches towards MLWS, the largest coverage being associated with an outfall pipe within the centre of the Site (approximate grid reference SH 60561 16350), running diagonally to the shore, into the subtidal area. The outfall pipe which supports these sessile biotopes will be retained throughout construction, with the upper shore section of the outfall pipe being integrated into the proposed revetment; this upper section does not support either LR.HLR.MusB.Sem.LitX or LR.FLR.Eph.UlvPor biotopes. Construction will not result in any habitat losses or damage and degradation and overall, the Proposed Development will have **no significant residual effects** upon these intertidal biotopes.

6.7.14 Large extents of blue mussels were observed growing on approximately two thirds of the existing timber groynes situated along Barmouth Beach. The blue mussels on site do not constitute a mussel 'bed' as per the Section 7 description, due to being associated with anthropogenic groyne structures. Blue mussels were also recorded on the outfall pipe discussed above which will be retained. All groynes within the Site will be removed to facilitate construction works and reduce risks to public safety, including approximately 514m of groynes (posts and boards) containing blue mussel growth. This represents a loss in intertidal biodiversity from within the Site. Removal of the groynes supporting blue mussels is also likely to result in mortality of the blue mussels. The loss of blue mussels is considered to represent a negative impact to intertidal biodiversity, and the Proposed Development will therefore have a **significant negative effect.**

Subtidal ecology

6.7.15 This section considers "off-site" subtidal features below MLWS that are not qualifying features of designated sites but may include habitats mentioned above in the Intertidal Ecology section which are located within the study area and ZoI for Option 2. This will include subtidal habitats that are deemed to be of local value or higher.

6.7.16 The desk-based Blue Mussel Assessment (see ES Volume 3, Appendix 6.3) confirmed blue mussel beds are highly likely to be present below MLWS in proximity to the Site. Blue mussel beds are a Priority Habitat and are sensitive to changes in water quality (e.g. pollution), mechanical disturbance, and increased sedimentation and turbidity. In the event Option 2 is selected, and without mitigation, the transportation and landing of the barge vessel (and associated tugboats) may cause direct habitat loss, damage and degradation, disturbance, and injury and mortality to blue mussel beds. This would represent a **significant negative effect** upon the local subtidal ecology.

Running water (G.2)

6.7.17 A small section (approximately 46m) of watercourse/ditch falls within the Site and was the only terrestrial habitat assessed of being local value or higher. The

watercourse/ditch is partly culverted and runs through the urban area adjacent to the Promenade Café and will be retained during construction. Embedded measures, including pollution prevention measures will ensure that this habitat it not negatively affected and there will be no loss or fragmentation, damage or degradation, or disturbance to this receptor. As a result, any potential impacts to the watercourse/ditch arising during construction are negligible and the Proposed Development will have **no significant residual effect**.

Dunes (H6)

6.7.18 Sand dunes located to the south of the Site are outside the Site boundary and will not be directly affected by construction activities. Potential construction-phase effects are limited to indirect pathways, namely changes to sand supply and aeolian transport. Construction works are localised to the upper intertidal zone and promenade and will be undertaken in the dry around low tide. These works will not introduce physical barriers to wind-driven sand transport, nor will they result in a material alteration to longshore sediment processes. Temporary disturbance to beach sediments during construction is expected to be highly localised, short-term and reversible, with no measurable reduction in sand availability to the off-site dune system. In the absence of direct interaction with the dunes and taking into account the scale, duration and nature of the construction works, the Proposed Development during construction will have **no significant residual effect**.

Bats

6.7.19 No trees are present within the Site or study area, resulting in a lack of roosting opportunities for tree roosting bat species. Several properties to the east of Marine Parade offer low to moderate roosting potential but will be retained during construction and the seawall and culverts do not have the potential to support bats. A dusk emergence survey confirmed no bat roosts were identified in the small substation building located along the Promenade. Overall, the habitats situated within the study area are exposed and offer sub-optimal foraging and commuting opportunities. Any impacts arising during construction will therefore have a negligible impact upon bats and the Proposed Development will have **no significant residual effect**.

Badger

6.7.20 No badger setts or evidence of badgers were recorded within the Site or study area. Woodland habitats located outside of the study area along the railway line do however provide suitable sett building and foraging habitat for badger. Badger may therefore be present locally and have the potential to travel in proximity to the Site and areas of active construction. Embedded measures include avoidance of construction activity during nocturnal hours, sensitive lighting of compounds, installation of temporary fencing around active construction, and provision of escape ramps/mammal. These measures will ensure there is no loss, fragmentation, damage or degradation to suitable badger habitat, and badgers themselves will not be disturbed or at risk of mortality or injury. Any impacts arising during construction will have a negligible impact upon badgers and the Proposed Development will have **no significant residual effect**.

Otter

6.7.21 No evidence of otter was recorded within the Site or study area. The terrestrial habitats present within the Site provide limited opportunities for otter as the watercourse is short (approximately 46m) and partly culverted. The habitats along Barmouth Promenade are also heavily disturbed by members of the public and dog walkers. The intertidal habitats provide opportunities for foraging and commuting otter and are hydrologically connected to the Pen Llŷn a'r Sarnau SAC and the Afon Eden SAC; otter are a qualifying feature of these sites as well as being a feature of interest of the Mawddach Estuary SSSI.

6.7.22 The HRA Report concluded that embedded measures which includes avoidance of construction activity during nocturnal hours, pollution prevention controls, sensitive lighting of compounds, installation of temporary fencing around active construction, and provision of escape ramps/mammal ladders, will negate any potential impacts to otter which may arise during construction. These embedded measures will ensure there is no loss, fragmentation, damage or degradation to suitable otter habitat, and otters themselves will not be disturbed or at risk of mortality or injury.

6.7.23 With the implementation of the Lighting Strategy and embedded mitigation measures, no significant residual effects on otter are anticipated during operation. As such, construction will have a negligible impact upon otter and the Proposed Development will have **no significant residual effect.**

Marine mammals

6.7.24 Marine mammals known to be present locally include grey seal, bottlenose dolphin, and harbour porpoise, all of which are associated with the Pen Llŷn a'r Sarnau SAC and West Wales Marine SAC. These species are assessed in greater detail in the designated sites section at 6.7.7 – 6.7.26.

6.7.25 The desk study did not return any records of further marine mammals, but an absence of records is indicative of under-recording and does not suggest species are absent locally. Other species of marine mammal are likely to be present within Barmouth and Cardigan Bay, and their presence is included as a precaution within this assessment. The disturbance impacts listed in 6.7.20 – 6.7.25 are also applicable to all other marine mammals that aren’t listed as a qualifying feature of a SAC.

6.7.26 Two grey seal pupping sites were identified during the desk study. The closest site, Dinas Mawddach pupping site, is located approximately 4km south of the Site, in the mouth of the Mawddach Estuary. The second site, Dyffyn Ardudwy pupping site, is located approximately 4km north of the Site.

6.7.27 The construction works themselves will be undertaken in dry conditions, either side of low tide, which negates any noise travelling to both pupping sites during construction, however if Option 2 is selected, the operation of marine vessels in proximity to the pupping sites would fall under the TTS for grey seals. It should be noted that both pupping sites are situated outside of the SAC boundaries and have been assessed as qualifying features of the designations based on the presence of FLL.

6.7.28 Indicative modelling (Appendix 6.10) shows that unweighted noise produced by the larger transport vessel which will reach the Dinas Mawddach pupping site are estimated to in the range of 140dB which is below the TTS threshold and the auditory injury threshold for grey seal (INJ can occur from 195dB SEL_{24} and TTS

from 175dB SEL_{24}). At the further Dyffryn Ardudwy pupping site, the noise levels are estimated to be in the range of 137dB which is below the INJ and TTS thresholds for grey Any transportation taking place in closer proximity than the large vessel (e.g. smaller vessel at 200dB making repeat journeys to the Site) will produce slightly higher dB ranges, however these are anticipated to remain below the auditory injury threshold for grey seals at the pupping sites.

6.7.29 Without mitigation, Option 2 may therefore result in a **significant temporary, negative effect** upon marine mammals, if marine mammals are present in the immediate area around the noise sources.

Birds

6.7.30 The Breeding Bird Habitat Appraisal concluded that the habitats present within the Site are unlikely to support any notable assemblages or high numbers of species associated with nearby designated sites such as North Cardigan Bay SPA, Bird's Rock SPA and Mawddach Estuary SSSI. Birds recorded during the PEA, Intertidal Biotope Survey and Winter Bird Surveys included common or widespread terrestrial and coastal species. Only one red-throated diver (the qualifying feature of the North Cardigan Bay SPA) was recorded nearshore, indicating the habitats within the Site and study area do not typically support this species. This designation is discussed in greater detail in the designated sites section at 6.7.7 – 6.7.21.

6.7.31 However, in the absence of mitigation, the HRA Report concluded that a likely significant effect could not be ruled out on the Northern Cardigan Bay SPA, due to potential visual disturbance and displacement of red-throated diver arising from vessel presence and movement associated with Option 2 (delivery of rock armour by sea). Overall, during construction Option 2 may therefore result in a **significant temporary, negative effect on red-throated diver.**

6.7.32 Embedded measures will ensure there is no loss, fragmentation, damage or degradation to suitable nesting or foraging habitats, and other bird species themselves will not be disturbed or at risk of mortality or injury. Overall, construction and both Options 1 and Option 2 will have a negligible impact upon birds and the Proposed Development will have **no significant residual effect for other bird species.**

Reptiles

6.7.33 The PEA walkover concluded that the habitats present within the Site were largely unsuitable for reptiles, being dominated by tidal and urban habitats. However, small pockets of tussocky dune and coastal grassland and ruderal vegetation provide potential for dispersal and foraging via the railway and watercourse/ditch, both of which will be retained. In addition, records of adder (a BAP species), slow worm and common lizard were provided by Cofnod within 2km of the Site indicating reptiles are present locally. Embedded measures will ensure there is no loss, fragmentation, damage or degradation to suitable habitats, and reptiles themselves will not be disturbed or at risk of mortality or injury. Overall, construction and Options 1 and 2 and will have a negligible impact upon reptiles and the Proposed Development will have **no significant residual effect.**

Invertebrates (Marine)

6.7.34 During EIA Scoping Reporting and Opinions, NRW's Biodiversity Unit raised the potential presence of piddocks (*Pholas dactylus* and *Barnea candida*) in the wooden groynes and intertidal clays within the Site. No evidence of piddocks were recorded during the Intertidal Biotope Survey or *Sabellaria alveolata* surveys which assessed the biotic community structure present on the groynes and *Sabellaria* reefs. However, no detailed grab or core sampling was conducted other than to confirm biotopes and associated biota in the littoral sand-based biotopes.

6.7.35 No piddocks were recorded on the groynes, and other habitats on site were not deemed suitable. The Proposed Development will result in the loss of 0.8ha of sand-based habitat through the placement of rock armour, with the sand-based substrate still being present underneath, but with reduced availability to burrowing species. Given the extent of suitable intertidal habitat which will be retained as part of the Proposed Development and the niches/crevices created by the rock armour, the overall impact of construction on piddock is negligible and the Proposed Development will have **no significant residual effect**.

6.7.36 Blue mussels have been discussed in greater detail in the Intertidal Ecology section at 6.7.16.

Fish

6.7.37 Marine and freshwater fish are known to be present locally, including Atlantic salmon, which is a qualifying feature of the Afon Eden SAC. This species is assessed in greater detail in the designated sites section at 6.7.8– 6.7.9. All other fish species which are not listed as a feature of a designated site are assessed within this section and their presence is included as a precaution within this assessment. The desk study did not return any records of fish, but an absence of records is indicative of under-recording and does not suggest fish are absent locally.

6.7.38 Embedded measures will ensure construction works are undertaken in dry conditions either side of low tide, avoiding any noise or vibration disturbance entering the water column. In addition, the short section of watercourse will be retained and protected during construction, resulting in no impacts to fish.

6.7.39 In the event Option 1 is selected, no disturbance impacts are anticipated due to a lack of impact pathways to the marine or freshwater environments.

6.7.40 In the event Option 2 is selected, the embedded measures will be sufficient to prohibit impacts from non-physical disturbance such as a pollution event, but they will not be adequate to protect marine fish from underwater noise. The presence of transport vessels could produce noise that may cause short-term disturbance (avoidance behaviour) to marine fish; however, the duration and exposure are considered to be *de minimis* and would not cause any physiological impacts and are therefore not significant. The overall impact of construction on fish will be negligible and the Proposed Development will have **no significant residual effect**.

Invasive Non-native Species (INNS)

6.7.41 Three species of INNS are known to be present within the Site and study area, two of which are terrestrial plant species (Japanese knotweed and Montbretia) with one marine species (modest barnacle). Embedded good practice measures

will ensure that none of the terrestrial INNS are spread via construction activity. The marine INNS is registered as “low risk” in Wales and is present on the timber groynes which will removed from Site and disposed of, therefore unlikely to spread. The biodiversity enhancement measures listed in Section 6.8 includes the recommended removal of Japanese knotweed from the Site, which will increase the condition of the underlying and surrounding habitats. The Proposed Development will have a positive residual effect if terrestrial INNS are removed.

6.7.42 In the event Option 2 is selected, without mitigation there could be an increased risk of spreading or introducing new INNS via high-risk activities such as ballast water release in proximity to the Site. The overall impact of this would be dependent upon the species of INNS which could be spread (e.g. a “low risk” species would not result in a significant residual effect). However, with the implementation of biosecurity measures which are to be outlined within the MVMP, the risk is negated.

Operational and Maintenance Effects

6.7.43 Operation is defined as the post-construction phase of the Proposed Development, including maintenance activities, until there is further development or until the project ceases to operate as a standard of protection against coastal flooding. Refer to ES volume 2, Chapter 2 Project Description, the description and period of maintenance activities, and the design life of the Proposed Development.

Otter

6.7.44 With the implementation of the Lighting Strategy**, no significant residual effects** on otter are anticipated during operation.

Habitats; Dunes (H6)

6.7.45 Sand dunes located to the south of the Site are outside the Site boundary and are proposed for mitigation/enhancement. Dune development and maintenance in this location are primarily driven by wind-driven (aeolian) sand transport rather than marine sediment supply alone. The Proposed Development involves localised works to the upper intertidal and promenade and does not introduce a barrier to aeolian sand transport or materially alter longshore sediment processes. While the dunes have not been surveyed and the precise Annex I habitat type is unconfirmed, the scale and nature of the works are not anticipated to result in a material reduction in sand supply to the off-site dune system. On this basis, and taking into account the proposed enhancement measures, no significant adverse effects on dune extent, condition or function are anticipated and the Proposed Development will have **no significant residual effect**.

6.7.46 There would be no further significant effects to ecological receptors from the operation or maintenance of the Proposed Development as, with embedded mitigation, there would be no anticipated changes to coastal processes, water and air quality, or any increase in lighting, recreational pressures or noise disturbance compared to the baseline.

6.7.47 Given the need to provide coastal flood protection up to 2075, maintenance provisions will be made up until this date. Given the planned change to managed realignment after this date, maintenance after this date is expected only to be in relation to ensuring public safety. It is therefore assumed that the defences will remain in place past 2075. The standard of protection will reduce

over time, but decommissioning of the Proposed Development has not been assessed.

6.8 Ecosystem Resilience

6.8.1 This section considers the effects of the Proposed Development on ecosystem resilience. Ecosystem resilience has been assessed using the DECCA framework (Diversity, Extent, Condition, Connectivity and Adaptability), to provide a structured appraisal of how the Proposed Development may influence the resilience of ecological receptors within the study area.

6.8.2 Table 6-14 presents an assessment of the baseline resilience of relevant ecosystems and indicates how the Proposed Development is anticipated to change these attributes.

Table 6-14. Resilience Assessment of the Existing Ecosystems along with Indication of how the Scheme may change this Resilience (Increase +/ Decrease -).

Ecosystem	Diversity	Extent / size	Condition	Connectivity	Aspect
Intertidal Biotopes					
Intertidal cobbles/ shingle (H1.2) LS.LCS.Sh.BarSh (Barren littoral shingle)	This habitat was defined as a species-poor community, lacking macrofaunal diversity (during intertidal biotope field surveys). These habitats are common and widespread within the wider geographical context and are not notable in terms of extent or botanical diversity. Due to low diversity, impacts would not significantly alter diversity of this habitat on site **No change anticipated (0)**	1.65ha of this habitat is present within the site, 0.7136ha of intertidal cobbles/shingle is anticipated to be lost. **Decrease in extent anticipated (-)**	Condition would remain the same as baseline for this habitat, a species-poor community, lacking macrofaunal diversity (during intertidal biotope field surveys). **No change anticipated (0)**	Reduction in cobbles/shingle which may provide shelter for some species, would be reduced with loss of extent. A wider expanse occurs to the north and forms a long stretch, extending north. **Decrease in connectivity anticipated (-)**	These habitats are common and widespread within the wider geographical context and are not notable in terms of extent or botanical diversity. This habitat may provide upper shore invertebrate refuge, may improve storm buffering, as such a reduction in storm resilience in absence of recovery to baseline. As such, aspect would remain similar to baseline, but with reduction in service of storm resilience. **Decrease in resilience anticipated (-)**
LR.MLR.BF.FvesB (*Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock)	This habitat is located outside the Site and shoreward of a *S.alveolata* reef (Annex I habitat). Due to the connectivity and proximity to the *S.alveolata* reef, this habitat is valued higher as it has potential to support other species associated with the reef. There is no anticipated direct or indirect impacts including loss or fragmentation, damage or degradation, disturbance, or mortality and injury of associated species. **No change anticipated (0)**	LR.MLR.BF.FvesB is situated approximately 120m north of the Site and therefore within the study area but will not be subject to direct or indirect impacts including loss or fragmentation, damage or degradation or disturbance, and as such, no loss of extent anticipated. **No change anticipated (0)**	Condition would remain the same as baseline for this habitat. **No change anticipated (0)**	Connectivity would remain as per baseline. **No change anticipated (0**	Aspects of resilience would remain similar to baseline, as there is no anticipated change from Proposed works. Climate-related pressures (e.g, temperature increase, storm intensity) are external drivers and not materially altered by the Proposed Development. **No change anticipated (0)**
LS.LBR.Sab.Salv (*Sabellaria alveolata* reefs on sand-abraded eulittoral rock)	Honeycomb worm reefs comprising of *Sabellaria alveolata* were observed in the rocky intertidal area north/northwest of the Site. Noting the importance of the 'reefs' as supportive of wider biodiversity, *Sabellaria spp*. reefs are listed as 'Biogenic Reefs', a sub-category of the 'Reefs' feature under Annex I of the Habitats Directive. *S.alveolata* reef is also listed as a Priority Habitat under Section 7 of the Environment (Wales) Act 2016 and is also part of the Annex I reef feature of the Pen Llŷn a'r Sarnau SAC, adjacent to the Site. The extent of the area identified during the survey meets the minimum requirements to be defined as a distinct biotope. There is no anticipated direct or indirect impacts including loss or fragmentation, damage or degradation, disturbance, or mortality and injury of associated species. **No change anticipated (0)**	Honeycomb worm reefs comprising of *Sabellaria alveolata* were observed north/northwest of the Site. The extent of the area identified during the survey meets the minimum requirements (20 metres squared) to be defined as a distinct biotope (approximately 1553m^2 squared). No change in hydrodynamics, no change in suspended sediment beyond baseline tolerance, no smothering risk and no change to wave exposure regime is anticipated. LS.LBR.Sab.Salv is situated north of the Site and therefore within the study area but will not be subject to direct or indirect impacts including loss or fragmentation, damage or degradation, disturbance, or mortality and injury of associated species and in absence of mitigation, no loss of extent anticipated. However, creation of 0.5ha of honeycomb worm reef has been proposed, increasing the extent of this habitat. **Positive change anticipated (+)**	Condition would remain the same as baseline for this habitat. **No change anticipated (0)**	Connectivity would remain as per baseline in absence of mitigation. With creation of additional *Sabellaria* habitat outlined in the intertidal mitigation below and BMTH-ARP-EAC-ZZ-DR-OE-000002, an increase in connectivity is anticipated. **Increase in connectivity anticipated (+)**	Aspects of resilience would remain similar to baseline, as there is no direct anticipated change from Proposed works. Climate-related pressures (e.g, temperature increase, storm intensity) are external drivers and not materially altered by the Proposed Development. However, an increase in extent would positively affect aspects of resilience. **Increase in aspects of resilience with anticipated mitigation (+)**

Ecosystem	Diversity	Extent / size	Condition	Connectivity	Aspect
LR.HLR.MusB.Sem.LitX (*Semibalanus balanoides* and *Littorina* spp. on exposed to moderately exposed eulittoral boulders and cobbles)	Small distinct areas of this habitat type are recorded within the Site and extend seaward into the SAC. This is a common habitat and diversity is not notable within this habitat. **No change anticipated (0)**	The eulittoral rock is unlikely to be subject to changes in extent, these species would likely be able to recolonise any temporary changes, as they are prone to seasonal variation. **No change anticipated (0)**	Condition would remain the same as baseline for this habitat. **No change anticipated (0)**	Connectivity may be subject to temporary disturbance but would return to baseline, and remaining areas retained would remain unchanged. **No change anticipated (0)**	Aspect would remain similar to baseline, and remaining areas retained would remain unchanged. **No change anticipated (0)**
LR.FLR.Eph.UlvPor (*Porphyra purpurea* and *Ulva* spp. on sand-scoured mid or lower eulittoral rock)	Small distinct areas of this habitat type are recorded within the Site and extend seaward into the SAC. This is a common habitat and diversity is not notable within this habitat. **No change anticipated (0)**	Unknown, loss of this habitat would be temporary where present on existing structures to be removed, however, the seaward eulittoral rock is unlikely to be subject to changes in extent, these species would likely be able to recolonise, as they are prone to seasonal variation. **No change anticipated (0)**	Condition would remain the same as baseline for this habitat. **No change anticipated (0)**	Connectivity may be subject to temporary disturbance but would return to baseline, and remaining areas retained would remain unchanged. **No change anticipated (0)**	Aspect would remain similar to baseline, and remaining areas retained would remain unchanged. **No change anticipated (0)**
Intertidal mud/ sand (H1.1) LS.LSa.MoSa.AmSco.Sco (*Scolelepsis* spp. in littoral sand) LS.LSa.MoSa.BarSa (Barren littoral coarse sand)	This habitat was defined as a species-poor community, lacking macrofaunal diversity (during intertidal biotope field surveys). These habitats are common and are not notable in terms of botanical diversity. **No change anticipated (0)**	These habitats are common and widespread within the wider geographical context and are not notable in terms of extent. 17.75ha is present on site and 1.718ha would be lost. *Scolelepsis spp* habitat extent in littoral sand lost. However, residual effects would be minimal after recovery as remaining habitat is contiguous. Loss of sand-based habitat from the placement of rock armour, would maintain the sand-based substrate still being present underneath, but with reduced availability to burrowing species. **Decrease in extent anticipated (-)**	Condition would remain the same as baseline for this habitat, a species-poor community, lacking macrofaunal diversity (during intertidal biotope field surveys). **No change anticipated (0)**	Connectivity is expected to remain similar to baseline, as there would be ample habitat on site which connects to the large extents of this common habitat in along the coast. **No change anticipated (0)**	No anticipated change, ecosystem function and resilience to be supported in retained areas. Temporary functional loss of sand-based habitat beneath rock armour. Residual effects are considered negligible. **No change anticipated (0)**
Other Marine Habitats – Blue Mussels on Groynes and Creation of Blue Mussel Bed S7 Habitat					
Blue mussels (located on the timber groynes and the proposed blue mussel bed S7 habitat created)	Blue mussels were observed growing on approximately two thirds of the existing timber groynes, as well as on the outfall pipe. Blue Mussel 'Beds' are listed as a Priority Habitat under Section 7 of the Environment (Wales) Act 2016; it is noted that the mussels, that are associated with the anthropogenic structures on site, do not constitute mussel 'beds' and do not align with the Section 7 description. Removal of the groynes supporting blue mussels is also likely to result in mortality to the blue mussels. The loss of blue mussels is considered to represent a negative impact to intertidal biodiversity. The Proposed Development will be creating 0.063ha of blue mussel bed in a natural habitat, as such, will mitigate for loss of diversity on groynes. **No change of diversity anticipated (0)**	514m of groynes are present on Site with existing surface area of suitable habitat currently approximately 514m^2. Large extents of blue mussels were observed growing on approximately two thirds of the existing timber groynes situated along Barmouth Beach. Blue mussels were also recorded on the outfall pipe discussed above which will be retained. All groynes within the Site will be removed to facilitate construction works and reduce risks to public safety, including approximately 514m of groynes (posts and boards) containing blue mussel growth. However, although blue mussel bed is not being lost, blue mussel habitat will decrease. With the addition of 0.063ha of blue mussel bed proposed, no change to mussel habitat extent is anticipated once the mitigation habitat is instated and favourable. **No change in extent anticipated (0)**	Condition on groynes would deteriorate due to loss of anthropogenic attachment structures and blue mussel mortality. However, with mitigation creating 0.063ha extension of existing blue mussel beds, the condition would remain as baseline. **No change in condition anticipated (0)**	Connectivity would decrease due to loss of suitable supporting habitat on site – albeit artificial and deteriorating. However, as mitigation seeks to increase connectivity between existing mussel beds within the SAC, the loss is adequately mitigated for. **No change in connectivity anticipated (0)**	The future baseline in which the groynes would naturally continue to decay and be lost from the Site has been accounted for, however, with the increase in habitat extent within the existing natural habitats within the protected SAC from proposed mitigation, a positive increase in aspects of resilience is anticipated. Climate-related pressures (e.g, temperature increase, storm intensity) are external drivers and not materially altered by the Proposed Development. **Increase in aspects of resilience anticipated (+)**
Terrestrial / Phase 1 Habitats					
Grassland Coastal grassland (H8.4) Amenity grassland (J1.2)	The coastal grassland occurs in small, managed verge strips dominated by short sward, with limited areas supporting greater species diversity, including some dune-associated species. Overall, this habitat is common and widespread, with limited extent and low botanical diversity. A coastal grassland area with higher composition of dune grassland species is limited in extent and in poor condition. The baseline amenity grassland recorded is outside the site and included for habitat creation.	Coastal grassland on site comprises 1.31 ha. 0.244 ha of coastal grassland will be lost through construction. Creation of 0.066ha of amenity grassland, with a mix of coastal species. Extent of coastal grassland will be reduced; net loss of 0.13ha of grassland (9.9% of baseline).	The grassland on site is relatively species poor, in comparison to grassland within the wider area. As grassland created will be amenity grassland, increase in condition cannot be determined. This would result in a decrease in ecological distinctiveness, however, with correct management, would remain in similar condition to baseline.	The created grassland proposed will have similar connectivity to the existing situation in terms of location. As such, the created grasslands will provide the same connectivity as baseline, which at baseline does provide a 'stepping stone' habitat for protected species and seed dispersal.	No anticipated change in adaptability. With correct management of ongoing removal of invasive species recorded in other habitats within the area, there may be a positive increase. **No change anticipated (0)**

Ecosystem	Diversity	Extent / size	Condition	Connectivity	Aspect
	Extent of coastal grassland will be reduced; however, grassland created on site to be tailored to coastal species. **No change anticipated (0)**	**Decrease of extent anticipated (-)**	**No change anticipated (0), dependent on successful implementation**	**No change anticipated (0)**	
Dunes (H6)	Sand dunes to the south of the site, not within the Site, Diversity not recorded. The dunes are proposed for mitigation/enhancement **Increase in diversity anticipated (+)**	Extent to remain unchanged, sand dune enhancement to preserve extent. **Maintenance of extent anticipated (0)**	Sand dunes to the south of the site, not within the Site, increase in condition anticipated with enhancement. **Increase in condition anticipated (+)**	Dunes will provide the same connectivity as baseline, which at baseline does provide an important habitat for protected species and seed dispersal. However, with increase in condition from enhancement, an increase in connectivity could indirectly be anticipated. **Increase in connectivity anticipated (+)**	Opportunities to enhance condition of the dunes would increase the aspects of resilience of this habitat. Climate-related pressures (e.g, temperature increase, storm intensity) are external drivers and not materially altered by the Proposed Development. However, the enhancement of the dunes would increase the aspects of resilience. **Anticipated increase in aspects of resilience (+)**
Running water (G2)	The ditch is largely culverted running through the urban areas and will not be impacted by the Proposed Development. **No change anticipated (0)**	A small section (approximately 46m) of watercourse/ditch falls within the Site Extent within the site is limited, approximately 46m. No change to extent. **No change anticipated (0)**	Condition not significant. This habitat is valued for riparian mammals and aquatic species. However, there is no anticipated change. **No change anticipated (0)**	Connectivity is hindered by culverts and as such, baseline levels demonstrate poor connectivity. No change in water quality, no change in flow regime, no culvert modification and no further barrier effects from proposed works. **No change anticipated (0)**	This habitat is valued as moderate for riparian mammals and aquatic species. However, no anticipated change **No change anticipated (0)**
Dense scrub (A2.1) and Scattered scrub (A2.2)	Due to the small infrequent areas of scrub within the Site it will support less species than the denser/ more biodiverse areas of off-site scrub which is more widespread. The diversity is limited. **No change anticipated (0)**	0.06ha of scrub is present, no scrub is anticipated to be lost. 0.04ha of introduced shrub (raised planters) are to be installed, however, these are not native species. **No change anticipated (0)**	Scrub is not considered to form part of any Priority Habitat this habitat would maintain the same condition. **No change anticipated (0)**	Scrub provides some connectivity along the terrestrial habitats and railway line, however, no anticipated changes in connectivity. **No change anticipated (0)**	Ongoing aspects of resilience likely to remain unchanged due to no loss. **No change anticipated (0)**
Tall ruderal herb (C3.1)	The ruderal occurs in small, strips around the former compound site, with limited species diversity. Throughout most of the tall ruderal vegetation were stands of Japanese knotweed, which outcompetes native species for resources (such as light, space). A minimal area of ruderal is to be lost (0.004ha), as such, this would not cause significant change in the diversity as ruderal is a transitional habitat. **No change anticipated (0)**	The extent of the ruderal occurs in small, strips around the former compound site, at 0.20ha. 0.004ha of ruderal is to be lost. This would not cause significant change in the extent due to the small size of the area and the transitional nature of this habitat. **Minor negative change anticipated (-)**	Small areas of low diversity ruderal growth within the Site and the presence of INNS within this habitat render the condition poor, as such, no change anticipated. **No change anticipated (0)**	Ruderal on site is predominantly around the compound areas, this would provide the same connectivity as baseline, with any ruderal within the scrub still likely providing some heterogeneity to the habitat. Further, the ecotone that ruderal provides between scrub and shorter vegetation swards would remain intact across remaining areas of the site, as the majority is preserved. **No change anticipated (0)**	Ruderal vegetation can be transitional and ephemeral in nature, however, ongoing resilience likely to remain unchanged due to the minimal loss of ruderal vegetation on site. **No change anticipated (0)**
Artificial sea wall (J3.5)	The sea wall has been colonised by barnacles and algae, with no notable communities present. Low diversity present in this habitat. The proposed works will allow for recolonisation of the new structures, as such, no significant change in diversity is anticipated. Consideration for habitat enhancements would increase diversity. **No change anticipated (0) accounting for recolonisation of new materials.**	The seawall is present along the entire length of Marine Parade, bordering where the land meets the coast. It is of masonry composite and is enhanced by areas of sheet metal piling in sections. the sea wall extent is 1.52ha. This area is to be replaced, and rock armour installed. As such, although there would be a change it would be a like-for-like neutral basis. **No change anticipated (0)**	The sea wall has been colonised by barnacles and algae, with no notable communities present. Low diversity present in this habitat and as such, not in a notable condition, with lack of heterogeneity of the surface area. **No change anticipated (0) accounting for recolonisation of new materials.**	Connectivity along shoreline to remain as baseline with the replacement of the sea wall. **No change anticipated (0)**	Aspect of resilience in this habitat not in a notable condition to support a diverse range of species, with current lack of heterogeneity of the surface area. **No change anticipated (0)**
Bare ground (J.4), Buildings (J3.6), Wall (J2.5), Hardstanding (J5)	N/A	N/A	N/A	N/A	N/A

6.9 Mitigation and Enhancement

6.9.1 This section outlines the mitigation required where significant effects have been identified in Section 6.7 and the ecosystem resilience table in Section 6.8.

Additional Mitigation of Construction Effects

6.9.2 Where adverse effects to receptors cannot be ruled out, additional mitigation must be recommended. The following mitigation measures have been proposed to reduce any adverse effects during construction. These measures will cover the following receptors:

- Designated Sites.
- Birds (red-throated diver).
- Intertidal ecology.
- Subtidal ecology.
- Marine mammals.

Marine Vessel Management Plan (MVMP)

6.9.3 Designated sites, subtidal ecology, red-throated diver (should delivery of rock armour occur between the overwintering period, September-end of February) and marine mammals may all be subject to negative impacts associated with the selection of transportation Option 2 (transportation of rock armour by sea).

6.9.4 In the event that Option 2 is selected, a Marine Vessel Management Plan (MVMP) will be produced. The MVMP will detail suitable avoidance measures to ensure sensitive and internationally important receptors are avoided, and any potential impacts arising from marine vessels are adequately mitigated for.

6.9.5 Receptors include sensitive sessile habitats at risk from direct impact and increased sedimentation, red-throated diver and marine mammals including bottlenose dolphin, harbour porpoise and grey seal at risk from visual and noise disturbance and displacement.

6.9.6 Pen Llŷn a'r Sarnau SAC contains habitats which are sensitive to increased sedimentation which may occur as a result of vessel movement within the SAC. This includes reefs- blue mussel beds are known to be present nearshore between the SAC boundary and the Site. Blue mussel beds are listed as a Section 7 Priority Habitat in Wales.

6.9.7 The MVMP will prescribe avoidance measures to prevent sedimentation within the SAC. This will include suitable routing options and mooring locations to avoid the most sensitive habitats. All vessels will moor outside of the SAC boundary, where practicably possible. If mooring is required within the SAC, it will be limited to the most suitable areas with the least sensitive habitats and lowest risk of sedimentation. Vessels will be instructed to reduce their speeds when entering the SAC to prevent excessive turbidity and sedimentation from propellor scour at shallow depths, as well as mitigate any risk of direct mortality/auditory injury to marine mammals from collision or noise impacts. As such, speed restrictions both within and outside the SAC are to be implemented and specified within the MVMP as a precautionary measure to minimise potential disturbance and injury/mortality to marine mammals that may be

present in the area. During transfer of rock armour from the main vessel to smaller barge vessel, a protocol will be in place to prevent unnecessary sedimentation through engine scour and to prevent materials being dropped overboard.

6.9.8 The MVMP will include measures (Biosecurity Risk Assessment) to avoid the spread of marine-based INNS, through sensitive management of materials and high-risk activities such as ballast water transfer.

6.9.9 The Pen Llyn a'r Sarnau SAC and West Wales Marine SAC support bottlenose dolphin, harbour porpoise and grey seals. Two grey seal pupping sites are also present in proximity to the Site but are not listed as qualifying features of the designated sites. The Northern Cardigan Bay SPA supports the red-throated diver qualifying species. The presence of transport vessels may result in underwater noise disturbance to sensitive marine mammals, direct mortality or injury to marine mammals and the physical presence and movement visual and noise disturbance to red-throated diver. Sources of noise disturbance may include the engines of the vessels during transport, engine noise if left running whilst moored, and mechanical sounds whilst transferring rock armour. Excessive noise levels could cause behavioural shifts. Excessive presence of vessels may increase the disturbance / displacement of red-throated diver.

6.9.10 The MVMP will describe avoidance and mitigation measures to reduce the levels of noise emitted from vessels during construction. This will include consideration of suitable routing and mooring options and will prescribe speed limitations based on anticipated engine noise when travelling within the SAC. All vessels will moor outside of the SAC boundary where possible, and engine management will be reviewed (e.g. turned down where practicable). During transfer of rock armour, a protocol will be in place to prevent underwater noise through unnecessary engine use and other mechanical noise. The protocol will prescribe sensitive handling of rock armour to reduce underwater noise during the transfer of materials and to prevent materials being dropped overboard.

6.9.11 The qualifying feature of the SPA comprises red-throated diver, which are particularly sensitive to vessel movements. The worst-case-scenario for vessel movement disturbance has been outlined in the HRA, however, even under an upper limit of what would be reasonably required to deliver the material by sea, adverse effects on site integrity can be ruled out with mitigation. Nevertheless, Vessel A anchoring offshore is standard practice for this delivery method, Vessel B shuttle barge operations are short-duration, repeat transits, not continuous high-speed movements. Works are constrained to daylight and low-tide "in the dry" operations, inherently limiting activity windows. The figures of vessel transits outlined in the worst-case-scenario represent a conservative worst-case upper bound for assessment purposes and are not to be exceeded. Mitigation would include the following:

- Select vessel anchoring and transit routes within the SPA to avoid known aggregations of birds, maintain direct transit routes to minimise travel distance through areas used by divers, and where possible, use existing, well-established routes.
- Ensure addition of the vessels for the delivery of rock armour does not exceed the maximum number of vessel transits through the SPA (to include vessel A transits to and from its proposed anchor location and vessel B transits to and from vessel A to the rock amour deposit location).

- Minimise length of time vessel A would be anchored within the SPA and ensure it does not exceed the maximum length of time allowed for mooring vessels in the SPA.
- Minimise noise disturbance by avoiding engine over-revving.
- Briefing of vessel crew on the purpose and implications of these vessel management practices (through toolbox talks).

6.9.12 Following the implementation of the mitigation the wintering population of red-throated diver would be stable or increasing and the foraging habitat of this species would not decrease significantly, and its habitat quality would remain unaffected by anthropogenic factors. With these measures in place secured through the MVMP, disturbance would be insufficient in magnitude, duration or frequency to affect population distribution or prevent the wintering red-throated diver population from remaining stable or increasing. No significant effect is anticipated as work will be avoided withing the overwintering season.

6.9.13 In the event that confidence in the MVMP cannot be obtained, it may be necessary to undertake in-situ noise monitoring to ensure decibel levels are kept below the TTS for bottlenose dolphin (181dB), harbour porpoise (161dB) and grey seal (175dB). Minimal vessels will be operating in localised area over a temporary period, whilst there is a vast expanse of alternative habitat for cetaceans and red throated diver to use. Continuous noise output will allows individuals to stay clear of any noise, thus significant effects are extremely unlikely and impact range would be within tens or metres only.

Intertidal/subtidal mitigation

6.9.14 The assessment of likely significant effects concluded that the Proposed Development would result in a negative impact to intertidal ecology. Although there is a loss of blue mussel habitat via the loss of approximately 514m of groynes (post and boards) maintaining blue mussels. To mitigate for the loss of groynes and the associated mussels that cannot feasibly be reinstated into the design, bespoke intertidal habitat creation measures have been proposed through creation of 0.5ha of *Sabellaria alveolata* habitat off site (north of the red line boundary refer to Appendix 6.1 Intertidal Biotope report, figure 4) and to enhance the existing offshore blue mussel beds through 0.3% increase in area.

6.9.15 The figure BMTH-ARP-EAC-ZZ-DR-OE-000002 outlines the phase 1 plan post-development, including the proposed indicative intertidal mitigation locations.

6.9.16 The LEMP and Habitat Management and Monitoring Plan (HMMP) will define the adaptive plan for *Sabellaria* reef and blue mussel habitat creation, outlining how the habitats will be constructed, monitored, and managed over time. This ensures that the habitat creation can respond to changing conditions and achieves its intended ecological outcomes, delivering a net benefit for biodiversity.

<u>Proposed Sabellaria habitat creation approach</u>

6.9.17 This habitat creation has been proposed to support the natural expansion of the existing *Sabellaria* reef through facilitation of passive larval recruitment and sediment retention. A reef expansion buffer of approximately 0.5 ha would be identified in proximity to the existing reef, located where abiotic and physical

conditions (including hydrodynamic regime, seabed composition and sediment mobility) most closely reflect those supporting the reef structures. The proximity of the buffer to the existing reef is intended to maximise exposure to locally retained larvae while maintaining functional connectivity with the source population.

6.9.18 Within this expansion area, a field of low profile, high-stability hard substrates (rock armour) would be deployed, arranged in spatially discrete clusters. Units would be oriented broadly perpendicular to the dominant tidal flow to locally reduce near-bed flow velocity, creating micro-habitats conducive to sediment deposition while avoiding large-scale alteration of sediment transport processes.

6.9.19 The hard substrates are intended to act as initial attachment points and sediment capture focal points, supporting natural reef colonisation processes rather than functioning as replacement reef. Design emphasis is placed on maintaining an adequate supply of medium-grained sand (approximately 125-350 µm) within the buffer, recognising that Sabellaria alveolata reef development is fundamentally dependent on sediment availability for tube construction and stabilisation.

6.9.20 Where specifically permitted and subject to marine licensing constraints, the limited translocation of small reef fragments into the created habitat may be considered as a supplementary measure to accelerate local colonisation. However, passive larval recruitment from the adjacent reef would remain the primary mechanism for reef establishment, with transplantation not relied upon for delivery of habitat extent.

6.9.21 Over the monitoring period, the area would be assessed for evidence of reef development, recognising the inherently dynamic and episodic nature of *Sabellaria* reef growth. Monitoring would focus on morphometric indicators, including reef patch area, thickness, tube density and degree of fragmentation, to track trajectory rather than guarantee outcomes. The approach is intended to remain adaptable, allowing modification in response to observed sediment dynamics, colonisation patterns and hydrodynamic feedback.

Proposed blue mussel habitat creation approach

6.9.22 A blue mussel bed habitat creation approach is proposed to support natural expansion of existing habitat extents in the study area, primarily through passive recruitment and subsequent aggregation. The creation area would be located adjacent to established beds, in areas where key conditions (tidal regime, hydrodynamic exposure and salinity) are comparable, to ensure suitability and increase ecological connectivity between the beds.

6.9.23 Habitat creation would be achieved by placing discrete patches of stable, heterogeneous hard substrate, to be defined within the LEMP and HMMP, principally hard substrate such as rock armour or, if appropriate, cobbles, ensuring sufficient size to reduce mobility under wave and tidal forcing. The material would be installed as low profile clusters to provide settlement surfaces and interstitial refuge, and to encourage the development and coalescence of mussel patches without materially altering local sediment transport or flow patterns.

6.9.24 The substrates are intended to act as colonisation nuclei. Where permitted and subject to licensing, limited seeding or translocation of small mussel clumps from adjacent donor areas may be considered to accelerate early establishment,

however, passive recruitment would remain the primary mechanism for the bed development.

6.9.25 Monitoring would be undertaken to confirm substrate stability and track bed formation, focusing on indicators such as mussel density, areal extent, patch connectivity and vertical structure, alongside evidence of associated fauna. The approach would remain adaptive, allowing refinement of layout and substrate grading in response to observed recruitment, hydrodynamic conditions and bed development.

6.9.26 Overall, provision of these intertidal enhancements will provide a Net Benefit for intertidal ecology as the habitats created are highly likely to support a wider diversity of intertidal species in natural habitats than currently present. Therefore, providing longer term resilience for the intertidal habitats on Site. This would therefore result in a longer-term net benefit for biodiversity providing a beneficial impact.

Mitigation of Operational Effects

6.9.27 No operational effects are anticipated therefore no further mitigation is proposed.

Enhancements

PPW [6] states that development should not cause any significant loss of habitats or populations of species (not including non-native invasive species), locally or nationally and must work alongside nature and it must provide a Net Benefit for Biodiversity (NBB). All schemes applying for planning permission must therefore demonstrate they have achieved a NBB and enhanced ecosystem resilience through applying the stepwise approach. In addition, where works require a Marine Licence, the determination will be made in accordance with the Welsh National Marine Plan [8], including Policy ENV_01, which requires proposals to assess and address impacts on marine ecosystems by applying the mitigation hierarchy to avoid, minimise and mitigate adverse effects, and to support the protection, restoration and enhancement of marine ecosystem resilience.

6.9.28 Several habitats would be directly impacted (lost) by the footprint of the Proposed Scheme. This included the following habitats which can be seen at ES Volume 4, Figure 6.1 Baseline Phase 1 Habitat Plan:

- Tall ruderal vegetation (C3.1) – 0.004ha lost.
- Intertidal mud/sand (H1.1) –1.718ha lost/covered.
- Intertidal shingle/cobbles (H1.2) – 0.7136ha lost/covered.
- Coastal grassland (H8.4) – 0.244ha lost.
- Artificial seawall (J3.5) – 0.259ha lost.
- Buildings (J3.6) – 0.004ha lost.
- Bare ground (J4) – 0.008ha lost.
- Other habitat (hardstanding) (J5) – 0.860ha lost.

6.9.29 Each of the habitats listed above were categorised as being of less than local value based on poor species diversity, low biomass, presence of INNS, or being limited in terms of coverage, or being an artificial urban feature. Their loss was therefore not significant, and the habitats were not carried through as sensitive receptors into the assessment of likely effects. All other habitats identified within the Site would be retained (no losses).

6.9.30 The Proposed Development would result in the creation of 0.066ha of amenity grassland and 0.04ha of introduced shrub (raised planters) and an increase in coverage of hardstanding and sealed surfaces, which includes the revetment itself (see ES Volume 4, Figure 6.2, Post-development Phase 1 Habitat Plan).

6.9.31 The amenity planting will comprise a mixture of native and climate resilient species (non-native) that are suitable for coastal environments and will provide pollen and nectar for a range of invertebrates. In the long-term, the shrub planting may provide nesting opportunities for breeding birds.

6.9.32 The intertidal mitigation will provide 0.5ha of *Sabellaria alveolata* habitat creation, and 0.063ha of blue mussel habitat, an overall increase of the 0.3% of blue mussel bed extent identified within the study area. The habitat creation and method statement is to be detailed within the LEMP. This off-site enhancement will comprise an extension to the existing Sabellaria boulder field to the north of the Site to provide opportunities for new *Sabellaria alveolata* reefs which can colonise from the existing population, along with expansion of existing mussel beds seaward of the site.

6.9.33 The reduction of 0.004ha of tall ruderal vegetation (C3.1) and 0.244ha of coastal grassland (H8.4) which is currently in poor condition and lacking in diversity does not represent a significant loss. Habitat loss will be mitigated and a net-benefit for biodiversity achieved through the enhancement of approximately 4ha of dune habitat to the south of the site.

6.9.34 The mitigation/enhancement strategy of approximately 4ha of existing dune habitat located immediately to the south of the Site would be designed following advice set out in *NRW 207 Advice options for sand dune management for flood and coastal defence report, 2017* [45], which includes studies on the Fairbourne Dunes, and as such, is most relevant on a local scale. The Fairbourne Dunes are in close proximity to the dune area proposed for enhancement, to the southern extent of the Mawddach Estuary SSSI. The strategy will seek to enhance ecosystem resilience by improving habitat condition, diversity and functional connectivity within the wider sediment cell[9]. The works will specifically support the restoration and maintenance of the dune habitats, recognising that these features are dependent on active sediment movement and early successional stages. Dune condition and compliance with Annex I criteria is improved through the presence of dynamic processes, bare sand and habitat mosaics rather than overstabilisation. Enhancement measures will undergo dynamic management appropriate to the baseline conditions. Measures would include the following, where appropriate: targeted dune re-profiling using existing sand, installation of biodegradable sand fencing to promote aeolian

[9] The dune proposed for enhancement is located within the same coastal sediment cell as the footprint of the proposed works, ensuring that mitigation operates within the functional geomorphological system that governs sediment transport, beach-dune sand exchange and coastal resilience. Managing dunes at a sediment-cell scale reflects NRW advice on dune management, which emphasises that dune systems should not be considered in isolation, but as part of a wider sediment pathway supplying and redistributing material along the coast.

sand trapping and embryo dune formation, selective vegetation management including the use of native sand-binding species where appropriate, and if necessary, managed access controls to reduce trampling pressure. Collectively, these measures will increase dune mobility, support natural recovery processes following storm events, and enhance structural and ecological diversity, resulting in a measurable improvement in dune system function, coastal resilience, and biodiversity value consistent with the adaptive, nature-based management approach promoted at the Fairbourne dunes. The LEMP and Habitat Management and Monitoring Plan (HMMP) will define the adaptive plan for the dune enhancement, outlining how the enhancement measures will be constructed, monitored, and managed over time. This ensures that the habitat can respond to changing conditions and achieves its intended ecological outcomes, delivering a net benefit for biodiversity.

6.9.35 Further enhancements which could possibly be incorporated into the design (depending upon third party agreements) to provide further benefits as part of the Proposed Development include the following:

- It is possible to enhance the amenity grassland to a more species rich neutral grassland in areas designated as “green space”. Species-mixes and management regimes will need to be altered to achieve this. With the proposed additions to the species-mix and changes to long-term management proposed this will represent an improvement in the *diversity* and *condition* of the habitats present onsite.
- Where feasible at lower tidal elevations, ecological enhancement structures can be integrated within sheet piles, which can create shallow water-retention features (with controlled drainage/overflow), providing refuge and improving species richness on otherwise smooth vertical surfaces.
- Removal of Japanese knotweed across the Site. This will require the expertise of a suitably qualified INNS specialist who will work directly with the Contractor. The removal of INNS will directly improve the quality and condition of the scrub, ruderal and grassland habitats surrounding the INNS, allowing native species to succeed thereby contributing to the resilience of this habitat.
- The permanent lighting design will include measures to reduce light spill onto sensitive habitats or features which could be used by light-sensitive species such as bats, birds and terrestrial mammals. A reduction in light levels on vegetative habitats will increase their suitability for light sensitive species and may provide new foraging resources in combination with the other measures that may be considered.
- A large area of bare ground to the east of the Promenade (formerly used as a compound) could be considered to create up to 0.6ha of species-rich coastal grassland habitat with native scrub to provide long-term opportunities for a range of protected and notable terrestrial species (e.g. nesting bird, invertebrates).However, this would be dependent upon third party agreements.

6.10 Residual Effects

6.10.1 Cumulative and in-combination effects are addressed within ES Chapter 15 Cumulative and In-Combination Effects.

6.10.2 No cumulative or in-combination effects from other projects or applications have been identified, therefore there are no residual effects.

6.11 Assessment Summary

6.11.1 All potential effects identified in the main assessment including those identified as negligible are presented in Table 6-14.

Table 6-15 Summary of effects matrix

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual effect
Designated sites	• Damage and or degradation to sensitive habitats (reefs, *Salicornia* and other annuals colonizing mud and sand, and Atlantic salt meadows) • Disturbance and auditory injury (to marine mammals, bottlenose dolphin, harbour porpoise and grey seal as well as red-throated diver)	Negative (significant)	Mitigation outlined in the Marine Vessel Management Plan (MVMP)	Negligible (not significant)
Intertidal ecology	Loss of blue mussel habitat[10]	Negative (significant)	Bespoke intertidal mitigation including *Sabellaria alveolata* habitat creation. Increase in extent of subtidal blue mussel beds, both S7 Habitats	Positive
Subtidal ecology	Damage and or degradation to sensitive habitats (blue mussel beds)	Negative (significant)	Marine Vessel Management Plan (MVMP).	Negligible (not significant)
Dunes (H6)	Negligible	Negligible	Mitigation for habitat loss and enhancement proposed	Positive
Running water (G.2)	Negligible	Negligible	None proposed	Negligible (not significant)
Bats	Negligible	Negligible	None proposed	Negligible (not significant)
Badger	Negligible	Negligible	None proposed	Negligible (not significant)

[10] (not qualifying as a S7 habitat blue mussel bed)

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual effect
Otter	Negligible	Negligible	None proposed	Negligible (not significant)
Marine mammals	Disturbance and auditory injury from the main transport vessel (to all marine mammals present locally, but particularly grey seal at the nearby pupping sites)	Negative (significant)	Marine Vessel Management Plan (MVMP)	Negligible (not significant)
Birds (Red-throated diver assessed within designated sites)	Negligible	Negligible	None proposed	Negligible (not significant)
Reptiles	Negligible	Negligible	None proposed	Negligible (not significant)
Invertebrates (Marine)	Negligible	Negligible	None proposed	Negligible (not significant)
Fish	Disturbance from vessels	Negligible	Marine Vessel Management Plan (MVMP)	Negligible (not significant)

Abbreviations List

CEMP	Construction Environmental Management Plan
CIEEM	Chartered Institute of Ecology and Environmental Management
CWS	Candidate Wildlife Site
DECCA	DECCA Framework: “Diversity, Extent, Condition, Connectivity and Aspects of ecosystem resilience”
EcIA	Ecological Impact Assessment
EcOW	Ecological Clerk of Works
EIA	Environmental Impact Assessment
EPS	European Protected Species
ES	Environmental Statement
FLL	Functionally Linked Land
GIS	Green Infrastructure Statement
GPP	Guidance for Pollution Prevention
HRA	Habitats Regulations Assessment
IEF	Important Ecological Features
INJ	Auditory Injury regarding marine mammals
INNS	Invasive Non-Native Species
JNCC	Joint Nature Conservation Committee
LBAP	Local Biodiversity Action Plan
LEMP	Landscape Environmental Management Plan
LSE	Likely Significant Effect
MAGIC	Multi-Agency Geographical Information for the Countryside
MLWN	Mean Low Water Neaps
MLWS	Mean Low Water Springs
MNCR	Marine Nature Conservation Review
MPA	Marine Protected Area
NRW	Natural Resources Wales
PEA	Preliminary Ecological Appraisal
PPW	Planning Policy Wales
PRA	Preliminary Roost Assessment
S7	Section 7 (Priority Habitats listed under the Environment (Wales) Act 2016)
SAC	Special Area of Conservation
SPA	Special Protected Area
SSSI	Site of Special Scientific Interest
TTS	Temporary Threshold Shift
UKBAP	UK Biodiversity Action Plan
WeBS	Wetland Bird Survey
WFD	Water Framework Directive
WCA	Wildlife and Countryside Act
YGC	Ymgynghoriaeth Gwynedd Consultancy
ZoI	Zone of Influence

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Cyngor Gwynedd

Barmouth North Promenade FAS

ES Chapter 7 Climate Change

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Contents

7. Climate Change **1**

7.1 Introduction 1

7.2 Legislation, Policy and Guidance 1

7.3 Scope of assessment 6

7.4 Stakeholder Engagement 7

7.5 Methodology 8

7.6 Baseline 15

7.7 Embedded Environmental Design Measures 17

7.8 Assessment of Likely Significant Effects 18

7.9 Mitigation and Enhancement 20

7.10 Residual Effects 21

7.11 Assessment Summary 21

8. References **23**

Tables

Table 7-1 List of Relevant Legislation 2

Table 7-2 Welsh Carbon Budgets, as legislated by the Climate Change Regulations (2021) 3

Table 7-3 List of Relevant National Policy 3

Table 7-4 List of relevant local policy, plans and strategies 5

Table 7-5 Summary of Climate Assessment scope 6

Table 7-6 NRW comments on scope of the Climate Change and the response 8

Table 7-7 Methodology for estimating emissions sources included in the GHG assessment 10

Table 7-8 Wales National Carbon Budgets 12

Table 7-9 Tyndall Centre carbon budgets for Gwynedd Council 13

Table 7.10 IEMA guidance levels of significance 13

Table 7.11 The GHG emissions during construction for Option 1 (if rock armour is sourced locally) 18

Table 7.12 The GHG emissions during construction for Option 2 (if rock armour is sourced from Norway) 19

Table 7.13 The GHG emissions during operation 19

Table 7.14 Compares the Proposed Development's emissions with Wales's Carbon Budgets 20

Table 7.15 Compares the Proposed Development's emissions with the Tyndall Centre Carbon Budgets for Gwynedd Council 20

Table 7.16 Summary of effects matrix 21

7. Climate Change

7.1 Introduction

7.1.1 This chapter provides an assessment of the likely significant effects on the Climate that may arise from the construction, operation and maintenance of Barmouth North Promenade Flood Defence Scheme (hereafter referred to as the 'Proposed Development'). The approach undertaken for this chapter has been supported by a scoping report submitted by Cyngor Gwynedd (Ymgynghoriaeth Gwynedd Consultancy (YGC)), engagement with statutory consultees, and scoping opinions received from Cyngor Gwynedd and Natural Resources Wales (NRW) on 30 April 2024 and 19 April 2024 respectively.

7.1.2 This chapter details the legislation, policy and guidance that is relevant to Climate Change, a summary of engagement undertaken, the methodology of assessment, and the embedded environmental design measures. This is followed by an assessment of likely significant effects of the Proposed Development on Climate Change, taking account of the embedded environmental design measures, and the need for any additional mitigation is then considered along with any proposals for enhancement design measures. This chapter concludes with a summary of likely significant residual effects.

7.1.3 This chapter is supported by ES Volume 3, Appendix 7.1 GHG assessment.

7.1.4 Since the GHG assessment was carried out, the design of the Proposed Development has been revised to reduce emissions through the reduction of material quantities. This has resulted in:

- Reduction in the length of the rock armour revetment by ~200m
- The proposed central wall being changed from a concrete wall to a kerb and balustrade.

7.1.5 These changes will reduce the overall GHG emissions of the scheme due to the reduced quantities of materials. However, this assessment considers the previous design as a worst case for the assessment of impacts. The outcomes of the assessment and its conclusions around effects are not affected.

7.1.6 This chapter should be read in conjunction with:

- ES Chapter 2 Project Description.
- ES Chapter 8 Community Considerations (Traffic).
- ES Chapter 6 Biodiversity and Protected Sites.
- ES Chapter 10 Flooding and Water Quality.
- ES Chapter 12 Marine and Coastal Physical Processes.

7.2 Legislation, Policy and Guidance

7.2.1 This section identifies the legislation, policy, guidance and other documentation that has informed the assessment of likely significant effects on Climate Change. This section is supported by the ES Volume 3, Appendix 1.1 Policy Context, which outlines overarching legislation and policy relevant to the Proposed Development.

Legislation

7.2.2 Table 7-1 lists the legislation relevant to this topic and the assessment of the likely significant effects.

Table 7-1 List of Relevant Legislation

Legislation	Relevance to Assessment
The Kyoto Protocol [1]	The Kyoto Protocol to the United National Framework Convention on Climate Change (UNFCCC). The Protocol was adopted in 1997 and provides legally binding emission reduction targets for 37 industrialised countries and economies in transition and the European Union. The Paris Agreement [2] was adopted by 196 parties at the UN Climate Conference of the Parties (COP 21) in 2015. It is an international treaty within the UNFCCC dealing with GHG emissions mitigation, adaptation and finance. It requires all signatories to declare their Nationally Determined Contributions (NDC) towards balancing anthropogenic sources and sinks of GHGs in the second half of this century with the objective of keeping global warming to well below 2°C and to pursue efforts to limit global warming to 1.5°C.
The Climate Change Act 2008 [3] – UK	A legally binding framework for addressing climate change in the UK. In relation to climate change adaptation, the Climate Change Act 2008 (the Act) sets the requirement for a national adaptation programme and associated publication of a climate change risk assessment every five years. In relation to climate change mitigation, it commits the UK to GHG emissions reductions and reporting.
The Climate Change Act 2008 (2050 Target Amendment) Order 2019 (UK) [4]	The Climate Change Act 2008 (2050 Target Amendment) Order 2019 revised the 2050 target established in the Act to achieve "net zero." This means that the net UK carbon account, which includes carbon dioxide and other specified greenhouse gases, must be at least 100% lower than the baseline year of 1990 by the year 2050.
The Environment (Wales) Act 2016 [5]	This Act is designed to encourage the sustainable management of natural resources and establish targets for the reduction of greenhouse gas (GHG) emissions, among other objectives. In relation to climate change, the Act mandates that the Welsh Ministers achieve specific targets for reducing GHG emissions originating from Wales. Key provisions in this section of the Act pertain to the 2050 emissions target, interim emissions targets, carbon budgets, and carbon units, among other elements.
The Environment (Wales) Act 2016 (Amendment of 2050 Emissions Target) [6]	The Environment (Wales) Act 2016 mandates that the Welsh Ministers guarantee that the net Welsh emissions account for the year 2050 is reduced to a specified percentage below the baseline. The proposed Amendment pertains to raising this percentage from 80% to 100%.
The Carbon Accounting (Wales) Regulations 2018 [7]	These regulations establish guidelines for carbon accounting and carbon units, which are essential for calculating the net Welsh emissions account as outlined in Part 2 of the Environment (Wales) Act 2016.
The Climate Change (Carbon Budgets) (Wales) Regulations 2018 [8]	The Climate Change (Carbon Budgets) (Wales) Regulations 2018 establish a maximum total for the net Welsh emissions account, referred to as the Carbon Budget, for the initial two budgetary periods: 2016 – 2020, which is set at an average of 23% below the baseline, and 2021 – 2025, which is established at 33% below the baseline.
The Climate Change (Carbon Budgets) (Wales) (Amendment) Regulations 2021 [9]	The Environment (Wales) Act 2016 mandates that the Welsh Ministers establish carbon budgets for each five-year budgetary period from 2016 to 2050. This regulation specifically addresses the adjustment of the carbon budget for the period 2021-2025, increasing the reduction target from 33% to 37% below the baseline. Additionally, it involves the

<table>
<tr><th>Legislation</th><th>Relevance to Assessment</th></tr>
<tr><td></td><td>establishment of the carbon budget for the period 2026-2030, aiming for an average reduction of 58% below the baseline.

Table 7-2 Welsh Carbon Budgets, as legislated by the Climate Change Regulations (2021)
<table>
<tr><th>Carbon budget</th><th>5-year period</th><th>Interim targets (Reduction below 1990 levels)</th><th>Average reduction below 1990 levels during the 5-year period</th></tr>
<tr><td>Second</td><td>2021-2025</td><td>-</td><td>37%</td></tr>
<tr><td>Third</td><td>2026-2030</td><td>63% by 2030.</td><td>58%</td></tr>
<tr><td>Fourth</td><td>2031-2035</td><td>-</td><td>Currently not established.</td></tr>
<tr><td>Fifth</td><td>2036-2040</td><td>89% by 2040.</td><td>Currently not established</td></tr>
<tr><td>Sixth</td><td>2041-2045</td><td>-</td><td>Currently not established</td></tr>
<tr><td>Seventh</td><td>2046-2050</td><td>100% by 2050.</td><td></td></tr>
</table></td></tr>
<tr><td>The Climate Change (Interim Emissions Targets) (Wales) (Amendment) Regulations 2021 [10]</td><td>This regulation introduces changes to the Climate Change (Interim Emissions Targets) (Wales) Regulations 2018, which established the interim emissions targets as outlined in Part 2 of the Environment (Wales) Act 2016. In particular, it adjusts the maximum figures for the net Welsh emissions account for 2030 (changing from 45% to 63% below the baseline) and for 2040 (changing from 67% to 89% below the baseline).</td></tr>
<tr><td>The Climate Change (Net Welsh Emissions Account Credit Limit) (Wales) Regulations 2021 [11]</td><td>The Climate Change (Net Welsh Emissions Account Credit Limit) (Wales) Regulations 2021 establishes the maximum allowable carbon units that can be credited to the net Welsh emissions account for the budgetary period from 2021 to 2025, with this limit set at 0% of the carbon budget.</td></tr>
<tr><td>Well-Being of Future Generations Act [12]</td><td>This act requires public bodies in Wales to think about the long-term impact of their decisions, to work better with people, communities and each other, and to prevent persistent problems such as climate change.</td></tr>
</table>

National Policy and Strategies

7.2.3 Table 7-3 lists the relevant planning policy and strategies, with paragraphs of relevance to the Climate Change assessment.

Table 7-3 List of Relevant National Policy

National Policy & Paragraph Number	Summary of Policy Requirement and Relevance
UK Marine Policy Statement (MPS) [13]	The UK Marine Planning System (MPS) serves as the framework for developing Marine Plans, in alignment with the objectives outlined in section 44 of the Marine and Coastal Access Act 2009. This statement is designed to facilitate and support the creation of Marine Plans that will advance the UK's transition to a low-carbon economy, thereby addressing the causes of climate change and ocean acidification while also adapting to their impacts.
UK Third Climate Change Risk Assessment 2022 [14]	The Act includes a requirement for UK Government to undertake a CCR Assessment every five-year period and to develop a programme for adaptation action in response to identified risks. The third CCR Assessment makes clear the risks of failing to act on climate change, and the UK's world leading approach to net zero must include action on adaptation to ensure resilience to climate change in the future.

National Policy & Paragraph Number	Summary of Policy Requirement and Relevance
UK Environmental Improvement Plan 2023 [15]	Establishes objectives aimed at minimising the risk of harm from environmental hazards, including flooding and drought, while also focusing on strategies for mitigating and adapting to climate change.
Welsh National Marine Plan (WNMP) 2019 [16]	This Plan encompasses both the inshore and offshore regions of Wales and has been developed and adopted in accordance with the Marine and Coastal Access Act (MCAA) 2009, as well as the UK Marine Policy Statement (MPS). Its primary aim is to facilitate the sustainable development of the Welsh marine area by aligning with Wales' well-being goals. It also supports the Sustainable Management of Natural Resources (SMNR) through informed decision-making, while considering the cumulative impacts of all activities within the marine environment. The WNMP has several policies related to climate change: • SOC_08: Resilience to coastal change and flooding – the Proposed Development should demonstrate how to it is avoiding significant adverse impacts upon coastal processes and minimise the risk of coastal change. • SOC_09: Effects on coastal change and flooding – the Proposed Development should demonstrate how it is resilient to coastal change and flooding over its lifetime. • SOC_10: Minimising climate change – related to avoid, minimise and/or mitigate GHG emissions. • SOC_11: Resilience to climate change – related to demonstrate that the impacts of climate change have been considered and adaptation measures have been taken into account.
Future Wales – the National Plan 2040 [17]	Future Wales is a National Development Framework that sets direction for development in Wales to 2040, which includes decarbonisation and climate-resilience.
Prosperity for All: A Low Carbon Wales [18]	The well-being goals and operational principles outlined in the Well-being of Future Generations (Wales) Act 2015 serve as guiding frameworks for Wales's decarbonisation efforts. In alignment with these objectives, this Plan sets forth a comprehensive framework for Wales's transition to a low carbon nation. It includes 100 policies and proposals aimed at directly reducing emissions and promoting the growth of a low carbon economy.
All Wales Plan 2021-25. Working together to reach net zero [19]	The Plan analyses case studies of different Wales actors (Transport, Energy, Buildings, Agriculture, among others) in achieving net zero emissions.
Wales Infrastructure Investment Strategy – December 2021 [20]	Chapter 1 – Ministerial Foreword: In December 2021, the Welsh Government established a strategy to create a clear framework for infrastructure investment that aims to achieve positive outcomes across the four domains of well-being: Environmental, Social, Economic, and Cultural Well-Being.
	Chapter 3 – Cross Cutting Principles, Paragraph 11: It is essential that the commitment to addressing climate change is reflected through investment across all sectors.
	Chapter 3 – Cross Cutting Principles, Paragraph 16: It is essential that, in the development of Proposed Development under this Strategy, policy officials conduct thorough analyses to assess the comprehensive impact of proposed programs on carbon emissions.

National Policy & Paragraph Number	Summary of Policy Requirement and Relevance
	Chapter 3 – Cross Cutting Principles: It is crucial to recognize the implications of climate change, such as flood risk, when formulating infrastructure investment proposals.
Planning Policy Wales – Edition 12 [21]	Paragraph 11 and 12: This Plan outlines the land use planning policies established by the Welsh Government. Its primary objective is to ensure that the planning system effectively contributes to the achievement of sustainable development while enhancing the social, economic, environmental, and cultural well-being of Wales.
	Paragraph 2.27: When assessing the proposal (Proposed Development), the causes and impacts of climate change will be fully taken into account (location, design, build, operation, decommissioning and restoration).
	Paragraph 3.33: The planning system is essential in addressing climate change risks, as it ensures that appropriate developments are situated in suitable locations.
	Paragraph 6.5.18: A fundamental consideration is the integration of climate change adaptation into coastal development strategies. This includes implementing measures to reduce vulnerabilities and actively seeking opportunities to enhance resilience within communities.

Local Policy and Strategies

7.2.4 The relevant local planning policy, plans and strategies to the Climate Change assessment is listed in Table 7-4.

Table 7-4 List of relevant local policy, plans and strategies

Local Policy, Plan & Strategy	Relevant policy	Relevance to Assessment
Angelsey and Gwynedd Joint Local Development Plan [22] [23]		In 2017, Gwynedd and the Isle of Anglesey County Council adopted this framework to guide and manage development. It addresses the demonstrated need for new housing and employment opportunities while also safeguarding the distinctive social, cultural, and environmental character of the region.
Carbon Management Plan [24]	Gwynedd Council – Joint Local Development Plan	The Carbon Management Plan outlines the Council's strategy for reducing its carbon emissions by 30% by the year 2014/15 and by 60% by the year 2021. According to the Gwynedd Council, by 2021 they achieve a reduction of 26.1%.
Climate and Nature Emergency Plan [25]	Gwynedd Council – Joint Local Development Plan	Due to the climate emergency declared in March 2019 by the Gwynedd Council, the Climate and Nature Emergency Plan was established. The aim of this plan is to outline the steps that the Council will take between 2022 and 2030 to reach out the net zero.
Technical Advice Note 15 Development, flooding and coastal erosion [26]		This Note offers technical guidance that complements the policies outlined in the PPW concerning flooding and coastal erosion. It establishes a framework for assessing flood risks associated with rivers, the sea, and surface water, as well as the potential for coastal erosion. Additionally, it provides insights into the implications of these risks and strategies for adapting to and coexisting with flood risk.

Standards and Guidance

7.2.5 The guidance and standards which relate to this topic are listed below.

- IEMA Environmental Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance [27].
- British Standards Institution (BSI) PAS 2080:2023 Carbon management buildings and infrastructure [28].

7.3 Scope of assessment

7.3.1 The Scoping Report prepared in February 2024 emphasizes the importance of integrating climate change considerations into the Environmental Impact Assessment (EIA). It is essential to understand the selection of materials, construction methods, and timelines, as well as to mitigate the impacts of climate change related to the Proposed Development. Therefore, climate change has been included in the scope of the EIA.

7.3.2 An EIA Scoping Opinion was adopted by Cyngor Gwynedd/Gwynedd Council and NRW on 30 April and 19 April 2024, respectively (refer to ES Volume 3, appendix 1.2 and 1.3). Cyngor Gwynedd supported including Climate Change within the scope of the Environmental Impact Assessment, although NRW provided no comment on it. Table 7-5 sets out matters scoped in and out of this assessment alongside a rationale.

Table 7-5 Summary of Climate Assessment scope

Assessment stage		Scope of Assessment
Construction	Climate Change Resilience Assessment (CCRA) and In-Combination of Climate Change Impact (ICCI) assessment	**Scoped out** – The vulnerability to climate change in the construction phase was not assessed as the construction programme is not expected to be long enough to experience any notable changes in the climate. However, extreme weather events are a feature of the baseline climate and projected climate at the time of construction and therefore it is expected that the CEMP (document reference-EN.F.15), prepared by the contractor (will be implemented during the construction period. The CEMP includes measures such as ensuring construction materials are covered when stored, and pro-active planning undertaken that accounts for the possibility of extreme weather events, including the use of extreme weather alert systems, for the protection of construction workers. Whilst impacts of climate change are already being experienced, particularly in terms of increased frequency and severity of extreme weather events such as storms and heatwaves, due to the relatively short construction duration, it is considered that good construction practice measures alongside the CEMP will appropriately mitigate climate change risks during the construction phase. Therefore, a Climate Change Resilience Assessment will be is scoped out of the EIA. In addition, topic specific assessments of significant and subsequent mitigation measures are unlikely to be impacted by climate change over the construction phase.
	GHG	**Scoped in** – As outlined in IEMA guidance, the Proposed Development has the potential to result in an increase in GHG emissions during the construction stage due to the potential for GHG emissions associated with the production of construction materials.

Assessment stage		Scope of Assessment
		PAS 2080 guidance [28] also sets out the importance of considering GHG emissions across the life cycle of the development. This assessment for construction is therefore scoped in.
Operation	CCR and ICCI	**Scoped out** – The Proposed Development itself aims to minimise the vulnerability of nearby receptors (details will be provided in the ES Volume 2- Chapter 10 Flooding and Water Quality and Chapter 12 Marine and Coastal Physical Processes) and consists primarily of various concrete walls, several existing sheet piles, and a rock toe armour, among other elements, which are not vulnerable to climate change. Given the nature of the Proposed Development, it is not anticipated that there will be significant exposure during the operations stage that has not already been addressed in the Volume 2- ES Chapter 10 on Flooding and Water Quality and Chapter 12 Marine and Coastal Physical Processes. Therefore, this assessment for operations has been excluded from the scope. In addition, topic specific assessments of significant and subsequent mitigation measures are unlikely to be impacted by climate change given the nature of the Proposed Development, through its operational lifespan.
	GHG	**Scoped in -** As outlined in IEMA guidance, the Proposed Development has the potential to result in an increase in GHG emissions during the operation stage, mainly related to maintenance activities. PAS 2080 guidance also sets out the importance of considering GHG emissions across the life cycle of the development. This assessment stage is therefore scoped in.
End of life – Decommissioning / Demolition	CCRA, ICCI and GHG	**Scoped out** – As it is assumed that the Proposed Development will not be decommissioned (the Proposed Development is being designed to provide a standard of protection to 2069, however, structural elements will be designed with a design life of more than 120 years design working life), it is considered that, once operational, it would be permanently functional. Hence, the GHG assessment for this stage is scoped out. If future decommissioning takes place, a CCR assessment should be based upon the most up to date UK/Wales climate projections available at the time of writing. This assessment stage is therefore scoped out.

7.4 Stakeholder Engagement

7.4.1 There has been no further stakeholder engagement other than the EIA Scoping Report and comments received in the EIA Scoping Opinion for Climate Change. These comments are outlined in the section below.

EIA Scoping Opinion

7.4.2 An EIA Scoping Opinion was adopted by Cyngor Gwynedd and Natural Resources Wales (NRW) on 30 April 2024 and 19 April 2024 respectively. There were no comments received from Gwynedd Council in relation to Climate Change and one comment from NRW which is presented in Table 7-6.

Table 7-6 NRW comments on scope of the Climate Change and the response

Scoping Opinion Comment	Response
The selection of materials, construction methods and timings will need to be understood and assessed to ensure that the climate change impacts of the project is minimised, in line with Gwynedd Council and Welsh Governments Climate change strategies.	This will be addressed within the GHG assessment in line with PAS2080 and all the legislation and policies described in previous sections.

7.5 Methodology

Study area

7.5.1 This section describes the spatial scope (i.e. the area which is impacted) for the assessment as it applies to GHG Assessment.

7.5.2 The study area for assessing GHG emissions focuses on emissions from the construction of the Proposed Development. This includes direct emissions from activities conducted within the red line boundary, and indirect emissions from activities outside this boundary, such as transportation of materials to the site and the carbon footprint of the construction materials used. The spatial scope considered for GHG emissions depends on the source of emissions being assessed. For this analysis, the spatial scope considered encompass the red line boundary, along with a transportation distance for construction materials ranging from 50 to 100 kilometres.

7.5.3 GHG emissions resulting from the Proposed Development will be released into the global atmosphere, which is considered as the receptor. In accordance with IEMA guidance, the sensitivity of this receptor (global climate) to increases in GHG emissions is classified as 'high.' This classification acknowledges the significant impact of global climate change and the cumulative effects of all sources of GHG emissions.

7.5.4 Regarding the temporal scope, for the GHG assessment this is the current baseline of the existing site, while the future baseline comprises the duration of the construction stage (one year) and the 120-year project design life (i.e. from the start of operation through to the end of the design life).

Baseline Methodology

7.5.5 The current baseline encompasses the existing seawall and beach. Given that the current infrastructure does not have any operational energy requirements and is maintained at a minimal level, it is assumed that the current baseline is zero GHG emissions.

Assessment Methodology

7.5.6 The GHG assessment has utilised a project lifecycle approach to estimate the GHG emissions resulting from the construction and operation of the proposed development, expressed in tonnes of CO_2 equivalent (tCO2e), in accordance with the guidance outlined in Section 7.2.5.

7.5.7 The only stage included within the GHG assessment is focused on the before use stage, hereafter referred to as the ‘construction stage’.

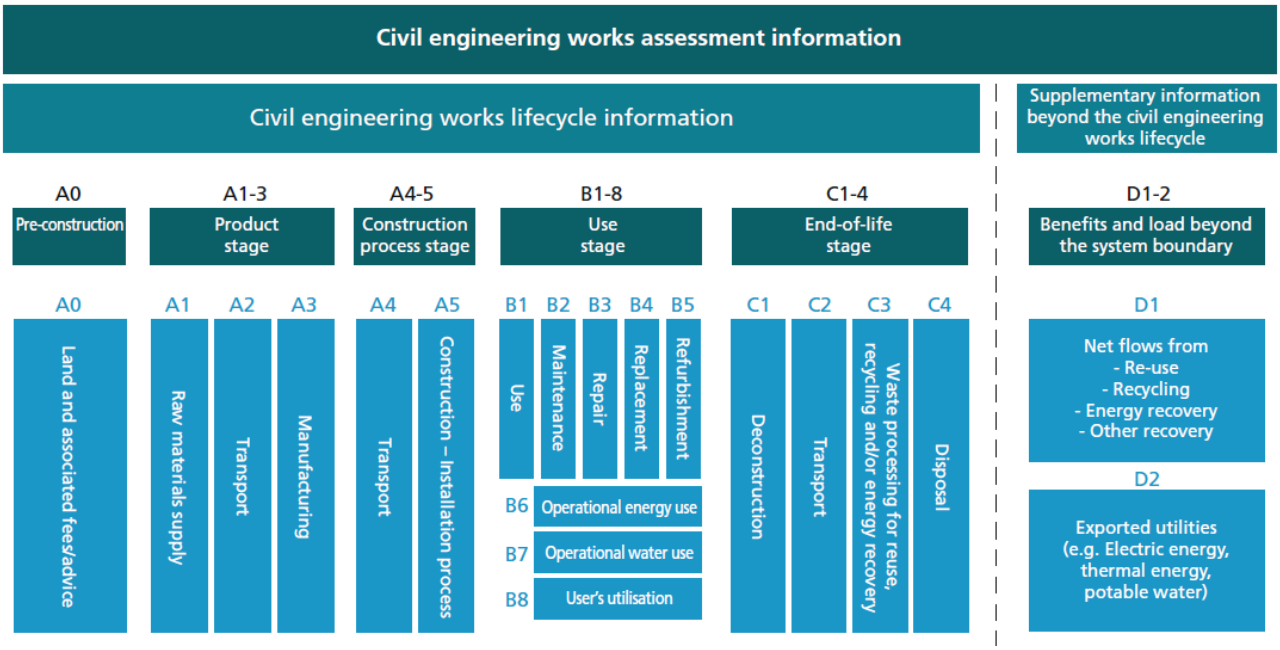
7.5.8 Estimated GHG emissions have been calculated using the equation below:

Activity data x GHG emissions factor = GHG emissions value

- Activity data is a measure of the quantity of an activity and relies on the type of activity being measured and how it is counted. For example, fuel use is usually measured in litres or tonnes, while construction materials and waste are measured in cubic meters or tonnes.
- GHG factor refers to the measurement of greenhouse gas emissions per unit of activity. These factors are sourced from both national and international databases.

7.5.9 The lifecycle stages included within the GHG Assessment are defined in Graphic 7-1, taken from the PAS2080 guidance [28], and summarises the key anticipated GHG emissions sources associated with the Proposed Development [28].

- The stages include:
  - the before use stage (A), or the 'construction phase'.
  - the use stage (B), or the 'operational phase'.
  - end of life stage (C), or the 'decommissioning phase.



Graphic 7-1 The GHG emissions assessment scope includes the before use stage (A), the use stage (B) and end of life stage (C)

7.5.10 In cases where activity data is not currently accessible during this phase of the design, industry benchmarks that reflect good practice have been employed. In cases where emissions cannot be quantified due to the absence of available benchmarks, a qualitative assessment has been conducted based on professional judgment. When calculating GHG emissions from the Proposed development the influence of Policy and Guidance on reducing future GHG emissions has been considered. Key assumptions and limitations considered are outlined in Sections 7.5.

7.5.11 Table 7-7 summarises the key anticipated GHG emission sources associated with the Proposed Development.

Table 7-7 Methodology for estimating emissions sources included in the GHG assessment

Emissions stage	Emissions Source	Assessment methodology	Data sources
Construction			
A1-A3	Structure, drainage, access roads and public realm works	Materials emissions factors have been taken from the Inventory of Carbon and Energy (ICE) version 3. Where specific material quantities are not available, benchmarks have been taken from the Arup Carbon Insights Platform - a library of "typologies" based on completed embodied carbon calculations from Arup projects. Where there is neither a carbon factor or benchmark available for a specific item, that item has been excluded from the assessment based on the PAS2080 cut-off rule.	Calculation based on Bill of Quantities: Material Volumes spreadsheet.
A4	Structure, drainage, access roads and public realm works	Transport emissions factor has been taken from the BEIS UK Government GHG Conversion Factors for Company Reporting (2023). The emissions factor is based on tonne-km's of building materials via HGV and via shipping. To allow for flexibility in delivery of the rock armour, two assessments have been conducted. Option 1: all rock armour to be sourced locally and delivered by HGV Option 2: rock armour delivered by boat, sourced from a European quarry.	Calculation based on Bill of Quantities: Material Volumes spreadsheet.
	Construction worker commuting	Transport emissions factor has been taken from the BEIS UK Government GHG Conversion Factors for Company Reporting (2023). The emissions factor is based on distance travelled (km) by construction workers.	Based on worker numbers and construction programme, ES Volume 2, Chapter 2 Project Description.
A5	Construction activities: Demolition, roads, earthworks, substructure, superstructure, fitout and roof	Energy (electricity, fuel, etc.) consumption from plant and vehicles, generators on-site, and construction worker commuting. Fuel consumption from transportation of materials to site (where these are not included in embodied GHG emissions). GHG emissions from transportation of workers to site. Carbon lost and gained from the removal and creation of habitats	High-level construction assumptions. See GHG Assessment Appendix for assumptions.
	Construction waste	Disposal of any waste generated by the construction processes.	High-level construction assumptions. See GHG

Emissions stage	Emissions Source	Assessment methodology	Data sources
		Carbon factors direct from BEIS UK Government GHG Conversion Factors for Company Reporting (2023).	Assessment Appendix for assumptions.
B2-B5	Maintenance activities	Energy (electricity, fuel, etc.) consumption from plant and vehicles, generators on-site, and maintenance worker commuting. Fuel consumption from transportation of materials to site (where these are not included in embodied GHG emissions)., if required for the maintenance activities. GHG emissions from transportation of workers to site.	Calculation based on Bill of Quantities: Material Volumes spreadsheet.

7.5.12 Regarding the interim emissions targets, The Climate Change (Interim Emissions Targets) (Wales) (Amendment) Regulations 2021 [10] stipulates that the net Welsh emissions account must be reduced by 63% from the baseline by 2030, and by 89% from the baseline by 2040.

7.5.13 To contextualise GHG emissions of the Proposed Development, the detailed GHG Impact Assessment provides a comparison against Wales's Interim Emissions Targets – Carbon Budgets. The main reference periods for assessing GHG emissions for the Proposed development, cover 2021-2030 (Second and Third Carbon Budgets). For local developments, these carbon budgets are broken down to be shared between local authorities by the Tyndall Centre [29]. There are therefore localised carbon budgets for Cyngor Gwynedd, which will also be used to give context to the scale of development from a GHG emission perspective. These are shown in Table 7-9.

Sensitivity

7.5.14 The single receptor for the GHG Assessment is the global atmosphere and all net emissions of GHGs to the atmosphere will contribute to climate change. The sources of GHG emissions are varied but there is only one impact pathway; GHG emissions released into the atmosphere contribute to global warming by absorbing heat that would otherwise be radiated into space.

7.5.15 For the GHG Assessment, emissions are not geographically limited and have a global effect rather than directly affecting local receptors. As per the IEMA guidance [27], the receptor is the global climate. The sensitivity of the climate to GHG emissions is 'high'. The rationale is as follows:

- GHG emission impacts could compromise the Climate Change Committee's (CCC) sectoral construction and net zero pathways and therefore the ability to meet its future carbon reduction trajectory.
- GHG emission impacts could compromise the UK's ability to reduce its GHG emissions and therefore the ability to meet its future legally binding carbon budgets.
- The extreme importance of limiting global warming to below 2°C above industrial levels, while pursuing efforts to limit such warming to 1.5°C as set out in the Paris Agreement and a recent report by the Intergovernmental Panel on Climate Change that highlighted the importance of limiting global

warming below 1.5 °C.

- Disruption to global climate is already having diverse and wide-ranging impacts to the environment, society, economic and natural resources. Known effects of climate change include increased frequency and duration of extreme weather events, temperature changes, rainfall and flooding, and SLR and ocean acidification. These effects are largely accepted to be negative, profound, global, likely, long term to permanent, and are transboundary and cumulative from many global actions.

Magnitude

7.5.16 The IEMA guidance [27] states that a key goal of EIA is to inform the decision maker about the relative severity of environmental effects such that they can be weighed in a planning balance. Therefore, it is essential to provide context for the magnitude of GHG emissions reported in the EIA in a way that aids evaluation of these effects by the decision maker. The crux of significance therefore is not whether a project emits GHG emissions, nor even the magnitude of GHG emissions alone, but whether it contributes to reducing GHG emissions relative to a comparable baseline consistent with a trajectory towards net zero by 2050.

7.5.17 The UK has set a legally binding GHG reduction target for 2050 with interim five-yearly carbon budgets which define a trajectory towards net zero. The 2050 target (and interim budgets set to date) are, according to the CCC, compatible with the required magnitude and rate of GHG emissions reductions required in the UK to meet the goals of the Paris Agreement.

7.5.18 The Environment (Wales) Act 2016 [5] establishes a framework for the Welsh Ministers to achieve specific targets aimed at reducing GHG emissions from Wales. In the initial version of the Act, it was mandated that the net Welsh emissions account for the year 2050 should be at least 80% below the baseline. However, the Environment (Wales) Act 2016 (Amendment of 2050 Emissions Target) Regulations 2021 have revised this requirement, increasing the target for the net Welsh emissions account for 2050 to a reduction of at least 100% from the baseline [6]. The Wales Carbon Budgets are shown in the Table 7-8 and the Tyndall Centre carbon budgets for Gwynedd are shown in Table 7-9 [29].

Table 7-8 Wales National Carbon Budgets

Year/Period	Emissions data and target level (mtCO2e)	Description
1990 / 1995[1]	56.23 [10]	Recorded baseline
2020	33.40 [30] [8]	Recorded baseline
2030	20.80 [30] [10]	Target
2040	6.19 [30] [10]	Target
2050	Net zero [6]	Target

[1] The Environment (Wales) Act 2016 sets 1990 as the baseline year for CO_2, CO and N_2O and 1995 for HFCs, PFCs, SF_6 and NF_3.

Table 7-9 Tyndall Centre carbon budgets for Gwynedd Council

Year/Period	Emissions data and target level (mtCO2e)
2018 - 2022	2.9
2023 - 2027	1.5
2028 - 2032	0.7
2033 - 2037	0.4
2038 - 2042	0.2
2043 - 2047	0.1
2048 - 2100	0.1

Significance of effect

7.5.19 IEMA guidance [27] provides criteria for assessing the significance of effects of GHG emissions from projects, these are presented in Table 7.10.

7.5.20 It is proposed that the GHG Assessment, therefore, uses the IEMA guidance to assess the significance of effects with the UK carbon budgets being used to provide context to the GHG emissions.

Table 7.10 IEMA guidance levels of significance

Effects	Significance level	Description	Example in the guidance
Significant adverse	Major adverse	A project that follows a 'business–as–usual' or 'do minimum' approach and is not compatible with the UK's net zero trajectory, or accepted aligned practice or area-based transition targets. It is down to the practitioner to differentiate between the 'level' of significant adverse effects, for example 'moderate' or 'major' adverse effects.	A project where GHG impacts are not mitigated or are only compliant with do–minimum standards set through regulation, and do not provide further reductions required by existing local and national policy for projects of this type. A project with major adverse effects is locking in emissions and does not make a meaningful contribution to the UK's trajectory towards net zero.
Significant adverse	Moderate adverse	The Proposed Scheme's GHG impacts are partially mitigated and may partially meet the applicable existing and emerging policy requirements but would not fully contribute to decarbonisation in line with local and national policy goals for projects of this type.	A project with moderate adverse effects falls short of fully contributing to the UK's trajectory towards net zero.

Effects	Significance level	Description	Example in the guidance
Not significant	Minor adverse	A project that is compatible with the budgeted, science-based 1.5°C trajectory (in terms of rate of emissions reduction) and which complies with up–to–date policy and 'good practice' reduction measures to achieve that. It may have residual emissions but is doing enough to align with and contribute to the relevant transition scenario, keeping the UK on track towards net zero by 2050 with at least a 78% reduction by 2035 and thereby potentially avoiding significant adverse effects.	A project where GHG impacts are fully consistent with applicable existing and emerging policy requirements and good practice design standards for projects of this type. A project with minor adverse effects is fully in line with measures necessary to achieve the UK's trajectory towards net zero.
Not significant	Negligible	A project that achieves emissions mitigation that goes substantially beyond the reduction trajectory, or substantially beyond existing and emerging policy compatible with that trajectory and has minimal residual emissions. This project is playing a part in achieving the rate of transition required by nationally set policy commitments.	A project where GHG impacts are reduced through measures that go well beyond existing and emerging policy and design standards for projects of this type, such that radical decarbonisation or net zero is achieved well before 2050. A project with negligible effects provides GHG performance that is well 'ahead of the curve' for the trajectory towards net zero and has minimal residual emissions.
Not significant	Beneficial	A project that causes GHG emissions to be avoided or removed from the atmosphere. Only projects that actively reverse (rather than only reduce) the risk of severe climate change can be judged as having a beneficial effect.	A project that's net GHG impacts are below zero and it causes a reduction in atmospheric GHG concentration, whether directly or indirectly, compared to the without–project baseline. A project with beneficial effects substantially exceeds net zero requirements with a positive climate impact.

7.5.21 Significance has been determined based on professional judgement balancing both quantitative and qualitative assessments of the whole-life GHG impact (construction and operation) of the Proposed Development against the IEMA definitions outlined above.

Limitations and Assumptions

Limitations

7.5.22 The GHG assessment uses data specific to the design at this point in time, design assumptions and GHG industrial benchmarks. As such, the GHG assessments outcome is considered an estimation and has an element of

uncertainty. For transparency the assumptions used in the assessment are outlined below, and the benchmarks used can be found in ES Volume 3, Appendix 7.1 GHG assessment.

Assumptions

7.5.23 The following principal assumptions have been used for the onshore GHG Assessment:

- Construction phase: emissions from traveling to site from workers and water use in the redline boundary have been calculated based on the workforce reaching a maximum of 50 site personnel. It is assumed each worker travels 30km to and from the site and require 90L of water per day.
- Construction phase: assessment of embodied carbon in materials is based upon internal modelling provided by the design team.
- National quarry resources that will provide the rock armour have been measured at a distance of 50km. This is an average of the distance of four local quarries.
- It has been assumed that international quarry material will be sourced from Norway. As such, it has been assumed to be sourced from the Port of Bergen. This is a sail distance of approximately 1,550km. Bergen the largest port in Norway and local to the Bremanger quarry.
- Where benchmarks for diesel consumption of the construction plant could not be found, it is assumed they use 10L diesel/h.

7.6 Baseline

Current Baseline

7.6.1 The baseline (do-minimum scenario) is the reference point against which the impact of the Proposed Development can be compared and assessed. This is often referred to as ‘business as usual’ where assumptions are made on projected cumulative GHG emissions over the study period. The do-minimum scenario for the proposed development comprises the cumulative GHG emissions within the agreed physical and temporal boundary of the proposed development but without implementation of the Proposed Development.

7.6.2 Hence, the GHG emissions without implementing the Proposed Development represent the current and future baseline (do-minimum) scenario. In this scenario it is assumed that no construction activity would take place, and the existing site would continue to operate over the study period. The site mainly comprises the beach, timber groynes, a promenade (from South to North Barmouth), and a primary, central and secondary wall and therefore the current GHG baseline is represented by maintenance and repair of these assets. There are a few residential properties nearby the site area.

Future Baseline

7.6.3 The climate hazards relevant to the Proposed Development are sea level rise, coastal erosion, coastal flooding and extreme weather events. These climate hazards are quantifiable through the UKCP18 climate models, these have therefore been described qualitatively through literature to demonstrate the trends.

Storm Surge

7.6.4 The Met Office UKCP18 Factsheet on storm surges, along with the Met Office article on UK and Global extreme weather events provides available information on UKCP18 marine projections and are summarised below:

- No significant changes in storm surges projected [31].
- It is currently unclear if storm surges will be more or less severe or remain same [32].
- Projections show small increase in frequency and intensity of storms in winter [33].
- Rising sea levels worsen the effect of storm surges, increasing the risk of coastal flooding [33].

Sea Level Rise

7.6.5 The Met Office UKCP18 Factsheet on sea-level rise (SLR) provides supplementary data on SLR trends [32]:

- SLR varies around the UK, with greater sea level rise projected with higher emissions scenarios.
- Tidal characteristics may change due to SLR.
- Both mean and extreme sea levels are projected to increase.
- SLR is the main factor in increased coastal flood risk in the UK.
- SLR is caused primarily by thermal expansion of water as global temperatures rise, and due to melting of land ice.

Coastal Erosion

7.6.6 The European Commission, an article on soil loss projections and the Environment Agency National Assessment provide information on coastal erosion trends:

- Increased rainfall intensity is projected to increase soil erosion in UK and Europe by 12-22.5% by 2050 [34].
- Change in land use has a small impact ~3% [35].
- Mean change in soil loss of UK by 2050 is ~25% for RCP 2.6 and ~50% for RCP8.5 [35].

7.6.7 These changes in climate trends are unlikely to pose direct risks to the Proposed Development as it is designed to protect against these climate changes. However, in the do minimum future baseline scenario, these climate changes are likely to continue to degrade the existing infrastructure, increasing the current risk to the receptors behind the flood walls.

7.6.8 A do minimum future baseline is therefore likely to include an increase in maintenance and repair to the existing flood protection and potentially damage to the receptors behind it. These damages and repairs have an inherent carbon cost associated with them in the embodied materials, waste generation and transportation of construction equipment and personnel.

7.7 Embedded Environmental Design Measures

7.7.1 The design includes a range of measures that have been embedded into the Proposed Development design to avoid or minimise environmental effects.

Embedded environmental design measures

7.7.2 As the design evolved, there was no longer a need for beach nourishment. A previous design required 75,000m^3 of beach nourishment which would have required an additional 13,500 lorry movements. The removal of this material from the design will have saved approximately 560 tCO2e from the embodied carbon and another 530 tCO2e from removed lorry movements.

7.7.3 Existing infrastructure has been retained where possible without impacting the effectiveness of the Proposed Development. The most impactful example of this is the retention of the primary wave wall. The original design would have seen this existing wall removed, and a higher wall put in its place, requiring more embodied materials, longer construction time and generating more waste. The model has shown that this upgrade is not required and therefore the original wall was adopted into the design.

Construction good practice measures

7.7.4 A range of measures relevant to the Climate Change are set out for the construction phase within the outline Construction Environmental Management Plan (document reference- EN.F.15).

7.7.5 Additional measures that are considered standard good practice to be implemented by the Principal Contractor (PC) to reduce the likelihood of impacts or their magnitude, if they were to occur. These measures, are outlined below:

- Increasing recyclability by segregating construction waste to be re-used and recycled where reasonably practicable.
- Adopting the Considerate Constructors Scheme to assist in reducing pollution, including GHG, from the Proposed Development by employing good industry practice measures.
- Designing, constructing and implementing the Proposed Development in such a way as to minimise the creation of waste and maximise the use of alternative materials with lower embodied carbon, such as locally sourced products and materials with a higher recycled content where feasible.
- Reusing suitable infrastructure and resources already available within the red line boundary where possible to minimise the use of natural resources and unnecessary materials (for example, reusing excavated soil for fill requirements or storing, preserving and restoring topsoil).
- Encouraging the use of lower carbon modes of transport by identifying and communicating local bus connections and pedestrian and cycle access routes to/ from the Proposed Scheme to all construction staff and providing appropriate facilities for the safe storage of cycles.
- Liaising with construction personnel for the potential to implement staff minibuses and car sharing options.
- Switching vehicles and plant off when not in use and ensuring construction vehicles conform to current European Union (EU) emissions standards.
- Conducting regular planned maintenance of the construction plant and

machinery to optimise efficiency.

7.8 Assessment of Likely Significant Effects

7.8.1 This section presents the assessment of likely significant effects on the Climate Change resulting from the construction, operation and maintenance of the Proposed Development. The likely significant effects of the Proposed Development have been identified taking into account the embedded environmental design measures outlined in Section 7.7. Further mitigation may be proposed as a result which is presented in Section 7.9. Refer to ES Volume 2 Chapter 4 EIA Approach, Section 4.7 for assumptions and limitations.

Construction Effects

7.8.2 This section presents the assessment of potential effects on the Climate Change resulting from the construction of the Proposed Development, refer to ES Volume 2, Chapter 2 Project Description. Construction is defined as all the works undertaken to build a Proposed Development and typically the majority of the impacts on the Climate Change will occur during this phase due to the embodied GHG emissions in materials. The potential effects are assessed based on detailed design presented in ES Volume 2 - Chapter 2 Project Description.

7.8.3 Table 7.12 and Table 7.11 outline the GHG emissions for both construction scenarios; Option 1 one that sources rock armour from Wales. Option 2 sources rock armour from Norway. These tables outline the GHG emissions associated with which activity during the construction phase. The full GHG assessment can be found in ES Volume 3, Appendix 7.1 GHG assessment.

Table 7.11 The GHG emissions during construction for Option 1 (if rock armour is sourced locally)

Pas 2080 Module	Emissions source (item)	Emissions over appraisal period (tCO2e)
Product Stage (A1 - A3)	Embodied Carbon	5,011
Construction Stage (A4-A5)	Transport of Materials	871
	Transport of Workers	226
	Waste Disposal	1,205
	Water use	796
	Fuel Use	852
Total		**8,961**

Table 7.12 The GHG emissions during construction for Option 2 (if rock armour is sourced from Norway)

Pas 2080 Module	Emissions source (item)	Emissions over appraisal period (tCO2e)
Product Stage (A1 - A3)	Embodied Carbon	5,011
Construction Stage (A4-A5)	Transport of Materials	1,688
	Transport of Workers	226
	Waste Disposal	1,205
	Water use	796
	Fuel Use	852
Total		**9,777**

Operational and Maintenance Effects

7.8.4 Operation is defined as the post-construction phase of the Proposed Development, including maintenance activities, until there is further development or until the site ceases to operate as a standard of protection against coastal flooding. Refer to ES Volume 2, Chapter 2 Project Description for the description and period of maintenance activities, and the design life of the Proposed Development.

7.8.5 Table 7.13 shows the GHG emissions associated with the maintenance of the Proposed Development. The full GHG assessment can be found in ES Volume 3, Appendix 7.1 GHG assessment.

Table 7.13 The GHG emissions during operation

Pas 2080 Module	Emissions source (item)	Emissions over appraisal period (tCO2e)
Maintenance, repair, replacement, refurbishment (B2, B3, B4, B5)	Maintenance and refurbishment	1,596
	Total	**1,596**

Lifecycle assessment and significance

7.8.6 Using the worst-case scenario Option 2 (rock armour sourced from Norway), the overall lifetime emissions of the Proposed Development are estimated as 10,557 tCO_2e. To contextualise these emissions and show their magnitude of impact the Welsh Carbon Budgets and the Tyndall Carbon Budgets for Gwynedd have been used, and are shown in Table 7.14 and Table 7.15.

Table 7.14 Compares the Proposed Development's emissions with Wales's Carbon Budgets

Contextualisation	Wales's Carbon Budget (tCO2e)	Proposed Development's contribution per carbon budget (tCO2e)	Percentage emissions against relevant emissions
2026	3,340,000	2,240	0.0671
2027	3,340,000	4,480	0.1341
2028	3,340,000	2,254	0.0675
2029	3,340,000	13	0.0004
2030	2,080,000	13	0.0006
2040	619,000	13	0.0021
2050	Net zero	1,304	N/A

Table 7.15 Compares the Proposed Development's emissions with the Tyndall Centre Carbon Budgets for Gwynedd Council

Contextualisation	Tyndall Centre carbon budgets (tCO2e)	Proposed Development's contribution per carbon budget (tCO2e)	% emissions against relevant emissions
2023 - 2027	1,500,000	6,721	0.45
2028 - 2032	700,000	2,293	0.33
2033 - 2037	400,000	67	0.02
2038 - 2042	200,000	67	0.03
2043 - 2047	100,000	67	0.07
2048 - 2100	100,000	705	0.70

7.8.7 Using the IEMA guidance, the assessment of significance is based on whether the Proposed Development aligns with the UK's trajectory to net zero, taking into account the mitigation measures adopted into the design. As Section 7.7 outlines, design decisions have been made throughout the design evolution which adopted the carbon mitigation hierarchy and designed out a large proportion of materials and therefore GHG emissions. In addition, the Proposed Development would require less than 1% of any annual Welsh Carbon Budget or any of the Tyndall Centre Carbon Budgets. From this it can be inferred that the Proposed Development would not hinder the UK or Wales's trajectory to net zero.

7.8.8 In accordance with IEMA guidance, a "minor adverse" impact is defined as one where mitigation is incorporated and the project aligns with the Wales's trajectory to net zero. Based on the embedded environmental design measures outlined in Section 7.7 the proportion of the carbon budgets required by the Proposed Development outlined in Table 7.14 and Table 7.15, ongoing design development, and the inherent carbon benefits of protecting existing infrastructure from damage, it is anticipated that the Proposed Development will result in a minor adverse impact. This level of impact is considered **not significant** in EIA terms.

7.9 Mitigation and Enhancement

7.9.1 This section outlines the mitigation required where significant effects have been identified.

Additional Mitigation

7.9.2 As there are no significant effects, no additional mitigation has been identified and there are no monitoring requirements going forward.

Enhancements

7.9.3 There are no additional enhancements to the Proposed Development specifically for GHG reductions. Any GHG reduction measure is defined as embedded environmental design features and has been outlined in Section 7.7.

7.10 Residual Effects

7.10.1 Cumulative and in-combination effects are addressed within ES Volume 2, Chapter 15 Cumulative and In-Combination Effects.

7.10.2 **No significant** effects from construction or operation have been identified and there are therefore **no significant** residual effects.

7.11 Assessment Summary

7.11.1 The Climate Change Chapter's summary of assessment, mitigation and residual effects are outlined in Table 7.16.

Table 7.16 Summary of effects matrix

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual effect
Global Climate	Increase in GHG emissions	**Not significant**	Carbon design measures adopted to reduce overall material requirements which reduced embodied GHG emissions and associated construction processes and transport emissions.	**Not significant**

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

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ARUP GRIFFITHS

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Barmouth North Promenade FAS

ES Chapter 8 Community Considerations

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Contents

8. Community Considerations **1**

8.1 Introduction 1

8.2 Legislation, Policy and Guidance 1

8.3 Stakeholder Engagement 6

8.4 Scope and methodology 8

8.5 Baseline 11

8.6 Embedded Environmental Design Measures 16

8.7 Assessment of Likely Significant Effects 18

8.8 Mitigation and Enhancement 26

8.9 Residual Effects 26

8.10 Assessment Summary 26

Abbreviations List **29**

References **30**

Tables

Table 8-1 Relevant legislation 2

Table 8-2 List of relevant national policies, plans and strategies 3

Table 8-3 List of relevant local policies, plans and strategies 4

Table 8-4 Gwynedd Council comments on scope relevant to community and the response 6

Table 8-5 Betsi Cadwaladr University Health Board comments on scope relevant to community and the response 6

Table 8-6 NRW comments on scope relevant to community and the response 7

Table 8-7 Community, health and wellbeing elements assessed 9

Table 8-8 Summary of effects matrix 26

8. Community Considerations

8.1 Introduction

8.1.1 This chapter provides an assessment of the likely significant effects on the community, including health and wellbeing, that may arise from the construction, operation and maintenance of the Barmouth North Promenade Flood Defence Scheme (hereafter referred to as the 'Proposed Development'). The approach undertaken for this chapter has been supported by an Environmental Impact Assessment Scoping Report submitted by Cyngor Gwynedd (Ymgynghoriaeth Gwynedd Consultancy (YGC)) and Scoping Opinions received from Cyngor Gwynedd and Natural Resources Wales (NRW) in April 2024.

8.1.2 This chapter describes the relevant legislation, policy and guidance, stakeholder engagement, assessment scope and methodology, community and health baseline information, embedded environmental design measures, assessment of likely significant effects of the Proposed Development on the community, additional mitigation and enhancement, and residual effects.

8.1.3 This chapter is supported by the following appendices and figures, contained in Volumes 3 and 4:

- Figure 8.1 Welsh Index of Multiple Deprivation (WIMP) Ranking.
- Figure 8.2 Community Receptors

8.1.4 This chapter draws on outcomes from the following assessments within the Environmental Statement (ES) (all of which have some element of community considerations), and should be read in conjunction with them:

- ES Chapter 5 Air Quality.
- ES Chapter 7 Climate Change.
- ES Chapter 9 Cultural Heritage.
- ES Chapter 10 Flooding and Water Quality.
- ES Chapter 11 Noise and Vibration.
- ES Chapter 13 Seascape and Landscape and Visual.
- ES Chapter 14 Cumulative and In-Combination Effects.

8.2 Legislation, Policy and Guidance

8.2.1 This section identifies the legislation, policy, guidance and other documentation that has informed the assessment of likely significant effects on the community arising from the Proposed Development. This section is supported by the ES Volume 3, Appendix 1.1 Policy Context, which outlines overarching legislation and policy relevant to the Proposed Development.

Legislation

8.2.2 The following legislation is relevant to this topic and the assessment of the likely significant effects:

- The Environment (Wales) Act 2016 [1].

- Well-being of Future Generation (Wales) Act 2015 [2].
- Active Travel (Wales) Act 2013 [3].

8.2.3 Table 8-1 provides detail on the relevance of this legislative framework to the assessment of likely significant effects from the Proposed Development.

Table 8-1 Relevant legislation

Legislation	*Relevant paragraphs and description*	*Relevance to assessment*
Environment (Wales) Act (2016)	The Environment (Wales) Act 2016 addresses the critical need for sustainable management of natural resources in Wales. It sets ambitious targets for biodiversity, climate change, and resource management, reflecting the Welsh Government's commitment to environmental sustainability.	The Environment (Wales) Act 2016 supports flood defence schemes by promoting sustainable natural resource management, which helps reduce flood risks. This promotes public health by preventing flood risk related health impacts.
Well-being of Future Generation (Wales) Act (2015)	The Well-being of Future Generations (Wales) Act 2015 aims to improve the social, economic, environmental, and cultural well-being of Wales for current and future generations through sustainable development principles.	The Act supports sustainable developments such as flood defence schemes that improve the economic, social and environmental wellbeing of Wales, achieving the goal of creating a healthier, more resilient Wales.
Active Travel (Wales) Act (2013)	The Active Travel (Wales) Act 2013 aims to make active travel the most attractive option for most shorter journeys. The Act requires local authorities in Wales to produce active travel maps and deliver year on year improvements in active travel routes and facilities. It requires highway authorities in Wales to make enhancements to routes and facilities for pedestrians and cyclists in all new road schemes and to have regard to the needs of walkers and cyclists in a range of other highway authority functions.	Cyngor Gwynedd prepared their Existing Route Map which identified current walking and cycling routes in Gwynedd. Cyngor Gwynedd have subsequently prepared the Integrated Network Map. The Integrated Network Map for the study area is found within Section 3.2 of the Transport Assessment for the Proposed Development. The shared use path within the Development extents is included as a walking and cycling route in this network map. The development proposals seek to improve the quality of this infrastructure and access to it.

National Policy and Strategies

8.2.4 The following national policies and strategies are relevant to this topic and the assessment of the likely significant effects:

- Planning Policy Wales Edition 12: Paragraphs [4].
- Welsh National Marine Plan [5].
- UK Marine Policy Statement [6].
- Future Wales – the National Plan 2040 [7].
- Llwybr Newydd: the Wales Transport Strategy 2021 [8].

8.2.5 More detail on the relevance of these national policies to the assessment can be found under in Table 8-2.

Table 8-2 List of relevant national policies, plans and strategies

National Policies, Plans and Strategies	*Relevant policies and description*	*Relevance to assessment*
Planning Policy Wales (2018)	**Promoting healthier places** Paragraph 3.22 aims at promoting healthier places by developing and maintaining places that support healthy, active lifestyles across all age and socio-economic groups, investing in walking and cycling infrastructure. Paragraph 6.6.25 states that developments should reduce, and must not increase, flood risk arising from river and/or coastal flooding on and off the development site itself.	The policy is relevant to the assessment of likely significant effects, particularly under the healthy lifestyles and flood risk and climate change health determinants.
Welsh National Marine Plan (2019)	**Policy SOC_02: Well-being of coastal communities** Proposals that contribute to the well-being of coastal communities are encouraged. **Policy SOC_08: Resilience to coastal change and flooding** Proposals should demonstrate how they are resilient to coastal change and flooding over their lifetime. **Policy SOC_09: Effects on coastal change and flooding** Proposals should demonstrate how they: • avoid significant adverse impacts upon coastal processes; and • minimise the risk of coastal change and flooding; Proposals that align with the relevant Shoreline Management Plan(s) and its policies are encouraged.	These policies support flood defence schemes that protect health by enhancing community well-being, building resilience, and avoiding increased flood or erosion risks. The policies are relevant to the assessment of likely significant effects, particularly under the flood risk and climate change health determinant.
UK Marine Policy Statement	**2.6.7 Climate change adaptation and mitigation** “Encouraging developments/projects to take account of the impacts of climate change over their estimated lifetime, in particular taking account of risks such as increased land and sea, temperatures and sea level rise and possible increase in risk from extreme events such as flooding and coastal erosion.” **2.6.8 Coastal change and flooding** “Coastal change and coastal flooding are likely to be exacerbated by climate change, with implications for activities and development on the coast. These risks are a major consideration in ensuring that proposed new developments are resilient to climate change over their lifetime.”	The policy statement is relevant to the assessment of likely significant effects, particularly in relation to the operational benefits with regards to reduced flood risk and increased coastal development and activities.

National Policies, Plans and Strategies	Relevant policies and description	Relevance to assessment
Future Wales – the National Plan 2040 (2021)	Policy 8 – Flooding The policy states that "opportunities for multiple social, economic and environmental benefits, including improved public realm, active travel facilities and securing green infrastructure, must be maximised when investing in flood risk management infrastructure".	The policy is relevant to the assessment of likely significant effects, particularly under the healthy lifestyles, flood risk and climate change health determinants and tourism effects.
Llwybr Newydd: the Wales Transport Strategy (2021)	Section 7.1 of the Strategy sets out the vision for active travel. The Strategy outlines the collaborative effort between the Welsh Government and partners to continuously develop a network of local routes for walking and cycling, support safer, better cycle paths and more space for active travel, and develop behaviour-change programmes to encourage modal shift, amongst other ambitions.	The policy is relevant to the assessment as the Proposed Development will provide more space for active travel by reallocating road space to crossings and public realm, as well as introducing new cycle parking. Improving the safety of the existing provisions is also a key part of the scheme, including improvements to street lighting.

Local Policy and Strategies

8.2.6 The following local policies and strategies are relevant to this topic and the assessment of the likely significant effects:

- Anglesey and Gwynedd Joint Local Development Plan 2011-2026 (2017) [9].
- Gwynedd County Council Rights of Way Improvement Plan [10].
- Gwynedd and Anglesey Local Well-being Plan 2023-2028 [11].

8.2.7 More detail on the relevance of these local policies and strategies to the assessment can be found in Table 8-3.

Table 8-3 List of relevant local policies, plans and strategies

Local Policy, Plan & Strategy	Relevant policy	Relevance to Assessment
Anglesey and Gwynedd Joint Local Development Plan 2011 - 2026 (2017)	Policy Arna 1: Coastal Change Management Section 6.5, Point 6.5.30	The Anglesey and Gwynedd JLDP was formally adopted in July 2017, with the Plan setting out the strategy and aims for development and land use covered by the two Planning Authorities and includes policies to implement the strategy and aims over a period of 15 years (2011-2026). Planning Policy Wales states that Local Authorities should help reduce the risk of flooding and the impact of coastal erosion by avoiding inappropriate development in vulnerable areas. **Policy Arna 1**: Coastal Change Management states the need for proposals for new or replacement coastal defence schemes to demonstrate that the works are consistent with the management approach for the frontage presented in the Shoreline Management Plan,

Local Policy, Plan & Strategy	Relevant policy	Relevance to Assessment
		and there will be no material adverse impact on the environment. Point 6.5.30 under Section 6.5 (Managing Growth and Development – Natural and Built Environment) of the Plan states that 'Councils have a duty in exercising their planning functions to preserve and enhance the significance, character and appearance of the Plan area's cultural and historic environment … [as they] contribute[s] to the enjoyment of life in the Plan area, [provides] a unique sense of identity and is a valuable economic asset'.
Gwynedd County Council Rights of Way Improvement Plan (2022)	Part 2, Theme A Part 4, Theme C, Section 4.6	In 2016, the Welsh Government presented guidelines to Local Authorities to prepare a new Rights of Way Improvement Plan. The Plan highlights the importance of accessible, well-maintained public rights of way and coastal paths for active travel and recreation, supporting health and well-being, ensuring accessibility of local rights of way for blind or partially sighted persons and others with mobility difficulties. In Part 2: Theme A of the Plan, the Council recognises its maintenance responsibilities as rights of way signage when paths leave the highway, the surface of most rights of way, bridges and structures, and the management of vegetation and removal of obstructions. Part 4: Theme C of the Plan covers the requirement for PRoWs to meet users' needs and Section 4.6 notes the demand for multi-use paths. It recognises the need for resilient, multi-use routes that enhance connectivity and provide opportunities for active travel and recreation contributing to wellbeing benefits and a valuable resource for the tourism industry in Gwynedd, particularly in coastal areas vulnerable to flooding.
Gwynedd and Anglesey Local Well-being Plan 2023-2028	The Plan identified three wellbeing objectives, that include working together to: 1. Mitigate the effect of poverty on the well-being of our communities. 2. Improve the well-being and achievement of our children and young people 3. Support our services and communities to move	The Gwynedd and Anglesey Local Well-being Plan 2023–2028 supports flood defence schemes as part of its goals to build climate resilience, protect public health, and ensure communities thrive in the long term. It links flood risk management to reduced health impacts associated with flooding such as injuries, stress, and disease, especially for vulnerable groups such as children and young people as well as those living in more deprived areas, while promoting safer, healthier living environments.

Local Policy, Plan & Strategy	Relevant policy	Relevance to Assessment
	towards Zero Net Carbon	

Standards and Guidance

8.2.8 The guidance and standards which relate to this topic are listed below.

- Institute of Environmental Management and Assessment (IEMA) Guide to Determining Significance for Human Health in Environmental Impact Assessment [12].
- Wales Health Impact Assessment Support Unit: A Practical Guide [13].

8.3 Stakeholder Engagement

EIA Scoping Opinion

8.3.1 An EIA Scoping Opinion was adopted by Cyngor Gwynedd and Natural Resources Wales (NRW) on 30 April 2024, 19 April 2024 respectively. The comments received in relation to community considerations and how these have been addressed are presented in Table 8-4, Table 8-5 and Table 8-6.

Table 8-4 Gwynedd Council comments on scope relevant to community and the response

Scoping Opinion Comment	*Response*
Construction work can cause noise and dust problems for nearby residents and a detailed management plan for how this will be mitigated should be prepared and submitted to the Local Planning Authority	This assessment considers environmental amenity effects on residents, including dust and noise, with particular reference to more sensitive groups within the population (Section 8.7). Mitigation related to noise and air are identified in ES Volume 2- Chapter 5 Air quality and Chapter 11 Noise and vibration.

Table 8-5 Betsi Cadwaladr University Health Board comments on scope relevant to community and the response

Scoping Opinion Comment	*Response*
From a population health perspective, the topics identified in the scoping report appear appropriate and sufficient for this type of application. It is recommended that the assessment also consider the potential impacts on mental health and wellbeing, particularly in relation to prolonged construction activity and changes to community spaces.	Impacts on mental health and wellbeing are considered throughout the assessment as outlined in Section 8.4 (paragraph 8.4.6). This includes consideration of wellbeing in relation to construction activity and community spaces.

Scoping Opinion Comment	Response
Additionally, where applicable, the assessment should include potential impacts on active travel (such as walking and cycling routes) and access to health and care services, especially during the construction phase.	Effects on the local community from changes to active travel routes are considered under 'Active travel'. Effects on the local community associated with access to health and care services are considered under 'Transport and accessibility'.

Table 8-6 NRW comments on scope relevant to community and the response

Scoping Opinion Comment	Response
The proposal should ensure that the works do not impact upon the excellent bathing water rating that Barmouth currently has.	Water quality considerations are covered in ES Chapter 10: Flooding and Water Quality. This assessment has not identified any likely significant effects on bathing water quality and therefore this issue is not considered further in the community assessment.
Large parts of the study area/application site are within a flood zone, therefore an FCA (Flood Consequences Assessment) may be required. We advise that an FCA is completed and submitted in support of the proposals.	Flood risk is considered in ES Volume 2, Chapter 10 Flooding and Water Quality and the FCA for the Proposed Development is provided alongside the ES (document reference BMTH-ARP-XGN-ZZ-RP-W-000003). The effects on the community of changes to flood risk are assessed in Section 8.7.

Non-Statutory Engagement

8.3.2 Non-Statutory Stakeholder engagement has been undertaken with key stakeholders in relation to community considerations. A summary of engagement undertaken is outlined below.

8.3.3 A Public Information Event was held on 28th January 2025, with 45 recorded attendees (and more who did not provide written responses), including members of the Barmouth Town Council. Responses showed general support for the scheme.

8.3.4 With regards to wider placemaking and enhancement, comments included requests for improved lighting on the Promenade wall and wider parking lanes. There was strong support for dedicated footpaths including disability access, dedicated cycle paths, sheltered benches and provision of accessible public WCs. Most respondents shared that they would use the Promenade more often if these enhancements were added. All respondents voted for the beach access points to be reinstated and incorporated into the design as they are currently unsafe and in poor condition.

8.3.5 Regarding impact of construction on tourism, respondents suggested for work to be carried out through autumn and winter before peak tourist season (through summer). Additionally, concerns were raised about overparking and lack of parking spaces.

8.3.6 An additional Public Information Event was held on 24th September 2025. This event's purpose was to explain how the design had progressed, as well as giving information on next steps including construction impacts. Members of the

public had the opportunity to provide feedback verbally and via feedback forms which were collated and summarised.

8.3.7 Members of the public, specialist consultees and key stakeholders were also able to feedback on the draft planning application for the Proposed Development through a variety of channels during the statutory pre-application consultation period (6th October 2025 - 28th November 2025) including phone, email and postal submissions.

8.3.8 An additional Public Information Event was held on 19th March 2026. This event's purpose was to provide further information explaining the design, how previous feedback had been taken into account and the other options that had been considered. Members of the public had the opportunity to provide feedback verbally and via feedback forms which were collated and summarised.

8.3.9 Members of the public raised concerns around the visual impact of the scheme, safety of rock armour and the impact on tourism in particular.

8.3.10 A discussion on rock armour safety was held with HM Coastguard and the Cyngor Gwynedd harbour teams on 24th April 2026, which concluded that the risk reduction measures put in place for the Proposed Development were in line with best practice, with communication to be ongoing.

8.3.11 The design has considered placemaking and enhancement measures as described in ES Volume 4, Chapter 2 Project Description and in Section 8.6 Embedded Environmental Design Measures.

8.4 Scope and methodology

Study area

8.4.1 This section describes the spatial scope (i.e. the area which is impacted) for the assessment as it applies to community considerations.

8.4.2 The study area includes a local study area focused on the community in and around Barmouth and a wider study area comprising the local authority area of Gwynedd. This allows for the consideration of effects on the local community such as amenity, access and parking etc, in addition to impacts on the wider population, e.g. access to the beach/promenade and traffic impacts on the wider road network etc. ES Volume 4, Figure 8.1 shows the red line boundary surrounding the extent of the Proposed Development and local study area considered for this assessment. The study area includes the following areas:

- Local study area - Lower Super Output Area (LSOA) Gwynedd 016F.
- Wider study area - Gwynedd.

Scope of Assessment

8.4.3 Effects on the community will arise from impacts of the Proposed Development on factors that affect people's health, wellbeing and quality of life. Those impacts considered to have a likely significant effect on the study area population have been scoped into the assessment. The factors, or determinants, scoped in / out are described in Table 8-1.

Table 8-7 Community, health and wellbeing elements assessed

Determinants of community, health and wellbeing effects	*Construction*	*Operation and maintenance*
Transport and accessibility (public transport, traffic movements, access and severance)	Scoped in	Scoped out Traffic flows and public transport will return to baseline conditions following completion of the construction phase.
Community safety (road safety, crime and anti-social behaviour, emergency services)	Scoped in	Scoped out No significant impacts on road safety, crime and anti-social behaviour or emergency services are foreseen during the operational phase of the Proposed Development. (Safety issues related to flooding are covered under Climate and flooding).
Active travel (walking, cycling and wheeling).	Scoped in	Scoped in
Environmental amenity (combined effects of air quality, noise and visual amenity on perceived environmental quality).	Scoped in	Scoped in
Open space, leisure and play (public access to green (terrestrial) open space, blue (water based) open space and recreational facilities)	Scoped in	Scoped in
Tourism and business[1] (tourist attractions, parking provision, local businesses like cafes)	Scoped in	Scoped in
Community and social infrastructure (schools, medical centres, care homes etc)	Scoped in	Scoped out There will be no direct or indirect impacts on schools, medical centres, care homes etc
Climate and flooding (flood risk)	Scoped out Effects on climate and flooding relate to the completed development and not the temporary construction phase.	Scoped in

Baseline Methodology

8.4.4 Community baseline data for the study area has been obtained from desktop study. The following information sources have been used to complete the baseline:

- Office for National Statistics [14].

[1] While not explicitly included as a wider determinant of health in the IEMA 2022 guidance [12], the Wales Health Impact Assessment Support Unit's 2021 HIA practical guide [29] lists 'Economic development' and 'Attractiveness of area' in its list of Health and Well-being Determinants. These are considered under the community, health and wellbeing element of 'Tourism and business'

- Stats Wales [15].
- National Survey for Wales [16].
- Ordnance Survey (OS) Open Data [17].

8.4.5 In addition to population data, baseline information relating to the community aspects considered in the assessment has been provided. This draws on information from other ES topic chapters (refer to ES Volume 2 Chapter 5 Air Quality, Chapter 10 Flooding and Water Quality, Chapter 11 Noise and Vibration and Chapter 13 Seascape and Landscape and Visual).

Assessment Methodology

8.4.6 The community assessment applies IEMA guidance [12], which gives parity to physical health and mental health. Health is defined according to the World Health Organization (WHO)'s definition as *'a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity'*. All aspects of health as described in the WHO definition are considered in the assessment, using the following terminology:

- 'Wellbeing' refers to issues such as comfort, happiness, psychological and social wellbeing and life satisfaction.
- 'Health' may refer to any or all aspects of health as defined by the WHO and encompasses wellbeing (above). It may also refer to specific mental or physical health conditions.

8.4.7 The receptors for community, health and wellbeing effects are the local and wider residential community and users of the beach, roads, footpaths and community infrastructure affected by the Proposed Development. Effects are considered at the population level, rather than individual level.

8.4.8 The assessment comprises the following stages:

- A review of the baseline demographic and health characteristics of the local population, identifying where there are vulnerabilities within the population.
- Identification of determinants of community and health effects that are likely to be impacted by the Proposed Development, including environmental, transport and socio-economic factors.
- An assessment of effects on communities, including health and wellbeing outcomes, resulting from the impacts of the Proposed Development during construction, operation and maintenance.
- Identification of mitigation measures to reduce any adverse effects and enhancement to improve outcomes for the community.

Assessment of significance

8.4.9 The community considerations assessment methodology follows the IEMA 2022 Guidance [12] for determining the significance of effects. The key steps in determining the significance of community, health and wellbeing effects are outlined below:

- Assess the magnitude of impact on a determinant of community, health and wellbeing effects (e.g. an environmental, transport, social or

economic factor) in accordance with the IEMA magnitude criteria [12]. This considers information such as exposure, scale, frequency, duration etc.

- Assess the sensitivity of the receptor population based on IEMA sensitivity criteria, based on factors such as the health and social status, presence of vulnerable groups etc.
- Determine significance of effect based on the magnitude of impact and sensitivity of receptor population, in accordance with IEMA health impact significance matrix [12].

Limitations and Assumptions

8.4.10 The assessment has relied on third party, publicly available health data for the baseline.

8.4.11 The assessment has relied on information provided by other topic assessments, such as noise, visual, traffic and transport assessment. Therefore any limitations and assumptions that apply to these topics are also applicable to this assessment.

8.4.12 The assessment of effects on community, health and wellbeing does not duplicate effects on human receptors that are relevant to health, where these are reported in other assessment chapters.

8.4.13 The assessment has assumed that an embargo on construction activities will take place across the school summer holiday weeks (mid-July to early September). The exact dates of this embargo and the impact of this on the construction traffic movements throughout the remaining construction period is still to be confirmed, subject to planning approval conditions on the works.

8.4.14 The level of resilience to the impacts of the Proposed Development will vary widely between individuals and therefore it is not possible to assess the effects on the health and wellbeing of individuals. In line with IEMA guidance [12], and the established approach in the field of public health, effects will be considered at the population level.

8.4.15 The assessment of effects on communities is qualitative, based on professional judgement, taking into account available information and evidence.

8.4.16 The study area for the community considerations assessment is not prescribed by guidance and therefore the selection of the study area has been based on the scale of the Proposed Development, potential impacts and professional judgement.

8.5 Baseline

Population profile – local study area

8.5.1 The local study area population is defined as the population of (LSOA Gwynedd 016F). This population is mainly concentrated in Barmouth, with a lower density of residents in the surrounding rural areas.

8.5.2 The local study area has a below average proportion of people of working age. According to the ONS Census 2021, the LSOA has a high proportion of people under the age of 16 (17.0%) compared to the wider study area of Gwynedd

(16.6%). It also has a higher proportion of people aged 65 and above (25.9%) than Gwynedd (23.2%) and Wales (21.4%).

8.5.3 According to the Welsh Index of Multiple Deprivation (2019), overall deprivation is around average, with the LSOA falling within the 50% least deprived areas nationally. The area also falls into this category for health deprivation, access to services and the physical environment. The area has above average levels of deprivation for employment, education, community safety and housing.

8.5.4 The local study area has a significantly higher proportion of people in social grade DE (i.e. Semi-skilled & unskilled manual occupations, unemployed and lowest grade occupations) (30%) in comparison with the Gwynedd (22%) and Wales (24.6%).

8.5.5 The local study area has a relatively low proportion of population with 'very good health' (44.2%) in comparison with Gwynedd (49.9%) and Wales (46.2%). Levels of disability are consistent with the local authority Gwynedd (19.2%).

Population profile – wider study area

8.5.6 According to the StatsWales 2010-2012 [15], female life expectancy for the local authority of Gwynedd, where the scheme is located, is 83.1 years which is higher than the Wales at 82.2 years. Male life expectancy in Gwynedd is 78.8 years, also higher than the Wales at 78.2 years.

8.5.7 According to Health Solutions Wales (Stats Wales) 2008 – 2010 [15], the standardised mortality ratio (SMR) for females is 104 and males is 99 in Gwynedd.

8.5.8 Approximately 54% of the population of Gwynedd is active at least 150 minutes in a week as compared to Wales (53%). With regards to prevalence of overweight, Gwynedd has a lower proportion of overweight population as compared to Wales. However, it has a larger proportion of obese residents (30%) in comparison with Wales (25%).

8.5.9 According to ONS 2018, the local authority of Gwynedd has a higher proportion of disability benefit claimants under the age of 16 (26.8%) and aged 65+ (65%) than Wales with 20.8% and 58.7% respectively.

8.5.10 According to ONS Health and Wellbeing (2011-2012 to 2022-2023) [14], the local authority of Gwynedd where the scheme lies, scored 3.5 on an anxiety average rating between 1 – 10. This is higher than the Wales, with a score of 3.3.

Population sensitivity

8.5.11 Based on the above data, certain vulnerable groups represent a higher than average proportion of the population in the study area. These groups, who are considered to have higher sensitivity to health effects than the general population, are described below together with a summary of key vulnerabilities.

- Children and adolescents are more likely to be pedestrians and require freedom to move between their home, school, and recreational activities. They lack the experience and judgement of adults whilst interacting with traffic and public spaces. They are therefore more at risk from the dangers of motorised transport. Children are also sensitive to effects on factors such as opportunities for exercise and play, education etc, as these can affect long term health outcomes.

- Older people are more likely to have impaired movement, reactions, hearing and sight, which can put them at higher risk from injury. Older people may also fear falls and be anxious about crossing the road safely or about the neighbourhood setting in general, which can lead to barriers to older people participating in healthy outdoor activities such as walking and can increase isolation.
- People who are on low-income, unemployed or economically inactive generally experience poorer health because they have fewer resources available to them to stay healthy and experience more stress. This group are more likely to use services and facilities in their local area and are less likely to have resources to adapt to change or mitigate shocks.
- People with poor health status or who are disabled are likely to be more vulnerable to changes in health determinants such as environmental conditions and accessibility, and are more likely to use local health and social services.

Community assets

Transport and accessibility

8.5.12 Traffic volumes moving through the local road network of Barmouth varies between months and seasons. August and January experience the highest and lowest volumes of traffic within the year, respectively.

8.5.13 Outside of the summer peak months, existing volumes of weekday traffic in the town are concentrated on routes closest to the town centre. The A496 experiences high volumes of traffic as it provides access into the town centre from the north and the south, while also acting as a through-route for traffic travelling between settlements on the coast and wider Gwynedd region. The A496 also experiences the highest volume of HGV movements. The one-way town centre gyratory, consisting of High Street, Jubilee Road and Beach Road, also experiences high volumes of traffic, particularly at the railway level crossing. The sensitivity of the vehicle users along these routes is considered to be medium.

8.5.14 Roads in the town along the seafront – Marine Parade, Promenade and The Quay – experience relatively lower volumes of traffic outside of the peak summer months. During the summer months, it is anticipated that these routes, like the entire local road network, will experience a significant uplift in traffic volumes due to the influx of visitors arriving by car. The sensitivity of the vehicle users along these routes is considered to be medium.

8.5.15 The Pen-y-Gogledd car park has a total capacity of 120 spaces including 6 disabled spaces. There is also on-street pay and display parking along the beach side of Marine Parade. The sensitivity of the users of the car parks is considered to be low to medium.

8.5.16 Barmouth Railway Station is located in the town centre and is served by the Cambrian Line. Services that run between Pwllheli and Birmingham International are infrequent, with a peak frequency of one train every two hours. The northbound and southbound platforms are accessible from Marine Parade and

Station Road respectively. The sensitivity of users of the Barmouth Railway Station is considered to be medium.

Community safety

8.5.17 The Coastguard station and Inshore Rescue Boat Station is located on the corner of Heol Idris and Marine Parade. Barmouth Lifeboat Station (RNLI) is located to the north of Barmouth main car park. The sensitivity of the Coastguard Station is considered to be high.

8.5.18 The Barmouth Ambulance Station is located on Marine Road, likely using the route along Marine Parade, Beach Road, A496 and High Street, providing emergency healthcare services to the community in Barmouth. The sensitivity of the Barmouth Ambulance Station is considered to be high.

Active travel

8.5.19 The shared use path that runs parallel to Marine Parade and the Promenade currently provides a pedestrian and cycle link segregated from traffic. This route provides a valuable link for access across the town, and forms part of National Cycle Network Route 8 (NCR8). The segregation from traffic and views across the beach encourage the use of this route for active travel and physical activity. NCR8 and the Wales Coast Path run along this route.

8.5.20 A number of PRoWs provide access to the foothills of the Rhinogydd mountains and Snowdonia National Park, offering panoramic views of the town centre and estuary.

8.5.21 There is currently no visitor demand data available for active travel routes. The sensitivity of users of active travel routes is considered to be medium.

Environmental amenity

8.5.22 Baseline conditions for environmental amenity, including air quality, noise and vibration and visual impacts are outlined in the respective chapters: ES Volume 2, Chapter 5 Air quality, Chapter 11 Noise and Vibration and Chapter 13 Seascape and Landscape and Visual.

Open space, leisure and play

8.5.23 The Barmouth promenade serves both as a sea defence and a recreational space. Erosion, storm damage, and tidal impacts have contributed to the deterioration of parts of the sea wall, promenade, and associated infrastructure. Seating, lighting, and wayfinding infrastructure are inconsistent, and accessibility remains limited in some areas due to uneven surfaces and unclear routes. Additionally, the promenade has little green space, offering few opportunities for planting or biodiversity enhancement. The sensitivity of the users of the promenade is considered to be medium.

8.5.24 Marine Parade, which runs parallel to the promenade area and provides access to Pen-y-Gogledd car park, is generally less than 5m wide. There is a shared use path that runs parallel to the road with access points down to the beach at intermittent intervals. Many of the existing access points have become unsafe to use as a result of beach drawdown and sediment movement on the beach

resulting in large voiding beneath the promenade and subsequent collapse. In addition, in the north there are numerous sets of steps down to the beach which are suspended in mid-air due to the lowering of the foreshore (refer to ES Volume 2- Chapter 2 Project Description for more details). The sensitivity of the users of the Marine Parade is considered to be medium.

8.5.25 Adjacent to Pen-y-Gogledd car park there is a skate park and provision of public toilets. There is also a café and wine bar located at this end of the Marine Parade which offers outside seating. The sensitivity of users of these community facilities is considered to be medium.

Tourism and business

8.5.26 Tourism is essential to the economy of the local and wider study area. The Gwynedd and Eryri 2035 Sustainable Visitor Economy Plan provides statistics for the visitor economy. This shows that, across Gwynedd, tourism employs a workforce of 18,244 and has a total value of the economy of £1.35 billion (2019). The number of overnight stays annually is 20.1 million.

8.5.27 In Barmouth, the majority of tourist footfall is concentrated around southern end of the beach and Promenade, due to the lack of amenities and beach access further north. While the area of north Barmouth where the Proposed Development is located is less frequented than the southern part of the beach, the Promenade and beach still provide valuable leisure and recreation resources which are used by tourists.

8.5.28 There are two schools in the local study area; Ysgol Y Traeth, a Welsh language infant and primary school (including nursery) on Princes Avenue with a total of 206 pupils (2023), and Oasis Nursery, a private Welsh language pre-school on Park Road. The sensitivity of schools is considered to be high, as they cater to a high proportion of vulnerable groups (children and young people).

8.5.29 There are multiple care homes in the local study area including, Treherne Care and Consultancy (on Station Road) and Hafod Mawddach home for the elderly, a residential home on Marine Road. The sensitivity of the care homes is considered to be high, as they cater to a high proportion of vulnerable groups (older people and people with long term illnesses or disabilities).

Future Baseline

8.5.30 According to StatsWales 2020 [15], the population of Gwynedd is projected to grow from 124,178 in 2018 to 127,109 in 2028 and to 132,200 by 2043. This suggests a 6.5% increase in the population of Gwynedd between 2018 and 2043. Additionally, the number of people aged 65 and above in Gwynedd is projected to increase from 28,171 in 2018 to 34,033 in 2043, showing a 20.8% increase in the number of elderly residents in Gwynedd.

8.5.31 According to the Gwynedd and Eryri 2035 Sustainable Visitor Economy Plan [18], the average number of visitors in the region in 2019 was 7.8 million. While there are no statistics available for tourism growth, according to the review of the Destination Management Plan in the 2035 Sustainable Visitor Economy Plan, there is previous growth trends for tourism in the region showing an 11% increase in the number of visitors from 2013 to 2020.

8.5.32 The Healthy Wales Healthy Weight 2019 Strategy [19] states that without appropriate action, the numbers of adults who will become obese or overweight in Wales is projected to increase to 64% of the population, which taken with projected population change, is another 160,000 adults by 2030. While specific projections for the local or wider study area are not available, this is relevant as Gwynedd has a higher rate of obesity than Wales.

8.5.33 The 'Climbing Higher: The Welsh Assembly Government Strategy for Sport and Physical Activity' [20] (2015) includes targets to increase the percentage of people in Wales using the natural environment from outdoor activities from 36% to 60% and ensure 95% of people in Wales have a footpath or cycle path within a 10-minute walk.

8.6 Embedded Environmental Design Measures

Embedded environmental design measures

8.6.1 The Proposed Development includes a range of measures that have been embedded into the design to avoid or minimise environmental effects, as described below.

- Improved access to the beach from Marine Parade and the Promenade has been designed to take account of the views of the local community (expressed during public consultation events).
- A refurbished beach access ramp will be redesigned in line with accessible design standards. All refurbished ramps and steps will feature handrails.
- All footpaths included in the works will be at least 2m in width. Where possible, parking bays parallel to walls or other obstacles will include an additional 0.5m to the space dimensions if adjacent to a wall or obstruction, to ensure sufficient room for passengers or drivers to safely and comfortably exit the vehicle.
- Any new signage will be positioned at a height and of a size which allows wheelchair users and mobility scooters to read comfortably while improving wayfinding to key assets along the route.
- New street lighting along the extent of the route will increase perceived safety for users along the promenade and Marine Parade, particularly at night and during the winter months.
- The built environment will be improved for those walking, cycling and wheeling, as well as for those driving, through the resurfacing of Marine Parade, landside footway and potentially the shared use path.
- The landscape design has been designed to suit the coastal environment and minimise maintenance requirements to reduce operational costs and ensure these elements of the design do not rapidly deteriorate.
- Traffic calming measures through the tightening of street width at nodes (at existing Marine Parade side-road junctions).
- Raised planters, cycle parking and other street furniture and seating areas to be added and new street lighting is proposed along the promenade.

- Various low maintenance landscaping features such as low growing vegetation will be installed along the promenade at nodes and Pen-y-Gogledd Car Park.

Construction Good Practice Measures

8.6.2 A range of construction good practice measures relevant to the Community Considerations assessment are included within the Outline Construction Environmental Management Plan (CEMP) (document reference- EN.F.15). The following measures are of particular importance for mitigating community impacts during construction:

- Construction and associated activities will be carried out in daylight hours only, Mondays to Saturdays (inclusive). No works on Sundays or Public/Bank Holidays unless advanced agreement is given by Cyngor Gwynedd. As an exception, there will be some works continuing outside of daylight hours during winter months. Temporary lighting will be installed for these works.
- An embargo on construction activities will take place across the school summer holiday weeks (mid-July to early September). The exact dates of this embargo and the impact of this on the construction traffic movements throughout the remaining construction period is still to be confirmed, subject to planning approval conditions on the works.
- Deliveries to the Site will take place outside of the typical road network peak periods wherever possible to minimise the impact of construction on the local highway network, subject to planning approval conditions on the construction phase.
- Measures will be put in place by the Contractor to encourage construction workers to travel to the Site by sustainable modes where possible. This will involve the Contractor promoting and encouraging car sharing among employees that live local to one another.
- Identification of suitable parking areas for construction workers, to avoid impacts on the local highways network.
- Suitable parking areas for construction workers will be identified by the Contractor to avoid impacts on the local highways network.
- Flood lighting, security lights, and any other obtrusive external lighting will be sensitively located to avoid nuisance to neighbouring properties.
- The Site information board shall be situated on Site with corresponding contact details. Contact can be made in case of any questions or concerns. Regular communications with various stakeholders and involving parties will be maintained during construction.
- The Contractor will liaise with the Coastguard in advance of the works to agree appropriate measures to avoid impacts on the operation of Barmouth Coastguard Station, such as reduced visibility or access.
- The Contractor will liaise with Ysgol Y Traeth, including specific discussions with the school to minimise impacts, for example, by restricting traffic movements at pick up and drop off times and notifying the school of any disruptive activities.

- The Contractor will liaise with Barmouth Ambulance Station, to avoid impacts on the operation of station during the construction works.

8.7 Assessment of Likely Significant Effects

8.7.1 This section presents the assessment of likely significant effects on the community resulting from the construction, operation and maintenance of the Proposed Development. The likely significant effects of the Proposed Development have been identified taking into account the embedded environmental design measures outlined in Section 8.6.

Construction Effects

8.7.2 This section presents the assessment of likely significant effects on the community, including health and wellbeing effects, resulting from impacts on the determinants identified in Table 8-1, during the construction of the Proposed Development. Construction is defined as those works undertaken to build the Proposed Development. ES Volume 4, Figure 8.2 shows the construction traffic routes and the key receptors that may experience effects during the works. The potential effects are assessed based on design information presented in ES Volume 2- Chapter 2 Project Description.

Transport and accessibility

8.7.3 Transport can influence mental and physical health outcomes through its effects on access to employment, services and social networks [21].

8.7.4 Construction workers are expected to arrive and depart site during the typical highway peak hours, contributing to localised congestion within the town, particularly during peak construction months. Children and families that use the A496, Beach Road and Marine Parade to access Ysgol Y Traeth on Princes Avenue may experience an increase in congestion and journey times due to increased traffic added by peak hours construction related movements.

8.7.5 During construction there is potential for construction vehicles accessing and egressing the town via the local road network to impact upon public transport services in Barmouth. Bus services (G23, T3C and T3 TrawsCymru) run along Beach Road, Jubilee Road and the High Street and therefore have the potential to be affected by minor delays as a result of increased congestion on these roads.

8.7.6 Barmouth Railway Station is located at the junction of Beach Road and Station Road, with Cambrian Coast Railway services providing a strategic public transport link to coastal towns in west Wales. While there will be no direct impacts on the Station, traffic congestion around Beach Road has the potential to affect journey times to the Station and the associated car park.

8.7.7 Construction activities are assessed as having a low magnitude of impact on transport modes, access, and connections due to the temporary nature of the works, affecting a population of medium sensitivity. As such, construction of the Proposed Development may have **a minor (not significant) adverse effect** on community wellbeing.

Community safety

8.7.8 Traffic volumes can influence actual or perceived changes in road safety for vehicle users and active travel users. HGVs in particular are typically involved in a disproportionate number of collisions involving pedestrians and cyclists and are therefore generally perceived as more unsafe than other vehicles.

8.7.9 The road traffic collision analysis reported in the ES Volume 4, Transport Assessment [BMTH-ARP-TEC-ZZ-RP-H-000001] has demonstrated that the town experiences a relatively low number of collisions across the local road network, with only 15 collisions recorded across the most recent five-year period. From the conducted traffic impact assessment, the highest percentage increase of total vehicles and HGVs is observed on Beach Road and Marine Parade. The data shows that no collisions have occurred on Beach Road, Marine Parade, or the Promenade. No or minimal changes to the risk of traffic injuries and collisions are predicted as a result of construction traffic movements.

8.7.10 Details of the plans for traffic management and provisions for active travel (including their interaction with vehicles) along Marine Parade during construction are still to be determined. Notwithstanding, the incremental increase in vehicle traffic generated by construction activities is negligible in relation to the current baseline, and therefore a negligible impact is predicted in respect to construction road safety.

8.7.11 The presence of construction sites can affect community safety, e.g. by attracting antisocial behaviour and crime (such as theft and vandalism) or by changing the levels of visibility and lighting along pedestrian routes, due to the presence of site hoarding and diversions. The Promenade and Marine Parade have poor levels of street lighting, which may exacerbate concerns about personal security in the vicinity of construction sites. Nevertheless, construction activities are expected to have a negligible impact on personal security.

8.7.12 The Barmouth Ambulance Station is located on Marine Road, likely using the route along Marine Parade, Beach Road, A496 and High Street. Increases in construction related traffic movements along these streets could potentially increase emergency response times, particularly for areas on the far side of the railway accessed via Beach Road. However, with the embedded measures listed in paragraph 8.6.2, including a requirement for the Contractor to liaise with the emergency services regarding appropriate traffic management measures, the magnitude of effect is considered to be low. As a high sensitivity receptor experiencing an impact of low magnitude, this results in a **minor (not significant) adverse effect** on health.

8.7.13 There is a Lifeboat Station located on the promenade to the east of Beach Road. This is not located on the construction traffic route and can be accessed from the east via The Quay, so vehicle access is not likely to be affected. With access to the lifeboat station and to the beach not obstructed there will be a negligible impact.

8.7.14 The Coastguard Station is located on Heol Idris, close to Marine Parade where the works will be carried out. The works will include the use of tall construction equipment, such as cranes, for short periods of time, which may temporarily obstruct views across the beach. Access to the beach will be maintained throughout construction but may be affected by diversions which could temporarily affect response times. However, with embedded measures listed in

paragraph 8.6.2, including a requirement for the Contractor to liaise with the Coastguard Station, the magnitude of impact is considered to be low. As a high sensitivity receptor relating to public safety, affected by a low magnitude of impact, this is assessed as a **temporary, minor (not significant) adverse effect on community health and wellbeing**.

Active travel

8.7.15 It is anticipated that pedestrians and cyclists will experience disruption due to the temporary closures that are to be phased out across various sections of the Promenade and Marine Parade during the construction works. Access along the full length of this route will be maintained for all users throughout construction. However, pedestrians will be diverted onto the footpath on the eastern (inland) side of Marine Parade, and cyclists may be required to mix with vehicular traffic on Marine Parade. Impacts on the shared footpath and cycleway will be temporary and localised and are not expected to deter the majority of active travel users.

8.7.16 Increased traffic flows on the local road network during construction, including increased HGV movements, may make the roads less attractive to walkers and cyclists. As described in Transport and accessibility above, no or minimal changes to the risk of traffic injuries are predicted as a result of construction traffic movements. However, the presence of HGVs has the potential to deter some individuals from using the affected routes, particularly vulnerable groups such as wheelchair and pushchair users and people with impaired mobility.

8.7.17 The magnitude of impacts on active travel routes in the local study area during construction is assessed as low. The sensitivity of the users of these routes is considered to be medium to high, resulting in a **minor (not significant) adverse effect on health and wellbeing** associated with impacts on active travel for the general population, including vulnerable groups.

Environmental amenity

8.7.18 The construction phase may impact environmental amenity through changes in air quality, noise and vibration and visual amenity, either individually or in combination. Changes in environmental amenity can affect people's willingness to use outside spaces, or influence the ways in which they are used. The quality of the public realm and outdoor spaces affects people's mental wellbeing, satisfaction with their local environment, sense of place and the value people attach to their neighbourhood.

8.7.19 The following environmental effects are relevant to this assessment:

- ES Volume 4, Chapter 5: Air Quality has not identified any significant adverse effects on air quality as a result of construction traffic movements or construction activities. Air emissions are therefore not considered to give rise to any significant effects on population health or contribute to amenity impacts.
- ES Volume 4, Chapter 11: Noise and Vibration has identified significant construction noise effects on community assets, including Residential dwellings on Tai'r Heli, Heol-Y-Llan, Heol-Llywelyn, Heol-Y-Plas and Heol-Y-Sarn, Barmouth Beach Club, Promenade Café, Barmouth Skate Park, Hendre Mynach Caravan Park, Min-Y-Mor Hotel, Ysgol Y Traeth School.

- ES Volume 4, Chapter 13: Seascape and Landscape and Visual assessed visual effects of construction, including construction plant and activities, traffic and temporary hoarding and lighting. Moderate adverse effects have been identified on the following receptors: people using Barmouth Beach, the PRoW Abermaw Rhif 24 Byway, Wales Coastal Path Long Distance Footpath and the National Cycle Route 8, people travelling along Marine Parade Road, residents along the A496 and people using Hendre Mynach Caravan Park.

8.7.20 Exposure to environmental noise is associated with adverse effects on mental and physical health [22]. In the context of a construction project the key outcomes include a reduction in the amenity and enjoyment of public and private spaces, annoyance and (where relevant) sleep disturbance. Visual amenity is a key factor in determining people's perception of a place's value, and influences factors such as character and tranquillity.

8.7.21 The combined noise and visual effects of construction activities include residential areas, public realm, key recreational routes and valued public spaces that are used for recreation. The presence of the construction works along Marine Parade and the Promenade will interrupt the existing open views across Barmouth Beach from the road, footpaths and cycleways, areas of public open space, amenities and residences along the sea front. The beach and Promenade are significant features contributing to the town's character and sense of place, and the construction works will temporarily detract from these aspects, reducing people's perception of the quality of the local area. This is likely to influence how people use the local environment, potentially deterring some people from spending time outdoors in the most affected areas. It is noted that local support for the Proposed Development (as described in Section 8.3) may increase people's tolerance of, and resilience to, these temporary effects.

8.7.22 The magnitude of impact on environmental amenity is assessed as low, and the sensitivity of the receptor population is medium. This results in **a temporary minor (not significant) effect** on community wellbeing associated with environmental amenity.

Open space, leisure and play

8.7.23 Access to green and blue space[2] can bring physical and mental health benefits by providing opportunities to meet and socialise, helping people to get together and building relationships and networks [23], by providing opportunities for physical activity. Time spent in contact with nature is known to be beneficial for mental health.

8.7.24 Barmouth Beach and the Promenade together provide an important area of public open space which are well used by the local community as well as visitors to the town. They provide a scenic setting with views of the coast, town and surrounding countryside. The northern half of the beach will be directly impacted by the construction works, with access temporarily restricted in areas effected by construction works. Areas of the beach further to the south will be indirectly affected by the visual and noise impacts of construction works.

[2] Green and blue spaces are natural and semi-natural areas, which includes local pocket parks, wild groves and meadows as well as ponds, canals, lakes and coastlines.

8.7.25 While the beach and Promenade will remain open throughout the works, their character, tranquillity, and setting will be altered by the presence of the construction works, and their amenity value will be temporarily reduced.

8.7.26 Barmouth skate park is located at the northern end of the Promenade. The setting of the skate park will be affected by construction work along the Promenade and in Pen-y-Gogledd Car Park. This resource is not expected to depend upon having a tranquil setting and therefore amenity impacts from the adjacent construction works are considered to have only a small effect on users. Access will be maintained throughout the construction period, but may be restricted by the temporary suspension of local parking spaces in the car park and along Marine Parade.

8.7.27 Open space, leisure and play resources will remain accessible throughout the construction period and are expected to continue to be used by the local community and visitors. However, localised access restrictions and indirect effects on setting and tranquillity may reduce the wellbeing benefits gained from using these resources and result in some individuals choosing not to use them. This is assessed as a medium magnitude effect on open space, leisure and play. The overall sensitivity of the receptor community is assessed as medium, resulting in a **temporary moderate (significant) adverse effect** on open space, leisure and play.

Tourism and business

8.7.28 The construction phase has the potential to temporarily impact key resources of importance to the local tourism industry, including:

- Impacts to Barmouth Beach and Promenade, due to temporary closure and diversion of the Promenade, and indirect impacts from noise and visual effects.
- Impacts on car parking capacity due to additional demand from construction workers and localised suspension of on-street parking spaces along the Promenade and Marine Parade
- Impacts on businesses including the Promenade Café & Wine Bar, Sandbanks Restaurant, Sandbanks Hotel and Min-Y-Mor Hotel, due to changes in access and loss of amenity.
- Impacts on holiday accommodation throughout the town – impacts on capacity due to use of hotels and B&B accommodation by construction workers.

8.7.29 Construction work will be paused during the peak holiday season in July-August, to reduce impacts on tourism and associated income and employment. However, as Barmouth receives visitors year-round, there is a potential for impacts on tourism outside of peak tourism periods, particularly during peak construction periods.

8.7.30 According to ES Volume 4, Transport Assessment, while demand for parking is generally lower than capacity during off-peak periods, there is a potential for impacts on parking if the town experiences a greater influx of visitors than is usually anticipated (for example if Barmouth experiences warm and dry weather).

8.7.31 It is uncertain to what extent local accommodation will be required by construction workforce. Given the relatively small workforce, and the suspension of works during the peak tourist season, it is considered unlikely that additional demand from construction workers will affect overall capacity, while work continuing in off-peak tourism season, there is a support accommodation providers in the low season.

8.7.32 Impacts on the beach and Promenade, as described under 'Open space, leisure and play' above, would potentially affect the desirability of Barmouth as a tourist destination. Due to the location of the works in the less frequented northern area, it is considered that effects on most key tourist attractions would be marginal and unlikely to deter visitors.

8.7.33 Attractions in proximity to the works, including the Promenade Café & Wine Bar and Restaurant and Sandbanks Restaurant, located on Marine Parade, will experience temporary impacts on access and amenity. While access will be maintained throughout the construction period, construction traffic and lane closures along Marine Parade may cause delays and inconvenience. There is a potential for these facilities to experience a temporary drop in visitor numbers during peak construction periods.

8.7.34 Overall, the magnitude of effects on tourism are assessed as low. Due to the dependence on the local economy on income from tourism and above average levels of employment deprivation, the sensitivity of the receptor community is assessed as high. This results in a **temporary minor (not significant) adverse effect** on health and wellbeing associated with impacts on tourism.

Community and Social Infrastructure

Health and social care services

8.7.35 Access to health and social care services such as hospitals and care facilities is linked to positive health outcomes. Reducing levels of access therefore has the potential to adversely affect health.

8.7.36 There is an assisted living facility, Hafod Mawddach home for the elderly, located on Marine Road. The Treherne Care and Consultancy is a care home located on Station Road. Residents of these facilities may experience changes in amenity and potentially increased journey times for residents, staff and visitors. Access will be maintained throughout the construction period and the day-to-day functioning of these facilities is not considered to be affected.

8.7.37 The sensitivity of users of health and social care services is considered to be high, as it comprises vulnerable groups such as older people, people with long-term illnesses or limited mobility. The magnitude of impact is considered to be low, resulting in a **minor (not significant) adverse effect**.

8.7.38 Impacts of construction of the Proposed Scheme on the Barmouth Ambulance Station is located on Marine Road is discussed in respect to Community Safety.

Schools

8.7.39 Barmouth Oasis Nursery pre-school, located on Park Road, may experience disruption due to construction traffic movements, potentially increasing journey times. No noise impacts on the nursery have been identified.

8.7.40 Ysgol Y Traeth School on Princes Avenue may experience increased journey times due to construction traffic along A496, High Street and Beach Road. A

significant construction noise effect has been identified, which has the potential to cause disruption to some school activities. As described in Section 8.6, the Contractor will liaise with the school to agree appropriate measures such as restricting traffic movements at pick up and drop off times and notifying the school of any noisy or disruptive activities. It is therefore considered that the magnitude of impact on the school will be low.

8.7.41 The sensitivity of users of schools and pre-schools is considered to be high, as children are identified as a vulnerable group. The magnitude of impact on the school and nursery is considered to be low. This results in a **temporary, minor (not significant) adverse effect** on community wellbeing associated with impacts on schools in the study area.

Operational and Maintenance Effects

8.7.42 Operation is defined as the post-construction phase of the proposed development, including maintenance activities, until there is further development or until the site ceases to operate as a standard of protection against coastal flooding. Refer to ES Volume 2, Chapter 2 Project Description, for the description and period of maintenance activities, and the design life of the Proposed Development. Impacts on community elements during this phase are described below.

Active travel

8.7.43 The Proposed Development will deliver enhanced hard and soft landscaping features, wayfinding and designated cycle parking facilities along Marine Parade and the Promenade. This will make this route more attractive to walkers and cyclists, potentially increasing its use as a recreational route. The changes are not predicted to materially increase the number of trips by active travel modes. However, the proposed improvements will support the continued use of this key active travel route in the longer term. The magnitude of effect on active travel is therefore assessed as low. The sensitivity of the local population is assessed as medium, resulting in a **minor (not significant) beneficial effect** on community health and wellbeing associated with active travel.

Open space, leisure and play

8.7.44 The proposed improvements to access and amenity along the northern section of the Promenade, and provision of safe access to Barmouth Beach, as described above, will improve the recreational amenity value of these assets and enable more people to use them. Improvements will also be made to the areas around Pen-y-Gogledd Car Park, including a grassed areas with maritime vegetation planting, and a space at the north end of the car park to be used by food and drink kiosks in the summer. These improvements will improve the amenity of open space at the north end of the Promenade, further encouraging use of the northern walkway and beach areas.

8.7.45 Improved beach access points will be particularly beneficial for vulnerable groups, such as pushchair and wheelchair users and people with impaired mobility, who are currently disproportionately affected by restricted access to the northern area of Barmouth Beach. The improvements will provide inclusive access to the health and wellbeing benefits associated with access to the beach, for all residents and visitors in the northern part of Barmouth. Seating and safer crossing points will also help more vulnerable people to access the Promenade.

These improvements are considered to have a permanent beneficial effect of medium magnitude on access to open space, leisure and play affecting both the general population with medium sensitivity, and particularly vulnerable groups with high sensitivity, **resulting in a moderate (significant) beneficial effect** on community health and wellbeing.

8.7.46 This would be considered to be a low magnitude impact on a population of medium sensitivity, representing a **minor (not significant) beneficial effect** on community health and wellbeing.

Tourism and business

8.7.47 Tourism is currently concentrated around south Barmouth due to the lack of amenities and beach access in north Barmouth. The northern end of the Promenade and Pen-y-Gogledd Car Park both currently lack features that appeal to visitors, placing limitations on the potential of this area of the town to benefit from local tourism.

8.7.48 While northern Barmouth is less frequented, the Promenade and beach provide valuable leisure and recreation amenity. The improvements to the Promenade and beach access, as described above, will help to make the northern part of Barmouth more attractive to tourists. This will benefit existing businesses in the area, such as the Promenade café, wine bar and restaurant, Sandbanks Hotel and Restaurant and the Min-Y-Mor Hotel, and may encourage further investment in tourism businesses. Broadening the appeal of north Barmouth will also help to reduce pressure on the popular south Promenade. It is therefore considered that the Proposed Development will support the growth of the tourism economy in Barmouth as a whole. This is assessed as a medium magnitude impact on business and tourism. Due to the reliance of Barmouth on the tourism industry, the sensitivity of the population to impacts on tourism is assessed as high. This results in a **moderate (significant) beneficial effect** on community health and wellbeing associated with increased incomes and economic prosperity generated by tourism.

Climate and flooding

8.7.49 Flooding poses a risk to public health, including potential injury and loss of life, as well as the stress and financial losses incurred in the event of a flood. The risk of flooding causes increased stress and can affect decisions around investment in businesses and property.

8.7.50 The provision of an improved flood defence infrastructure would protect businesses and neighbourhoods near the coastline and within Flood Zones, reducing the risk of flooding and associated loss of life, injury, financial loss and emotional distress. Additionally, the reduced risk of flooding would support health and wellbeing by reducing levels of anxiety associated with the potential for flooding and supporting investment and regeneration in north Barmouth.

8.7.51 The reduction in flood risk is assessed as a beneficial impact of high magnitude affecting a population of medium sensitivity. This gives rise to a **major (significant) beneficial effect** on the health and wellbeing of the community in north Barmouth.

8.8 Mitigation and Enhancement

8.8.1 This section outlines the mitigation required where significant effects have been identified.

Additional Mitigation of Construction Effects

8.8.2 The following additional mitigation measures are proposed during construction:

- Impacts on parking at the Pen-y-Gogledd car park during construction should be reduced where possible. This may include measures such as restricting closure of the car park to the quieter, winter months and/or maintaining partial access to the car park throughout the works.

Mitigation of Operational Effects

8.8.3 No significant adverse effects have been identified during the operation of the Proposed Development and therefore no additional mitigation is proposed.

8.9 Residual Effects

8.9.1 No significant residual effects have been identified during the construction and operation of the Proposed Development and therefore, no additional mitigation is proposed.

8.10 Assessment Summary

8.10.1 Table 8-8 outlines all effects identified in the main assessment including those identified that were not significant and the residual assessment.

Table 8-8 Summary of effects matrix

Receptor	*Potential Impact*	*Significance of effect*	*Mitigation proposed*	*Residual effect*
Construction effects				
Transport and accessibility – local study area community	Localised, temporary increases in journey times to local services and amenities due to construction traffic impacts, affecting community wellbeing.	Temporary, minor adverse (not significant)	Impacts on parking at the Pen-y-Gogledd car park during construction should be reduced where possible.	Temporary, minor adverse (not significant)
Community safety – local study area community	Effect on operation of the Coastguard Station and Lifeboat Station due to construction activities. Effect on safety of beach users.	Temporary, minor adverse (not significant)	No additional mitigation proposed	Temporary, minor adverse (not significant)
Active travel – local study area community (vulnerable groups)	Potential reduction in active travel, particularly for vulnerable groups, due to construction traffic and impacts on the Promenade.	Temporary, minor adverse (not significant)	No additional mitigation proposed	Temporary, minor adverse (not significant)

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual effect
Environmental amenity – local study area community	Combined noise and visual effects, reducing perceptions of neighbourhood amenity and affecting wellbeing	Temporary, minor adverse (not significant)	No additional mitigation proposed	Temporary, minor adverse (not significant)
Open space, leisure and play – local and wider study area community	Impacts on quality and accessibility of the beach, Promenade and Skate Park. Reduction in health and wellbeing benefits gained from these resources.	Temporary, moderate adverse (significant)	No additional mitigation proposed	Temporary, moderate adverse (significant)
Tourism and business – local and wider study area community	Disruption of tourism businesses and resources due to construction activities. Adverse effects on wellbeing due to reduced income from tourism.	Temporary, minor adverse (not significant)	No additional mitigation proposed	Temporary, minor adverse (not significant)
Community and social infrastructure – local study area community (vulnerable groups)	Change in access to, and amenity of, care homes and schools. Effects on wellbeing of users.	Temporary, minor adverse (not significant)	No additional mitigation proposed	Temporary, minor adverse (not significant)
Operational and Maintenance				
Active travel – local study area community	Improved wayfinding, amenity, safety and comfort for pedestrians and cyclists on the Promenade and Marine Parade. Supports active travel and associated health benefits.	Permanent, minor beneficial (not significant)	No additional mitigation proposed.	Permanent, minor beneficial effect (not significant)
Open space, leisure and play – local study area community (including vulnerable groups)	Improvements to the Promenade and beach access points. Increased health benefits of access to open space, leisure and play, particularly for people with impaired mobility.	Permanent, moderate beneficial (significant)	No additional mitigation proposed.	Permanent, moderate beneficial (significant)
Tourism and business – local and wider study area community	Improvements to the north Promenade and beach access, supporting the growth of the tourism economy in Barmouth. Health benefits associated with improved incomes.	Permanent, moderate beneficial (significant)	No additional mitigation proposed.	Permanent, moderate beneficial (significant)

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual effect
Climate and flooding (local community, particularly in north Barmouth)	Reduction in flood risk and associated risks to health and safety.	Permanent, major beneficial (significant)	No additional mitigation proposed.	Permanent, major beneficial (significant)

Abbreviations List

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

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Cyngor Gwynedd

Barmouth North Promenade FAS

ES Chapter 9 Cultural Heritage

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Contents

9. Cultural Heritage **1**

9.1 Introduction 1

9.2 Legislation, Policy and Guidance 1

9.3 Stakeholder Engagement 3

9.4 Methodology 5

9.5 Baseline 9

9.6 Embedded Environmental Design Measures 42

9.7 Assessment of Likely Significant Effects 43

9.8 Mitigation and Enhancement 48

9.9 Residual Effects 49

9.10 Assessment Summary 50

Abbreviations List **53**

Glossary **54**

References **55**

Tables

Table 9-1 List of Relevant Legislation 2

Table 9-2 List of Relevant National Policy 2

Table 9-3 List of relevant local policy, plans and strategies 2

Table 9-4 Cyngor Gwynedd and Cadw comments on scope of the cultural heritage assessment and the response 3

Table 9-5 Criteria for heritage significance 7

Table 9-6 Magnitude of impact 8

Table 9-7 Matrix for relative significance of effect 8

Table 9-8 Archaeological and cultural (historical) time periods 9

Table 9-9 Residual effects of construction 49

Table 9-10 Summary of effects matrix 51

Graphics

Graphic 9-1 1795 map of Barmouth by John Evans. Six Counties of North Wales. Print. The National Library of Wales. Reproduced under a Creative Commons license 16

Graphic 9-2 1888 Ordnance Survey six-inch map of the Site. Surveyed 1887. Merionethshire Sheet XXXVI.NW. Reproduced with permission of National Library of Scotland under a CC BY (Creative Commons Attribution) licence 18

Graphic 9-3 1901 Ordnance Survey six-inch map of the Site. Revised 1900. Merionethshire Sheet XXXVI.NW. Reproduced with permission of National Library of Scotland under a CC BY (Creative Commons Attribution) licence. 20

Graphic 9-4 Richards, S.L. 1930. Barmouth Sea Defence Works. National Archives. Reference: BT 356/8975/PT4 22

Graphic 9-5 Richards, S.L. 1930. Barmouth Sea Defence Works. Typical Cross Section. National Archives. Reference: BT 356/8975/PT3 23
Graphic 9-6 1938 Ordnance Survey six-inch map of the Site. Merionethshire Sheet XXXVI.NW. Reproduced with permission of National Library of Scotland under a CC BY (Creative Commons Attribution) licence. 26
Graphic 9-7 1953 Ordnance Survey six-inch map of the Site. Revised 1949. Merionethshire Sheet XXXVI.NW. Reproduced with permission of National Library of Scotland under a CC BY (Creative Commons Attribution) licence. 28
Graphic 9-8 Aerial imagery of the Site, dated December 2006. Google Earth Pro 31
Graphic 9-9 Aerial imagery of the Site, dated April 2020. Google Earth Pro 32

Photographs

Photograph 1 View north along the promenade and roadway from the southern end of the Site. Shingle is covering the 1930s stone-faced apron wall which forms part of the Primary Wall. 33
Photograph 2 View north along the promenade, showing the Primary Wall (left), Central Wall (centre) diving the promenade and roadway, and the Secondary Wall (right 34
Photograph 3 View north along the beachfront, showing the Primary Wall, timber groynes, and shingle steps down to the beach 34
Photograph 4 View northwest showing the beach and timber groynes 35
Photograph 5 View west showing timber groyne (right) and timber cradle (left) 35
Photograph 6 View north showing the 1930s stone-faced apron wall which forms part of the Primary Wall. 36
Photograph 7 View south showing the 1930s stone-faced apron wall and stone steps, 1930s concrete stepped sea wall, and 1970s wave return wall which form part of the Primary Wall. 36
Photograph 8 View south showing the 1930s stone-faced apron wall and stone steps, 1930s concrete stepped sea wall, and 1970s wave return wall which form part of the Primary Wall. 37
Photograph 9 View west showing the northern end of the 1930s sea defences, with 1930s stone-faced apron wall and concrete stepped sea wall, and 1970s wave return wall, which form part of the Primary Wall. 37
Photograph 10 View north showing storm damage to the Central Wall dividing the promenade and roadway 38
Photograph 11 View west of rear of rain shelter 38
Photograph 12 View east of front of rain shelter 39

9. Cultural Heritage

9.1 Introduction

9.1.1 This chapter provides an assessment of the likely significant effects on Cultural Heritage that may arise from the construction, operation and maintenance of Barmouth North Promenade Flood Defence Scheme (hereafter referred to as the 'Proposed Development'). The approach undertaken for this chapter has been supported by a Scoping Report submitted by Cyngor Gwynedd (Ymgynghoriaeth Gwynedd Consultancy (YGC)), engagement with statutory consultees, and Scoping Opinions received from Cyngor Gwynedd and Natural Resources Wales (NRW) on 30 April 2024 and 19 April 2024 respectively.

9.1.2 This chapter details the legislation, policy and guidance that is relevant to Cultural Heritage, a summary of engagement undertaken, the methodology of assessment, and the embedded environmental design measures. This is followed by an assessment of likely significant effects of the Proposed Development on Cultural Heritage, taking account of the embedded environmental design measures. The need for any additional mitigation is then considered along with any proposals for enhancement design measures. This chapter concludes with a summary of likely significant residual effects.

9.1.3 The Cultural Heritage elements considered with this chapter for the Proposed Development include:

- Designated historic assets (historic assets of national importance).
- Non-designated historic assets (historic assets of local or regional importance, or those of potentially national importance that are not currently designated).
- Registered Historic Landscapes.

9.1.4 This chapter is supported by the following appendices:

- Environmental Statement (ES) Volume 3, Appendix 9.1 Cultural Heritage Gazatteers.
- Environmental Statement (ES) Volume 3, Appendix 9.2 Heneb Archaeological Watching Brief.

9.1.5 This chapter is supported by the following figures:

- ES Volume 4, Figure 9.1.
- ES Volume 4, Figure 9.2.
- ES Volume 4, Figure 9.3.

9.2 Legislation, Policy and Guidance

9.2.1 This section identifies the legislation, policy, guidance and other documentation that has informed the assessment of likely significant effects on Cultural Heritage. This section is supported by ES Volume 3, Appendix 1.1, which outlines overarching legislation and policy relevant to the Proposed Development.

Legislation

9.2.2 Table 9-1 lists the legislation relevant to this topic and the assessment of the likely significant effects.

Table 9-1 List of Relevant Legislation

Legislation	Relevance to Assessment
The Historic Environment (Wales) Act 2023 [1]	This Act builds on and makes important changes to the two main UK laws that provide the legislative framework for the protection and management of the historic environment: the Ancient Monuments and Archaeological Areas Act (1979) and the Planning (Listed Buildings and Conservation Areas) Act (1990).

National Policy and Strategies

9.2.3 Table 9-2 lists the relevant planning policy and strategies, with paragraphs of relevance to the Cultural Heritage assessment.

Table 9-2 List of Relevant National Policy

National Policy & Paragraph Number	Summary of Policy Requirement and Relevance
Planning Policy Wales Edition 12: Paragraphs Chapter 6. Distinctive and Natural Places (2024) [2]	The policy states that the characteristics and environmental qualities of places varies across Wales, creating distinctive or unique features associated with their particular natural or cultural heritage and these should be recognised and valued, in and of, themselves and should be protected and enhanced.
Technical Advice Note 24: The Historic Environment (2017) [3]	This note makes clear that in policy terms, the historic environment is defined as all aspects of the environment resulting from the interaction between people and places through time, including all surviving physical remains of past human activity, whether visible, buried or submerged, and deliberately planted or managed.

Local Policy and Strategies

9.2.4 The relevant local planning policy plans and strategies to the Cultural Heritage assessment is listed in Table 9-3.

Table 9-3 List of relevant local policy, plans and strategies

Local Policy, Plan & Strategy	Relevant policy	Relevance to Assessment
Anglesey and Gwynedd Joint Local Development Plan 2011 - 2026 (2017) [4]	Policy PS 20	This policy requires development to preserve and enhance historic assets including scheduled ancient monuments, listed buildings and their curtilages, Conservation Areas and buildings or architectural/historic/cultural merit that are not designated or protected.
	Policy AT 1	This policy requires development within or affecting the setting and/or significant views of Conservation Areas, World Heritage Sites and Registered Historic Landscapes, Parks and Gardens to have regard to the character appraisals, management plans and registers. Such proposals should be supported by a heritage impact assessment.

Local Policy, Plan & Strategy	Relevant policy	Relevance to Assessment
	Policy AT 3	Policy AT 3 requires proposals to conserve and seek opportunities to enhance buildings, structures and areas which are non-designated historic assets and create a sense of local character, identify and variation.

Standards and Guidance

9.2.5 The guidance and standards which relate to this topic are listed below.

- *Code of conduct: professional ethics in archaeology.* Chartered Institute for Archaeologists, 2014, rev. 2022 [5].
- *Standard and guidance for historic environment desk-based assessment*. Chartered Institute for Archaeologists, 2014, rev. 2020 [6].
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- *Heritage Impact Assessment in Wales.* Cadw, 2017 [8].
- *Setting of Historic Assets in Wales.* Cadw, 2017 [9].
- *Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs).* The Welsh Archaeological Trusts, 2022 [10].

9.3 Stakeholder Engagement

9.3.1 Engagement has been undertaken with key stakeholders as part of the Scoping Opinion and through direct engagement as described in paragraph 9.3.3.

Environmental Impact Assessment (EIA) Scoping Opinion

9.3.2 An EIA Scoping Opinion was adopted by Cyngor Gwynedd and Cadw in April 2024. The comments received in relation to Cultural Heritage are presented in Table 9-4 and how these have been addressed.

Table 9-4 Cyngor Gwynedd and Cadw comments on scope of the cultural heritage assessment and the response

Organisation	Scoping Opinion Comment	Response
Cyngor Gwynedd and Cadw	A number of listed buildings are located inside 1km of the Proposed Development and that the proposal could have an impact on their settings. It is therefore recommended the impact of the Proposed Development on the setting of the listed buildings should be carried out in accordance with the Welsh Government guidance given in the document "The Setting of Historic Assets in Wales". A stage 1 assessment is expected to be carried out for all the designated historic assets listed in Cadw's letter, which will determine the need, if necessary, for stages 2 to 4 to be carried out for specific historic assets. The results of the stage 1 assessment should be included in the EIA, probably in an appendix.	This assessment considers potential impacts upon all known historic assets within a 1km buffer from the boundary of the Site. An assessment has been carried out for all the designated historic assets within this 1km study area. This is documented in section 9.7.

Organisation	Scoping Opinion Comment	Response
Cyngor Gwynedd and Cadw	An Assessment of the Significance of the Impact of the Development on the Historic Landscape is not required to be included in the EIA. However, the Registered status and characteristics of the local historic landscape should be taken into consideration during scheme design.	The Registered landscapes and supporting local historic landscape characterisation are included in the baseline (section 9.5) and have been considered within the impact assessment documented in section 9.7. There is also a Seascape and Landscape and Visual assessment included in ES Volume 2-, Chapter 13 Seascape and Landscape and Visual.
Cyngor Gwynedd and Cadw	The scoping document does not appear to have considered the impact of the proposed works on undesignated historic assets including archaeological features. A desk-based historic environment assessment should be prepared in accordance with the standards and guidance set by the Chartered Institute for Archaeologists, and this should include a walkover survey of the beach along with archaeological monitoring of any geotechnical test pits that are excavated.	The baseline assessment and impact assessments in this EIA chapter have been prepared in accordance with the standards and guidance for desk based assessment and have been informed by walkover survey. The excavation of geotechnical test pits for the project was archaeologically monitored by Heneb. The results of the monitoring inform the assessment of archaeological potential this chapter.
Cyngor Gwynedd	The scope of assessment can be relatively tightly focused around the scheme. The history of Barmouth has been previously documented in some detail through characterisation studies, and desk-based research should be directed towards establishing the potential for impact rather than providing a more general overview, with a view to informing suitable mitigation measures (by design or field investigation).	The baseline assessment in this chapter focuses on the history of Barmouth as it relates to the construction and historic interest of the sea defences and to inform the analysis of the setting of buildings within the town. The assessment also focuses on the archaeological potential of the beach deposits. Mitigation measures are discussed in section 9.6, which deals with embedded design measures and section 9.8 which covers additional mitigation and enhancement.

Non-Statutory Engagement

9.3.3 Non-Statutory stakeholder engagement has been undertaken with the following bodies:

- Royal Commission on the Ancient and Historical Monuments (RCAHM) of Wales in relation to the intertidal and marine areas of the study area and monitoring requirements.
- Cadw in relation to the potential impacts on designated historic assets on the terrestrial side of the study area (set out in Section 9.4.1 below). Cadw have

indicated that they are satisfied with this chapter's approach the consideration of potential impacts on designated heritage assets.

- Heneb in relation to the archaeological and historical baseline and the monitoring of Ground Investigations on the beach deposits. Heneb confirmed they will review the assessment of effects following completion of the beach deposits GI monitoring results which will inform the assessment.

9.4 Methodology

Study area

9.4.1 The assessment presented in this chapter considers potential impacts upon all known historic assets within a 500m buffer from the boundary of the Site, with all designated historic assets considered beyond this to a 1km buffer from the boundary of the Site. In instances where historic assets are recorded as a point but represent parts of area or linear monuments, are part of a larger feature, or are located on the boundary of the study area, professional judgement has been applied to determine their inclusion.

Grouping historic assets

9.4.2 In instances where multiple historic assets (both designated and non-designated) share a common typology, proximity, period, or contextual and/or associative connection or commonality, they are grouped together for the purpose of assessing any impact(s) or effect(s) which may be brought about because of the Proposed Development.

Data and information sources

9.4.3 The Cultural Heritage baseline data for the study area has been obtained from desktop study and walkover surveys. Data has also been obtained through the archaeological monitoring of geotechnical test pits excavated for the project. Archaeological monitoring of eight test pits was undertaken by Heneb in September 2025 (refer to ES Volume 3, Appendix 9.2).

9.4.4 The following information sources have been used to complete the baseline assessment:

- British Geological Survey – for 1:50,0000 geological mapping and historic borehole records obtained via a Web Map Service.
- Cadw – for data and information regarding designated historic assets.
- DataMap Wales – for georeferenced historic aerial photography and Light Detection And Ranging (LiDAR) Digital Terrain Model (DTM) data.
- Google Earth Pro – for current and historic aerial and satellite imagery.
- Heneb – for Historic Environment Record (HER) data – this includes information regarding non-designated historic assets and previous archaeological and historic environment and archaeological surveys and investigations.
- Llyfgell Genedlaethol Cymru (National Library or Wales) – for georeferenced tithe maps and apportionments, country, Welsh county, and other historic maps.

- National Library of Scotland – for historic Ordnance Survey (OS) maps (this is the repository for the UK wide mapping).
- Cyfoeth Naturiol Cymru (Natural Resources Wales) LANDMAP – for data and information regarding Cultural and Historic Landscapes.
- Royal Commission on the Ancient and Historical Monuments of Wales (RCAHMW) – for data and information regarding designated and non-designated terrestrial and marine historic assets entered onto the National Monuments Record of Wales (NMRW).
- A visit to Meirionnydd Record Office, Gwynedd Archives.
- A visit to the National Archives, London, to consult original plans of the 20th century sea defences.

9.4.5 A site visit was undertaken by a Cultural Heritage specialist on 21st October 2024. The Site and study area were walked over. The primary wall was assessed from the promenade and from the beach, and the length of the parade was walked in both directions, during the day and again at night. Barmouth Conservation Area was also included in the walkover (see ES Volume 4 Figure 9.1).

9.4.6 A Zone of Theoretical Visibility (ZTV) has been used to help identify potentially sensitive assets. The ZTV was modelled using 1m DTM representing a worse-case in visibility from the Proposed Development. For further information regarding the ZTV methodology and processing, refer to Section 13.2.3 Assessment of visual effects, in ES Volume 3 Appendix 13.2 Seascape, Landscape and Visual Impact Assessment Methodology.

Historic assets and Cultural and Historic landscapes

9.4.7 Gazetteers of recorded historic assets and Historic and Cultural landscapes located throughout the study area are available in ES Volume 3, Appendix 9.1. Throughout this report:

- Designated historic assets are referred to using Cadw's Reference Number (RN).
- Non-designated historic assets are referred to using Heneb's Preferred Reference Number (PRN).
- Historic assets entered onto the NMRW are referred to using the RCAHMW National Preferred Reference Number (NPRN).
- Areas of Cultural Landscape and Historic Landscape are referred to using Cyfoeth Naturiol Cymru's Unique Identifier (UID).

9.4.8 Where historic assets represent constituent parts of one larger historic asset, they will be grouped together.

Cultural Heritage Terminology

9.4.9 A list of abbreviations and a glossary have been provided for reference at the end of this chapter.

Assessment Methodology

Impact assessment and significance criteria

9.4.10 The methodology for the assessment of value, the magnitude of potential impacts(s) to cultural heritage, and the significance of any effects(s) received by a historic asset are determined according to the definitions and the criteria for establishing significance set out in Table 9-5 and Table 9-6, which have been developed using Table 3.2N and Table 3.4N of Design Manual Roads and Bridges (DMRB) LA104 and informed by DMRB LA106. Although primarily intended for use in assessing the impact of highways projects on cultural heritage, the DMRB methodology is a suitable for adaptation to assess impact and environmental effects brought about by large, complex linear and non-linear developments.

9.4.11 Where DMRB uses 'Negligible' for the assessment of value, this report uses 'Low Value' so that 'Negligible' is reserved for effects only.

9.4.12 Each asset is assigned a level of heritage significance (value) in accordance with the criteria set out in Table 9-5.

Table 9-5 Criteria for heritage significance

Heritage significance (value)	Typical descriptors
Very High	Very High importance and rarity, international scale, and very limited potential for substitution. Includes world heritage sites and nominated sites.
High	High importance and rarity, national scale, and limited potential for substitution. Includes scheduled monuments, listed buildings (all grades), registered parks and gardens (all grades), conservation areas containing very important buildings, undesignated structures of clear national importance, undesignated assets of schedulable quality and importance.
Medium	Medium or High importance and rarity, regional scale, limited potential for substitution. Includes conservation areas containing buildings that contribute significantly to historic character and some non-designated archaeological remains.
Low	Low or Medium importance and rarity, local scale.
Very Low	Very Low importance and rarity, local scale.

9.4.13 Impacts may arise during construction or operation phases of the Proposed Development and may occur to the physical fabric of an asset or may arise from changes within its setting. The magnitude of impact rating is assigned with reference to a five-point scale as set out in Table 9-6.

Table 9-6 Magnitude of impact

Magnitude of impact (degree of change)	Typical descriptors	
Major	Adverse	Loss of asset and/or quality and integrity of asset; severe damage to key characteristics, features or elements.
	Beneficial	Large-scale or major improvement of asset quality; extensive restoration; major improvement of attribute quality or setting.
Moderate	Adverse	Partial loss of asset, but not adversely affecting the integrity; partial loss of/damage to key characteristics, features or elements.

Magnitude of impact (degree of change)	Typical descriptors	
	Beneficial	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality.
Minor	Adverse	Some measurable change in attributes, quality, or vulnerability; minor loss of, or alteration to, one (maybe more) key characteristics, features or elements.
	Beneficial	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring.
Negligible	Adverse	Very minor loss or detrimental alteration to one or more characteristics, features or elements.
	Beneficial	Very minor benefit to or positive addition of one or more characteristics, features or elements.
No change		No loss or alteration of characteristics, features or elements; no observable impact in either direction.

9.4.14 The likely significance of effect(s) which may be brought about by the Proposed Development is evaluated according to the DMRB methodology outlined in the Significance Matrix set out in LA104 Table 3.8.1. This methodology is provided in Table 9-7 which combines the assessment of an historic asset's heritage significance with the magnitude of impact it may receive.

Table 9-7 Matrix for relative significance of effect

		Magnitude of impact (degree of change)				
		No change	**Negligible**	**Minor**	**Moderate**	Major
Heritage Significance (Importance)	**Very High**	Neutral	Slight	Moderate / Large	Large / Very Large	Very Large
	High	Neutral	Slight	Slight / Moderate	Moderate / Large	Large / Very Large
	Medium	Neutral	Neutral / Slight	Slight	Moderate	Moderate / Large
	Low	Neutral	Neutral / Slight	Neutral / Slight	Slight	Slight / Moderate
	Very Low	Neutral	Neutral	Neutral / Slight	Neutral / Slight	Slight

9.4.15 In accordance with standard EIA practice, and for the purposes of the EIA Regulations, a significance of effect assessed as being Moderate, Large, or Very Large (shaded grey in the matrix above) is considered to be 'significant'.

Assumptions

9.4.16 It is assumed that the data, information, and primary and secondary sources obtained from all organisations, institutions, bodies, or individuals is accurate at the time of its acquisition and/or consultation. This material does not prohibit the existence of further features or remains which are unknown at present. This assessment, therefore, represents a professional judgement of likelihood rather than a definitive statement of the presence or absence of archaeological features, remains, and/or deposits within the Site.

9.5 Baseline

Current Baseline

9.5.1 This section sets out existing conditions and identifies potential receptors and their value, as per the methodology. The archaeological and cultural (historical) periods used throughout this report are based on the chronology for Wales [11], which is curated by the RCAHMW and communicated by the Forum on Information Standards in Heritage. These periods are presented in Table 9-8.

Table 9-8 Archaeological and cultural (historical) time periods

Period		Date range
Archaeological	Prehistoric	From the earliest appearance of humans in the British Isles (c. 1,000,000BCE) to the end of the Iron Age in 43CE.
	Palaeolithic	From the earliest appearance of humans in the British Isles (c.1,000,000BCE) to the end of the last Ice Age around 8,500 years BCE.
	Mesolithic	8,500BCE – 4,000BCE
	Neolithic	4,000BCE – 2,200BCE
	Bronze Age	2,200BCE – 700BCE
	Iron Age	700BCE – 43CE
Cultural	Roman	43CE – 410CE
	Early Medieval	410CE – 1086CE
	Medieval	1086CE – 1536CE
	Post Medieval	1536CE – 1899CE
	20th Century	1900CE – 1999CE
	21st Century	2000CE - present
Uncertain	-	Used when a date for the creation or construction of an artefact or archaeological feature or other remains cannot be determined.

Source: Forum Information Standards in Heritage [11]

Overview

Designated historic assets

9.5.2 There are 50 listed buildings within the study area, none of which are within the Site.

9.5.3 There is one Grade I listed building in the study area. This is the Parish Church of Saint Mary and Saint Bodfan (RN: 4906).

9.5.4 There are five Grade II* listed buildings in the study area. These are:

- Morris & Co, General Cambrain Establishment (former Drapers Shop) (RN: 15464).
- Glan Glasfor to the rear of Morris & Co (RN: 15465).
- Plas Mynach (RN: 5244).
- St John's Church (RN: 15467).
- Ty Gwyn with Davey Jones's Locker Café (RN: 4897) .

9.5.5 Four of the Grade II* listed buildings, all of them except Plas Mynach, are within the Abermaw (Barmouth) Conservation Area.

9.5.6 There are 44 Grade II listed buildings in the study area, 39 of which are located within Abermaw (Barmouth) Conservation Area.

9.5.7 Barmouth Conservation Area within the study area but is outside the Site.

9.5.8 All identified designated historic assets are shown in ES Volume 4, Figure 9.1

Non-designated historic assets

9.5.9 There are 87 non-designated historic assets within the study area. 51 of these are from the HER, and 35 are from the NMRW. One additional asset, a probable c.1930s iron rain shelter, was identified during the site walkover.

9.5.10 All identified non-designated historic assets are shown in ES Volume 4, Figure 2.

Registered Historic Landscapes

9.5.11 There two Registered Historic Landscapes within the Site, Ardudwy and Mawddach.

9.5.12 The identified Registered Historic Landscapes are shown in ES Volume 4, Figure 3.

Geology and topography

9.5.13 The Site is located within the seaside town of Barmouth, which lies on the estuary of the Afon Mawddach and Cardigan Bay, on the Irish Sea. The Site includes part of the flat Barmouth beach and includes the intertidal zone as well a section of the town's sea defences including a promenade and sea walls. To the west, the Site is overlooked by sharply rising high ground. Approximately 2km to the east are the Garn Mountain and Ffridd y Graig hill, which rise up to more than 250m.

9.5.14 British Geological Survey data shows that the bedrock geology within the Site is sandstone, siltstone and mudstone of the Harlech Grits and Rhinog Formations. These are sedimentary rocks formed between 526 and 499 million years ago during the Cambrian period. The northern end of the Site is characterised by siltstone and mudstone interbedded bedrock of Llanbedr Formation, formed between 526 and 508 million years ago during the Cambrian period.

9.5.15 British Geological Survey data shows that the superficial geology along the flat beach and within the intertidal zone within the Site are Coastal Zone Deposits, comprising gravel, sand, silt and clay formed between 11.8 thousand years ago and the present during the Holocene. To the east of this, along the groynes and below the promenade, the superficial geology is recorded as Blown Sand, which formed between 2.588 million years ago and the present. At the far northern end of the Site the superficial geology is recorded as Storm Beach Deposits. This deposit of gravel was formed between 2.588 million years ago and the present. These deposits of sands and gravels along the coastal plain are interspersed with layers or pockets of peat. These represent that part of the coastline drowned by rising sea levels during the post glacial period. The peat layers are exposed occasionally in the intertidal zone of the eroded coastal edge, for 5km along the shore. Some of the intertidal peats have been dated using Radiocarbon dating. The underlying salt marsh was dated to c.6000 Before Present (BP, meaning before 1950CE), while the forest bed has been dated from the c.5400BP to 3900BP.

9.5.16 The archaeological finds that have been retrieved from the peats along the foreshore include Mesolithic flint picks, flint flakes, an antler tool and a hearth which was dated to the c.4000BP from the surrounding peat, as well as red deer bones and wild cattle. A timber trackway, radiocarbon dated to the 12th to 14th centuries BCE, has been investigated in the intertidal zone at Llanaber to the north of the Site. As well as this a nearby tree stump produced a date within the Roman period. Therefore, where the peats survive, they preserve evidence of archaeological importance, potentially revealing evidence of millennia of history, including organic material rarely preserved inland, such as animal remains, timber jetties, platforms and trackways.

9.5.17 In early 2025, a programme of Ground Investigation, comprising several boreholes, was undertaken along the North Promenade on the landside, with the boreholes being drilled through the concrete surface of the promenade itself [39]. Borehole BH02 found a deep natural layer of very loose greyish brown silty sand from 2.40m below the ground surface, which was sealed by the layers of made ground laid down for the construction of the promenade. Between 2.40m and 3.65m below the ground surface, in the upper part of the layer, this layer contained pockets of plastic grey pseudo-fibrous peat. As ground level in this location was 5.03m below Ordnance Datum (OD), the peat was present from 2.63m below OD to 1.38m below OD.

9.5.18 In September 2025 eight geotechnical test pits were excavated as part of Ground Investigation works undertaken for the project along a 1.2 km stretch of on foreshore along the North Promenade within the Site. The pits were excavated to a depth of 4 m below ground level. The excavation of these pits was archaeologically monitored by Heneb, and a report produced on the findings [12]. The sequence of deposits identified in the test pits comprised shingle and cobbles overlying shell-rich sands, with these sediments broadly consistent with foreshore and nearshore deposition at the mouth of the Mawddach. In addition to the sequence of sediments, parts of the modern coastal defences and structural elements of the sea wall were exposed during the works. However, no features or deposits of archaeological significance were identified during the works. The report notes that the foreshore is a dynamic environment, shaped by storm events, tidal asymmetry, and glacial inheritance, resulting on a locally varable pattern of survival of paleoenvironmental deposits. While no earlier archaeological horizons were identified during the archaeological monitoring the report concludes that, the potential for such remains to occur locally remains high.

9.5.19 Within the wider study area, outside of the Site to the east, the superficial geology is Devensian till, which formed between 116 and 11.8 thousand years ago.

Registered Historic Landscapes

9.5.20 The Site lies within the area of two Registered Historic Landscapes of Outstanding Historic Interest, the Ardudwy Historic Landscape to the north and the Mawddach to the south.

9.5.21 The lowland area of the Ardudwy Historic Landscape comprises the coastal plain, narrower to the south where the Site lies, but wider to the north in Morfa Dyffryn and Morfa Harlech. Within the overarching Ardudwy Registered Historic Landscape, Heneb have identified two Historic Landscape Character Areas:

Southern Coastal Strip (PRN: 18236) and Fieldscape, lower hill slopes (PRN: 18234) [13].

9.5.22 The Southern Coastal Strip has a historic landscape character which developed from a farming landscape to one of seaside resort in the 20th century. The fieldscape historic landscape character area lies to the east of the Site but within the study area. It is also notable for its evidence for prehistoric settlement as well as for its pattern of large, regular fields divided by drystone walls.

9.5.23 The Mawddach historic landscape includes the most southern part of the Site, closer to the Mawddach estuary. Within the overarching Registered Historic Landscape, Heneb have identified two Historic Landscape Character Areas: Barmouth (PRN: 18331) and Dinas Oleu rocky heights (PRN: 18332) [14].

9.5.24 Barmouth is situated to the northern side of the Mawddach Estuary, and it was a small, hard to access, fishing settlement until the 18th century, when the town's economy grew substantially. The first reason for this was its location by the sea. Shipbuilding had begun in the areas in the 1750s and, by 1770, Barmouth was established as a small port in coastal trade, mostly based on the Meirionnydd woollen industry. The expansion of the trade, which counted a hundred ships registered in the port in 1795, prompted an Act of Parliament for the enlargement of the harbour in 1797. The coastal trade continued until the opening of the railway in 1867, which contributed to the decline of the port.

9.5.25 However, the opening of the coastal Cambrian Railway in 1867, led to a second major driver of growth for the town. The railway bridged the estuary, dramatically altering the landscape and opening the door to tourism and holidaymaking. This led to the development of Barmouth's distinctive Victorian architectural character. The railway stimulated a major campaign of building including the rebuilding of existing hotels, such as the Cors y Gedol which was rebuilt in 1873, and several new boarding houses and domestic terraces. A public water supply was opened in 1873, and commercial establishments, shops and banks opened.

9.5.26 The second historic landscape character area identified by Heneb within the study area is the Dinas Oleu rocky heights. It is a rocky headland which stands above the town of Barmouth to the east of the Site. It was donated to the National Trust in 1895 [14].

Prehistoric (1,000,000BCE – 43CE)

9.5.27 There is limited evidence from the Palaeolithic period in Wales as a whole, with the last glaciation appearing to have removed the majority of evidence from this time [15]. Some of the earliest evidence for human activity in Wales can be found at Bontnewydd near St Asaph where a fragment of Neanderthal upper jaw bone was found in a cave in the River Elwy valley, some 45km north of Barmouth. The individual probably lived during an interglacial period in c.230,000BCE during the Palaeolithic (c.1,000,000BCE – 8,500BCE). The human presence within Wales appears to have been intermittent during the Palaeolithic with an apparent absence from about 21,000 years ago until roughly 13,000 years ago [16]. There are no recorded Palaeolithic sites or finds within the study area.

9.5.28 As the last ice age ended and the climate warmed at the start of the Holocene, sea levels rose. Present understanding of changing sea levels since the beginning of the Holocene is that the sea levels have risen some 55m and much of what is now the seabed and intertidal zone would have been dry land before

inundation beginning some 12,000 years ago. Exposures of intertidal peat and submerged forest deposits at Clarach, Borth, Tywyn, Llanbedr and Morfa Dyffryn, to the north of the Site, provide proof of inundated landscapes dating back to the end of the last ice age, while petrified remains of trees found at Ynyslas and in the Dyfi Estuary, date back 4,500 years.

9.5.29 Britain was recolonised by humans during the Mesolithic period (8,500BCE – 4,000BCE), with the environment and climate beginning to stabilise around 7,000BCE. While evidence for human activity during the Mesolithic period has been recorded throughout Wales, the recovery of stratified remains is rare, with the earliest confidently dated Mesolithic site in Wales in use around 9,200 years ago [16].

9.5.30 Although there are no recorded Mesolithic sites or finds within the study area, it is possible that a land surface contemporary with the Mesolithic period, potentially containing artefacts and paleoenvironmental evidence, is submerged or buried within the Site.

9.5.31 The earliest recorded farming communities in Wales date from c.4,000BCE and mark the beginning of the Neolithic period (4,000BCE – 2,200BCE). The cultural shift from semi-nomadic to permanent settlement sites and agricultural practice brought with it considerable change, including the construction of complex, large stone funerary monuments [16]. The HER records a possible standing stone (PRN: 103566) in the northeast of the study area, which may date to Late Neolithic or Bronze Age period.

9.5.32 Metal tools are first recorded in Wales late in the Neolithic in c.2,500BCE [17]. These early metal tools would have been composite copper implements, and it was not until the Neolithic to Bronze Age transition (2,200BCE – 700BCE) that the knowledge, skill, and technology to alloy copper with tin became prominent. During the late Bronze Age more advanced and complex tools, objects, decorations, and weapons were being produced and increasingly began to reflect regional styles [16]. The HER records that a Bronze Age bronze looped socketed spearhead (PRN: 4173) was found in a peatmoss near Barmouth in c.1869, although its precise findspot and present whereabouts are unknown.

9.5.33 By the Iron Age (700BCE – 43CE) Wales could be broadly divided into four tribal regions based on the tool typologies and artistic styles which began to appear on metalwork during the late Bronze Age. These regions comprise the lands of the *Ordovīces* in mid- and north Wales and the Isle of Anglesey, those of the *Deceangli* in northeast Wales, of the *Demetae* in southwest Wales, and of the *Silures* in southeast Wales [16]. The extent of the Ordovīces tribal lands is unconfirmed; it may have been limited to the region north of the River Dyfi and River Dee but could have also included the study area.

9.5.34 A round bottomed bronze bowl (PRN: 4164) recorded in 1905 was said to have been found in the marsh near the sea at Barmouth. The archaeologist Arthur Evans considered it to be a pre-Roman import from Italy, or of 'Late Celtic' work, and it is likely that it was imported in the Late Iron Age or Roman period (PRN: 4164).

Roman (43CE – 410CE)

9.5.35 The *Ordovīces* resisted the Roman (43CE – 410CE) occupation of their territory until 77CE-78CE when their surviving stronghold on the Isle of Anglesey was overcome.

9.5.36 The HER records the find of a copper alloy penannular finger ring (PRN: 24131) decorated with snake head terminals of Roman date (c.100-c.300CE) within the study area.

Early Medieval (410CE – 1086CE)

9.5.37 Following the withdrawal of direct rule from Rome in 410CE, the study area and its environs became part of the sub-kingdom of *Dunoding*, within the larger Kingdom of Gwynedd. Emerging throughout the mid-5th century the Kingdom of Gwynedd and its rulers were important throughout the Early Medieval period, retaining a high degree of political influence and physical dominance over north Wales until the Norman invasion of Wales between 1067 and 1081

9.5.38 Bodfan, a Welsh saint, is recorded as having established the first church at Llanaber, in the northern part of the study area, in the 6th century, likely in the location now occupied by the Medieval St Mary and St Bodfan Church (Grade I listed building, RN: 4906).

9.5.39 Displayed within St Mary and St Bodfan Church are two Early Medieval inscribed stones, both of a 5th or early 6th century date which were found within the study area. One, known as is the Calixtus Stone (findspot PRN: 6897), is a rough pillar stone, 1.3m x 0.5m x 0.25m, and was placed in the church in the 19th century and having been previously used as a footbridge at the neighbouring Beilwart farm. The inscription has been read as: CAELIXTUS MONEDO REGI and is thought to mean 'Calixtus King of Mona'. The second (findspot PRN: 6895) is a rough pillar stone of local Cambrian grit, 1.5m x 0.35m x 0.2m, inscribed AETERN[I(?)] / ET / AETERN[(A)E(?). The stone commemorates Aeternus and Aeterna, presumably a brother and a sister, and most probably a pair of twins [18]. Both of the inscribed stones were recorded by antiquary Lewis Morris in c.1737 [18].

9.5.40 The second stone was found buried in sand 20ft (6m) below the high-water mark by workmen during the building of the Barmouth seawall in February 1931 [18]. It is likely that the stone was *in situ* and was buried by tidally deposited and/or wind-blown sand over time, before being uncovered by the workmen.

Medieval (1086CE – 1536CE)

9.5.41 The Norman invasion of Wales was largely undertaken in the 1080s and 1090s, when the Normans attacked and occupied areas across the country of Wales. The Principality of Gwynedd remained independent until the death of Llywelyn II in 1282, after which it was annexed to England. Under the terms of the Statute of Rhuddlan in 1284, Wales was re-organised into six shires, with the study area falling within Merionethshire.

9.5.42 In 1188, the chronicler Gerald of Wales described a journey around Wales, which involved crossing over the mouth of the Mawddach by ferry, indicating that a ferry was operating at this time.

9.5.43 St Mary and St Bodfan Church, Llanaber (Grade I listed building, RN: 4906), within the northern part of the study area, largely dates from the early 13th century, with elements of the building showing the transition from Norman architecture to the Early English Style. The chancel is a remodelling of an earlier one, which may date to the 12th century. The founding of the church has been attributed to Hywel ap Gruffydd ap Cynan, a benefactor of Cymer Abbey, and great-grandson of Owain Gwynedd. A fragment of a late 13th century stone

expanded-arm cross was found in 1858 when the west wall of the church was being taken down and is now built into the face of the west end of the nave. The church was substantively restored in 1860.

9.5.44 Within Barmouth itself is a late Medieval first floor hall house, known as Ty Gwyn y Bermo (RN: 4897). Located on the quay, it was built between 1460 and 1485 by Gryffydd Fychan of Corsygedol, a Lancastrian and one of the principal supporters of Jasper Tudor, Earl of Pembroke. It is a Grade II* listed building.

Post Medieval (1536CE – 1899CE)

9.5.45 The Act of Union of 1536 joined Wales to England. The earliest documentary record of a community in Barmouth is in the ‘Survey of the Ports, Creeks and landing places on the Welsh Coast', from 1565, commissioned by Queen Elizabeth I. This states that Barmouth had only four houses, as well as two little boats used to carry passengers over the estuary [14]. It is likely that these houses were on the steep hill side to the east of the estuary, where early historic core of the settlement was located.

9.5.46 Barmouth remained a relatively small and inaccessible fishing settlement until it started to rapidly develop from the 1750s, when boat-building started within the town, as a trading port and boat-building centre. A 1748 map of Barmouth and its harbour, drawn before its rapid development in the second half of that century, shows the town as being tightly focused on land on the northern side of estuary and the high ground near this to the northwest [19]. The map does not show streets, but rather six buildings clustered together that are indicative of the settlement. The sand dunes are labelled as ‘sand hills’ and the land near these and the flatter beach to the west where the Site is located is undeveloped at this time [19].

9.5.47 By 1770, the town was well-established as a small port in coastal trades, based largely on the Meirionnydd woollen industry. Other exports were also mostly derived from the Mawddach valley, and included wood, paving stones, slate, and cloth from the mills in Dolgellau. With land routes still difficult the wool and other exports was shipped out of the port of Barmouth, feeding a boom in local ship building. In just 20 years from 1770 to 1790, records show that a total of 138 vessels were built on the Mawddach estuary. In 1795, a hundred ships registered in the port at Barmouth, and in 1797 an Act of Parliament was undertaken for the enlargement of the harbour. The extent of Barmouth Harbour is shown on Graphic 9-1.

Graphic 9-1 1795 map of Barmouth by John Evans. Six Counties of North Wales. Print. The National Library of Wales. Reproduced under a Creative Commons license

9.5.48 An 1801 map, drawn to show the route of the turnpike road from Barmouth to Llanelltyd, shows a similar view to the 1795 map, and shows that at this time Barmouth still comprised buildings clustered tightly together near to the estuary along High Street [20]. It also shows three buildings to the west of this main street, probably indicating some expansion of the town out to the west by this time, although the beach and beachfront within the Site was still undeveloped [20].

9.5.49 In the first half of the 19th century, Barmouth was well-known for its shipbuilding and for exports of minerals, including copper and gold from Snowdonia. Reflecting the town's importance in maritime trade, there are a number of shipwrecks recorded within the study area in the early to mid-19th century. In 1805, the Caminha (NPRN: 272691), a Portuguese brig on passage from Oporto to London with a cargo of wine and fruit, was embayed to the north of Sarn Badrig's Causeway and eventually went onshore and was totally wrecked near Barmouth.

9.5.50 In February 1825, The Neptune (NPRN: 273325), a wooden sailing vessel on passage from New Orleans to Liverpool, was wrecked near Barmouth. The crew and cargo were saved.

9.5.51 In October 1825, two wooden sailing ships, the Jane (NPRN: 519260) and the Linnet (NPRN: 519261), both on the passage from Porthmadoc to Cardiff, went ashore at near Barmouth during a violent gale. The crews of both vessels were saved.

9.5.52 In 1843, the Bertholly (NPRN: 273353), a wooden schooner, was driven ashore two miles north of Sarn-y-bwch. The vessel was later recovered.

9.5.53 Also in 1843, the Edwin (NPRN: 273354), a wooden schooner built in 1840 that was carrying a cargo of coal from Mostyn to Barmouth, went on shore a half mile north of Barmouth. During an exceptionally low tide in March 1934, the hull timbers of the wreck were uncovered, and a short length of anchor chain was recovered. A link from the chain was used for a memorial plaque now held at the Barmouth Sailor's Institute.

9.5.54 Part of a large wooden rudder was washed ashore at Barmouth in 1998 and is from an unknown shipwreck (NPRN: 506539). The rudder is now on display at Barmouth museum.

9.5.55 In the early decades of the 19th century, during the Romantic movement, Barmouth became a tourist destination and a favourite stop on tours of north Wales by wealthy travellers.

9.5.56 The 1844 tithe map of the Parish of Llanaber shows that the town of Barmouth at this time was still focused on High Street, with the beach and seafront within the Site remaining undeveloped. The tithe map is held in the National Library of Wales and is not reproduced due to copyright restrictions.

9.5.57 In 1867, the opening of the coastal Cambrian Railway (which linked Aberystwyth with Pwllheli), which included a permanent bridge across the mouth of the estuary, brought in increasing numbers of tourists, particularly workers and their families, who came in large numbers from the factories of the West Midlands.

9.5.58 The influx of tourists sparked by the opening of the railway (PRN: 34919) stimulated the expansion of the town, and the use of the beachfront for leisure activities, especially sea bathing, which had become fashionable in the Victorian period. In the 1878, Marine Terrace, a large-scale development which included a large hotel, was built on the beachfront to the east of the Site. A triangle of land in front of this Site was laid out according to a more formal plan and named Marine Parade. Its structured formality was likely due in part due to the activities of the Local Board, the first one of which was elected in 1872. Marine Parade included a promenade along the beachfront in front of Marine Terrace. Late 19th century photographs of Barmouth show people walking along Marine Parade, as well as people walking and sitting on the beach in front of Marine Terrace, and sea bathing, which become popular in this period [21]

9.5.59 To accommodate the growing population, in 1873 a reservoir was built at Llyn Bodlyn, above Talybont, to provide Barmouth's public water supply. The growing population also required an upgraded sewerage system. In 1890 a new holding tank and discharge pipe were completed. Running for around 150 metres across the beach within the Site, the flap-operated, cast-iron pipe discharged raw sewage into the sea at high tide [22].

9.5.60 In 1893, plans were drawn up for a sea wall to protect the harbour [23]. This wall was relatively short and was located to the east of and outside of the Site, closer to Barmouth Harbour.

9.5.61 In 1889, St John's Church (RN: 15467), designated a Grade II* listed building, was built specifically to provide for the town's population of English-speaking visitors.

9.5.62 Graphic 9-2 shows the Site in the late 1880s. The beachfront was undeveloped at this time, although the line of the 1890 sewer line is shown, perhaps indicating that was under construction at this time.

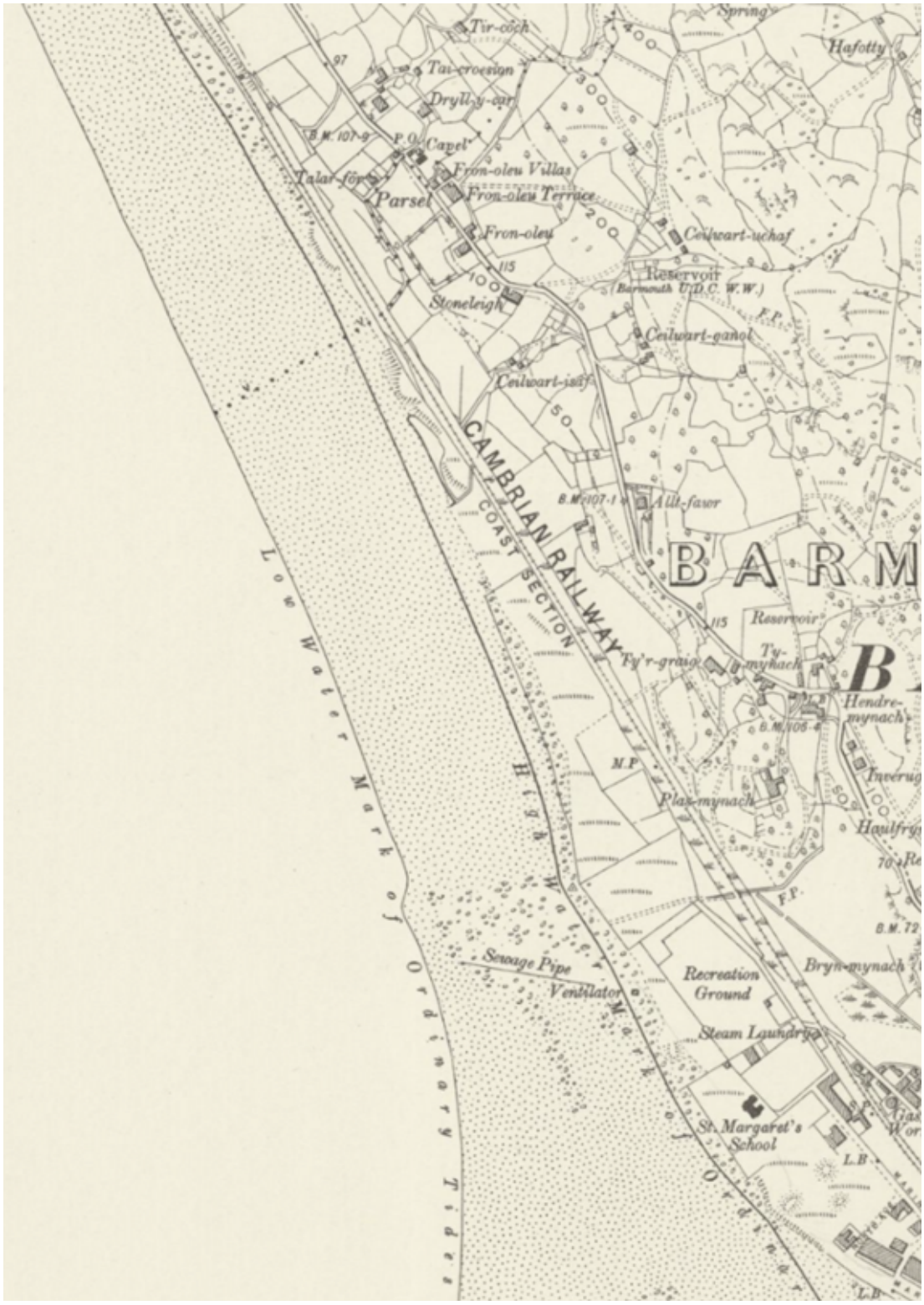
Graphic 9-2 1888 Ordnance Survey six-inch map of the Site. Surveyed 1887. Merionethshire Sheet XXXVI.NW. Reproduced with permission of National Library of Scotland under a CC BY (Creative Commons Attribution) licence

20th century (1900CE – 1999CE)

9.5.63 Graphic 9-3 shows the Site in at the start of the 20th century. The beachfront was still undeveloped at this time, although the 1890 sewer line was in place by this time.

9.5.64 A map included in the 1909 guidebook *History of Barmouth and its Vicinity*, shows that at this time the bathing beach was the area of beach closest to the town and near to the estuary, and outside of the Site [24]. It was noted that this beach:

"is all fine smooth sand and is deservedly popular among children and bathers. Viewed from these sands, the appearance of the town is particularly Romantic, and is said to resemble strangely the fortification of Gibraltar" [24].



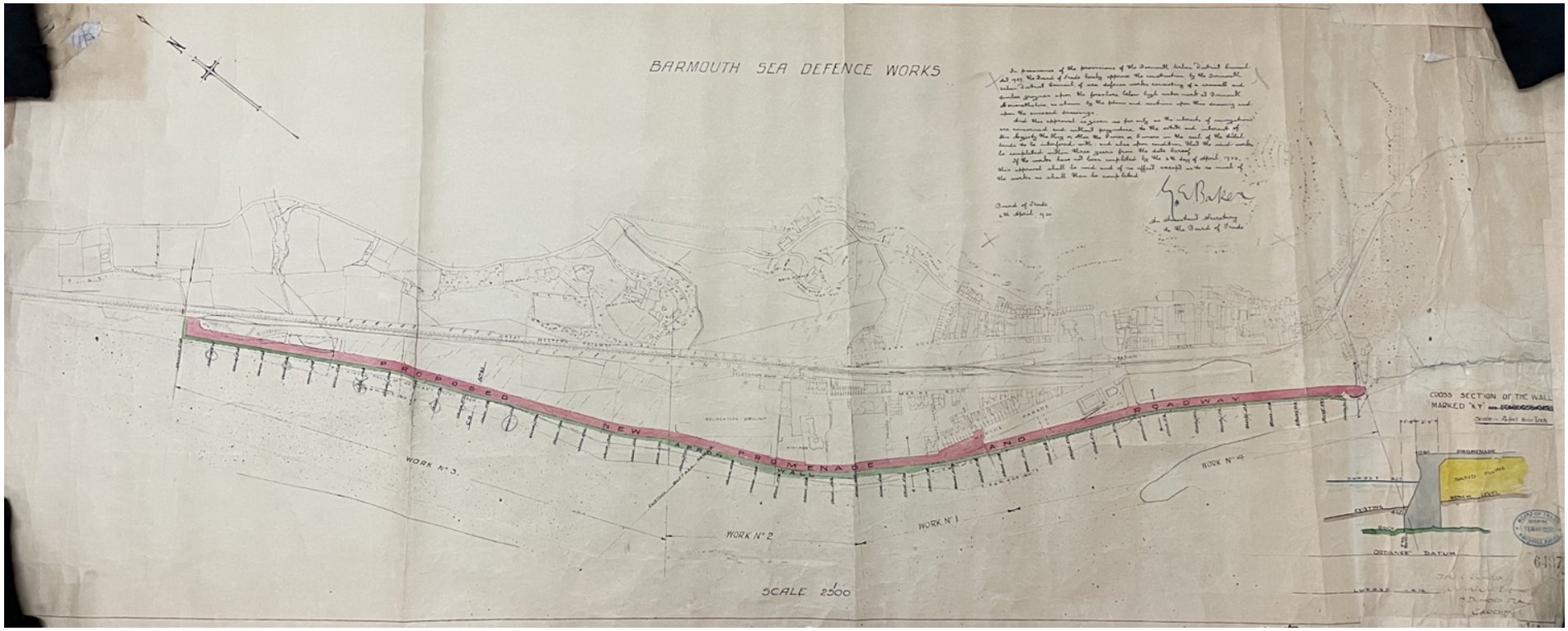
Graphic 9-3 1901 Ordnance Survey six-inch map of the Site. Revised 1900. Merionethshire Sheet XXXVI.NW. Reproduced with permission of National Library of Scotland under a CC BY (Creative Commons Attribution) licence.

9.5.65 In 1925, the Cardiff engineer Stanley L. Richards drew up plans, sections, and elevations, for new sea defences in Barmouth [25]. This scheme of works was to be located to the immediate north of Marine Parade, the promenade along the beachfront in front of Marine Terrace, on land partially within the Site.

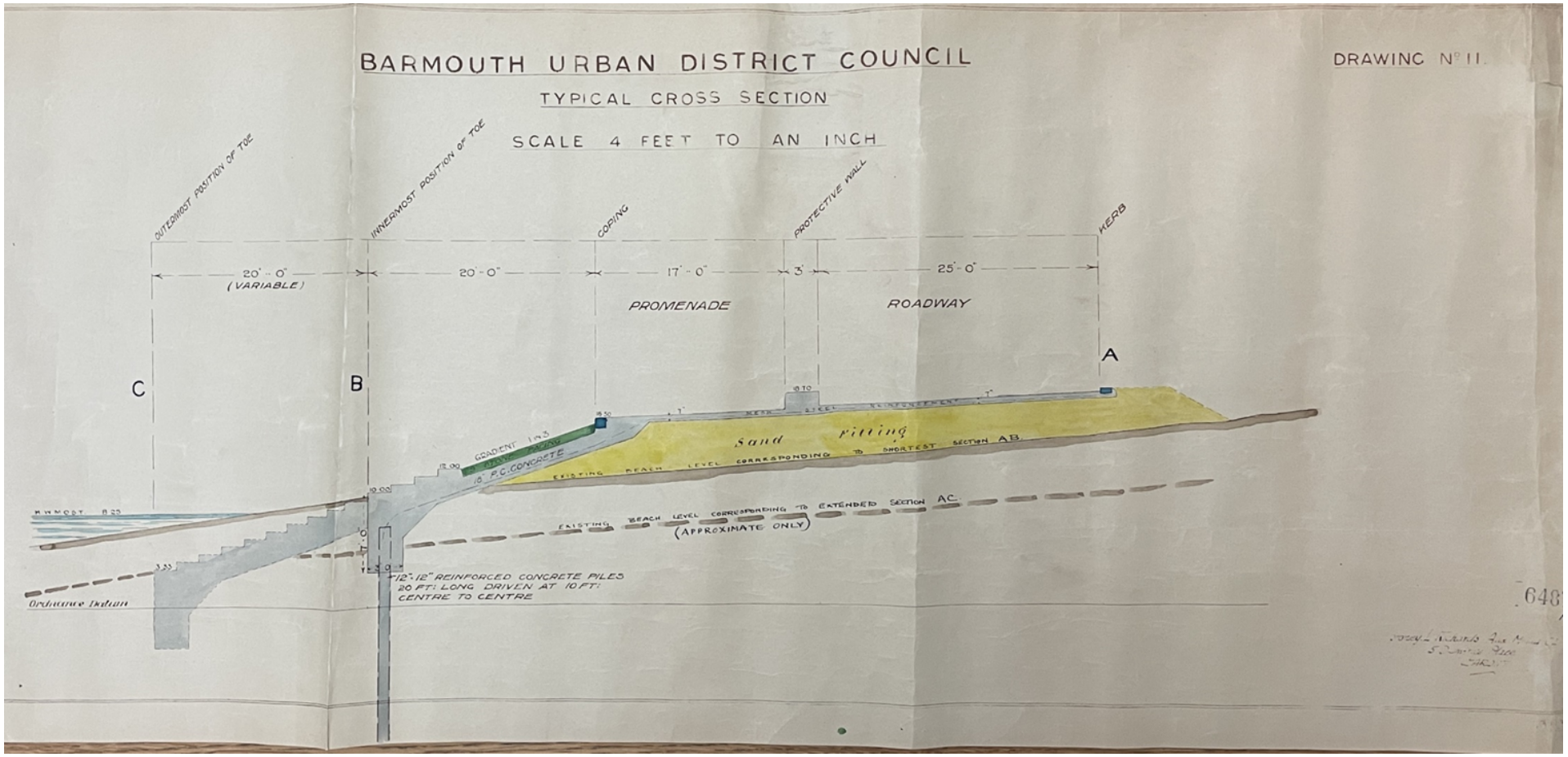
9.5.66 After economic growth in the first two decades of the 20th century, Wales's industries endured a prolonged slump from the early 1920s to the late 1930s, leading to widespread unemployment and poverty, and Richard's sea defence scheme was not constructed.

9.5.67 In 1928 a great storm devastated sections of the Barmouth's promenade. Subsequently, in January 1929, a meeting of Barmouth ratepayers adopted a resolution in favour of the promotion of a parliamentary bill empowering the council to construct seawalls and promenades, to acquire Barmouth harbour, and to bring electricity to the town.

9.5.68 In 1929, Barmouth Urban District Council promoted a new scheme of defences designed by Stanley L. Richards on the same design as his 1925 plans, but on a much larger scale, with the defences to extend for a length of a mile and half of beachfront. The Board of Trade approved the construction of the sea defences in 1929, and in 1930 plans (shown in Graphic 9-4 and Graphic 9-5) for the sea defences were drawn up by Richards [26].



Graphic 9-4 Richards, S.L. 1930. Barmouth Sea Defence Works. National Archives. Reference: BT 356/8975/PT4



Graphic 9-5 Richards, S.L. 1930. Barmouth Sea Defence Works. Typical Cross Section. National Archives. Reference: BT 356/8975/PT3

9.5.69 On April 1930, Barmouth Urban Council accepted the tender of the Demolition and Construction Co. London for constructing the sea defence scheme, which was to comprise a promenade, seawalls, and roads, and dredging Barmouth Harbour [27]. The Unemployment Grants Committee gave a grant of 75% toward the scheme, and Stanley L. Richards was placed in charge of the construction of the works. The resident engineer was A.G. Booth of Sheffield, while the principal contractors were the Demolition and Construction Company Ltd of Westminster [28].

9.5.70 Photographs of the works in progress show that they employed rails laid on timber sleepers on the beach, which were used for a tall steam-powered piling rig, which drove in the timber piles for the groynes [21]. Rails also appear (PRN: 400450) to have been laid on the beach for hand-pushed metal mine-style carts, while timber boards were also laid on the beach to form walkways [21]. Hand tools including wheelbarrows, buckets, and shovels were also used. Photographs also show metal mine-style carts abandoned on the beach and being covered by drifts of sand [21].

9.5.71 The sea defences completed in under three years and were declared open by David Lloyd George on 22nd September 1933. The completed sea defences protected the whole of the seafront within the urban area along a length of one and half miles and comprised a sloping apron sea wall of concrete faced with Welsh granite, the lower portion being stepped and the toe carried into the beach and supported by piles, approx. 7,200ft (2.2km) long, with a reinforced concrete promenade, roadway or carriage drive, and footpath, as well as 46 timber groynes [29].

9.5.72 The apron wall was constructed at a slope of one in three, the lower portion consisting of concrete steps with 2ft treads and 8-inch rise, and the upper portion of concrete reinforced with 6-inch mesh B.R.C fabric and faced with North Wales granite. The minimum thickness of the apron wall was 2ft 3 inches (69cm). The granite coping of the apron wall was set at the same level along the whole of the wall, which was 16.5ft (5m) above ordnance datum and was constructed of 12-inch by 9-inch dressed granite [29].

9.5.73 The toe wall was a reinforced concrete beam, 7ft (2.13m) deep by 3ft (91cm) thick, carried on 12-inch by 12-inch reinforced concrete piles driven at 10ft (3m) centres to a depth of about 24ft (7.32m) below the beach level [29].

9.5.74 The promenade was keyed into the apron wall and was 18ft 6 inches wide (5.64m) and the roadway 25ft (7.62m) wide. Both were of reinforced concrete, and both had a cross fall seaward of one in 24 in order to drain off surface water [29]. They consisted of a 7-inch (18cm) thickness of concrete reinforced with 6-inch mesh reinforcement and were constructed on the alternate bay method, with expansion joints provided at regular intervals throughout the length of the work. The backing or filling behind the apron wall and below the promenade and roadway consisted of sand filled up to a level of 8ft above highwater mark. Provision was made for dealing with land and storm water, which was carried in cast iron pipes through the work and discharged through 30-inch pipes carried on pitch pine cradles on the foreshore.

9.5.75 A protective wall 3ft. wide was intended to divide the promenade from the roadway. This wall was:

“Intended as a base for seating and as a screen to trap blown sand” [28].

9.5.76 This wall was built of coursed stone rubble, with a distinctive spiked stone top, and was referred to as a cock'n hen parapet wall (Liverpool Daily Post, 1968).

9.5.77 Each of the 46 timber groynes was 150ft (46m) long and the groynes were positioned 150ft (46m) apart, at right angles to the seawall [29]. The groynes were made of creosoted pine supplied by Robinson, David, and Co. Ltd. of Cardiff, and were mainly intended to protect the toe wall, although they gave further actual protection by raising the level of the beach by as much as 10ft (3m) in places.

9.5.78 Electricity was brought to the town during the construction of the scheme, with the work of laying the cables on the promenade being undertaken by Messers Overhead Ltd of London [29].

9.5.79 The project sought to use local material as far as possible, and the whole of the concrete aggregate, about 52,000 tonnes, was quarried and crushed in the town. All the concrete piles and kerbs were cast on the Site, while the stone facing used for the sea wall was obtained from Minffordd, in the same county as Barmouth, while the dressed granite coping was quarried at Trefor, Caernarvonshire [29].

9.5.80 The construction works employed four hundred men at one time, and it was a condition of that grant that 20 per cent of the men employed were brought in from distressed areas. These men were mainly drawn from the economically depressed areas of South Wales and from the North of England. The total cost of the works at completion was about £170,000 with about 63 per cent of this sum contributed by the Unemployment Grants Committee [29].

9.5.81 The sea defence scheme considerably increased the popularity of Barmouth as a tourist destination, and increased access to and visits to the land within the Site in particular.

9.5.82 On the opening of the scheme the press reported that:

"Against almost insurmountable difficulties the engineers pushed forward with ingenious defences, and today they hold the enemy at bay" [30].

9.5.83 The Liverpool Echo declared that:

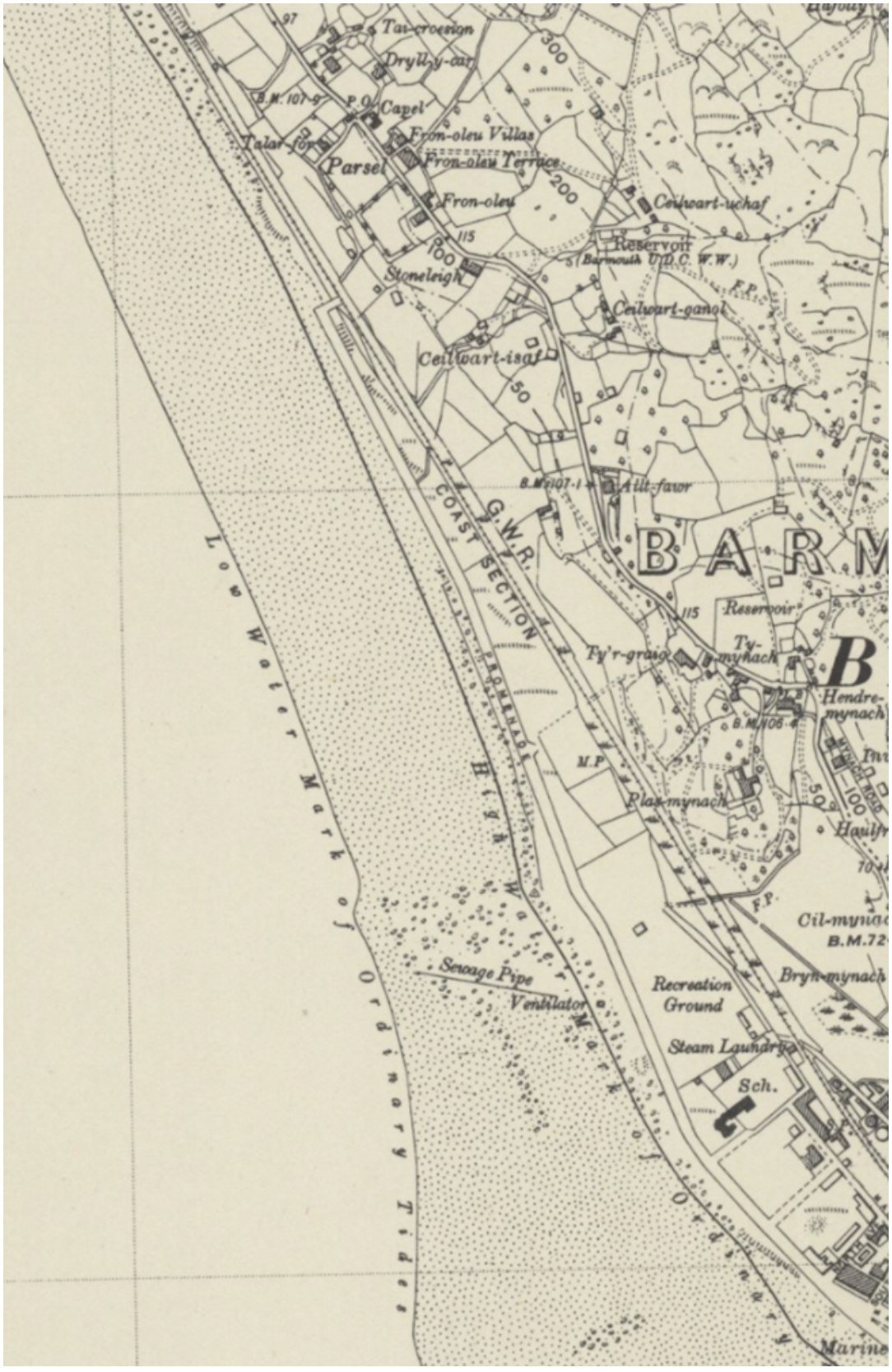
"It is one of the most ambitious schemes of its kind in the country and represents man's achievement in grappling for years with the sea, which has threatened to destroy the town of Barmouth" [31].

9.5.84 It was also noted that:

"The town as a seaside resort has been very considerably improved as the result of these improvements, and the number of visitors during the past season, which was more than double that of any previous season, speaks well for the future" [29].

9.5.85 In his role as patron of the National Council of Social Service and as part of a tour of Welsh unemployment centres, The Prince of Wales visited the completed sea defences in May 1934, and drove along the promenade [32].

9.5.86 Graphic 9-6 shows the Site in 1938. This map shows the completed sea defence scheme, including the promenade.

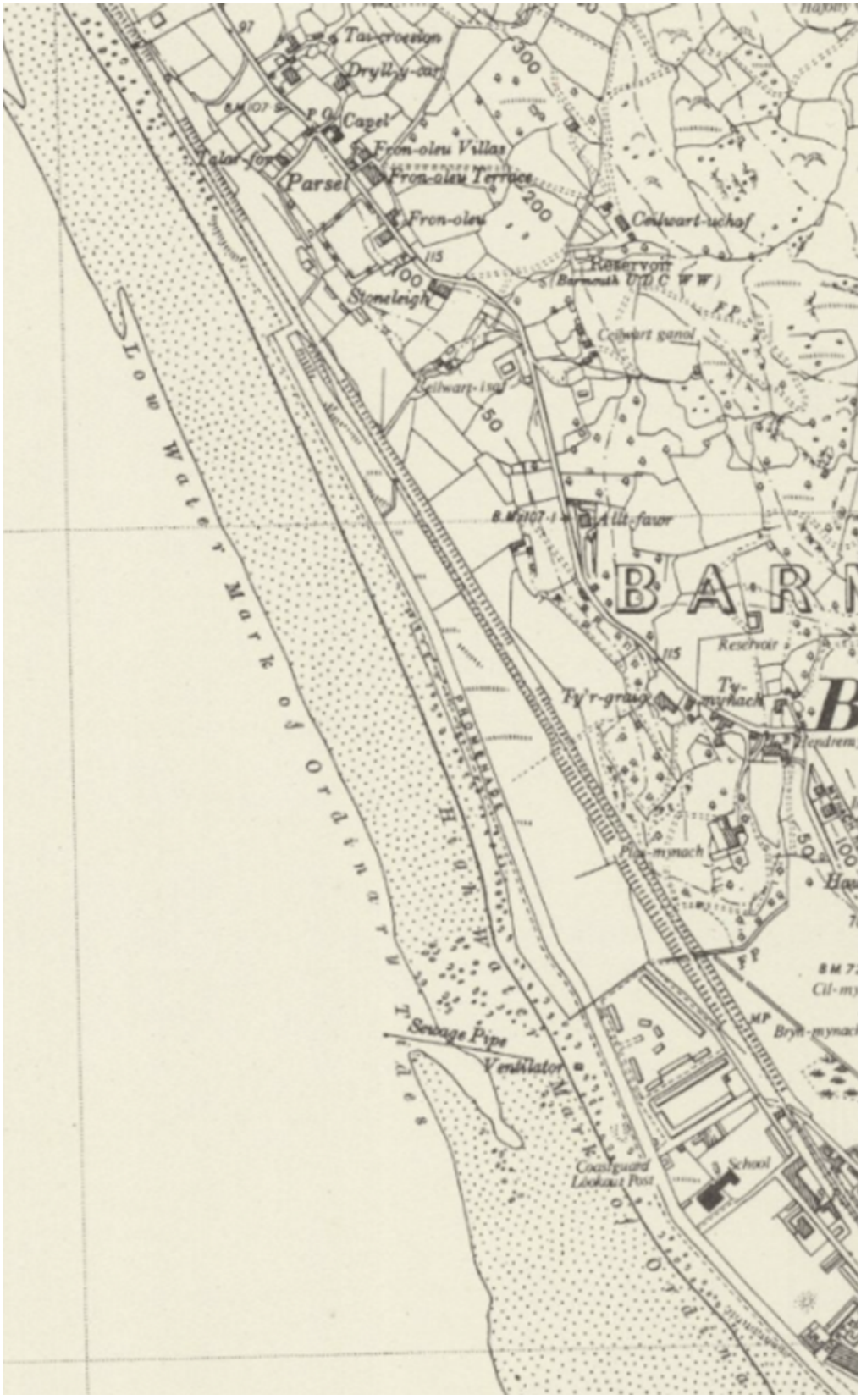


Graphic 9-6 1938 Ordnance Survey six-inch map of the Site. Merionethshire Sheet XXXVI.NW. Reproduced with permission of National Library of Scotland under a CC BY (Creative Commons Attribution) licence.

9.5.87 In 1939 the Second World War broke out. An aerial photograph (not reproduced) taken in 1941 shows a system of trenches close to the beach at Barmouth.

These were located outside of the Site in the area is now occupied by residential housing estates (PRN: 34158). There is also documentary evidence of an aircraft crash of a military training plane in 1941, which led to the death of two servicemen. The site of the crash is not known precisely, but any remains of the aircraft would be considered Protected Military Remains if present (PRN: 515634).

9.5.88 The 1953 1:25,000 OS Outline Series map, revised in 1952, shows a rectangular structure fronting onto the promenade, which is likely the concrete and metal wind and rain shelter which is still present at this location. While this shelter was in place by 1952 when the outline series map was revised, it is not shown on 1953 25-inch OS map, which was revised in 1949 (Graphic 9-7), implying that it was likely erected between 1949 and 1952.



Graphic 9-7 1953 Ordnance Survey six-inch map of the Site. Revised 1949. Merionethshire Sheet XXXVI.NW. Reproduced with permission of National Library of Scotland under a CC BY (Creative Commons Attribution) licence.

9.5.89 In 1954, plans were drawn up for a £37,000 scheme was undertaken to provide for repairs to the seawall, estimated at £29,000, construction of groynes at

£7,500, and the formation of expansion joints in the back wall [33] [34]. These works were undertaken in 1955.

9.5.90 In 1967 storms caused thousands of pounds worth of damage to the sea defences [35]. Subsequently, in January 1968, plans were submitted for a £240,000 scheme of sea defence works, including a barrier from the shore across the channel to Ynys-Y-Bawd Island at £44,000, the rebuilding of the harbour quay wall at £11,000, and a wave return wall at £82,000 [35]. The wave return wall was to be a curved wall which would cause the sea to curl back on itself and was to be 3ft 6 inches in height along the entire one-and-a-half miles length of the promenade, as a parapet at the crest of the existing apron wall. The works also included the repair of the promenade and construction of steps at the existing access points. A substantial sum was also estimated in regard to the construction and reconstruction of groynes.

9.5.91 In November 1968, as the council pushed to get the scheme approved, it was reported that further damage had occurred to the sea defences, with the Liverpool Post reporting that:

"Sandbags are a housing estate's last-ditch protection from the cruel sea. Giant waves pounding against the parapet wall on Barmouth's promenade have breached it in several places. Now people on the seafront estate live in fear of King Neptune's wrath. They dread the high tides, when sea water has been known to reach their front gardens or rush down an alleyway at the back of a block of flats" [36].

9.5.92 In that same year, it was reported that the cock'n hen parapet wall had washed away and been demolished in parts [36].

9.5.93 The £240,000 scheme was approved and in November 1970, the Prince of Wales was invited to lay foundation stone [37]. The scheme was completed and by 1974 it was reported that the:

"wave return wall, built as part of Barmouth's major sea defence scheme, has already proved its worth during high tides and storms" [38].

9.5.94 In 1987, the 1890 holding tank and sewerage discharge pipe were replaced by a new pipe, buried beneath the beach, which discharges treated waste [22]. A sewage plant and pumping station was built the same time. The 1890 pipe was not removed and remains buried nearby [22].

9.5.95 Graphic 9-8 shows the Site in 2006, and Graphic 9-9 shows the Site in 2020. Both images how the existing sea defences, including promenade and groynes, and the 1987 sewerage pipe.

9.5.96 In October 2021, shifting sand patterns revealed three sections of narrow-gauge rail track on the beach within the Site, as well as a pair of wheels [17] (PRN: 100450). These may be associated with the installation of the 1890 sewer pipe, late 19th or early 20th century sea bathing, or the construction of the 1930s sea defences.

9.5.97 Since the 1970s to the present, Barmouth has continued to face pressure from the sea, with recent storms bringing flooding and damaging the existing sea defences. In March 2021 around 180 square metres of the northern promenade collapsed following high tides and strong winds [22].

9.5.98 Damage observed on the site visit undertaken in October 2024 included the collapse of part of the stone wall diving the promenade from the roadway at the northern end of the Site.

9.5.99 The HER records the find of animal bones (PRN: 6889) eroding out of the beach at base a of shingle bank, 10-15cm deep, within the Site. The bones appeared to be part of a full skeleton of a large animal, possible a deer or cow. A dark clay/sandy layer nearby which appeared to be an old ground surface. Wood was reported to be present in peat further to the north of this find. The date of this find is not recorded, and it could be prehistoric in date.

Graphic 9-8 Aerial imagery of the Site, dated December 2006. Google Earth Pro

Graphic 9-9 Aerial imagery of the Site, dated April 2020. Google Earth Pro

Walkover survey

9.5.100 A site visit and walkover survey were undertaken on 21st October 2024. The whole length of the promenade and roadway within the Site was walked along by day and at night. The beachfront within the Site was also visited, as were the conservation area and listed buildings within the study area.

9.5.101 Photograph 1 through to Photograph 10 show the existing sea defences, including the primary, central and secondary sea walls which date from the 1930s through to the 1970s, while Photograph 11 and Photograph 12 show the likely c.1950 concrete rain shelter.

Photograph 1 View north along the promenade and roadway from the southern end of the Site. Shingle is covering the 1930s stone-faced apron wall which forms part of the Primary Wall

Photograph 2 View north along the promenade, showing the Primary Wall (left), Central Wall (centre) diving the promenade and roadway, and the Secondary Wall (right)

Photograph 3 View north along the beachfront, showing the Primary Wall, timber groynes, and shingle steps down to the beach

Photograph 4 View northwest showing the beach and timber groynes

Photograph 5 View west showing timber groyne (right) and timber cradle (left)

Photograph 6 View north showing the 1930s stone-faced apron wall which forms part of the Primary Wall

Photograph 7 View south showing the 1930s stone-faced apron wall and stone steps, 1930s concrete stepped sea wall, and 1970s wave return wall which form part of the Primary Wall

Photograph 8 View south showing the 1930s stone-faced apron wall and stone steps, 1930s concrete stepped sea wall, and 1970s wave return wall which form part of the Primary Wall

Photograph 9 View west showing the northern end of the 1930s sea defences, with 1930s stone-faced apron wall and concrete stepped sea wall, and 1970s wave return wall, which form part of the Primary Wall

Photograph 10 View north showing storm damage to the Central Wall dividing the promenade and roadway

Photograph 11 View west of rear of rain shelter

Photograph 12 View east of front of rain shelter

Archaeological Potential

9.5.102 Present understanding of changing sea levels since the beginning of the Holocene confirms that the sea levels have risen some 55m, and the seabed, intertidal zone, and land within the Site would have been land before inundation beginning some 12,000 years ago. Exposures of intertidal peat and submerged forest deposits at elsewhere in the region provide evidence of inundated landscapes dating back to the end of the last ice age and later. Locally, The HER records evidence of animal bones (PRN: 6689) eroding out of the beach at base a of shingle bank within the Site, with a dark clay/sandy layer nearby which appeared to be an old ground surface, and wood was reported to be present in peat further to the north of this find.

9.5.103 In early 2025, a programme of Ground Investigation, comprising several boreholes, was undertaken along the North Promenade on the landside, with the boreholes being drilled through the concrete surface of the promenade itself [39]. Borehole BH02 found a deep natural layer of very loose greyish brown silty sand from 2.40m below the ground surface, which was sealed by the layers of made ground laid down for the construction of the promenade. Between 2.40m and 3.65m below the ground surface, in the upper part of the layer, this layer contained pockets of plastic grey pseudo-fibrous peat. As ground level in this location was 5.03m below Ordnance Datum (OD), the peat was present from 2.63m below OD to 1.38m below OD.

9.5.104 In September 2025, further Ground Investigation, comprising eight geotechnical test pits, was undertaken along a 1.2 km stretch of on foreshore along the North Promenade. The pits were excavated to a depth of 4 m below ground level. The excavation of these pits was archaeologically monitored by Heneb, and a report produced on the findings [12]. The sequence of deposits identified in the test pits comprised shingle and cobbles overlying shell-rich sands, with these sediments broadly consistent with foreshore and nearshore deposition at the mouth of the

Mawddach. In addition to the sequence of sediments, parts of the modern coastal defences and structural elements of the sea wall were exposed during the works. However, no features or deposits of archaeological significance were identified during the works. The report notes that the foreshore is a dynamic environment, shaped by storm events, tidal asymmetry, and glacial inheritance, resulting on a locally varable pattern of survival of paleoenvironmental deposits. While no earlier archaeological horizons were identified during the archaeological monitoring the report concludes that the potential for such remains to occur locally remains high.

9.5.105 There is potential for submerged and buried landscapes, which may contain paleoenvironmental evidence and/or artefacts, from the Palaeolithic period onward, to be present within the Site. Due to environmental conditions, artefacts may include well-preserved timber and other organic remains. Peat is also likely to retain a good paleoenvironmental record. As well as prehistoric remains, these buried landscapes are also likely to retain evidence from later periods, as erosion has moved the seafront further inland over time, with the shifting coastline and coastal beach sands burying earlier land surfaces. Bronze Age, Roman, and Early Medieval finds within the Site suggest that further evidence relating to these periods may be buried within the Site; of particular interest is the finding of an Early Medieval inscribed stone, found, likely in situ, buried below the sand, during the building of the 1930s sea defence works.

9.5.106 In the 19th century Barmouth was well-known for its shipbuilding and minerals export, and in the 18th and 19th centuries there was an increase in marine traffic. There are a number of shipwrecks recorded within the study area, and there is potential for wrecks of ships and their cargo to be found within the Site on seabed, within the intertidal zone, and on the beach. A track across the beach leading to what was likely a slipway is shown on the earliest OS map, indicating a landing place within the Site.

9.5.107 There is some potential that archaeological evidence relating to the use of the Site for leisure and sea bathing in the 19th and early 20th centuries may be present within the Site, although this is limited as until the building of the sea defences in the 1930s these activities were largely focused in areas beyond the Site, on areas of the beach closer to the historical core of Barmouth and the estuary.

9.5.108 The 1890 cast-iron sewer pipe is known to buried within the Site, and the Site may also preserve evidence of its construction, such as rails, tools, and machinery.

9.5.109 The 1930s sea defences were constructed using rails for a steam-driven piling rig and mine-style carts, as well as hand tools. There is potential for physical evidence of this construction activity to survive within the Site, and rails and wheels exposed within the Site in 2021 may relate to these works.

9.5.110 The Site may also contain evidence of earlier phases of sea defences and sea walls, and of the Victorian seafront and promenade. It may also contain deposits of rubbish and refuse, including rubbish pits and artefacts deposited through accidental loss.

Significance

9.5.111 This section provides an assessment of value of designated and non-designated historic assets within the study area and of potential archaeological remains

within the Site. In line with the Conservation Principles for the sustainable management of the historic environment in Wales, this chapter takes a comparative approach to significance, assigning historic assets and archaeological remains significance at local, regional, or national levels, where local is the lowest level of significance and national the highest. The greater the significance of an historic asset, the greater the weight that should be attached to sustaining its heritage values.

9.5.112 All designated historic assets are of high value and of national significance due to their special historical and architectural interests, which lies in their evidential, historical, communal and aesthetic values.

9.5.113 All non-designated built historic assets of are low value due to their historical value at a local level.

9.5.114 Findspots are not of significance, as the finds or artefacts, which hold evidential and historic values, have been moved from those locations, with the locations not in themselves holding significance.

9.5.115 Paleoenvironmental evidence and/or artefacts from the Palaeolithic period and Mesolithic period would be of evidential value for their ability to reveal more about ways of life in Wales during these time periods. Finds of single artefacts from these periods are likely to be of low value. However, *in situ* Palaeolithic artefacts, or evidence of discrete Mesolithic activities such as knapping events in association with paleoenvironmental evidence and/or organic artefacts, is nationally rare and may be of regional or higher value depending on their date, nature, and intactness.

9.5.116 Remains dating to the Neolithic, Bronze Age, Iron Age, Roman, and Medieval activity would be of evidential value and are likely to be of low value. Remains of Early Medieval activity would be of evidential value, and may be of low or medium value, through their association with other important finds from this period in the local area, including the nationally rare find of an inscribed Early Medieval stone on Barmouth beach in the 1930s.

9.5.117 Remains of and finds associated with Post-Medieval boats and ships, and other maritime activity in this period, would be of evidential value for their ability to reveal information about maritime trade and exchange in this period, and the growth and development of Barmouth over time. Such remains are likely to be of low value, although shipwrecks may be of medium importance depending on their date, nature, intactness, associated cargo, and identification and history.

9.5.118 Other Post-Medieval remains, such as access tracks and landing places shown on historical OS mapping, such as NPRN: 525439, the 1890s cast-iron sewer pipe, evidence of sea defences and sea walls, and deposits of rubbish and refuse, would likely be of evidential value at a local level for their ability to reveal information about the rapid growth and development of Barmouth over this period, and would be of low importance.

9.5.119 Evidence relating to the construction of the 1930s seawall is likely to be low value for its evidential value for its ability to reveal information about the construction of the sea defences, the nature of labour and work on Unemployed Grants Schemes in this period, and the development of Barmouth, and of low value. Known rail tracks and associated finds eroding out of the sand (PRN: 100450) may date to this period and are likely to be of evidential value and low importance.

Future Baseline

9.5.120 In the context of the study area, where many of the known historic assets are protected by designation, either individually as listed buildings or collectively through the conservation area, it is assumed that development decisions will be made which preserve these assets in their current form and so their presence would remain.

9.5.121 The 20th century sea defences were designed to protect Barmouth and upgrading. If not upgraded, tidal flooding could impact built historic assets.

9.5.122 Archaeological and paleoenvironmental remains, which could be present in the peat below the beach sand and shingle deposits, are vulnerable to erosion, particularly during storm events which can expose the peats to the elements. Climate change is likely to contribute to more frequent and more extreme storm events, which means that currently unrecorded archaeological remains could both be revealed along the coastline within the Site and also rapidly lost once exposed.

9.6 Embedded Environmental Design Measures

9.6.1 The design includes a range of measures that have been embedded into the Proposed Development designed to avoid or minimise environmental effects. The design measures embedded for Cultural Heritage are described for embedded design measures and construction good practice measures.

Embedded environmental design measures

9.6.2 The Proposed Development is currently evolving through an iterative design process. There are a range of measures which have been embedded into the Proposed Development design primarily to avoid or minimise seascape, landscape and visual effects (Refer to ES Volume 2- Chapter 13 Seascape and Landscape and Visual). Several of these are also relevant to Cultural Heritage as they minimise change to the historic landscape character and the setting of historic assets including the Registered Historic Landscapes, the Barmouth Conservation Area and listed buildings with settings which include the seafront. The measures include:

- The Proposed Development will be aligned with the existing coastal form to reduce abrupt transitions between the built and natural elements.
- The height of the secondary wall will be designed to a maximum height of 1.55m above ground level. Where feasible, the height will be reduced to balance effective flood protection and preserve key views.
- The rear-facing side of the secondary sea wall, toward the residential properties, will be finished with high-quality natural stone aggregate to complement the existing wall materials.
- The flood gates at the access points will be finished with high-quality cladding to match the secondary sea wall and designed where possible as open, visually permeable structures to reduce their visual mass.
- Where possible, locally sourced natural stone will be used for the rock armour to reflect the coastal setting.

- Existing grass verges disturbed during construction will be reseeded to restore their pre-construction condition.

Construction good practice measures

9.6.3 Measures relevant to Cultural Heritage are set out for the construction phase within the Outline Construction Environmental Management Plan (CEMP) (document reference- EN.F.15) provided as part of the planning application and marine licence documentation.

9.6.4 The following measures will be put in place during construction:

- Physical impacts to buried archaeological remains which could be present within beach deposits will be avoided by preventing deep rutting from plant movements. This will involve a precautionary method, such as track matting at key locations, including where archaeology is likely to be present and / or where repeated movements of heavy plant is planned.
- Temporary construction and permanent work lighting will be required during construction. All lighting will be positioned and directed away from sensitive locations and minimise light spill.

9.7 Assessment of Likely Significant Effects

9.7.1 This section presents the assessment of likely significant effects on Cultural Heritage resulting from the construction, operation and maintenance of the Proposed Development. The likely significant effects of the Proposed Development have been identified taking into account the embedded environmental design measures outlined in section 9.6. Further mitigation proposed as a result of the likely effects is presented in section 9.8.

9.7.2 The Proposed Development comprises a combination of repairs to the existing seawall and sheet piled wall, construction of a replacement central wall on the promenade and a replacement secondary wall, rebuilding of access ramps to the beach, and the installation of new rock armour revetment at the top of the beach.

9.7.3 Following the baseline assessment summarised above and taking into account the embedded environmental design measures detailed in section 9.5, the following resources were scoped in for assessment of impacts and effects. Details of how the assessment and methodology respond to scoping responses are set out in Table 9-4. According to the methodology in section 9.4, some resources have been grouped together for the purpose of this assessment.

Designated historic assets scoped in

- Abermaw Conservation Area and the listed buildings within it.
- Parish Church of Saint Mary and Saint Bodfan (Grade I listed building, RN: 4906).
- Plas Mynach (Grade II* listed building, RN: 5244), Porth Mynach (Grade II listed building, RN: 15499) and Plas Mynach Lodge (Grade II listed building, RN: 15498).
- Former Domestic Stable Block at Hendre Coed Isaf (Grade II listed building, RN: 15501) and Barn At Hendre Coed Isaf (Grade II listed building, RN: 15500).

- Catholic Church of St Tudwal and attached Presbytery (Grade II listed building, RN: 87924).
- Registered Historic Landscapes of Outstanding Interest: Mawddach and Ardudwy.

Non-designated historic assets scoped in

- Known archaeological remains within the Site: rail tracks and associated finds eroding out of the sand (PRN: 100450) and track and landing place shown on 1st edition OS mapping (NPRN: 525439).
- Wrecks in close proximity to the Site: the wreck of the Jane (NPRN: 519260 and NPRN 518258) and the wreck of the Linnet (NPRN 519261). Both went ashore in 1825.
- Unrecorded archaeological features, remains, and/or deposits with the Site, particularly those which may be present within peat below the sand and shingle.

9.7.4 All of the historic assets identified within the baseline but not listed have been scoped out due to their distance, limited intervisibility/ glimpsed views with the Proposed Development, and there being no known non-visual association between the resources and the Site, meaning there is considered to be no potential for their value to be affected as a result of the Proposed Development. This includes the recorded location of findspots (PRN: 6889) and (PRN: 6895) which, although an indicator of archaeological potential, have no significance as findspots as the artefacts, which hold evidential and historic values, have been removed.

Construction Effects

9.7.5 This section presents the assessment of potential effects on Cultural Heritage resulting from the construction of the Proposed Development. The potential effects are assessed based on detailed design presented in ES Volume 2, Chapter 2 Project Description.

Construction phase impacts – temporary

9.7.6 Two options are proposed for delivery of Rock materials to the Site. These options are the use of haul routes, which would use existing A roads, Option 1, and the alternative, delivery by sea, known as Option 2. These Options are set out in full within ES Volume 1, Chapter 2 Project Description paragraphs 2.12.6 – 2.12.11.

9.7.7 The existing A roads are major roads and are in constant use by vehicle traffic. As such the use of these roads for delivery of materials would not result in additional traffic on the roads that would be of a magnitude to have a potential impact from change to the setting of historic assets. The vehicles using these routes to deliver materials to Site would blend with the existing expected volume of vehicular traffic already using the roads and would have no effect on historic assets along the route of the road beyond that exerted by the regular use of the roads by vehicles. Therefore, as a result of this option historic assets would not receive an impact (no change), resulting in a **neutral effect**, which is **not significant**.

9.7.8 The alternative option, Option 2 delivery by sea, would comprise a barge vessel anchored offshore for up to two weeks at a time, on approximately four occasions. During this time a tipper boat with shallow draught would transfer material from the barge to shore using an on-board excavator. The tipper boat would make approximately 10 to 20 journeys. Material would be tipped onto the seabed at high tide which would then be sorted and moved at low tide (considered further under the permanent construction impacts below). Barmouth is a seaside resort town, which historically featured a large shipbuilding and maritime trade industry and presently features an active harbour and marina. The use of vessels to transport material, in the scale and frequency proposed, is in keeping with Barmouth's past and present maritime activity and would blend with current maritime traffic processes within the area, including the day-to-day functioning of Barmouth as a tourist resort and harbour. Therefore, as a result of this option historic assets would not receive an impact (no change), resulting in a **neutral effect**, which is **not significant**.

9.7.9 As well as road or maritime traffic to the Site, the works will require construction plant and vehicle movements and operation along the seafront, promenade, and beach. Due to distance, intervening built form, and limited visibility, it is not anticipated that any designated or non-designated built historic assets would experience temporary changes in their setting as a result of what would be glimpsed views of construction activities within the Site, at a level which would make a contribution to their significance. Therefore, as a result of these works built historic assets would not receive an impact (no change), resulting in a **neutral effect**, which is **not significant**.

Construction phase impacts - permanent (physical)

9.7.10 Archaeological remains primarily possess evidential value, which contributes to their significance. They may also hold historic value, shedding light on past practices and ways of living.

9.7.11 Deposits of peat are known to be present along the coast, with some deposits dated to the Mesolithic and later prehistoric periods. These deposits can contain well-preserved paleoenvironmental remains and organic artefacts. Artefacts from later periods, such as the Roman period and Early Medieval period, have also been found within the study area, likely in association with buried historic land surfaces.

9.7.12 Remains of and finds associated with Post-Medieval boats and ships, and other maritime activity, may also be present at the beach, as well as other Post-medieval remains, such as the 1890s cast-iron sewer pipe detailed on historic mapping, evidence of 19th century sea defences and sea walls, and deposits of rubbish and refuse, and evidence relating to the construction of the 1930s seawall.

9.7.13 The Proposed Development comprises a combination of repairs to the existing seawall and sheet piled wall, construction of a replacement central wall on the promenade and a replacement secondary wall, rebuilding of access ramps to the beach, and the installation of new rock armour revetment at the top of the beach. Works that require excavation into the beach and foreshore, or that may disturb the ground through rutting, may impact or remove archaeological remains and/or deposits within or associated with buried prehistoric and historic landscapes. This could range from a minor to major magnitude of impact,

depending on the nature of the archaeological remains affected and the amount of the asset which is impacted.

9.7.14 Unrecorded archaeological remains within the Site, which could be present within and below the beach and foreshore, are of unknown heritage significance. While the majority of unrecorded archaeological remains would most likely be of low heritage significance some, including Palaeolithic, Mesolithic and Early Medieval remains could be of medium to high heritage significance. There are also two wrecks recorded in close proximity to the Site: the wreck of the Jane (NPRN 519260 and NPRN 518258) and the wreck of the Linnet (NPRN 519261). Both went ashore in 1825. The locations of wrecks are uncertain, but it is possible that parts of the wrecks or associated remains may be present within the Site. Fragmentary remains would likely be of low to medium heritage significance, while more complete remains would be more likely to be of high heritage significance. Depending on their sensitivity and the magnitude of impact, removal of archaeological remains could bring about a significance of effect of **slight, moderate, or large adverse**. A slight adverse effect is **not significant**. Moderate and large adverse effects are **significant**. Significant adverse effects would most likely result from the total loss of remains of medium to high heritage significance, such as some Palaeolithic, Mesolithic and Early Medieval remains, or the remains of shipwrecks. Mitigation measures relating to unrecorded archaeological remains are set out in Section 9.8.2 below.

9.7.15 The known archaeological remains within the Site, rail tracks and associated finds eroding out of the sand (PRN: 100450) and a track and landing place shown on 1st edition OS mapping (NPRN: 525439) are likely of low heritage significance. The removal of these remains would result in a moderate to major magnitude of impact, depending on whether the remains are totally or only partially lost. In accordance with Table 9-7, this would result in either a slight or moderate adverse effect. Given the 20th century date and relatively low historic and evidential interest of these features, which survive as part of combination of records and physical features, this is assessed as a likely **slight adverse effect**, which is **not significant**.

9.7.16 Unrecorded and recorded archaeological features, remains, and/or deposits located outside of the Site would not receive an impact (no change), resulting in a **neutral effect**, which is **not significant**.

9.7.17 In addition to the potential physical impacts on archaeological remains, the works would be a permanent change within the Registered Historic Landscapes of Mawddach and Ardudwy. Both are considered to be assets of high heritage significance. However, due to the nature of the proposals, which would result overall in a sea defence with limited additional height, and which would use materials in keeping with the existing defences, there would be no impact (no change) as a result of the works, resulting in a **neutral effect**, which is **not significant.**

Construction phase impacts/effects- permanent (non-physical)

9.7.18 Non-physical, permanent construction impacts upon heritage resources from the Proposed Development would be limited to those related to changes in their setting. Where a group of resources is considered to have a strong spatial and/ or contextual association which contributes to their collective significance, they are assessed as a group.

9.7.19 The permanent works would result in several changes to the existing sea defences. Notably, a new rock armour revetment would be constructed at the top of the beach and the secondary wall would be demolished and rebuilt as a concrete wall. The design of this wall would be in keeping with the existing concrete primary wall.

9.7.20 Abermaw Conservation Area is centred around the historic High Street and encompasses a concentration of buildings from the town's Victorian heyday. It includes numerous designated assets within it, including the Grade II* St. John's Church (RN: 15467), Ty Gwyn (RN: 4897), and Morris & Co and building to rear (RN: 15464 and 15465). The conservation area represents Barmouth's historic Victorian commercial and tourist core, and it is tightly focused to the southeastern end of the town with views of the estuary. Views to the western shoreline are limited to glimpsed views due to the buildings in between. With the exception of some very limited views towards the Site from areas of higher ground within the conservation area, most of the conservation area is outside the Zone of Theoretical Visibility. The views from the conservation area towards the estuary would not be affected by the proposed works due to the direction of the views, the very partial visibility of the Proposed Development, and the small change in height to the existing sea defences proposed. The conservation area and listed buildings within it would, therefore, not receive an impact (no change) as a result of the works, resulting in a **neutral effect**, which is **not significant**.

9.7.21 The Parish Church of Saint Mary and Saint Bodfan (Grade I listed building, RN: 4906) is situated in a prominent position in Llanaber overlooking the sea, with open views up and down the coast. It is within a large churchyard, with gravestones in rows and areas of open space, which extends across a large area of land to the south of the church. Its churchyard setting makes a positive contribution to its significance through its historical functional relationship and through providing a quiet and contemplative place to view the church. Its prominence along the coast makes a strong positive contribution to its significance by highlighting its historical and present importance to its worshipping community. This prominence would not be affected by the proposed works, with only a small change in height to the existing sea defences proposed. These assets would therefore not receive an impact (no change) as a result of the works, resulting in a **neutral effect**, which is **not significant**.

9.7.22 Plas Mynach (Grade II* listed building, RN: 5244) is a large country house, designed by architect John Douglas and built in 1883. It has group value with its former coach-house, Porth Mynach (Grade II listed building, RN: 15499), and its lodge, Plas Mynach Lodge (Grade II listed building, RN: 15498). Plas Mynach sits within landscaped, wooded, grounds, which survive to the present, and it has a prominent position overlooking the coast. The lodge is situated along the A496 road, which forms the northern and eastern boundary of the grounds and from which the drive which provides access to the house and grounds runs. The grounds are bounded to the west by the railway line. Being the designed, landscaped grounds for the house, the grounds make a strong positive contribution to the significance of the house, coach-house and lodge, and provide an area from which to view the house and other buildings. The trees within the grounds restrict view of the coast from the house and other buildings, nevertheless, the house's prominent coastal position makes a strong positive contribution to its significance, through highlighting the wealth and status of its creator. This prominence would not be affected by the proposed works, with only a small change in height to the existing sea defences proposed. These assets

would therefore not receive an impact (no change) as a result of the works, resulting in a **neutral effect**, which is **not significant**.

9.7.23 The Former Domestic Stable Block at Hendre Coed Isaf (Grade II listed building, RN: 15501) and Barn At Hendre Coed Isaf (Grade II listed building, RN: 15500) are located in Llanaber, on land along the eastern side of the A496 road, overlooking the coast. Holiday accommodation units occupy land immediately to the north and east of the assets, while there is a graveyard to the west, on land adjacent to the coast and A496. There is open green space to the northwest. The road, and coast are part of the assets' historical setting and make a positive contribution to their significance. The holiday accommodation surrounds the buildings to the east and north and make a negative contribution, through crowding land that was historically a fairly open, grazed landscaped. With only a small change in height to the existing sea defences proposed, these assets would not receive an impact (no change) as a result of the works, resulting in a **neutral effect**, which is **not significant**.

9.7.24 The Catholic Church of St Tudwal and attached Presbytery (Grade II listed building, RN: 87924) is situated fronting the A496 road in Barmouth, in a residential and commercial area of the town. Its setting within the town makes a positive contribution to its value through highlighting its social and communal purpose. Due to existing built form, it is not anticipated that the proposed works will be visible from the church. The proposed works would not change the setting of this asset, and it would not receive an impact (no change) as a result of the works, resulting in a **neutral effect**, which is **not significant**.

Operational and Maintenance Effects

9.7.25 Operation is defined as the post-construction phase of the Proposed Development, including maintenance activities, until there is further development or until the Site ceases to operate as a standard of protection against coastal flooding. ES Volume 2, Chapter 2 Project Description should be referred to for the description and period of maintenance activities, and the design life of the Proposed Development.

9.7.26 There would be no significant effects to historic assets from the operation of the Proposed Development as there would be no changes in noise, lighting or appearance that would qualitatively impact historic assets through change in their setting in comparison to the baseline.

9.7.27 Given the need to provide coastal flood protection up to 2075, maintenance provisions will be made up until this date. Given the planned change to managed realignment after this date, maintenance after this date is expected only to be in relation to ensuring public safety.

9.7.28 It is therefore assumed that the defences will remain in place past 2075 and not decommissioned. The standard of protection will reduce over time. Therefore, decommissioning of the Proposed Development has not been assessed.

9.8 Mitigation and Enhancement

9.8.1 This section outlines the mitigation required where adverse effects have been identified.

Additional Mitigation of Construction Effects

9.8.2 The following additional mitigation is proposed for archaeology:

- Low tide intertidal walkover survey to be undertaken across the beach and foreshore pre-construction but relatively close to the start of work to allow any features exposed by most recent storms/high tides to be identified and recorded. If archaeological remains of high value are identified, then these may need to be left *in situ* and protected during the course of the works.
- Archaeological monitoring where excavation into the beach deposits is required. This is largely limited to works along the sheet pile wall and the rebuilt access ramps.

Mitigation of Operational Effects

9.8.3 No operational effects are assessed therefore no further mitigation is proposed.

Enhancements

9.8.4 No enhancement measures have been implemented for Cultural Heritage beyond the need for mitigation measures.

9.9 Residual Effects

9.9.1 Cumulative effects are addressed within ES Volume 2, Chapter 15 Cumulative and In- Combinationn Effects.

9.9.2 All significant effects identified from construction will be mitigated as outlined in section 9.8. An assessment of residual effects is presented in Table 9-9.

9.9.3 No significant effects from operation have been identified, and therefore there are no residual effects.

Table 9-9 Residual effects of construction

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual significance of effect
Unrecorded archaeological remains within the Site	Total or partial removal or disturbance of below ground archaeological, deposits, remains, and/or features	Slight to large adverse effect (permanent)	Programme of archaeological survey, monitoring, and recording	Neutral to slight adverse (depending on significance of remains) through combination of preservation by record and preservation in situ through construction methodology
Known archaeological remains within the Site: rail tracks and associated finds eroding out of the sand (PRN: 100450) and a track and landing place shown on	Total or partial removal or disturbance of below ground archaeological, deposits, remains, and/or features	Slight adverse (permanent)	Programme of archaeological survey, monitoring, and recording	Neutral, with preservation by record

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual significance of effect
1st edition OS mapping (NPRN: 525439)				
Registered Historic Landscapes Mawddach and Ardudwy	Construction of new defences and modifications to existing within the registered landscapes	Neutral	None proposed	Neutral

9.10 Assessment Summary

9.10.1 All effects identified in the main assessment including those identified that were not significant and the residual assessment are presented in Table 9-10.

Table 9-10 Summary of effects matrix

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual effect
Unrecorded archaeological remains within the Site	Total or partial removal or disturbance of below ground archaeological, deposits, remains, and/or features	Slight to large adverse effect (permanent)	Programme of archaeological survey, monitoring, and recording	Neutral to slight adverse
Known archaeological remains within the Site: rail tracks and associated finds eroding out of the sand (PRN: 100450) and a track and landing place shown on 1st edition OS mapping (NPRN: 525439)	Total or partial removal or disturbance of below ground archaeological, deposits, remains, and/or features	Slight adverse (permanent)	Programme of archaeological survey, monitoring, and recording	Neutral
Registered Historic Landscapes Mawddach and Ardudwy	Construction of new defences and modifications to existing within the registered landscapes	Neutral	None proposed	Neutral
Abermaw Conservation Area and the designated assets within it.	Changes to setting	Neutral	None proposed	Neutral
Parish Church of Saint Mary and Saint Bodfan (Grade I listed building, RN: 4906).	Changes to setting	Neutral	None proposed	Neutral
Plas Mynach (Grade II* listed building, RN: 5244), Porth Mynach (Grade II listed building, RN: 15499) and Plas Mynach Lodge (Grade II listed building, RN: 15498).	Changes to setting	Neutral	None proposed	Neutral
Former Domestic Stable Block at Hendre Coed Isaf (Grade II listed building, RN:	Changes to setting	Neutral	None proposed	Neutral

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual effect
15501) and Barn At Hendre Coed Isaf (Grade II listed building, RN: 15500).				
Catholic Church of St Tudwal and attached Presbytery (Grade II listed building, RN: 87924).	Changes to setting	Neutral	None proposed	Neutral

Abbreviations List

BCE	Before Common Era
BP	Before Present (1950CE)
c.	Circa (approximate or around)
CE	Common Era
cm	Centimetre(s)
DMRB	Design Manual Roads and Bridges
DTM	Digital Terrain Model
EIA	Environmental Impact Assessment
ES	Environmental Statement
ft	Foot or Feet (measurement)
HER	Historic Environment Record
km	Kilometre(s)
LiDAR	Light Detection And Ranging
m	Metre(s)
NMRW	National Monuments Record Wales (RCAHMW)
NPRN	National Preferred Record Number (RCAHMW)
NRW	Natural Resources Wales
OD	Ordnance Datum
OS	Ordnance Survey
PRN	Preferred Reference Number (Heneb)
RN	Reference Number (Cadw)
RCAHMW	Royal Commission on the Ancient and Historical Monuments of Wales
UID	Unique Identifier
YGC	Ymgynghoriaeth Gwynedd Consultancy

Glossary

Term	Definition
Bronze Age	A historic period, lasting from 2200BCE to 700BCE, when some objects, weapons. and tools were made of bronze.
Early Medieval	A historic period, lasting from 410CE to 1086CE.
Iron Age	A historic period, lasting from 700BCE to 43BCE, when some objects, weapons. and tools were made of iron.
Listed buildings	Building of special architectural or historic interest, recorded in the List of Buildings of Special Architectural or Historic Interest compiled according to the provisions of the Planning (Listed Buildings and Conservation Areas) Act 1990. Such buildings are subdivided into Grade I, II* and II (in descending importance).
Medieval	A historic period, lasting from 1086CE to 1536CE.
Mesolithic	The middle part of Stone Age, lasting 8,500BCE to 4,000BCE.
Neolithic	The latter part of Stone Age, lasting 4,000BCE to 2,200BCE, when agriculture was introduced.
Palaeolithic	The early phase of Stone Age, lasting between 1 million BCE to 8,500BCE.
Roman	A historic period, lasting between 43CE to 410CE, where the Romans occupied the British Isles.
Post-medieval	A historic period, lasting from 153 CE to 1899CE.

Source: Arup, 2025.

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Cyngor Gwynedd

Barmouth North Promenade FAS

ES Chapter 10 Flooding and Water Quality

Reference: BMTH-ARP-EWE-ZZ-RP-OE-000002

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Contents

10. Flooding and Water Quality **1**
10.1 Introduction 1
10.2 Legislation, Policy and Guidance 2
10.3 Stakeholder Engagement 6
10.4 Methodology 8
10.5 Baseline 14
10.6 Embedded Environmental Design Measures 19
10.7 Assessment of Likely Significant Effects 20
10.8 Mitigation and Enhancement 22
10.9 Residual Effects 23
10.10 Assessment Summary 23
Abbreviations List **26**
Glossary **26**
References **27**

Tables

Table 10-1 List of Relevant Legislation 2
Table 10-2 List of Relevant National Policy 4
Table 10-3 List of relevant local policy, plans and strategies 5
Table 10-4 NRW comments on scope of the Proposed Development and response 7
Table 10-5 Estimating the value of water environment attributes 9
Table 10-6 Estimating the magnitude of an impact on an attribute 10
Table 10-7 Significance matrix (taken from Table 3.8.1 of LA 104) 12
Table 10-8 Summary of WFD baseline status 15
Table 10-9 Protected areas in proximity to Site 16
Table 10-10 Sensitivity of identified receptors 18
Table 10-11 Summary of effects matrix 23

10. Flooding and Water Quality

10.1 Introduction

10.1.1 This chapter provides an assessment of the likely significant effects on flooding and water quality that may arise from the construction, operation and maintenance of Barmouth North Promenade Flood Defence Scheme (hereafter referred to as the 'Proposed Development'). The approach undertaken for this chapter has been supported by a scoping report submitted by Cyngor Gwynedd (Ymgynghoriaeth Gwynedd Consultancy (YGC)), engagement with statutory consultees, and scoping opinions received from Cyngor Gwynedd and Natural Resources Wales (NRW) on 30 April 2024 and 19 April 2024 respectively.

10.1.2 This chapter details the legislation, policy and guidance that is relevant to flooding and water quality, a summary of engagement undertaken, the methodology of assessment, and the embedded environmental design measures. This is followed by an assessment of likely significant effects of the Proposed Development on flooding and water quality, taking account of the embedded environmental design measures, and the need for any additional mitigation is then considered along with any proposals for enhancement design measures. This chapter concludes with a summary of likely significant residual effects.

10.1.3 Flooding and water quality elements considered with this chapter for the Proposed Development include:

- Surface and coastal water.
- Groundwater.
- Existing drainage.
- Future baseline.

10.1.4 This chapter is supported by:

- a Water Framework Directive Assessment (document number BMTH-ARP-EWE-ZZ-RP-OE-000003).
- a Flood Consequences Assessment (document number BMTH-ARP-XGN-ZZ-RP-W-000003).
- a Surface Water Drainage Strategy (document number BMTH-ARP-CDG-ZZ-RP-C-000001).

10.1.5 This chapter is supported by the following figures, contained in Volume 4:

- Figure 10.1.

10.1.6 This chapter should be read in conjunction with:

- ES Chapter 6 Biodiversity and Protected Sites.
- ES Chapter 7 Climate Change .
- ES Chapter 12 Marine and Coastal Physical Processes.
- ES Chapter 15 Cumulative and In-Combination Effects.

10.2 Legislation, Policy and Guidance

10.2.1 This section identifies the legislation, policy, guidance and other documentation that has informed the assessment of likely significant effects on Flooding and Water Quality. This section is supported by the ES Volume 3, Appendix 1.1 Policy Context, which outlines overarching legislation and policy relevant to the Proposed Development

Legislation

10.2.2 Table 10-1 lists the legislation relevant to this topic and the assessment of the likely significant effects.

Table 10-1 List of Relevant Legislation

Legislation	Relevance to Assessment
The Water Environment (Water Framework Directive) (England and Wales) Regulations (WER) (amended 2017) [1]	The largest and most influential piece of UK legislation for the water environment and transposes the Water Framework Directive into Welsh law. NRW is the competent authority responsible for delivering the requirements in Wales. The legislation takes an integrated approach to the sustainable management of water by considering the interactions between surface water, groundwater and water-dependent ecosystems. Under the WER, water bodies are the basic management units and are defined as all or part of a river system or aquifer. These water bodies form part of a larger River Basin District (RBD), for which River Basin Management Plans (RBMPs) are developed and environmental objectives are set. These RBMPs are produced every six years, in accordance with the river basin management planning cycle. The WER requires classification of the current condition of water bodies. This is referred to as their 'status' or, for artificial or heavily modified water bodies, their 'potential'. The WFD also requires the setting of a series of objectives for maintaining or improving conditions so that water bodies reach and/or maintain at least 'Good' overall status or potential. These overall Environmental Objectives are to: • prevent the deterioration in the status of aquatic ecosystems, protect them and improve the ecological condition of waters; • aim to achieve at least 'Good' status for all water bodies by 2015. Where this is not possible and subject to the criteria set out in the Directive, aim to achieve Good status by 2021 or 2027; • meet the requirements of WFD Protected Areas. • promote sustainable use of water as a natural resource. • conserve habitats and species that depend directly on water. • progressively reduce or phase out the release of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment/ • progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants. • contribute to mitigating the effects of floods and droughts.
The Environmental Permitting (England and	This instrument amends the Environmental Permitting (England and Wales) Regulations 2016 to ensure that, on the UK's exit from the

Legislation	Relevance to Assessment
Wales) (Amendment) (EU Exit) Regulations 2019 [2]	European Union (EU), they remain fully operable. The Environmental Permitting Regulations (England and Wales) (2016) consolidate the system of environmental permitting in England and Wales, replacing the Environmental Permitting (England and Wales) Regulations 2010. They widened the existing environmental permitting and compliance system in England and Wales by integrating the existing permitting regimes covering pollution prevention and control and waste management licensing, water discharge consents, groundwater authorisations and radioactive substances regulation authorisations.
The Environment Act 2021 [3]	The Act sets out specific targets around water quality and resource management.
Environmental Protection Act 1990 [4]	The Act sets out legislative provisions aimed at controlling pollution arising from industrial and other processes for waste management.
Water Resources Act 1991 [5]	The Act sets out the responsibilities of NRW in relation to water pollution, resource management, flood defence, fisheries, and navigation.
Land Drainage Act 1991 [6]	The Act requires that a watercourse be maintained by its owner. It also provides functions to internal drainage boards and local authorities to manage watercourses and provide consenting powers for proposed works to watercourses associated with development.
Water Act 2014 [7]	The Act describes the environmental permitting regime with regard to flood defence consents.
Environment (Wales) Act (2016) [8]	The Act requires the 'sustainable management of natural resources' and sets out a framework to ensure this is a core consideration in decision making, including the State of Natural Resources Report (SoNARR) and a Natural Resources Policy (NRP). The NRP sets three national priorities for managing Wales' natural resources: • Delivering nature-based solutions. • Increasing renewable energy and resource efficiency. • Taking a place-based approach. The Act also sets a legal target of reducing greenhouse gas emissions in Wales by at least 80% in 2050. The Proposed Development should support the management of flood risk through an integrated approach to help achieve long-term sustainability. This should include increasing resilience to the effects of climate change. The project should also help reverse the decline of biodiversity and enhance ecosystems through providing biodiversity net gain.
Flood Risk Regulations 2009 [9]	The regulation transposes the EU Floods Directive. Requiring the Environment Agency and local authorities to prepare flood risk assessment reports, flood hazard maps, flood risk maps and flood risk management plans. The Proposed Development should help manage and reduce flood risk in Barmouth. The strategy should utilise information prepared by NRW and local authorities, such as flood risk mapping and management plans, to help inform and guide the strategy to see that measures are effective and targeted to where they are most needed.
Flood and Water Management Act 2010 [10]	The Act provides for better flood risk management for people, homes and businesses, whilst also addressing the threat of water scarcity and protecting the affordability of water drainage charges and protects water supplies to the consumer. The Proposed Development should comply with the requirements of the Act. The Proposed Development should help better manage water in the catchment to help reduce risk of flooding to people, properties and infrastructure. The Proposed Development should be developed in partnership with other risk management authorities to deliver flood risk management to better benefit communities.

Legislation	Relevance to Assessment
Salmon and Freshwater Fisheries Act 1975 (as amended) [11]	The Salmon and Freshwater Fisheries Act (SAFFA) is legislation that aims to protect freshwater fish, with a particularly strong focus on salmon (*Salmo salar*) and trout (*Salmo trutta*). The legislation covers a broad range of topics, but of particular relevance to development are those sections covering water pollution, habitat disturbance and fish migration routes. Under Section 2 (4) it is an offence to wilfully disturb spawn, spawning fish or spawning areas and under Section 4 (1) it is an offence to knowingly permit the flow of poisonous matter and polluting effluents into river courses that are poisonous or injurious to fish or the spawning grounds, spawn or food of fish. Sections 9 to 15 are concerned with fish passage and migration routes. It is the duty of the waterway owner that when constructing dams, screens or sluices to provide and maintain a facilitating fish pass for migrating salmon or trout

National Policy and Strategies

10.2.3 Table 10-2 lists the relevant planning policy and strategies, with paragraphs of relevance to the flooding and water quality assessment.

Table 10-2 List of Relevant National Policy

National Policy & Paragraph Number	Summary of Policy Requirement and Relevance
Planning Policy Wales Edition 12: Paragraph 6.6 Water and Flood Risk [12]	New or improved flood defences in coastal and/or riverside locations should be carefully planned, ensuring all potential environmental effects, both on and off-shore. The relevant policies from the West of Wales Shoreline Management Plan 2 should be considered. Flood defence works can provide opportunities to achieve wider social, economic and environmental benefits, which should be maximised where possible. Nature based solutions should be the first consideration given the opportunity to deliver other multiple benefits, including habitat creation, biodiversity enhancement and water quality improvements. Overall, green infrastructure opportunities can benefit ecosystem resilience and provide opportunities for leisure facilities or renewable energy generation.
Welsh National Marine Plan (WNMP) 2019 [13]	This WNMP is the first marine plan for Wales and represents the start of shaping Welsh inshore and offshore marine waters to support economic, social, cultural and environmental objectives. It sets out how decision-makers would consider proposals for the sustainable development of the marine area. Marine planning would guide the sustainable development of the marine area by setting out how decision-makers would consider proposals. It has been prepared and adopted under the Marine and Coastal Access Act (MCAA) 2009. The WNMP and supporting material should be used by applicants to shape proposals and licence applications for the sustainable development of the Plan area.
Future Wales – the National Plan 2040 [14]	The Plan sets the direction for development in Wales to 2040 and identifies National and Regional Growth Areas. It supports flood risk management in response to factors such as rising sea levels and increased rainfall caused by climate change.
Planning Policy Wales Technical Advice Note 15: Development and Flood Risk (TAN 15) [15]	TAN 15 provides technical guidance which supplements the policy set out in PPW in relation to development and flooding. It advises

National Policy & Paragraph Number	Summary of Policy Requirement and Relevance
	on development and flood risk and provides a framework for the assessment of flooding.
The National Strategy for Flood and Coastal Erosion Risk Management in Wales (2020) [16]	This is the second National Strategy on Flood and Coastal Erosion Risk Management (FCERM) for Wales, replacing the 2011 Strategy. It is prepared under the terms of the Flood and Water Management Act 2010.This Strategy sets out how Welsh Government intend to manage the risks from flooding and coastal erosion across Wales. It sets objectives and measures for all partners to work towards. The aim of the strategy is to reduce the risk to people and communities from flooding and coastal erosion. Five objectives are identified to achieve this. These are: • Improving our understanding and communication of risk. • Preparedness and building resilience. • Prioritising investment to the most at risk communities. • Preventing more people becoming exposed to risk. • Providing an effective and sustained response to events. The Proposed Development should support the ambitions outlined in the National FCERM Strategy for Wales. This includes through increasing resilience of the area to flooding, supporting the use of nature-based solutions, support sustainable growth, delivering biodiversity net gain and contribute to environmental net gain.

Local Policy and Strategies

10.2.4 The relevant local planning policy, plans and strategies to the flooding and water quality assessment is listed in Table 10-3.

Table 10-3 List of relevant local policy, plans and strategies

Local Policy, Plan & Strategy	Relevant policy	Relevance to Assessment
Anglesey and Gwynedd Joint Local Development Plan 2011 - 2026 (2017) [17]	Policy ARNA 1: Coastal Change Management Area	Proposals for new or replacement coastal defence schemes will only be permitted where it can be demonstrated that the works are consistent with the management approach for the frontage presented in the Shoreline Management Plan (SMP), and there will be no material adverse impact on the environment.
	Policy PS 5: Sustainable Development	All proposals should reduce the amount of water used and wasted; reducing the effect on water resources and quality; managing flood risk and maximizing use of sustainable drainage schemes; and progressing the objectives of the Western Wales River Basin Water Management Plan.
	Policy PS 6: Alleviating and adapting to the effects of climate change	Requires proposals to be located away from flood risk areas and reduce the overall risk of flooding.
	PCYFF 3: Design and place shaping	The drainage systems of proposals should be designed to limit surface water runoff and flood risk and prevent pollution.
	PCYFF 6: Water conservation	All proposals should implement flood minimisation or mitigation measures where possible, to reduce surface water run-off and

Local Policy, Plan & Strategy	Relevant policy	Relevance to Assessment
		minimise its contribution to flood risk elsewhere.
Level 1 Strategic Flood Consequence Assessment 2015 [18]	All	The SFCA was prepared to support the Local Development Plan. It helps to: • Determine appropriate development policies and land allocations that avoid or minimise flood risk from all sources. • Assess any future development proposals in line with the precautionary framework in PPW and TAN15.
Gwynedd Local Flood Risk Management Strategy [19]	All	The purpose is to address potential flood risks arising from local sources within the boundaries of the Authority. It also specifies objectives to manage flood risk and measures to achieve those objectives.
West of Wales Shoreline Management Plan. Unit 21 - St Ann's Head to Great Ormes Head [20]	Policy Development Zone (PDZ) 11	The intent of this SMP is to maintain defences, along with operation of the harbour. Town and seafront enhancements would be supported in line with a “Hold the line” policy. The project spans three policy units, Barmouth South (Hold the Line for all epochs), Barmouth North (Hold the Line in Epoch 1, Managed Realignment in Epoch 2 and 3) and Llanaber (Hold the Line for all epochs).
Western Wales RBMP [21]	All	RBMPs are drawn up for the 11 RBDs in England and Wales as a requirement of the WFD. The plan for the Western Wales RBD is managed by NRW and sets out the programme of measures needed to achieve the objective of the WFD over the next 6-year period (2015-2021).
Western Wales FRMP [22]	All	The Western Wales Flood Risk Management Plan (FRMP) was first published in 2015 by NRW. The plan gives an overview of the flood risk in the Western Wales RBD and set out intended priorities to manage and reduce flood risk over the next 6 years and beyond.

Standards and Guidance

10.2.5 The guidance and standards which relate to this topic are listed below.

- Flood Estimation Handbook [23].
- EurOtop (2018). Manual on water overtopping of sea defences and related structures [24].
- Design Manual for Roads and Bridges (DMRB) LA 113: Road drainage and the water environment [25].
- Control of Water Pollution from Construction Sites – Guide to Good Practice (SP156) [26].
- Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors (C532) [27].
- Control of Water Pollution from Linear Construction Projects – Technical Guidance (C648) [28].

10.3 Stakeholder Engagement

10.3.1 Stakeholders were engaged via the scoping opinion in 2024.

10.3.2 A pre application meeting was also held with the Cyngor Gwynedd Sustainable Drainage Approval Body (SAB) and Arup on 13th February 2025 to discuss the design principles of the application.

EIA Scoping Opinion

10.3.3 An EIA Scoping Opinion was adopted by Cyngor Gwynedd/Gwynedd Council (supported by YGC) and NRW on 30 April 2024 and 19 April 2024 respectively. Comments received in relation to flooding and water quality from Gwynedd Council repeat comments from NRW, which are presented jointly in Table 10-4 with a response describing how these comments have been addressed within this chapter.

Table 10-4 NRW comments on scope of the Proposed Development and response

Scoping Opinion Comment	Response
NRW have requested that proposal should not look to impact upon the excellent bathing water rating Barmouth currently has. Access to the bathing water sampling point 20014 at grid reference SH6084015900 should not be affected as access to the sampling point will be required from the 1st of May – 30th of September. The area around the sample point will need to be impact free during these months.	The Barmouth bathing water area is screened into the assessment (Section 10.5), introduces mitigation (10.6) and finds no likely significant effects (Section 10.7) to this receptor.
It is noted that 74,000m^3 of shingle for the beach recharge and 12,000 tonnes of rock to construct the rock toe and under-layering. NRW have requested that you consider where this will be sourced from and whether it will cause loose sediment to be washed into the sea and cause discolouration.	The assessment introduces mitigation (10.6) to reduce the risk of discoloration and finds no likely significant effects (Section 10.7) to receiving waterbodies.
The CEMP should include methods to deal with any loose sediment that maybe stored on the site from running into any watercourse and pollution prevention measures.	The assessment introduces mitigation (10.6) to manage the risk of material mobilisation.
As stated in the submitted Business Case- Initial Environmental Appraisal document, large parts of the study area/application site are "….within a flood zone, therefore a Flood Consequence Assessment may be required…". NRW would agree that a Flood Consequence Assessment (FCA) should be compiled and submitted in support of the proposal. This would ensure that all parties are fully aware of the benefits of the scheme and the standard of protection afforded by the proposals for the town.	A Flood Consequences Assessment has been prepared and provided as part of the planning application and marine licence application documents. Document reference BMTH-ARP-XGN-ZZ-RP-W-000003.
The FCA should also investigate and address possible sources of flooding to the town from the north end of the works. As indicated on the submitted (draft) drawing ARP-XX-DR-CS-0001-GA P02, the flood cell extends beyond the study area and additional flood mitigation measures to prevent overtopping are required and to be determined at detailed design. NRW have advised that these details are included in the submission.	A Flood Consequences Assessment has been prepared and provided as part of the planning application and marine licence application documents. Document reference BMTH-ARP-XGN-ZZ-RP-W-000003.
NRW have recently completed a study on wave overtopping along the Tremadog Bay which includes the study area/this application site. It may be beneficial for the scheme promoters to seek outputs and animations of the hydraulic modelling as they may be beneficial in associating the design/compilation of any FCA and ensure that the flood route to the north can be managed for a range of events. The 0.1% Annual Exceedance probability event + allowances for climate change should be considered.	A Flood Consequences Assessment has been prepared and provided as part of the planning application and marine licence application documents. Document reference BMTH-ARP-XGN-ZZ-RP-W-000003.
It is highly recommended that you contact the Development & Flood Risk team prior to submission to discuss the above	A Flood Consequences Assessment has been prepared and provided as part of the

Scoping Opinion Comment	Response
(developmentandfloodrisk.northmid@cyfoethnaturiolcymru.gov.uk)	planning application and marine licence application documents. Document reference BMTH-ARP-XGN-ZZ-RP-W-000003.

10.4 Methodology

Study area

10.4.1 This section describes the spatial scope (i.e. the area which may experience significant effects) for the assessment as it applies to Flooding and Water Quality.

10.4.2 The study area is risk-based and uses the 'source – pathway – receptor' pollutant linkage principle to determine appropriate receptors to be included.

10.4.3 The study area includes the site boundary, all water bodies within 250m and high-value water bodies within 2km, up to the point of potential effect from the Proposed Development. High-value water bodies are defined as any defined in the Western Wales RBMP or any protected/designated under UK legislation.

10.4.4 The underlying groundwater body has also been considered within the assessment. The 500m buffer was selected based on professional judgement of the potential impacts posed by the Proposed Development and is in line with study areas for assessments of the impact on the water environment undertaken for other linear schemes. Water bodies outside of the 500m buffer were selected based on professional judgement of their value and connectivity to the Site.

10.4.5 The extent of the study area is presented in ES Volume 4, Figure 10.1.

Baseline Methodology

10.4.6 The Flooding and Water Quality baseline data for the study area has been obtained from a desktop study.

10.4.7 The following information sources have been used to complete the baseline assessment:

- Ordnance Survey Open Data.
- NRW 'Water Watch Wales' Cycle 3 data [29].
- NRW Bathing waters data [30].
- NRW Western Wales RBMP (2021-2027) [21].
- MAGIC Map [31].
- Online historical maps.
- Information from historic and recent ground investigations.

10.4.8 Further to the list above, the appendix and supporting documents to this ES chapter (referenced in Section 10.1) also provide baseline information.

Assessment Methodology

10.4.9 The assessment approach for this Proposed Development is adapted from the guidance presented within DMRB LA113 [25] using professional judgement. This guidance was designed for road and bridge construction; however it is considered appropriate for other linear infrastructure such as this.

10.4.10 Following the identification of baseline conditions and key receptors, the assessment methodology comprises assessing the value (or sensitivity) of the identified receptors that can be affected by the construction and operation of the Proposed Development. A combination of the sensitivity of the receptor under consideration and the magnitude of the impact concerning the receptor has been used to determine the significance of the effects.

10.4.11 The outcome has been used to aid the development of appropriate mitigation measures to avoid or reduce potential adverse effects.

10.4.12 All assessments follow a source – pathway – receptor approach. For there to be a risk of impact to surface water or groundwater, a source, pathway and receptor all have to be present to create a linkage. In the context of this chapter, pollutant sources comprise sources associated with the construction and operation of the Proposed Development, and the receptors are the receiving water environment, including surface waters and groundwater, and flood risk receptors.

Sensitivity of receptors

10.4.13 The value of each water environment feature within the study area was determined according to the criteria set out in Table 10-5. These criteria are based upon Table 3.69 of LA 113, modified for relevance to the Proposed Development.

Table 10-5 Estimating the value of water environment attributes

Receptor Value (Sensitivity)	Criteria	Attribute	
Very High	Nationally significant attribute of high importance	Surface water	Site protected/designated under UK legislation (Special Area of Conservation (SAC), Special Protection Area (SPA), Site of Special Scientific Interest (SSSI), Ramsar site, salmonid water) /Species protected by European legislation Ecology and Nature Conservation
		Groundwater	Principal aquifer providing a regionally important resource and/or supporting a site protected under UK legislation Ecology and Nature Conservation Groundwater locally supports Groundwater Dependent Terrestrial Ecosystems (GWDTE) SPZ1
		Flood risk	Essential infrastructure or highly vulnerable development

Receptor Value (Sensitivity)	Criteria	Attribute	
High	Locally significant attribute of high importance	Surface water	Water body having a WFD classification shown in a RBMP Species protected under European or UK legislation Ecology and Nature Conservation Bathing Water.
		Groundwater	Principal aquifer providing locally important resource or supporting a river ecosystem Groundwater supports a GWDTE SPZ2
		Flood risk	More vulnerable development
Medium	Of moderate quality and rarity	Surface water	Water body not having a WFD classification shown in a RBMP
		Groundwater	Aquifer providing water for agricultural or industrial use with limited connection to surface water SPZ3
		Flood risk	Less vulnerable development
Low	Lower quality	Surface water	Minor artificial water features
		Groundwater	Unproductive strata
		Flood risk	Water compatible development

Magnitude of impacts

10.4.14 The approach used to assess magnitude of impacts on water environment features considers the change to the receptor. This considers the severity of impact of the Proposed Development, together with the vulnerability of the receptor to change.

10.4.15 Table 10-6 summarises the potential magnitude of any construction or operation impact on the receptor. These are based upon Table 3.71 of LA 113, modified for relevance to the Proposed Development.

Table 10-6 Estimating the magnitude of an impact on an attribute

Magnitude	Criteria	Attribute	
Major adverse	Results in loss of attribute and/or quality and integrity of the attribute	Surface water	Loss or extensive change to a fishery Loss of regionally important public water supply Loss or extensive change to a designated nature conservation site Reduction in water body WFD classification
		Groundwater	Loss of, or extensive change to, an aquifer Loss of regionally important water supply Loss of, or extensive change to GWDTE or baseflow contribution to protected surface water bodies Reduction in water body WFD classification Loss or significant damage to major structures through subsidence or similar effects
		Flood risk	Increase in peak flood level >100mm

Magnitude	Criteria	Attribute	
Moderate adverse	Results in effect on integrity of attribute, or loss of part of attribute	Surface water	Partial loss in productivity of a fishery Degradation of regionally important public water supply or loss of major commercial/industrial/agricultural supplies Contribution to reduction in water body WFD classification
		Groundwater	Partial loss or change to an aquifer Degradation of regionally important public water supply or loss of significant commercial/industrial/agricultural supplies Partial loss of the integrity of GWDTE Contribution to reduction in water body WFD classification Damage to major structures through subsidence or similar effects or loss of minor structures
		Flood risk	Increase in peak flood level >50mm
Minor adverse	Results in some measurable change in attributes, quality or vulnerability	Surface water	Minor effects on water supplies
		Groundwater	Minor effects on an aquifer, GWDTEs, abstractions and structures
		Flood risk	Increase in peak flood level >10mm
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity	Surface water	No measurable impact upon a surface water.
		Groundwater	No measurable impact upon an aquifer and/or groundwater receptors
		Flood risk	Negligible change to peak flood level (≤ +/- 10mm)
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	Surface water	Minor improvement in WFD quality element
		Groundwater	Reduction of groundwater hazards to existing structures Reductions in waterlogging and groundwater flooding
		Flood risk	Decrease in peak flood level >10mm
Moderate beneficial	Results in moderate improvement of attribute quality	Surface water	Contribution to improvement in water body WFD classification
		Groundwater	Contribution to improvement in water body WFD classification Improvement in water body catchment abstraction management Strategy (CAMS) (or equivalent) classification Support to significant improvements in damaged GWDTE
		Flood risk	Decrease in peak flood level >50mm
Major beneficial	Results in major improvement of attribute quality	Surface water	Improvement in water body WFD classification
		Groundwater	Recharge of an aquifer. Improvement in water body WFD classification
		Flood risk	Decrease in peak flood level >100mm

Magnitude	Criteria	Attribute
No change		No loss or alteration of characteristics, features or elements; no observable impact in either direction

Significance of effect

10.4.16 By combining the magnitude of impact (or change) and the value of each water environment feature, an assessment has been made of the significance of effect, considering the possibility and nature of mitigation. The resultant effects may be either negative (adverse), positive (beneficial) or neutral, depending on the nature of the impact.

10.4.17 In accordance with Table 3.8.1 of LA 104, the significance of effect upon the receptor is assessed using the matrix in Table 10-7. Effects are defined on a nine-point scale (very large beneficial, large beneficial, moderate beneficial, slight beneficial, neutral, slight adverse, moderate adverse, large adverse or very large adverse).

10.4.18 Where the matrix suggests more than one likely outcome, for instance slight or moderate, professional judgement has been used in conjunction with the descriptors in Table 10-7 to arrive at a robust conclusion.

Table 10-7 Significance matrix (taken from Table 3.8.1 of LA 104)

		Magnitude of impact (degree of change)				
		No change	Negligible	Minor	Moderate	Major
Environmental value (sensitivity)	Very high	Neutral	Slight	Moderate or large	Large or very large	Very large
	High	Neutral	Slight	Slight or moderate	Moderate or large	Large or very large
	Medium	Neutral	Neutral or slight	Slight	Moderate	Moderate or large
	Low	Neutral	Neutral or slight	Neutral or slight	Slight	Slight or moderate
	Negligible	Neutral	Neutral	Neutral or slight	Neutral or slight	Slight

10.4.19 Effects of moderate or major significance represent a significant effect. Moderate adverse effects represent a significant effect that requires mitigation, and function as means for the decision maker to take account of the likely significant effects of the Proposed Development.

Construction impacts

10.4.20 LA 113 [25] recommends that an assessment of construction impacts should use the advice given in CIRIA Report C648 Control of Water Pollution from Linear Construction Projects [32] on potential impacts arising during the construction phase and the assessment and mitigation of these risks.

10.4.21 The potential impacts of construction on surface waters or sediment runoff, water quality, flood risk and groundwater quality or level have been assessed based on the anticipated construction methods and sequencing Refer to ES Volume 2, Chapter 2 Project Description for further information about construction, maintenance activities and design life.

10.4.22 Outline measures to reduce construction impacts are incorporated into the contractor's Outline Construction Environmental Management Plan (CEMP) (document reference- EN.F.15), provided as part of the planning application and marine licence application documents.

Operational impacts

10.4.23 The assessment of operational impacts is centred around WFD compliance and flood risk management. The methodology for each is described in the following sections.

WFD compliance assessment

10.4.24 A WFD compliance assessment has been prepared for the Proposed Development (document number BMTH-ARP-EWE-ZZ-RP-OE-000003), with reference to relevant guidance [33]).

10.4.25 The WFD assessment identifies how the Proposed Development has the potential to affect each of the quality elements of the relevant water bodies and if this results in non-compliance with the WFD. The results of the other assessments in this chapter are used to inform the WFD assessment, where considered applicable.

10.4.26 For the relevant WFD water bodies, the potential effect of the Proposed Development upon any mitigation measures identified within the Western Wales RBMP has been assessed. At a minimum, the Proposed Development should not prevent water body improvement, and should ideally contribute to improvement.

Flood risk

10.4.27 A Flood Consequence Assessment (FCA) has been prepared for the Proposed Development (document number BMTH-ARP-XGN-ZZ-RP-W-000003 provided with the planning application and marine licence application documentation).

10.4.28 This has been carried out in alignment with the requirements of TAN 15 [15]. Broadly this comprises (a) qualitative assessment, and (b) quantitative assessment based on numerical flood modelling.

10.4.29 The FCA includes the details of the methodology used to assess the risk of flooding from coastal, pluvial, fluvial and groundwater sources as a result of the Proposed Development.

10.4.30 Climate change allowances have been derived and applied in the modelling for each of the epoch years assessed, namely 2025, 2075 and 2125. These have been derived for sea level rise and for rainfall (also applied for the watercourse inflows) using the current Welsh Government FCA climate change guidance [34].

Limitations and Assumptions

Limitations

10.4.31 The models used to assess the baseline and the Proposed Development are based on the best available information at the time. The modelling results and analyses are therefore dependent not only on the individual model limitations and assumptions but also on the quality and accuracy of this data. When using

results from modelling studies, it is essential to interpret them carefully and make allowances for uncertainties in the model predictions.

10.4.32 For the specific limitations related to the wave, sediment, and inundation models, please refer to the individual appendices in the FCA (document reference BMTH-ARP-XGN-ZZ-RP-W-000003).

Assumptions

10.4.33 The baseline information used within this chapter has been summarised from a variety of desk-based sources, numerical modelling studies, existing assessments, historical and recent ground investigations which have been assumed to be correct.

10.4.34 The wave, sediment, and inundation modelling undertaken by ABPmer (included in the FCA, document reference BMTH-ARP-XGN-ZZ-RP-W-000003) have been used to establish the flood risk in the area. For the assumptions of each model please refer to the relevant technical report.

10.5 Baseline

Current Baseline

10.5.1 This section sets out existing conditions and identifies potential receptors and their value, as per the methodology.

Water Environment Setting

10.5.2 The Site is primarily coastal and urban in nature, comprising a long sandy and fine-shingle beach in Cardigan Bay. The promenade provides access to Barmouth Beach. The beach levels significantly decrease, and the defences deteriorate in condition, moving towards the northern extent of the Site.

10.5.3 Directly to the east of the Site is the settlement of Barmouth, occupying a linear strip of coastline between the beach and Barmouth Slab, a natural rock-face reaching a height of 253m AOD.

10.5.4 The western extent of the Site falls below Mean High Water Springs (MHWS) and therefore intersects a small part of Cardigan Bay.

10.5.5 The mouth of the Mawddach Estuary is located 1.2km south of the Proposed Development.

WFD baseline

10.5.6 The location of the Proposed Development in relation to WFD waterbodies is shown in Figure 1 of the Water Framework Directive Assessment (document number BMTH-ARP-EWE-ZZ-RP-OE-000003).

10.5.7 The Site is located within the Meirionydd WFD Management Catchment in the Western Wales RBD. The Site is within the Cardigan Bay North WFD Coastal waterbody (GB621009600000). Mawddach Transitional waterbody (GB511006407100) is located approximately 1km south of the Site.

10.5.8 The WFD surface waterbodies have a natural hydromorphological designation. Cardigan Bay North WFD coastal waterbody and Mawddach WFD transitional waterbody have Moderate ecological status.

10.5.9 The site overlays Meirionnydd groundwater body (GB41002G203200). Meirionnydd WFD groundwater waterbody has Poor ecological status; the Reason for Not Achieving Good (RNAG) is an abandoned mine.

10.5.10 There are no WFD River Waterbody Catchments, WFD Canals, WFD Surface Water Transfers, nor WFD Lakes within 2km of the Site.

10.5.11 There are no Opportunity Catchments nor Targeted Waterbodies within 2km of the Site.

10.5.12 A summary of the WFD baseline status is presented in Table 10-8. Further information is available in the Water Framework Directive Assessment (document number BMTH-ARP-EWE-ZZ-RP-OE-000003).

Table 10-8 Summary of WFD baseline status

Waterbody parameters	Meirionnydd	Cardigan Bay North	Mawddach
Waterbody ID	GB41002G203200	GB621009600000	GB511006407100
Waterbody Type	Groundwater	Coastal	Transitional
Waterbody Area (km^2)	1347	712	9.5
Distance from Site	0m (site overlies)	0m (site overlies)	1km south
Hydromorphological Designation	N/A	Natural	Natural
Overall Status	Poor	Moderate	Moderate
Ecological Status	N/A	Good	Good
Chemical Status	N/A	Moderate	Moderate

International statutory designated sites

10.5.13 WFD Protected Areas are shown on Figure 2 of Water Framework Directive Assessment, (document reference BMTH-ARP-EWE-ZZ-RP-OE-000003).

10.5.14 The Lleyn Peninsula and the Sarnau Special Area of Conservation (SAC) is located 100m west of Site. The Meirionnydd Oakwoods and Bat Sites SAC is located 350m east of Site but is not hydrologically connected to the site and is therefore not considered further in the assessment.

10.5.15 To the south of the Site is the Mawddach Estuary Site of Special Scientific Interest (SSSI), whilst the hillside to the east of the Site is designated as the Barmouth Hillside SSSI. Barmouth Hillside SSSI is not hydrologically connected to the site and is therefore not considered further in the assessment.

Bathing water area

10.5.16 Barmouth beach is a designated bathing water. NRW assesses water quality at designated bathing water sites in Wales from May to September. The water quality sample point 20014 is located opposite the North Avenue by the Marwyn Hotel (latitude, longitude: 52.72, -4.062, easting, northing: 260840, 315900).

10.5.17 Annual water quality assessments for bathing water in Barmouth is Excellent in 2025, as well as Excellent in 2024, 2023, 2022, 2021.

Other protected areas

10.5.18 The Mawddach shellfish waters protected area is located 800m south of the study area and encompasses the lower reaches of the Mawddach Estuary.

10.5.19 There are no Nitrate Vulnerable Zones (NVZ) within 2km of the Site. There are no Groundwater Dependent Terrestrial ecosystems within 2km of the Site.

10.5.20 The Site is within Meirionnydd Groundwater Drinking Water Protected Area. Given the Site's proximity to the coast and its limited interaction with groundwater, this protected area is not at risk from the Proposed Development and is therefore not considered further.

10.5.21 There are no Drinking Water Protected Area Lakes nor Drinking Water Protected Area River Catchments within 2km of the Site. There are no Urban Wastewater Treatment Regulation Areas within 2km of the Site.

10.5.22 There are no known Private Water Supplies within the Study Area.

10.5.23 Table 10-9 summarises the names of designated sites relevant to flooding and water quality, and their orientation relative to the Site.

Table 10-9 Protected areas in proximity to Site

Designation	Name	Approximate proximity to Site
SAC	Pen Llyn a'r Sarnau / Lleyn Peninsula and the Sarnau	100m west of Site, parallel to Site
SAC	Coedydd Derw a Safleoedd Ystlumod Meirion / Meirionnydd Oakwoods and Bat Sites	350m east of Site
SSSI	Aber Mawddach / Mawddach Estuary	400m south of Site
SSSI	Barmouth Hillside	350m east of Site
Bathing water area	Barmouth beach	Within and west of Site
Shellfish water	Mawddach designated shellfish water	800m south of Site
Drinking Water Protected Area	Meirionnydd Groundwater Drinking Water Protected Area	Underlying Site

Emergency or storm overflows

10.5.24 There are two outfalls within 2km of the bathing water, operated by Dŵr Cymru Welsh Water (DCWW), as shown on ES Volume 4, Figure 10.1. One is a pumped surface water outfall and the other is a wastewater outfall.

Ordinary waterbodies

10.5.25 There are two unnamed small waterbodies that intersect the Site, as shown on as shown on ES Volume 4, Figure 10.1:

- A small waterbody, locally known as the Hofotty and named here as Ordinary Watercourse 1, intersects the site near Promenade Café. It flows through an existing culvert into the sea. At present it does not have a non-return valve and the outfall appears to be largely blocked.
- A small waterbody, locally known as the Gellfawr and named here as Ordinary Watercourse 2, intersects the site near Heol-Y-Plas. It flows through

an existing culvert and via one of two pumped outfalls into the sea. Both outfalls have existing non-return valves.

WFD habitat classification

10.5.26 WFD habitats are considered in this chapter to inform the water quality assessment. Further information can be found in ES Volume 2- Chapter 6 Biodiversity and Protected Sites and in the Water Framework Directive Assessment (document reference BMTH-ARP-EWE-ZZ-RP-OE-000003).

Higher sensitivity habitats

10.5.27 Blue mussels are located on lower sections of the groynes within the study area. For the purpose of this assessment, a precautionary approach is taken in assuming these mussel are WFD higher sensitivity habitats. Further blue mussel beds are located 110m to the south of the Site. The location of these areas are shown in the Water Framework Directive Assessment (document reference BMTH-ARP-EWE-ZZ-RP-OE-000003).

Lower sensitivity habitats

10.5.28 Four WFD lower sensitivity habitats are located either within and/or adjacent to the Site, as shown in the Water Framework Directive Assessment (document reference BMTH-ARP-EWE-ZZ-RP-OE-000003). These comprise:

- Gravel and Cobbles are present within the northern extend of the Site;
- Intertidal Soft Sediment is present throughout the Site;
- Subtidal Soft Sediment is adjacent to the west of the Site; and
- Rocky shore is present within the centre of the Site.

Flood risk

10.5.29 Coastal flooding is the primary risk in the area, with areas also at risk of surface water flooding. There is no fluvial flood risk as there are no Main Rivers in the study area.

10.5.30 The flood risk from the surface water to much of the Site is High, meaning that each year, this area has a chance of flooding of greater than 1 in 30 (3.3%) [35].

10.5.31 Coastal flooding is experienced during storm events, with wave overtopping of the primary wall being the main source. A notable historic event was recorded 03 January 2014. Further information on flood risk, including figures showing areas at risk of flooding, can be found in the FCA (document reference BMTH-ARP-XGN-ZZ-RP-W-000003).

10.5.32 There is no risk of flooding from reservoirs in the study area.

Baseline receptor summary

10.5.33 From the baseline described above, the receptors within the baseline with the potential to be affected by the Proposed Development are summarised in Table 10-10.

Table 10-10 Sensitivity of identified receptors

Receptor	Sensitivity	Reasoning
Cardigan Bay North coastal waterbody	High	WFD water bodies
Mawddach WFD transitional waterbody		
Meirionnydd WFD groundwater body		
Lleyn Peninsula and the Sarnau SAC	Very High	SAC protected/designated under European and UK legislation, nationally significant attribute of high importance
Mawddach Estuary SSSI	Very High	SSSI protected/designated under UK legislation, nationally significant attribute of high importance
Highly vulnerable development	High	As defined in TAN 15, Figure 4 [15].
Barmouth bathing water area	High	Bathing water area listed under UK legislation, locally significant attribute of high importance
Blue mussel beds WFD higher sensitivity habitat	High	Habitat listed under UK legislation, locally significant attribute of high importance
WFD lower sensitivity habitats within or adjacent to Site	Medium	Habitat listed under UK legislation, of moderate quality and rarity
Less vulnerable development	Medium	As defined in TAN 15, Figure 4 [15].
Water compatible development	Low	As defined in TAN 15, Figure 4 [15].

Future Baseline

10.5.34 The future baseline of the Site relates to anticipated changes in flood risk relating to sea level rise and changes in rainfall due to climate change. Both result in increasing flood risk to receptors.

10.5.35 The baseline flood modelling for the Proposed Development accounts for these. This is described in detail in the FCA (document reference BMTH-ARP-XGN-ZZ-RP-W-000003).

10.6 Embedded Environmental Design Measures

10.6.1 The design includes a range of measures that been embedded into the Proposed Development design to avoid or minimise environmental effects. The design measures embedded for flooding and water quality are described for embedded design measures and construction good practice measures.

Embedded environmental design measures

- Production by the Contractor of a Construction Flood Risk Management Plan, to set out the methodology to be followed to maintain coastal protection throughout the construction phase.
- Construction of the Proposed Development in phases, thereby minimising any temporary increase in flood risk and minimising the potential for environmental effects during construction.
- Following best practice guidance with reference to pollution prevention throughout the construction and operational phases [36].

Construction Good Practice Measures

10.6.2 A range of measures relevant to flooding and water quality are set out for the construction phase within the Outline CEMP (document reference- EN.F.15).

10.6.3 The following groups of measures are of particular importance that will be put in place during construction:

- The Contractor shall develop and implement a robust Construction Flood Risk Management Plan before the commencement of the construction phase.
- To reduce the potential increase in flood risk and increased erosion during the temporary removal of flood defences, works should be scheduled as far as is practicable for lower tides and taking weather forecasts into account for stormy periods. Alternatively, enforced temporary closures of the Promenade may be required during the works. If damage to the existing defences occurs, temporary works to shore up the structures would be undertaken to prevent failure.
- To reduce the risk of reduced water quality in Barmouth bathing water area, works to be scheduled to avoid summer holiday periods.
- The Contractor shall develop and implement the CEMP detailing the practical and necessary measures required during construction to prevent the pollution of the surrounding environment.
- The CEMP shall include a procedure for groyne removal to manage possible sediment suspension and contaminant mobilisation from the works.
- The CEMP will include a fuel spillage procedure, requirements for fuel storage locations, restrictions to tidal working times and general protocols to reduce adverse impacts on water quality.
- The CEMP will include a materials storage procedure to prevent loose sediment stored on site from being mobilised and dispersed into receiving watercourses. The CEMP will include methods to manage unintended mobilisation of materials stored on site.
- The material specification will consider source and specification of materials and their preparation, to avoid discoloration into receiving waterbodies.
- Regular on-the-spot visual monitoring would be undertaken during the construction phase to determine any visible changes to water quality in the marine environment.
- The Biosecurity Risk Assessment covers the measures required to safely manage the import of materials from other sites into the intertidal area with respect to INNS and the recommendations would be incorporated into the CEMP.

10.7 Assessment of Likely Significant Effects

10.7.1 This section presents the assessment of likely significant effects on flooding and water quality resulting from the construction, operation and maintenance of the Proposed Development. The likely significant effects of the Proposed Development have been identified taking into account the embedded

environmental design measures outlined in Section 10.6. Further mitigation may be proposed as a result which is presented in Section 10.8.

Construction Effects

10.7.2 This section presents the assessment of potential effects on flooding and water quality resulting from the construction of the Proposed Development, refer to ES Volume 2 Chapter 2 Project Description. Construction is defined as all the works undertaken to build a proposed development and typically the majority of the impacts on flooding and water quality will occur during this phase as this is when physical changes occur. The potential effects are assessed based on design elements presented in ES Volume 2, Chapter 2 Project Description.

Water quality

10.7.3 Plant and equipment movement would be required in close proximity to sensitive receptors such as: Cardigan Bay North coastal waterbody, Barmouth bathing water area, Lleyn Peninsula and the Sarnau SAC, Blue mussel beds WFD higher sensitivity habitat.

10.7.4 There is a potential risk of water pollution from oil or fuel spills which could result in a deterioration of water quality in the surface water. This impact is anticipated to have a **slight adverse** significance with construction good practice measures implemented as presented in the Outline CEMP (document reference- EN.F.15).

10.7.5 There is a potential risk for additional organic material and INNS to be introduced to the WFD waterbodies. This impact is anticipated to have a **slight adverse** significance.

10.7.6 There is a potential risk for increase in turbidity in hydrologically-connected waterbodies due to plant and material movement. The introduction of new materials for the Proposed Development could contribute to discoloration during installation. These risks could decrease the water quality and status of water environments and functionally-linked habitats. This impact is anticipated to have a **slight adverse** significance.

10.7.7 There is a potential risk for increase in turbidity in hydrologically-connected waterbodies due to groyne removal, which could mobilise sediment into suspension, and may contain pollutants. These risks could decrease the water quality and status of water environments and functionally-linked habitats. This impact is anticipated to have a **slight adverse** significance with construction good practice measures implemented as presented in the Outline CEMP (document reference- EN.F.15).

10.7.8 The Proposed Development is not anticipated to impact the Meirionnydd WFD groundwater body as the Proposed Development does not involve groundwater abstraction, and any piling works are expected to be along the coastline at the edge of this waterbody. The Proposed Development would not alter flow paths or create pollution pathways to regional groundwater. The impact to the water quality of the Meirionnydd WFD groundwater body is **neutral**.

Flood risk

10.7.9 Given the nature of the site and Proposed Development, the site and equipment would be at risk of coastal flooding during the construction phase. A

Construction Flood Risk Management Plan will set out the methodology to be followed during construction to maintain coastal protection.

10.7.10 With these embedded environmental design measures in place, the effect upon flood risk during construction would be **neutral** and not significant.

Operational and Maintenance Effects

10.7.11 Operation is defined as the post-construction phase of the proposed development, including maintenance activities, until there is further development or until the site ceases to operate as a standard of protection against coastal flooding. Refer to ES Volume 2, Chapter 2 Project Description for the description and period of maintenance activities, and the design life of the proposed development. Some impacts on flooding and water quality may occur during this phase.

Water quality

10.7.12 There is a potential risk of discoloration due to the permanent introduction of new materials for the Proposed Development. These risks could decrease the water quality and status of water environments and functionally-linked habitats. This is anticipated to result in a **slight adverse** significance.

Flood risk

10.7.13 The Proposed Development aims to improve the existing coastal defences and provide increased flood and erosion protection to people and property in Barmouth.

10.7.14 The Proposed Development would provide new and improved sea defence to reduce the flood risk to 757 properties.

10.7.15 During the operation of the Proposed Development, there are considered to be a **large beneficial effects** to flood risk.

10.8 Mitigation and Enhancement

10.8.1 This section outlines the mitigation required where significant effects have been identified.

Additional Mitigation of Construction Effects

10.8.2 No significant construction effects have been identified, therefore no additional mitigation is required.

10.8.3 No additional monitoring requirements have been identified.

Mitigation of Operational Effects

10.8.4 No significant operational effects have been identified, therefore no additional mitigation is required.

10.8.5 Monitoring requirements in relation to flood risk and water quality have been identified and presented below.

Water quality

10.8.6 Regular visual monitoring would be undertaken during any maintenance works to determine any visible changes to the marine environment.

10.8.7 Chemicals used for cleaning of the beach access points (stairs and slipways) would be specified to be non-hazardous to confirm that there is no adverse impact on the sediment and water quality.

Flood risk

10.8.8 Regular monitoring and maintenance of flood defence structures would be undertaken within the red line boundary and would continue throughout the life of the flood defence structures. Maintenance would include:

- Reactive maintenance and repair of revetment, coastal defence structures, steps and slipways as identified following routine inspections (this is anticipated to be minimal in the medium term).
- Cleaning and maintenance of slipways and flood gates (hinges and seals) with a suitable inspection regime.

Enhancements

10.8.9 The Proposed Development is intended to provide enhancements to flood risk, by carrying out coastal flood and erosion risk management works on a 1.2km length of frontage at the in the North Promenade region of Barmouth.

10.8.10 The alleviation of flood risk in Barmouth could improve resilience of the water and wastewater network, such as to reduce the frequency and duration of storm overflow events. This would improve water quality in the water environment (e.g. WFD waterbodies, WFD habitats, bathing water) by reducing the release of contaminated wastewater via emergency or storm overflows (see Paragraph 10.5.24).

10.9 Residual Effects

10.9.1 The assessment has identified a large beneficial effect upon flood risk in the defended area during operation.

10.9.2 No significant adverse effects from construction or operation have been identified and there are therefore no significant residual adverse effects.

10.10 Assessment Summary

10.10.1 Table 10-11 summarises the effects identified in the water quality and flood risk assessment, alongside their significance.

Table 10-11 Summary of effects matrix

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual effect
WFD surface water bodies: Cardigan Bay North coastal waterbody	Water pollution from oil or fuel spills from plant and equipment movement on the beach.	Slight adverse	N/A	Slight adverse

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual effect
Mawddach WFD transitional waterbody				
	Introduction of additional organic material and INNS	Slight adverse		Slight adverse
	During construction: increase in turbidity and discoloration in the WFD waterbodies	Slight adverse		Slight adverse
	During construction: remobilisation of contaminants due to groyne removal	Slight adverse		Slight adverse
	During operation: discolouration of materials and loose sediment into sea	Slight adverse		Slight adverse
Lleyn Peninsula and the Sarnau SAC	Water pollution from oil or fuel spills from plant and equipment movement on the beach.	Slight adverse		Slight adverse
	Introduction of additional organic material and INNS	Slight adverse		Slight adverse
	During construction: increase in turbidity	Slight adverse		Slight adverse
	During operation: discolouration of materials and loose sediment into sea	Slight adverse		Slight adverse
Barmouth bathing water area	Water pollution from oil or fuel spills from plant and equipment movement on the beach.	Slight adverse		Slight adverse
	Introduction of additional organic material and INNS	Slight adverse		Slight adverse
	During construction: increase in turbidity around sampling point 20014	Slight adverse		Slight adverse
	During operation: discolouration of	Slight adverse		Slight adverse

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual effect
	materials and loose sediment into sea			
Blue mussel beds WFD higher sensitivity habitat	Water pollution from oil or fuel spills from plant and equipment movement on the beach.	Slight adverse		Slight adverse
	Introduction of additional organic material and INNS	Slight adverse		Slight adverse
	During construction: increase in turbidity	Slight adverse		Slight adverse
	During operation: discolouration of materials and loose sediment into sea	Slight adverse		Slight adverse
WFD lower sensitivity habitats within or adjacent to Site	Water pollution from oil or fuel spills from plant and equipment movement on the beach.	Slight adverse		Slight adverse
	Introduction of additional organic material and INNS	Slight adverse		Slight adverse
	During construction: increase in turbidity	Slight adverse		Slight adverse
	During operation: discolouration of materials and loose sediment into sea	Slight adverse		Slight adverse
Defended area (properties)	During construction: flood risk	Neutral		Neutral
	During operation: reduction in flood risk	Large beneficial		Large beneficial

Abbreviations List

AGC	Alun Griffiths Contractors
AOD	Above Ordnance Datum
BGS	British Geological Society
CAMS	Catchment abstraction management Strategy
CEMP	Construction Environmental Management Plan
D&B	Design and Build
DCWW	Dŵr Cymru Welsh Water
DMRB	Design Manual for Roads and Bridges
ECI	Early Contractor Involvement
EIA	Environmental Impact Assessment
ES	Environmental Statement
FAS	Flood Alleviation Scheme
FCA	Flood Consequences Assessment
FCERM	Flood and Coastal Erosion Risk Management
FRMP	Flood Risk Management Plan
GWDTE	Groundwater Dependent Terrestrial Ecosystems
INNS	Invasive Non-Native Species
LLFA	Lead Local Flood Authority
MHWS	Mean High Water Springs
NRP	Natural Resources Policy
NRW	Natural Resources Wales
OBC	Outline Business Case
OS	Ordnance Survey
PDZ	Policy Development Zone
RBD	River Basin District
RBMP	River Basin Management Plan
RNAG	Reason for Not Achieving Good
SAC	Special Area of Conservation
SAFFA	Salmon and Freshwater Fisheries Act
SMP	Shoreline Management Plan
SoNARR	State of Natural Resources Report
SSSI	Site of Special Scientific Interest
TAN	Technical Advice Note
WER	Water Environment Regulations
WFD	Water Framework Directive
YGC	Ymgynghoriaeth Gwynedd Consultancy

Glossary

Quality elements	Refers to the specific biological, chemical, and physical characteristics used to assess the status of water bodies under the Water Framework Directive (WFD).

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Cyngor Gwynedd

Barmouth North Promenade FAS

ES Chapter 11 Noise and Vibration

Reference: BMTH-ARP-ENV-ZZ-RP-OE-000001

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Contents

11. Noise and Vibration **1**

11.1 Introduction 1

11.2 Legislation, Policy and Guidance 1

11.3 Stakeholder Engagement 5

11.4 Methodology 6

11.5 Baseline 9

11.6 Embedded Environmental Design Measures 10

11.7 Assessment of Likely Significant Effects 11

11.8 Mitigation and Enhancement 16

11.9 Residual Effects 16

11.10 Assessment Summary 17

Abbreviations List **20**

Glossary **21**

References **23**

Tables

Table 11-1 List of Relevant Legislation 2

Table 11-2 List of Relevant National Policy 3

Table 11-3 List of relevant local policy, plans and strategies 4

Table 11-4 Cyngor Gwynedd comments on scope of the noise and vibration assessment and the response 5

Table 11-5 NRW comments on scope of the noise and vibration assessment and the response 5

Table 11-6 Thresholds of potential significant effects at dwellings from on-site noise sources 7

Table 11-7 Predicted construction noise levels at residential locations 13

Table 11-8 Predicted construction noise levels at non-residential locations 14

Table 11-9 Residual effects of construction 16

Table 11-10 Summary of effects matrix 17

11. Noise and Vibration

11.1 Introduction

11.1.1 This chapter considers the likely significant effects of noise and vibration associated with the Proposed Development on the surrounding area. A full description of the Proposed Development is provided in ES Volume 2, Chapter 2 Project Description. The Proposed Development is located within the community of Barmouth, which includes mixed commercial, residential, shared public open space and community and tourism facilities located within the surrounding area.

11.1.2 The approach undertaken for this chapter has been supported by an EIA Scoping report submitted by Cyngor Gwynedd (Ymgynghoriaeth Gwynedd Consultancy (YGC)), engagement with statutory consultees, and Scoping opinions received from Cyngor Gwynedd and Natural Resources Wales (NRW) on 30 April 2024 and 19 April 2024 respectively.

11.1.3 This chapter details the legislation, policy and guidance that is relevant to the Proposed Development, a summary of engagement undertaken, the methodology of assessment, and the embedded environmental design measures. This is followed by an assessment of likely significant effects of the Proposed Development on the community of Barmouth, taking account of the embedded environmental design measures, and the need for any additional mitigation is then considered along with any proposals for enhancement design measures. This chapter concludes with a summary of likely significant residual effects. Discussion of in combination and cumulative effects is presented in ES Volume 2, Chapter 14 Cumulative and In- Combination effects.

11.1.4 This chapter is supported by the following appendices (see ES Volume 3):

- Appendix 11.1- Landside Sound Survey report.
- Appendix 11.2- Construction Plant Machinery

11.1.5 This chapter is supported by the following figures (see ES Volume 4):

- Figure 11.1- Noise and Vibration Baseline Monitoring and Assessment Locations.

11.1.6 This chapter should be read in conjunction with:

- ES Chapter 6 Biodiversity and Protected Sites.
- ES Chapter 7 Climate Change.
- ES Chapter 8 Community Considerations.
- ES Chapter 13 Seascape and Landscape and Visual.
- ES Chapter 15 Cumulative and In-Combination Effects.

11.2 Legislation, Policy and Guidance

11.2.1 This section identifies the legislation, policy, guidance and other documentation that has informed the assessment of likely significant noise and vibration effects on the community of Barmouth. This section is supported by the ES Volume 3, Appendix 1.1 Policy Context, which outlines overarching legislation and policy relevant to the Proposed Development.

Legislation

11.2.2 Table 11-1 lists the legislation relevant to this topic and the assessment of the likely significant effects.

Table 11-1 List of Relevant Legislation

Legislation	Relevance to Assessment
The Environment (Wales) Act 2016 [1]	Section 11 of the Act requires NRW to prepare and publish area statements that it considers appropriate for the purpose of facilitating the implementation of the natural resources policy (NRP). The national challenges and opportunities for the sustainable management of natural resources identified in the NRP include “reducing noise pollution” and “supporting preventative approaches to health outcomes”.
Well-being of Future Generation (Wales) Act 2015 [2]	The Well-being of Future Generations (Wales) Act is about improving the social, economic, environmental and cultural well-being of Wales. This is relevant for the assessment of construction noise and vibration.
The Town and Country Planning Act 1990 [3] and the Planning and Compulsory Purchase Act 2004 [4]	These Acts are the principal statutory controls over land use in Wales and are supplemented by other statutes and subordinate legislation. The law specifies how local planning authorities should regulate development through the planning system. This is relevant for the assessment of construction noise and vibration.
Environmental Noise (Wales) Regulations 2006 [5]	The Environmental Noise (Wales) Regulations 2006 implement the EU Environmental Noise Directive (END) 2002/49/EC in Wales and setting out provisions with respect to strategic noise maps and action plans.
The Control of Pollution Act 1974 [6]	The Control of Pollution Act provides local planning authorities with the power to control noise or vibration pollution from sites of construction. This may include specific controls to restrict activities identified as causing disturbance. Conditions regarding hours of operation will generally be specified and noise and vibration limits at certain locations may also be applied in specific cases. The powers afforded to the local planning authorities include prosecution for failure to comply with the requirements of a notice served under the act, and a system of providing prior consent for works to be carried out in a specified manner so as to reduce the likelihood of causing disturbance (‘section 61 consents’).
Environmental Protection Act 1990 [7]	The Environmental Protection Act provides LPAs with powers to serve, or request a magistrate to serve, abatement notices against noise (including vibration) from premises that are considered to be a nuisance. Section 79 of the act imposes a duty on local authorities to inspect its area to detect any statutory nuisances (noise emitted from premises so as to be prejudicial to health or a nuisance caused by vehicle, machinery or equipment) from time to time, and to investigate any complaint made by a person living in the area.
Environment (Air Quality and Soundscapes) (Wales) Act 2024 [8]	The aim of the Act is to improve the quality of our air environment and reduce the impacts of airborne pollution on human health, nature, the environment and our economy. The Act includes provisions related to noise and soundscapes, requiring Ministers to produce a national strategy on soundscapes.

National Policy and Strategies

11.2.3 Table 11-2 lists the relevant planning policy and strategies, with paragraphs of relevance to the noise and vibration assessment.

Table 11-2 List of Relevant National Policy

National Policy & Paragraph Number	Summary of Policy Requirement and Relevance
Planning Policy Wales Edition 12 [9]: Paragraph 6.7.3	Certain natural sounds (like birds or water) promote tranquillity, while familiar everyday sounds can be reassuring. In contrast, noise pollution harms health and well-being. Public bodies create noise action plans to reduce harmful noise and protect good soundscapes, focusing on the most polluted areas. Although only high noise levels qualify as statutory nuisances, lower levels can still disrupt amenity and should be addressed through planning. The planning system must protect amenity and cannot rely solely on statutory nuisance laws.
Welsh National Marine Plan [10]	The Welsh National Marine Plan states the Welsh Government's policies for, and in connection with, the sustainable development of the marine plan area. The plan puts into place more robust requirements on developers and public authorities, giving Welsh Government a stronger basis for determining and licensing activities in accordance with our values. Noise and vibration are captured under the sustainability appraisal aspects of the plan.
UK Marine Policy Statement [11]	This Marine Policy Statement is the framework for preparing Marine Plans and taking decisions affecting the marine environment and includes a focus on managing noise in the marine environment
Future Wales – the National Plan 2040 [12]	Future Wales outlines the national development framework, including the strategy for using the planning system to address key national priorities. It is focussed around a spatial plan for identifying areas for development and infrastructure investment, to ensure that this is complementary and is undertaken in a sustainable way. It refers to noise mostly in terms of ensuring noise from transport sources are minimised or at least reduced, and no unacceptable adverse impacts are allowed from renewable and low carbon energy projects qualifying as Developments of National Significance. The Proposed Development does not qualify as a Development of National Significance or a transport scheme and so the framework is not applicable to this development. It is noted that the intention of the document to mitigate and minimise noise from development is in line with Planning Policy Wales.
Technical Advice Note (TAN) 11 – 1997 [13]	TAN 11 provides guidance on the minimisation of adverse noise impacts through the planning system without placing unreasonable restrictions on development or adding unduly to the costs and administrative burdens of business. It outlines considerations for which Local Planning Authorities (LPAs) should take into account in drawing-up development plan policies and when determining planning applications for a development which will either generate noise or be exposed to existing noise sources. With regards to the introduction of noise generating development, TAN 11 states that LPAs must ensure that noise generating development does not cause an unacceptable degree of disturbance. It also states that noise characteristics (e.g. sudden impulses, irregular noise, distinguishable sounds, etc.) are relevant and require special consideration, in particular for industrial developments. TAN 11 provides advice on mitigation measures and describes the approach to assessment of noise from industrial and commercial developments, which refers to BS4142 [14]
SMP2 – Shoreline Management Plan 2 [15]	West of Wales Shoreline Management Plan 2 (SMP2) is a non-statutory policy document that outlines how to manage the risk of coastal flooding and erosion. Noise and vibration are captured under the environmental assessment aspects of the plan.

National Policy & Paragraph Number	Summary of Policy Requirement and Relevance
Noise and Soundscape Plan for Wales 2023-2028 [16]	The noise and soundscape plan sets out: a summary of the evidence, current policies, and priorities for the next 5 years.

Local Policy and Strategies

11.2.4 The relevant local planning policy, plans and strategies to the airborne and underwater noise assessment are listed in Table 11-3.

Table 11-3 List of relevant local policy, plans and strategies

Local Policy, Plan & Strategy	Relevant policy	Relevance to Assessment
Anglesey and Gwynedd Joint Local Development Plan 2011 - 2026 (2017) [17]	Policy AMG 4	Policy AMG 4: Coastal Protection part 2 iv. Requires consideration to ensure the proposal does not cause unacceptable harm to the area's biodiversity interests due to their location, scale, form, appearance, material, noise, or emissions or due to an unacceptable increase in traffic. In relation to waste management, the policy also requires the development and associated traffic not to result in unacceptable disturbance to local communities through noise.

Standards and Guidance

11.2.5 The guidance and standards which relate to this topic are listed below.

- BS4142:2014+A1:2019 Methods for rating and assessing industrial and commercial sound [14].
- BS5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise [18].
- BS5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration [19].
- Construction Noise - A good practice guide to the preparation, submission and management of Section 61 consents (Association of Noise Consultants (ANC), 2021) [20].
- Calculation of Road Traffic Noise (CRTN) [21].
- Groundborne vibration caused by mechanised construction works, TRL Report 429 (Transport Research Laboratory, 2000) [22].
- Transport and Road Research Laboratory (TRRL) – Traffic Induced Vibration in Buildings - Research Report 246 (TRRL 1986) [23].
- BS EN 61672-1:2013 Electroacoustics. Sound level meters – Specifications [24].
- ISO 9613-2 Acoustics - Attenuation of sound during propagation outdoors [25].
- Institute of Environmental Management and Assessment (IEMA) Guidelines for Environmental Noise Impact Assessment 2014 [26].
- World Health Organization (WHO) Environmental Noise Guidelines for the European Region 2019 [27].
- World Health Organization (WHO) Guidelines for Community Noise 1999 [28].
- Night Noise Guidelines for Europe (NNG) 2009 [29].

- NRW Evidence Report No. 529: Review and recommendations on assessment of noise disturbance for marine mammals [30].
- NRW Evidence Report No: 448: Underwater acoustic surveys: review of source characteristics, impacts on marine species, current regulatory framework and recommendations for potential management options [31].

11.3 Stakeholder Engagement

EIA Scoping Opinion

11.3.1 An EIA Scoping Opinion was adopted by Cyngor Gwynedd/Gwynedd Council (supported by Ymgynghoriaeth Gwynedd Consultancy (YGC)) and Natural Resources Wales (NRW) on 30 April 2024 and 19 April 2024 respectively. The comments received in relation to the Proposed Development are presented in Table 11-4 and Table 11-5 together with how these have been addressed.

11.3.2 A meeting was held with the Environmental Health department of Cyngor Gwynedd/Gwynedd Council on 27 February 2025 to discuss the noise survey and approach to the assessment.

Table 11-4 Cyngor Gwynedd comments on scope of the noise and vibration assessment and the response

EIA Scoping Opinion Comment	Response
The Public Protection Service are in broad agreement with the contents of the Environmental Impact Assessment Scoping Opinion Report (ref. 8718) and discussions should be entered with the Public Protection Service to determine the scope of a noise and vibration assessment in accordance with that of Construction Noise Assessment BS 5228 ABC Method [18].	Assessment of construction noise is undertaken in accordance with BS 5228-1 [18] ABC Method.
The Public Protection Service, Gwynedd Council, have advised that as part of the EIA, an environmental management plan (EMP) should be incorporated. This should consist of the set of mitigation, monitoring, and institutional measures to be taken during implementation and operation to eliminate adverse environmental and social impacts, offset them, or reduce them to acceptable levels.	An Outline Construction Environmental Management Plan (CEMP) (document reference- EN.F.15) has been produced and provided with the planning submission and marine licence documents

Table 11-5 NRW comments on scope of the noise and vibration assessment and the response

EIA Scoping Opinion Comment	Response
The EIA Scoping Opinion makes no reference to marine mammals or fish receptors that are features of European Designated Sites. NRW A have advised that Marine Mammals of the Pen Llyn a'r Sarnau SAC (Designated Special Area of Conservation) would need to be considered due to possible noise disturbance from the piling activity. Likewise, NRW have highlighted that the potential for the piling activity to impact on migratory fish from underwater noise and vibration and should be considered for the Afon Eden – Cors Goch Trawsfynydd SAC which has salmon as a feature.	Underwater noise baseline, prediction and assessment of effects on marine mammals and fish receptors are included within Chapter 6 Biodiversity and Protected Sites.

11.4 Methodology

11.4.1 This section outlines the methodology followed to assess the potential likely significant effects of the Proposed Development in relation to noise and vibration including: effects scoped into the assessment; study area; methodology; and assessment of significant effects.

Effects scoped into the assessment

11.4.2 Effects that were scoped out for the noise and vibration assessment are operational noise and vibration and decommissioning noise and vibration.

11.4.3 Effects that were scoped in for the noise and vibration assessment relevant to the construction phase were: construction airborne noise; construction vibration; construction road traffic noise; and construction road traffic vibration.

11.4.4 Effects from underwater noise on marine mammals and fish receptors were scoped in for the ecology assessment and are reported in ES Volume 2, Chapter 6 Biodiversity and Protected Sites.

Study area

11.4.5 The Proposed Development is located at Barmouth North Promenade as shown in ES Volume 4, Figure 11.1. The landside noise sensitive receptors are located to the east of the Proposed Development across its length.

11.4.6 Following guidance in BS 5228-1 [18], the study area for the construction noise assessment is 300m from any construction activity, or the area within which sound levels from the Proposed Development are forecast to give rise to potential impacts, whichever is the greater.

11.4.7 The study area for the construction vibration assessment is 100m from any construction activity, or the area within which vibration levels from the Proposed Development are forecast to give rise to potential impacts, whichever is the greater.

11.4.8 The construction traffic noise study area is defined as 50m from the carriageway edge of public roads with the potential for an increase in basic noise level (BNL) of 1 dB(A) or more. These routes are determined on review of the data which is generated by the transport assessment. The procedure for calculating a BNL is set out by the CRTN document [21] and relates to a noise level at a reference location 10m from the carriageway edge.

11.4.9 For construction traffic vibration, the study area is based upon guidance presented by TRRL Report 246 (1990) [23], which indicates that the vertical peak particle velocity (PPV) from a fully laden heavy goods vehicle (HGV) travelling at 20 mph on a road surface with a 10mm height bump would result in ground-borne vibration levels of less than 0.3mm/s at a distance of approximately 2m. The study area was defined as 2m from the carriageway edge of any route used by HGVs.

Baseline Methodology

11.4.10 The airborne noise baseline data for the study area has been obtained from a desktop study and surveys.

11.4.11 The following information sources have been used to complete the landside baseline assessment:

- Airborne baseline noise measurement site survey (November 2024).
- Strategic Environmental Noise Mapping from “DataMapWales” [32].

11.4.12 A site visit was undertaken by two Arup noise and vibration specialists in November 2024.

11.4.13 This survey consisted of three days of unattended logging in two locations and three measurements at each of three attended measurement locations. The attended measurements were each 15 minutes duration and, taken 1.2 m above ground level using a Class 1 sound level meter.

11.4.14 No baseline vibration survey was required.

Receptor sensitivity

11.4.15 The IEMA ‘Guidelines for Environmental Noise Impact Assessment’ (IEMA, 2014) [26] notes that receptors may have various sensitivities to noise but does not specifically define a sensitivity scale.

11.4.16 The sensitivities of receptors have been considered when selecting the assessment criteria used to describe the magnitude of impact. As such, it was not necessary to define a separate sensitivity scale for noise and vibration receptors.

Construction noise methodology

11.4.17 The BS5228-1 [18] standard provides information on the prevention and control of construction noise and includes a procedure for predicting construction noise and assessing its potential impacts. The calculation of construction noise levels at selected locations have been based on typical noise levels of the key noise-generating plant, taken from BS5228-1 [18] and experience of projects of similar scale. Calculations also take account of typical percentage on-time, propagation distance, details of the intervening ground cover, topography and screening.

11.4.18 Thresholds for determining potential significant effects from construction noise have been set based upon the ‘ABC’ methodology set out in BS5228-1 [18]. For residential receptors, the potential significant effect threshold is determined using the existing measured ambient noise level, rounded to the nearest 5 dB and evaluated in relation to the thresholds set out in Table 11-6.

Table 11-6 Thresholds of potential significant effects at dwellings from on-site noise sources

Assessment category and threshold value period	Threshold value, dB		
	Category A	Category B	Category C
Night-time (23:00 – 07:00)	45	50	55
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75
Other: Weekday evenings (19:00 – 23:00) Saturdays (13:00 – 23:00) Sundays (07:00 – 23:00)	55	60	65

Assessment category and threshold value period	Threshold value, dB		
	Category A	Category B	Category C
Category A: threshold value to use when ambient noise levels (rounded to the nearest 5dB) are less than these values. Category B: threshold value to use when ambient noise levels (rounded to the nearest 5dB) are the same as Category A values. Category C: threshold value to use when ambient noise levels (rounded to the nearest 5dB) are higher than Category A values. Note 1: A potential significant effect is indicated if the $L_{Aeq,T}$ noise level arising from the site exceeds the threshold level for the category appropriate to the ambient noise level. Note 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total LAeq, T noise level for the period increases by more than 3 dB due to site noise.			

11.4.19 Having established if there is a potential significant effect using the ABC method, the final assessment of significance is evaluated by taking into account the following factors:

- Change in noise levels (and resulting noise impact on receptors).
- Level of noise exposure.
- Level and character of the existing noise environment.
- Number and grouping of adversely affected dwellings and shared community facilities.
- Any unique features of the source or receiving environment in the local area.
- The potential combined exposure to noise and vibration.
- The frequency and duration over which temporary construction impacts may occur.

11.4.20 For non-residential receptors, significant effects were determined on a receptor-by-receptor basis taking into account:

- The use and sensitivity of the receptor.
- The design of the receptor affected.
- Change in noise levels (and resulting noise impact on receptors).
- Level of noise exposure.
- Level and character of the existing noise environment.
- Any unique features of the source or receiving environment in the local area.
- The potential combined exposure to noise and vibration.
- The frequency and duration over which temporary construction impacts may occur.

11.4.21 The threshold level for potential construction noise significant effects on public open spaces is taken as 5 dB or more above the existing daytime ambient noise level ($L_{Aeq,16h}$).

11.4.22 The threshold level for potential construction noise significant effects on school buildings is taken as 50 dB or more and a change of more than 3 dB above the existing daytime ambient noise level ($L_{Aeq,30min}$). The threshold level for potential significant effects on outdoor teaching spaces is taken as 55 dB or more and a change of more than 3 dB above the existing daytime ambient noise level ($L_{Aeq,30min}$), with at least one area suitable for outdoor teaching where noise levels are below 50 dB $L_{Aeq,30min}$.

Construction vibration

11.4.23 Vibration levels have been predicted at selected receptors based upon guidance presented in BS 5228-2 [19].

11.4.24 The threshold level for potential construction vibration significant effects on residential buildings and hotels is taken as 0.3 mm/s PPV.

11.4.25 The risk of structural damage due to construction vibration is considered by reference to criteria set out in BS 7385-2 [33] . For structurally sound buildings, this is 6mm/s PPV for continuous vibration and 12 mm/s for transient vibration at the base of the building and half these values for potentially vulnerable buildings.

Construction road traffic noise on public highways

11.4.26 The threshold level for potential construction road traffic noise significant effects on residential buildings and hotels is taken as a change in traffic noise of 3 dB or more where the total traffic noise exposure is greater than 55 dB $L_{A10,18hr}$ at the façade.

11.4.27 The threshold level for potential construction road traffic vibration significant effects on residential buildings and hotels is taken as 0.3 mm/s PPV.

Assessment of cumulative effects

11.4.28 Cumulative and in-combination effects are addressed within ES Volume 2, Chapter 15 Cumulative Effects.

Limitations and Assumptions

Limitations

11.4.29 While the programme of construction works has been prepared for the Proposed Development, the days and weeks that noisy equipment will be used has not been defined at this stage.

Assumptions

11.4.30 It is assumed that several of the main construction works will progress across the site between the north and the south so that works near each receptor will occur as a proportion of the programme duration for these activities.

11.5 Baseline

11.5.1 Barmouth is a town located within a rural setting on the coast. Background noise levels include those generated by local traffic as well as natural coastal sounds (wind, waves, birds and amenity users). Noise and vibration sensitive receptors in the study area include residential properties, hotels, caravan park, skate park, café and a school.

11.5.2 Details of the baseline ambient noise survey are presented in ES Volume 3, Appendix 11.1.

11.5.3 The measured daytime ambient noise levels were 55 dB L_{Aeq} or lower at all monitoring locations when rounded to the nearest 5 dB. Evening and night-time ambient noise levels were 55 dB L_{Aeq} at the south end of the promenade and 45 dB L_{Aeq} at the north end of the promenade when rounded to the nearest 5dB.

Future Baseline

It is not anticipated that the future baseline would change in a 'Do Minimum' scenario. The existing sources of noise are from surrounding road and rail traffic that are not anticipated to increase in traffic volume or speed by an amount that would result in appreciable increase in ambient noise levels.

11.6 Embedded Environmental Design Measures

11.6.1 The design includes a range of measures that have been embedded into the Proposed Development design to avoid or minimise environmental effects. The design measures embedded for Noise and Vibration are described for construction good practice.

Construction Good Practice Measures

11.6.2 A range of measures relevant to noise and vibration are summarised below and are set out in the Outline Construction Environmental Management Plan (CEMP) (document reference- EN.F.15) Examples of typical measures include the following:

- Careful selection of plant and construction methods. Only plant conforming to relevant national, EU or international standards, directives and recommendations on noise and vibration emissions should be used.
- Design and use of site enclosures, housing and temporary stockpiles, where practicable and necessary, to provide acoustic screening at the earliest opportunity.
- Where practicable, doors and gates should not be located opposite occupied noise-sensitive buildings. The mechanisms and procedures for opening doors/gates will minimise noise, as far as reasonably practicable.
- Choice of routes and programming for the transport of construction materials, spoil and personnel.
- Careful programming so that activities which may generate significant noise are planned with regard to local occupants and sensitive receptors.

11.6.3 Other construction measures that will contribute to noise mitigation, and which will be included within the CEMP include the following:

- All vehicles and mechanical plant shall be fitted with effective exhaust silencers and shall be maintained in good and efficient working order and operated to minimise noise emissions.
- All compressors and generators shall be 'sound reduced' models fitted with properly lined and sealed acoustic covers which shall be kept closed whenever the machines are in use, and all pneumatic percussive tools shall be fitted with mufflers or silencers of the type recommended by the manufacturers.
- All machines in intermittent use shall be shut down in the intervening periods between works or throttled down to a minimum. Lorry engines will be switched off, as soon as practicable, when vehicles are stationary.
- Noise emitting equipment which is required to run continuously shall be housed in a suitable acoustic enclosure.
- Temporary noise barriers will be used to reduce noise levels where appropriate and practicable. Such measures can be particularly appropriate

for stationary or near-stationary plant such as pneumatic breakers, piling rigs and compressors. Barriers should be located as close to the plant as possible and, in order to provide adequate attenuation and should have a mass per unit area of at least 7 kg/m^2.

- Plant and equipment liable to create noise and/or vibration whilst in operation will, as far as reasonably practicable, be located away from sensitive receptors and away from walls reflecting towards sensitive receptors.
- Materials for night-time working shall be delivered, where practicable, during normal hours of working and be placed as close as possible to the work area for which they are required.
- Where reasonably practicable, fixed items of construction plant shall be electrically powered in preference to combustion engine driven.
- Doors on plant and equipment will be kept closed.

11.6.4 Best practicable means (BPM) as defined in Section 72 of the Control of Pollution Act 1974 [6] to control noise disturbance is the measure of particular importance that will be put in place during construction to control noise.

11.6.5 There would be no target threshold for BPM as this should be adopted by the contractor for the works irrespective of whether significant effects are identified by the assessment. BPM places a duty on the contractor to minimise and mitigate impacts with reasonable measures, for example working hours, quieter processes where practicable, use of well-maintained and quieter powered mechanical equipment and methods of piling if required.

11.7 Assessment of Likely Significant Effects

11.7.1 This section presents the assessment of likely significant noise and vibration effects resulting from the construction of the Proposed Development. The likely significant effects of the Proposed Development have been identified taking into account the construction good practice measures. The potential effects are assessed based on design presented in ES Volume 2, Chapter 2 Project Description.

Construction Noise Effects

11.7.2 The principal construction works considered for the construction noise and vibration assessment are:

- Material delivery (rock, sheet piles, underlayer).
- Mobilise site compound and set up access.
- Beachside works (underlayer, rock revetment, access steps, primary wall, installation of sheet piles).
- Landside works (central kerb and balustrade and secondary flood wall, placemaking).
- Promenade / roadworks.
- Car parks and additional areas.
- Finishes / reinstate and demobilise.

11.7.3 ES Volume 3 Appendix 11.2- Construction Plant Machinery details the plant machinery assumed for the assessment. The works are proposed to take place over a 24 month construction programme.

11.7.4 The site construction compound (figure number to be added for final issue) will be located centrally within the Proposed Development and to the east of Marine Parade. The compound would house offices, welfare and storage units. It would also be used for temporary storage of rock armour and other construction materials, plant and equipment.

11.7.5 The construction works will mainly be undertaken Monday to Friday, daytime only, for 10 hours a day between 07:00 and 19:00 hours. Any working outside these hours (as may be required to work efficiently around the tides) will be controlled by the management processes set out in the Environmental Management Plan (Document reference: BMPH-ARP-EGN-ZZ-RP-OE-000011). See Section 11.6 for examples of measures relevant to noise and vibration that will be included in the Environmental Management Plan.

11.7.6 Daytime construction noise levels at a selection of the nearest sensitive receptors were predicted based on the relevant construction plant, propagation distances, on times and programme. The receptor locations included in the predictions are as follows:

Barmouth Beach Club	(Assessment Location 1)
Dwellings adjacent to Barmouth Beach Club	(Assessment Location 2)
Barmouth Skate Park	(Assessment Location 3)
Promenade Café	(Assessment Location 4)
Hendre Mynach Caravan Park	(Assessment Location 5)
Dwellings onTai'r Heli	(Assessment Location 6)
Dwellings on Heol-Y-Llan	(Assessment Location 7)
Dwellings on Heol-Llywelyn	(Assessment Location 8)
Dwellings on Heol-Y-Plas and Heol-Y Sarn	(Assessment Location 9)
Dwellings setback more than 50m from Marine Parade	(Assessment Location 10)
Min-Y-Mor Hotel	(Assessment Location 11)
Dwellings adjacent to Min-Y-Mor Hotel	(Assessment Location 12)
Ysgol Y Traeth School	(Assessment Location 13)

11.7.7 The noise predictions at these locations were calculated for the most exposed and closest facades to the construction works.

11.7.8 The results of the prediction of construction noise are presented in Table 11-7. This table presents the impact threshold category value, the predicted construction noise levels are representative of the highest monthly noise levels for each construction activity.

Table 11-7 Predicted construction noise levels at residential locations

Assessment Location	Receptor	ABC threshold $dBL_{Aeq,day}$	Predicted daytime construction noise levels $dBL_{Aeq,day}$	Construction activity resulting in construction noise levels exceeding ABC threshold
2	Dwellings adjacent to Barmouth Beach Club	65	70	Beachside works for rock revetment, steps and sheet piles. Landside works for primary and secondary wall. Promenade, car parking and roadworks.
6	Dwellings onTai'r Heli	65	73	Beachside works for rock revetment, steps and sheet piles. Landside works for primary and secondary wall. Promenade and roadworks. Works at site compound.
7	Dwellings on Heol-Y-Llan	65	73	Beachside works for rock revetment, steps and sheet piles. Landside works for primary and secondary wall. Promenade and roadworks.
8	Dwellings on Heol-Llywelyn	65	74	Beachside works for rock revetment, steps and sheet piles. Landside works for primary and secondary wall. Promenade and roadworks.
9	Dwellings on Heol-Y-Plas and Heol-Y-Sarn	65	73	Beachside works for rock revetment, steps and sheet piles. Landside works for primary and secondary wall. Promenade and roadworks.
10	Dwellings north of Princess Avenue that are setback more than 70m from Marine Parade	65	65	Construction noise not predicted to exceed ABC threshold
12	Dwellings adjacent to Min-Y-Mor Hotel	65	72	Beachside works for rock revetment, steps and sheet piles. Landside works for primary and secondary wall. Promenade and roadworks. **Note – beachside works in this area have been removed from the design following this assessment.**

Table 11-8 Predicted construction noise levels at non-residential locations

Assessment Location	Receptor	Future baseline noise level dBLAeq,day	Predicted daytime construction noise levels* dBLAeq,day	Construction activity resulting in construction noise levels exceeding baseline
1	Barmouth Beach Club	49	70	Beachside works for rock revetment, steps and sheet piles. Landside works for primary and secondary wall. Promenade, car parking and roadworks.
3	Barmouth Skate Park	54	78	Beachside works for rock revetment, steps and sheet piles. Landside works for primary and secondary wall. Promenade, car parking and roadworks.
4	Promenade Café	54	75	Beachside works for rock revetment, steps and sheet piles. Landside works for primary and secondary wall. Promenade, car parking and roadworks. Works at site compound.
5	Hendre Mynach Caravan Park	55	70	Beachside works for rock revetment, steps and sheet piles. Landside works for primary and secondary wall. Promenade, car parking and roadworks. Works at site compound.
11	Min-Y-Mor Hotel	54	72	Beachside works for rock revetment, steps and sheet piles. Landside works for primary and secondary wall. Promenade and roadworks.
13	Ysgol Y Traeth School	54	69	Beachside works for rock revetment, steps and sheet piles. Landside works for primary and secondary wall. Promenade and roadworks. **Note – beachside works in this area have been removed from the design following this assessment.**

11.7.9 Construction noise at residential receptors represented by assessment locations 2, 6, 7, 8, 9 and 12 are predicted to exceed the daytime threshold. The duration of construction noise impacts at each receptor would likely be a result of sheet piling (~2 weeks), rock revetment (~2 weeks), the primary wall and secondary wall (~1 week each) and promenade/roadworks (~2 weeks). In addition,

assessment location 2 would likely be from exposure to car parking works (~2 weeks). Therefore**, significant temporary adverse** construction noise effects are likely at these residential receptors.

11.7.10 The residential receptors represented by assessment location 10 may be exposed to construction noise that exceeds the evening threshold as a result of working around the tides. The duration of evening works is not anticipated to occur for more than 2 weeks at each receptor. Therefore, the temporary construction noise effects at these receptors are assessed to be minor adverse and **not significant**.

11.7.11 Construction noise at non-residential receptors represented by assessment locations 1, 3, 4, 5, 11 and 13 would be more than 10dB above the future baseline noise levels. The levels are above the criteria for outdoor public spaces and outdoor teaching spaces at the school. The duration of construction noise impacts at each receptor would likely be a result of sheet piling (~2 weeks), rock revetment (~2 weeks), the primary wall and lego wall (~1 week each) and promenade/roadworks (~2 weeks). In addition, assessment location 1, 3, 4 and 5 would likely be from exposure to car parking works (~2 weeks). Therefore, **significant temporary adverse** construction noise effects are likely at these non-residential receptors.

Construction Vibration Effects

11.7.12 The predicted vibration levels at the nearest receptors from activities such as piling and ground compaction have been performed according to the formulas in BS5228-2 [19]. Predicted vibration levels are 1.2mm/s PPV at assessment location 12 and 0.7mm/s PPV at assessment locations 4, 6, 7, 8, 9 and 11. The primary source of vibration is from piling with likely lower levels of vibration from roller ground compaction and concrete breaking.

11.7.13 Short term vibration impacts during daytime hours are predicted at receptors represented by assessment locations 4, 6, 7, 8, 9, 11 and 12. These receptors will not be exposed to vibration over a significant periods of time and prior notification will be provided as set out in the EMP. The vibration levels can be tolerated by people given prior warning and explanation and BPM will ensure no structural damage is caused. The temporary construction vibration effects are assessed to be minor adverse and **not significant**.

Construction Traffic

11.7.14 In most locations, the predicted traffic noise increase due to construction vehicles occurs in areas with low existing traffic noise exposure or results in a negligible change in traffic noise (< 1dB). Should rock deliveries come by road (rather than by sea), during the busiest month of construction traffic, the receptors on Marine Parade between Princess Avenue and Heol Idris are predicted to experience a 3 dB traffic noise increase.

11.7.15 Short term construction traffic impacts during daytime hours on Marine Parade are predicted at receptors represented by assessment locations 11 and 12. The residents and occupants of these properties will be given prior waring and explanation, and BPM will be employed to control noise. The temporary construction traffic noise effects are assessed to be minor adverse and **not significant**.

11.7.16 There are no buildings located within the traffic vibration study area from 2m of the construction traffic routes. Therefore, temporary construction traffic vibration effects are assessment to be negligible and **not significant**.

11.7.17 As stated in paragraph 11.4.2 operational noise and vibration are scoped out of the noise and vibration assessment has had been agreed in the scoping phase.

11.8 Mitigation and Enhancement

11.8.1 This section outlines the mitigation required where significant effects have been identified.

11.8.2 To minimise the level of noise to which sensitive receptors will be exposed, the construction work will be conducted in accordance with the Outline CEMP. The CEMP will contain established control measures based upon the BS5228-1 [18].

11.8.3 Liaison with residents and property owners at locations where significant adverse effects are likely will be carried out to inform them of noisy activities and timescales. To monitor the level of noise to which sensitive receptors are exposed, construction noise monitoring will be conducted as required. Construction noise monitoring involves continuous and detailed measurement of noise levels around construction sites to ensure they comply with agreed limits and to minimise disturbance to nearby residents.

11.9 Residual Effects

11.9.1 Cumulative effects are addressed within ES Volume 2, Chapter 15 Cumulative Effects.

11.9.2 All significant effects identified from construction will be mitigated as outlined in Section 11.8. An assessment of residual significant effects is presented in Table 11-9.

Table 11-9 Residual effects of construction

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual significance of effect
Barmouth Beach Club	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Dwellings adjacent to Barmouth Beach Club	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Barmouth Skate Park	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Promenade Café	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Hendre Mynach Caravan Park	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Dwellings on Tai'r Heli	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual significance of effect
Dwellings on Heol-Y-Llan	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Dwellings on Heol-Llywelyn	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Dwellings on Heol-Y-Plas and Heol-Y-Sarn	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Min-Y-Mor Hotel	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Dwellings adjacent to Min-Y-Mor Hotel	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Ysgol Y Traeth School	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant **Note – beachside works in this area have been removed from the design following this assessment.**

11.10 Assessment Summary

Table 11-10 Summary of effects matrix

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual effect
Barmouth Beach Club	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Dwellings adjacent to Barmouth Beach Club	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Barmouth Skate Park	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Promenade Café	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Hendre Mynach Caravan Park	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Dwellings on Tai'r Heli	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual effect
Dwellings on Heol-Y-Llan	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Dwellings on Heol-Llywelyn	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Dwellings on Heol-Y-Plas and Heol-Y-Sarn	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Min-Y-Mor Hotel	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Dwellings adjacent to Min-Y-Mor Hotel	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Ysgol Y Traeth School	Construction noise	Temporary adverse significant	BPM, community liaison, monitoring	Temporary adverse significant
Dwellings north of Princess Avenue that are setback more than 70m from Marine Parade	Construction noise	Not significant	BPM	Not significant
Barmouth Beach Club	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Dwellings adjacent to Barmouth Beach Club	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Barmouth Skate Park	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Promenade Café	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Hendre Mynach Caravan Park	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Dwellings on Tai'r Heli	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual effect
Dwellings on Heol-Y-Llan	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Dwellings on Heol-Llywelyn	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Dwellings on Heol-Y-Plas and Heol-Y-Sarn	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Dwellings north of Princess Avenue that are setback more than 70m from Marine Parade	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Min-Y-Mor Hotel	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Dwellings adjacent to Min-Y-Mor Hotel	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Ysgol Y Traeth School	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant

Abbreviations List

AGC	Alun Griffiths Contractors
BNL	Basic Noise Level
BPM	Best Practicable Means
CEMP	Construction Environmental Management Plan
CRTN	Calculation of Road Traffic Noise
D&B	Design and Build
ECI	Early Contractor Involvement
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
END	Environmental Noise Directive
ES	Environmental Statement
EU	European Union
FAS	Flood Alleviation Scheme
HGV	Heavy Goods Vehicle
IEMA	Institute of Environmental Management and Assessment
LPA	Local Planning Authority
NRP	Natural Resources Policy
NRW	Natural Resources Wales
OBC	Outline Business Case
PPV	Peak Particle Velocity
SAC	Designated Special Area of Conservation
TAN	Technical Advice Note
TRRL	Transport and Road Research Laboratory
WHO	World Health Organization
YGC	Ymgynghoriaeth Gwynedd Consultancy

Glossary

Decibel (dB)	The ratio of sound pressures, which we can hear, is a ratio of 106 (one million: one). For convenience, therefore, a logarithmic measurement scale is used. The resulting parameter is called the 'sound pressure level' (L_p) and the associated measurement unit is the decibel (dB). As the decibel is a logarithmic ratio, the laws of logarithmic addition and subtraction apply.
dB(A)	The unit used to define a weighted sound pressure level, which correlates well with the subjective response to sound. The 'A' weighting follows the frequency response of the human ear, which is less sensitive to low and very high frequencies than it is to those in the range 500Hz to 4kHz. In some statistical descriptors the 'A' weighting forms part of a subscript, such as L_{A10}, L_{A90}, and L_{Aeq} for the 'A' weighted equivalent continuous noise level.
Equivalent continuous sound level	Another index for assessment for overall noise exposure is the equivalent continuous sound level, L_{eq}. This is a notional steady level which would, over a given period of time, deliver the same sound energy as the actual time-varying sound over the same period. Hence fluctuating levels can be described in terms of a single figure level.
Statistical noise levels	For levels of noise that vary widely with time, for example road traffic noise, it is necessary to employ an index which allows for this variation. The L_{10}, the level exceeded for ten per cent of the time period under consideration, has been adopted in this country for the assessment of road traffic noise. The L_{90}, the level exceeded for ninety per cent of the time, has been adopted to represent the background noise level. The L_1, the level exceeded for one per cent of the time, is representative of the maximum levels recorded during the sample period. A weighted statistical noise levels are denoted L_{A10}, dBL_{A90} etc. The reference time period (T), is normally included, e.g. $dBL_{A10,\ 5min}$ or $dBL_{A90,\ 8hr}$.
Maximum noise level	This is generally expressed as the maximum A-weighted noise level (L_{Amax}) and represents the maximum instantaneous noise level that occurred with the monitoring period. Certain assessment criteria recommend maximum noise levels to avoid disturbance as well as limits for longer-term averaged noise exposures.
Frequency	The rate of repetition of a sound wave. The subjective equivalent in music is pitch. The unit of frequency is the Hertz (Hz), which is identical to cycles per second. A thousand hertz is often denoted kHz, e.g. 2kHz = 2000Hz. Human hearing ranges approximately from 20Hz to 20kHz. For design purposes, the octave bands between 63Hz to 8kHz are generally used. The most commonly used frequency bands are octave bands, in which the mid frequency of each band is twice that of the band below it. For more detailed analysis, each octave band may be split into three one-third octave bands or in some cases, narrow frequency bands.

Sound pressure level

The sound power emitted by a source results in pressure fluctuations in the air, which are heard as sound.

The sound pressure level (L_p) is 10 times the logarithm of the ratio of the measured sound pressure (detected by a microphone) to the reference level of 2 x 10-^{5}Pa (the threshold of hearing).

Thus L_p (dB) = 10 log $(P_1/P_{ref})^2$ where P_{ref}, the lowest pressure detectable by the ear, is 0.00002 pascals (i.e. $2x10^{-5}$ Pa).

The threshold of hearing is 0dB, while the threshold of pain is approximately 120dB. Normal speech is approximately 60dB(A) or more and a change of 3dB is only just detectable. A change of 10dB is subjectively twice, or half, as loud.

Vibration

Vibration may be expressed in terms of displacement, velocity and acceleration. Velocity and acceleration are most commonly used when assessing structure borne noise or human comfort issues respectively. Vibration amplitude may be quantified as a peak value, or as a root mean squared (rms) value.

Vibration amplitude can be expressed as an engineering unit value e.g. 1 mms-^{1} or as a ratio on a logarithmic scale in decibels:

Vibration velocity level, dB = 20 log (V/V_{ref}) (where the preferred reference level, V_{ref}, for vibration velocity = 10^{-9} ms-^{1}).

The decibel approach has advantages for manipulation and comparison of data.

Typical noise levels

Some typical dB(A) noise levels are given below:

Noise level, dB(A)	**Example**
130	Threshold of pain
120	Jet aircraft take-off at 100m
110	Chain saw at 1m
100	Inside disco
90	Heavy lorries at 5m
80	Kerbside of busy street
70	Loud radio (in typical domestic room)
60	Office or restaurant
50	Domestic fan heater at 1m
40	Living room
30	Theatre
20	Remote countryside on still night
10	Sound insulated test chamber
0	Threshold of hearing

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ES Chapter 12 Marine and Coastal Physical Processes

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Contents

12. Marine and Coastal Physical Processes **1**

12.1 Introduction 1

12.2 Legislation, Policy and Guidance 2

12.3 Legislation 2

12.4 National Policy and Strategies 2

12.5 Local Policy and Strategies 4

12.6 Standards and Guidance 5

12.7 Stakeholder Engagement 5

12.8 Methodology 7

12.9 Baseline 8

12.10 Embedded Environmental Design Measures 19

12.11 Assessment of Effects 20

12.12 Zone of influence 23

12.13 Mitigation 24

12.14 Residual Effects 24

12.15 Alignment with SMP2 26

12.16 Coastal Squeeze 27

Abbreviations List **29**

References **30**

Tables

Table 12-1 List of Relevant Legislation 2

Table 12-2 List of Relevant National Policy 3

Table 12-3 List of relevant local policy, plans and strategies 4

Table 12-4 Gwynedd Council comments on scope of the Marine and Coastal Physical Processes and the response 5

Table 12-5 NRW comments on scope of the Marine and Coastal Physical Processes and the response 6

Table 12-6 Tidal water levels (Total Tide secondary port of Barmouth). See Appendix 12.4. 9

Table 12-7 Extreme still water levels for the year 2025 derived from CFBD (2018) and UKCP18 RCP8.5 70th percentile projections 10

Table 12-8 Extreme significant wave height predictions at Barmouth frontage for the year 2019 11

Table 12-9 SLR allowances using latest Welsh Government (2022) guidance 16

Table 12-10 Extreme Still Water Levels for 2025 and future epochs derived from CFBD (2018) and SLR UKCP18 RC8.5 70th%ile projections (extracted from Appendix 12.4) 16

Table 12-11 Recommended national precautionary sensitivity ranges for offshore wind speed and wave height (extracted from Appendix 12.4) 17

Table 12-12 Summary of effects matrix 25

Graphics

Graphic 12-1 Aerial Image of North Promenade showing coastline for different existing tidal levels (MHWN =1.3 mODN in blue, MHWS = 2.6 mODN in red, HAT 3.3 mODN in black), ODN Datum 10

Graphic 12-2 Wave extraction location (red circle) overlaid over admiralty chart 11

Graphic 12-3 Wave roses showing significant wave height at circa -7 mODN for the year 2019 12

Graphic 12-4 Changes in beach levels between LiDAR surveys in 2006 and 2022 – ABPmer (Appendix 12.5) 14

Graphic 12-5 SMP2 policy units of Barmouth. Llanaber (11.16), Barmouth North (11.15) and Barmouth South (11.14) (Appendix 12.2) 27

12. Marine and Coastal Physical Processes

12.1 Introduction

12.1.1 This chapter provides an assessment of the likely significant effects on the Marine and Coastal Physical Processes that may arise from the construction, operation and maintenance of Barmouth North Promenade Flood Defence Scheme (hereafter referred to as the 'Proposed Development').

12.1.2 This chapter has considered the scoping report submitted by Cyngor Gwynedd (Ymgynghoriaeth Gwynedd Consultancy (YGC)), engagement with statutory consultees, and scoping opinions received from Cyngor Gwynedd and Natural Resources Wales (NRW) on 30 April 2024 and 19 April 2024 respectively.

12.1.3 This chapter details the legislation, policy and guidance that is relevant to the Marine and Coastal Physical Processes, a summary of engagement undertaken, the methodology of assessment, and the embedded environmental design measures. This is followed by an assessment of likely significant effects of the Proposed Development on Marine and Coastal Physical Processes, taking account of the embedded environmental design measures, and the need for any additional mitigation is then considered along with any proposals for enhancement design measures. This chapter concludes with a summary of likely significant residual effects.

12.1.4 The Marine and Coastal Physical Processes chapter provides a general site description, placing the site within the regional geographical and environmental context and giving an overview of regional coastal processes. This informs the setting of the proper spatial maximum zone of influence for potential impacts of the proposed works which has been considered in this chapter.

12.1.5 Marine and Coastal Physical Processes receptors include:

- Tidal levels
- Extreme water and surge levels
- Waves
- Beach and coastal erosion
- Sediment Transport

12.1.6 This chapter is supported by the following appendices, all contained in Volume 3:

- Appendix 12.1 - ABPmer (2019), Barmouth North Promenade, Wave modelling, extremes analysis and overtopping, ABPmer Report No. R.3105. A report produced by ABPmer for Arup, May 2019 (referred herein R3105).
- Appendix 12.2 - ABPmer (2019), Barmouth North Promenade, Coastal Processes, ABPmer Report No. R.3096. A report produced by ABPmer for Arup, February 2019 (referred herein R3096).
- Appendix 12.3 - ABPmer (2021), Barmouth North Promenade, Shoreline modelling - risk reduction assessment, ABPmer Report No. R.3589. A report produced by ABPmer for Arup, April 2021.
- Appendix 12.4 - ABPmer (2024), Barmouth North Promenade D&C, Consideration of revised water level estimates, Ref 5501/TN01. A report produced by ABPmer for Arup, Oct 2024.

- Appendix 12.5 - Coastal Processes Technical Note by Arup. Appendix A: ABPmer (2024), Barmouth North Promenade D&C, Coastal Process and Option Review, Ref R.4718. A report produced by ABPmer for Arup, Dec 2024.
- Appendix 12.6 - Barmouth Beach Blown Sand Management Options Report prepared for Gwynedd Council KPAL Report No: 19100 27 October 2016, Pye, K., Blott, S., 2016.

12.1.7 This chapter is supported by the following figures, all contained in ES Volume 4:

- Figure 12.1 Coastal Processes: Zone of Influence
- Figure 12.2 Coastal Processes: Zone of Influence and Protected Areas

12.1.8 This chapter should be read in conjunction with:

- ES Chapter 6 Biodiversity and Protected Sites
- ES Chapter 7 Climate Change
- ES Chapter 8 Community Considerations
- ES Chapter 9 Cultural Heritage
- ES Chapter 10 Flooding and Water Quality
- ES Chapter 13 Seascape and Landscape and Visual
- ES Chapter 15 Cumulative and In-Combination Effects

12.2 Legislation, Policy and Guidance

12.2.1 This section identifies the legislation, policy, guidance and other documentation that has informed the assessment of likely significant effects on the Marine and Coastal Physical Processes. This section is supported by the ES Volume 3, Appendix 1.1 Policy Context, which outlines overarching legislation and policy relevant to the Proposed Development.

12.3 Legislation

12.3.1 Table 12-1 lists the legislation relevant to this topic and the assessment of the likely significant effects.

Table 12-1 List of Relevant Legislation

Legislation	Relevance to Assessment
The Environment (Wales) Act 2016	Section 6 under Part 1 of the Act introduced an enhanced duty (the S6 duty) for public authorities in the exercise of functions in relation to Wales. The S6 duty requires that public authorities must seek to maintain and enhance biodiversity so far as consistent with the proper exercise of their functions and in so doing promote the resilience of ecosystems. In doing so, public authorities must have regard to the list of species and habitats published under Section 7, the State of Natural Resources Report. (SoNaRR) and any relevant Area Statement(s).
Well-being of Future Generation (Wales) Act 2015	Well-being goal: Capacity to adapt to climate change Indicator 32 ‘Reducing flood risk to homes and businesses’

12.4 National Policy and Strategies

12.4.1 Table 12-2 lists the relevant planning policy and strategies, with paragraphs of relevance to the Marine and Coastal Physical Processes assessment.

Table 12-2 List of Relevant National Policy

National Policy & Paragraph Number	Summary of Policy Requirement and Relevance
Planning Policy Wales (PWW) Edition 12	**Section Coastal Change** Policies 6.5.14 to 6.5.20 have been considered in this assessment.
Welsh National Marine Plan	**SOC_08: Resilience to coastal change and flooding** Proposals should demonstrate how they are resilient to coastal change and flooding over their lifetime.
	SOC_09: Effects on coastal change and flooding Proposals should demonstrate how they: • avoid significant adverse impacts upon coastal processes; and • minimise the risk of coastal change and flooding; Proposals that align with the relevant Shoreline Management Plan(s) and its policies are encouraged.
	SOC_11: Resilience to climate change Proposals should demonstrate that they have considered the impacts of climate change and have incorporated appropriate adaptation measures, taking into account Climate Change Risk Assessments for Wales. Proposals that contribute to climate change adaptation and/or mitigation are encouraged.
	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.
	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
	ENV_06: Air and water quality Proposals should demonstrate that they have considered their potential air and water quality impacts and should, in order of preference: a. avoid adverse impacts; and/or b. minimise adverse impacts where they cannot be avoided; and/or c. mitigate adverse 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.
West of Wales Shoreline Management Plan 2 (SMP2)– St Anne's Head to Great Orme	The West of Wales Shoreline Management Plan 2 (SMP2) is a strategic, non-statutory policy document that sets out a long-term framework for managing coastal risks along the region's shoreline. It assesses coastal processes, flood and erosion risks, and the environmental, social, and economic implications of different management approaches. SMP2 gives guidance on driving sustainable coastal defence strategies while balancing the need for protection with the natural dynamics of the coastline.

National Policy & Paragraph Number	Summary of Policy Requirement and Relevance
	Section 6.2 Summary of SMP2 Policy Units Table Coastal Area D – Summary SMP2 preferred policies for Policy Units PU11.14 to PU11.16
UK Marine Policy Statement	**Section 2.6.7 Climate change adaptation and mitigation** Policies 2.6.7.1 to 2.6.7.9 (Pages 23 and 24) have been considered in this assessment.
	Section 2.6.8 Coastal change and flooding Policies 2.6.8.1 to 2.6.8.6 (Pages 24 and 25) have been considered in this assessment.
	Section 3.1 Marine protected areas Policies 3.1.1 to 3.1.8 (Pages 27 and 28) have been considered in this assessment.
TAN 14: Coastal Planning (1998)	*TAN 14: Coastal Planning* provides guidance on managing development in coastal areas, emphasizing the need to account for coastal erosion, flooding, and long-term changes. It highlights the importance of the SMP in shaping development decisions and avoiding areas that require costly engineering interventions. The document stresses the need for environmental protection, ensuring that development does not disrupt coastal habitats or exacerbate risks like coastal squeeze.
TAN 15: Development, Flooding, and Coastal Erosion (2022)	*TAN 15: Development, Flooding, and Coastal Erosion* provides guidance on assessing and managing risks from flooding and coastal erosion in development planning. The guidance supports sustainable development by encouraging risk-aware planning and resilience to future flooding and coastal erosion impacts.

12.5 Local Policy and Strategies

12.5.1 The relevant local planning policy plans and strategies to the Marine and Coastal Physical Processes assessment are listed in Table 12-3.

Table 12-3 List of relevant local policy, plans and strategies

Local Policy, Plan & Strategy	Relevant policy	Relevance to Assessment
Anglesey and Gwynedd Joint Local Development Plan 2011 - 2026 (2017)	Policy PS 6	Ensuring that the ability of landscapes, environments and species to adapt to the harmful effects of climate change is not affected, and that compensatory environments are provided if necessary;
	Policy ARNA 1	Proposals for new or replacement coastal defence schemes will only be permitted where it can be demonstrated that the works are consistent with the management approach for the frontage presented in the Shoreline Management Plan, and there will be no material adverse impact on the environment.
	Policy PS 19	The development is to conserve and enhance the natural environment and coastline and outlines that developments should consider relevant supplementary planning guidance including SPG Wildlife Sites and SPG Gwynedd Landscape Character.
	Policy AMG 4	Coastal Protection requires development to not cause harm to SACs and biodiversity areas.
	Policy AMG 5	The proposal is to protect and enhance locally important biodiversity and that developers produce an Ecological Assessment which highlights the relevant local biodiversity issues.

12.6 Standards and Guidance

12.6.1 The guidance and standards which relate to this topic are listed below.

- NRW Guidance Note GN13 - Scoping an Environmental Impact Assessment for Marine Developments (2017) [1].
- NRW Guidance Note GN19 - Completing a coastal or physical processes assessment for small-scale projects (2024) [2].
- NRW Guidance Note GN41 - (EIA) (2025) [3].
- Met Office UKCP18 Marine Report (2018) [4].

12.7 Stakeholder Engagement

EIA Scoping Opinion

12.7.1 An EIA Scoping Opinion was adopted by Cyngor Gwynedd/Gwynedd Council (supported by Ymgynghoriaeth Gwynedd Consultancy (YGC)) and Natural Resources Wales (NRW) on 30 April 2024 and 19 April 2024 respectively. The comments received in relation to Marine and Coastal Physical Processes are presented in Table 12-4 and Table 12-5 and details are included on how these have been addressed.

Engagement with NRW

12.7.2 A meeting with NRW Marine Advisory and Cyngor Gwynedd/Gwynedd Council was held on the 10 July 2025 where the key issues associated with coastal processes for the Proposed Development were described. Due consideration has been given to the NRW Guidance notes: GN19 - Completing a coastal or physical processes assessment for small-scale projects and GN41 Marine Physical Processes Guidance to inform Environmental Impact Assessment (EIA).

Table 12-4 Gwynedd Council comments on scope of the Marine and Coastal Physical Processes and the response

Scoping Opinion Comment	Response
We would agree that marine and coastal physical process is scoped into the assessment.	Marine and coastal physical processes are scoped into the assessment.
NRW have noted that as regards to Physical Processes a spatial maximum zone of influence for potential impacts of the proposed works has not been presented. A suitable spatial maximum zone of influence should be confirmed.	A suitable spatial maximum zone of influence is confirmed (see section 12.12).
NRW have stated that the scoping report submitted provides insufficient detail regarding potential direct and indirect impacts of the Construction, Operation and Decommission phases of the proposed works to Physical Processes.	Direct and indirect impacts of the Construction and Operation phases of the proposed works to Physical Processes are provided in sections Construction Effects and Operational and Maintenance Effects. The Proposed Development does not include decommissioning.
The Scoping Report notes that the Shoreline Management Plan relevant to the site is Hold the Line for epoch 1 while transitioning to Managed Realignment by epoch 2 and 3. The EIA must consider whether works are in line with the relevant SMP.	The EIA considers alignment of the works with the relevant SMP (see section 12.15).

Table 12-5 NRW comments on scope of the Marine and Coastal Physical Processes and the response

Scoping Opinion Comment	Response
We agree that marine and coastal physical process must be scoped into the assessment. A spatial maximum zone of influence for potential impacts of the proposed works has not been presented. This must be included with the EIA.	Marine and coastal physical processes are scoped into the assessment. A suitable spatial maximum zone of influence is confirmed (see section 12.12).
NRW also state that scoping report submitted provides insufficient detail regarding potential direct and indirect impacts of the Construction, Operation and Decommission phases of the proposed works to Physical Processes this must be addressed within the EIA"	Direct and indirect impacts of the Construction and Operation phases of the proposed works to Physical Processes are provided in sections Construction Effects and Operational and Maintenance Effects. The Proposed Development does not include decommissioning.
The Scoping Report notes that the Shoreline Management Plan relevant to the site is Hold the Line for epoch 1 while transitioning to Managed Realignment by epoch 2 and 3. The EIA must consider whether works are in line with the relevant SMP.	The EIA considers alignment of the works with the relevant SMP (see section 12.15).
There is guidance on NRW website surrounding when a coastal squeeze assessment may be necessary. We encourage you to review and follow the guidance.	Coastal Squeeze assessment eligibility requirements assessed in Section 12.16.

12.7.3 Comments were received from NRW dated 27 November 2025 as part of the Statutory Pre-Application Consultation – Town and Country Planning (Development Management Procedure) (Wales) Order 2012 as Amended. Consideration has been given to these comments, as summarised in Table 12-6.

Table 12-6 NRW comments as part of the Statutory Pre-Application Consultation

Statutory Pre-Application Consultation Comment	Response
NRW advised that a coastal squeeze assessment is submitted with planning application.	HRA Coastal Squeeze Addendum (doc ref BMTH-ARP-EBD-OFFSH-TN-OE-000003) has been produced to provide a Coastal Squeeze Assessment, considering the proposed policy change and section 12.16 amended to reflect the assessment.
NRW advised that the aeolian transport, impact of the revetment on dunes and the removal of the groynes impact on aeolian transport should be assessed.	These aspects have been considered in section *Sediment transport and beach morphology* including key conclusions in relation to the wind driven (aeolian) sand transport which have been extracted from the report Barmouth Beach Blown Sand Management Options Report prepared for Gwynedd Council KPAL Report No: 19100 27 October 2016, Pye, K., Blott, S., 2016 (Appendix 12.6.)
NRW advised clarifications of the baseline sediment transport model	Clarifications of the baseline sediment transport model have been added in section *Sediment Transport* including likely sand transport processes.

Statutory Pre-Application Consultation Comment	Response
NRW concluded that the provided zone of influence is reasonable; however, NRW advised that specific details should be given into the determination of the extent of the zone in this section. NRW advised that the 100m longshore extent was justified.	Numerical justification has been provided to determine the zone of influence in section 12.12 *Zone of influence*. It is noted that the 100m longshore extent has been modified to 15m as a result of the reduced extent of rock revetment which has been assessed to cause only localised effects.

Non-Statutory Engagement

12.7.4 Non-Statutory Stakeholder engagement has been undertaken with key stakeholders in relation to the Marine and Coastal Physical Processes. A summary of engagement undertaken is outlined below.

12.7.5 Stakeholder engagement was undertaken with NRW Marine Advisory and Cyngor Gwynedd/Gwynedd Council in a meeting held on the 10 July 2025 where the key issues dealing with coastal processes were described.

12.8 Methodology

Assessment Methodology

12.8.1 The EIA assessment methodology follows the NRW Guidance Note GN41 - Marine Physical Processes Guidance to inform Environmental Impact Assessment (EIA) (2025) for the determination of zone of influence and assessment of change and likely impacts. The EIA approach is based on the approach set out within ES Volume 2, Chapter 4 EIA approach applied to change and likely impacts identified.

12.8.2 The stages assessed in this chapter include the steps listed below.

- Conceptual understanding and characterisation of present and future baseline conditions including climate change allowances.
- Initial project description.
- Definition of maximum Zone of influence.
- Assessment of change and likely impacts.
- Assessment of significance:
  - Assigning value (or sensitivity) to receptors or resources.
  - Assigning magnitude of impact.
  - Assigning significance.
- Mitigation
- Residual effect
- Enhancements

12.9 Baseline

Current Baseline

12.9.1 This section sets out existing conditions and identifies potential receptors and their value, as per the methodology.

Description of the site elements affected by coastal processes

12.9.2 The Site location is set out in ES Chapter 2. The beach north of North Promenade is comprised of a shingle/cobble bank that fronts the railway line. Along North Promenade and to the south of North Promenade, the sediments are mainly comprised of sand with isolated pockets of shingle/cobbles along the upper foreshore.

12.9.3 A large beach with dynamic foredunes and embryo dunes lies to the south of Barmouth North Promenade at the Mawddach Estuary (see section Habitats and Ecology for wider ecological considerations).

12.9.4 Timber groynes are in place in front of the promenade to control the longshore movement of sediment, the groynes condition varies from north to south. However, these have been assessed as generally in poor condition and have very limited functionality with the exception of one refurbished groyne which seems to be retaining the coarser material in the upper part of the beach. In-between each of the groynes there are small pockets of sand-shingle beaches which become sandier in a southerly direction.

12.9.5 According to Appendix 12.2 Coastal Process and Option Review report by ABPmer, site visits undertaken in 2024 indicate that:

- Along the northern end of the frontage, the wall is undermined due to significant beach lowering has occurred against the sea wall.
- Coarse sediment (pebble/cobble) fillet exists along northern half the frontage blocked/trapped within a very slight ‘V’ in the seawall alignment.
- Reduced beach levels in central portion of frontage were observed.
- Along the southern section of the frontage (and extending along Barmouth, South Promenade), there is a significant coarse sediment in the and lower upper beach. The full extent of these shoals in the lower beach is unknown as sand material moves around, covering and exposing the coarse material in the process.
- Intermediate damage to the wall from past overtopping events seems to have occurred in the northern frontage where there is significant beach lowering,

12.9.6 Given the tidal range at Barmouth, the existing sea defences along North Promenade are exposed to the incident wave climate for significant periods over the tidal cycle, therefore exposing the defence to wave overtopping and hinterland flooding.

Metocean conditions

12.9.7 Water levels referenced in this section are extracted from the document: Consideration of revised water levels estimates, by ABPmer which can be found in ES Volume 3, Appendix 12.4.

Tidal Levels

12.9.8 Predicted tidal water levels to Admiralty Chart Datum (CD) and Ordnance Datum Newlyn (ODN) were obtained from Admiralty Total Tide by ABPmer and are presented in Table 12-7. The values presented are current and are representative of levels in 2025.

Table 12-7 Tidal water levels (Total Tide secondary port of Barmouth). See Appendix 12.4.

Reference Still Water Level	Chart Datum (mCD)	Ordnance Datum Newlyn (mODN)
Highest astronomical tide (HAT)	5.70	3.26
Mean high water springs (MHWS)	5.00	2.56
Mean high water neaps (MHWN)	3.70	1.26
Mean sea level (MSL)	2.72	0.28
Mean low water neaps (MLWN)	1.90	-0.54
Mean low water springs (MLWS)	0.70	-1.74
Lowest astronomical tide (LAT)	0.30	-2.14
Mean Spring Range	4.30m	
Mean Neap Range	1.80m	

12.9.9 During spring tides, the water level reaches the sea defence along most of the frontage, as can be seen in Graphic 12-1.

Graphic 12-1 Aerial Image of North Promenade showing coastline for different existing tidal levels (MHWN =1.3 mODN in blue, MHWS = 2.6 mODN in red, HAT 3.3 mODN in black), ODN Datum

Extreme Water Levels and Surge

12.9.10 The extreme still water levels for the current epoch were extracted from the Coastal Flood Boundary Dataset (CFBD, 2018) included in Appendix 12.4, at the dataset point closest to the Barmouth frontage (point 834). These water levels account for the impact of storm surges.

12.9.11 As the CFBD dataset provides water levels for the base year 2017, the extracted levels were adjusted to the 2025 using the UKCP18 (RCP8.5 70th %ile) Sea Level Rise (SLR) scenario and 95th %ile for sensitivity tests following the Welsh Government, (2022) Guidance “Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales”. More detail on the procedure can be found in Section 2.3 of Appendix 12.4, Refer to Table 12-8 for the extreme water levels in 2025.

Table 12-8 Extreme still water levels for the year 2025 derived from CFBD (2018) and UKCP18 RCP8.5 70th percentile projections

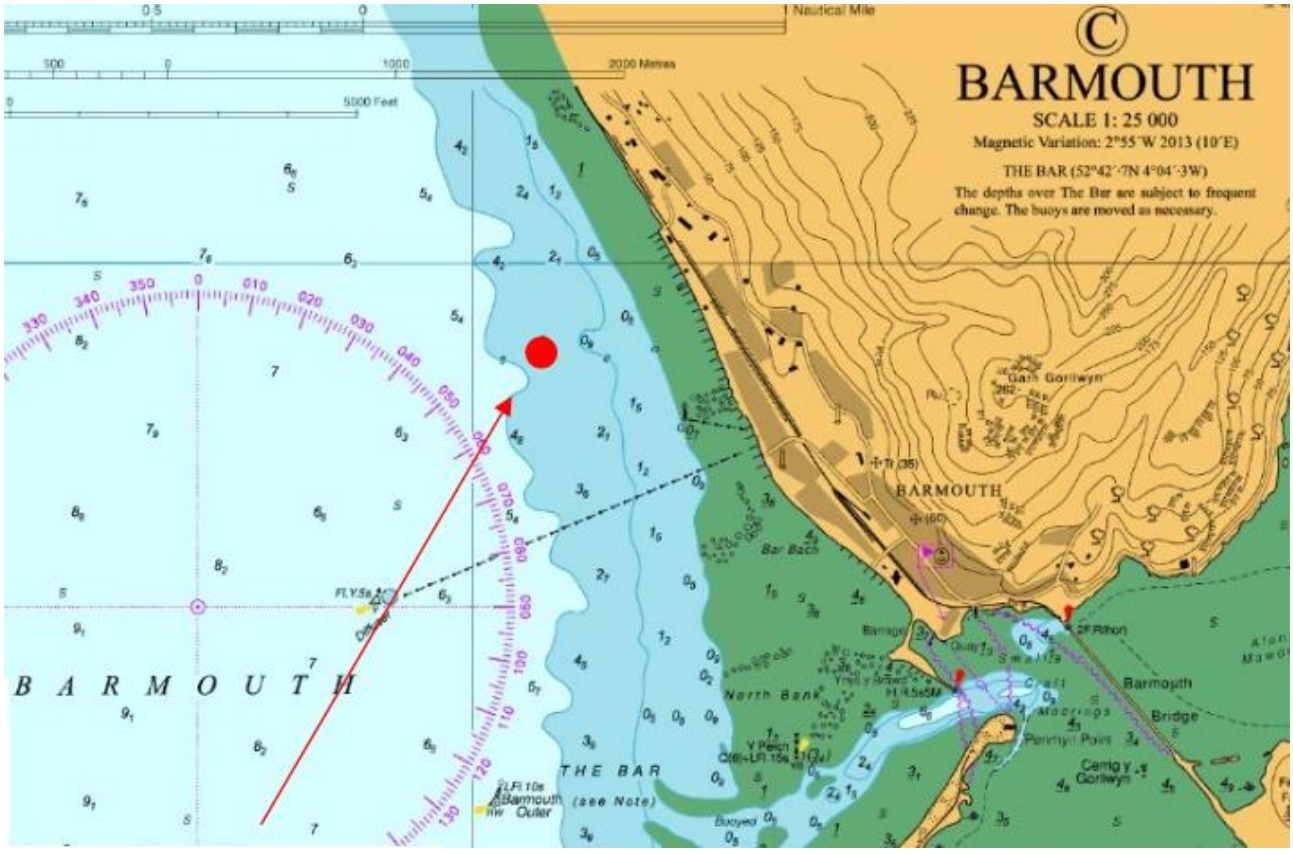
Return Period	AEP (%)	Epoch 2025 (mODN)
T1	63	3.50
T10	10	3.90
T50	2	4.17

Return Period	AEP (%)	Epoch 2025 (mODN)
T100	1	4.29
T200	0.5	4.41
T1000	0.1	4.70

Waves

12.9.12 Predicted extreme wave heights reaching the Barmouth frontage were derived from a regional wave model by ABPmer at OBC stage in 2019 described in ES Volume 3, Appendix 12.2. The results are based on a 39 year hindcast timeseries of wave heights and were subject to an Extreme Value Analysis and Joint Probability Analysis. The full methodology and assumptions behind the wave model are presented in Appendix 12.2.

12.9.13 The model extraction point, selected as representative of the entire beach extent, is located at an offshore position in front of Barmouth North Beach, along the -7 mODN contour (see Graphic 12-2).



Graphic 12-2 Wave extraction location (red circle) overlaid over admiralty chart

12.9.14 The results at the model extraction point for the year 2019 are presented in Table 12-9.

Table 12-9 Extreme significant wave height predictions at Barmouth frontage for the year 2019

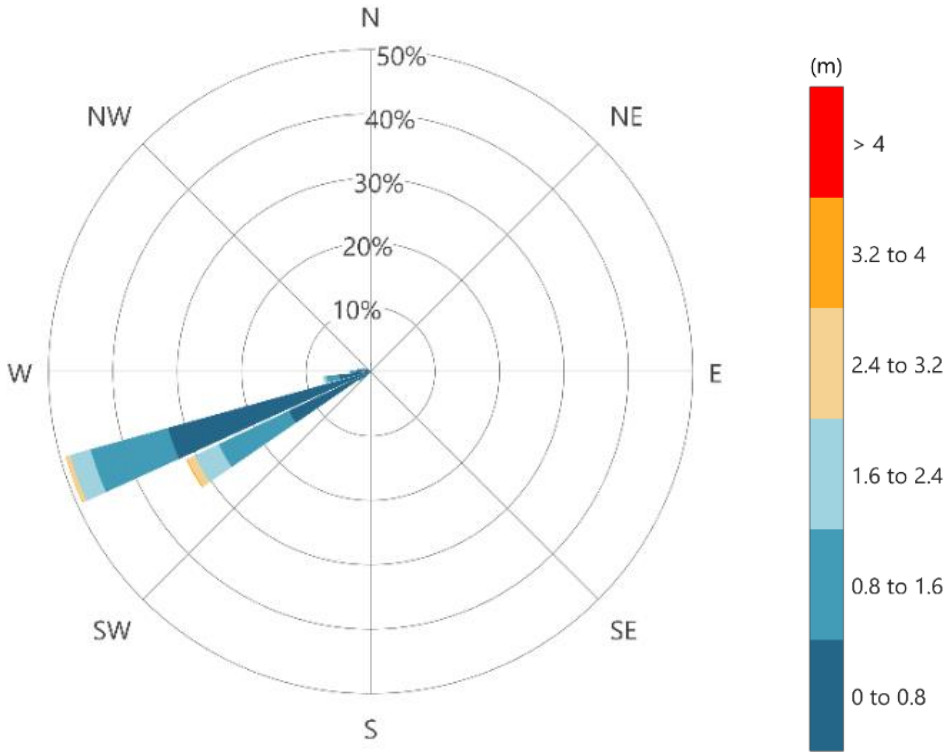
Return Period	AEP (%)	Epoch 2019 (mODN)
T1	63	3.67

Return Period	AEP (%)	Epoch 2019 (mODN)
T10	10	4.12
T50	2	4.24
T100	1	4.27
T200	0.5	4.29
T1000	0.1	4.32

12.9.15 To derive the maximum wave heights in the current year 2025, the Welsh national precautionary sensitivity ranges for offshore wave height can be applied, as per Welsh Government guidance. For the year 2025, an indicative 5% increase in offshore extreme wave height is proposed (refer to Table 10 in Appendix 12.4). However, it was considered appropriate for wind and wave increases to be considered as a sensitivity test rather than be included in the future 39 year hindcasts. To assess the sensitivity, wind speed and wave height at the model boundary were increased by 10% for the 2119 epoch.

12.9.16 The wave model results indicate that the dominant wave direction approaching the Barmouth frontage is from the southwest, with an average direction of 244°, as shown in Graphic 12-3. The narrow range of approaching wave directions observed in the figure is likely due to the prevailing offshore wave conditions and the presence of the northern headland, which limits wave energy from reaching the site from the north-westerly sectors.

12.9.17 Wave direction is largely unaffected by increases in water level, therefore the direction of waves in 2025 can be assumed to be unchanged. (Appendix 12.1)



Graphic 12-3 Wave roses showing significant wave height at circa -7 mODN for the year 2019

12.9.18 Other than the local shoals near the mouth of the Mawddach Estuary, the nearshore bathymetry directly offshore from the North Promenade frontage is relatively smooth and featureless. Therefore, the dominant wave energy approaches the frontage from a relatively consistent angle that is close to shore normal.

Coastal Processes

Historical Beach Evolution Trends

Desktop Study

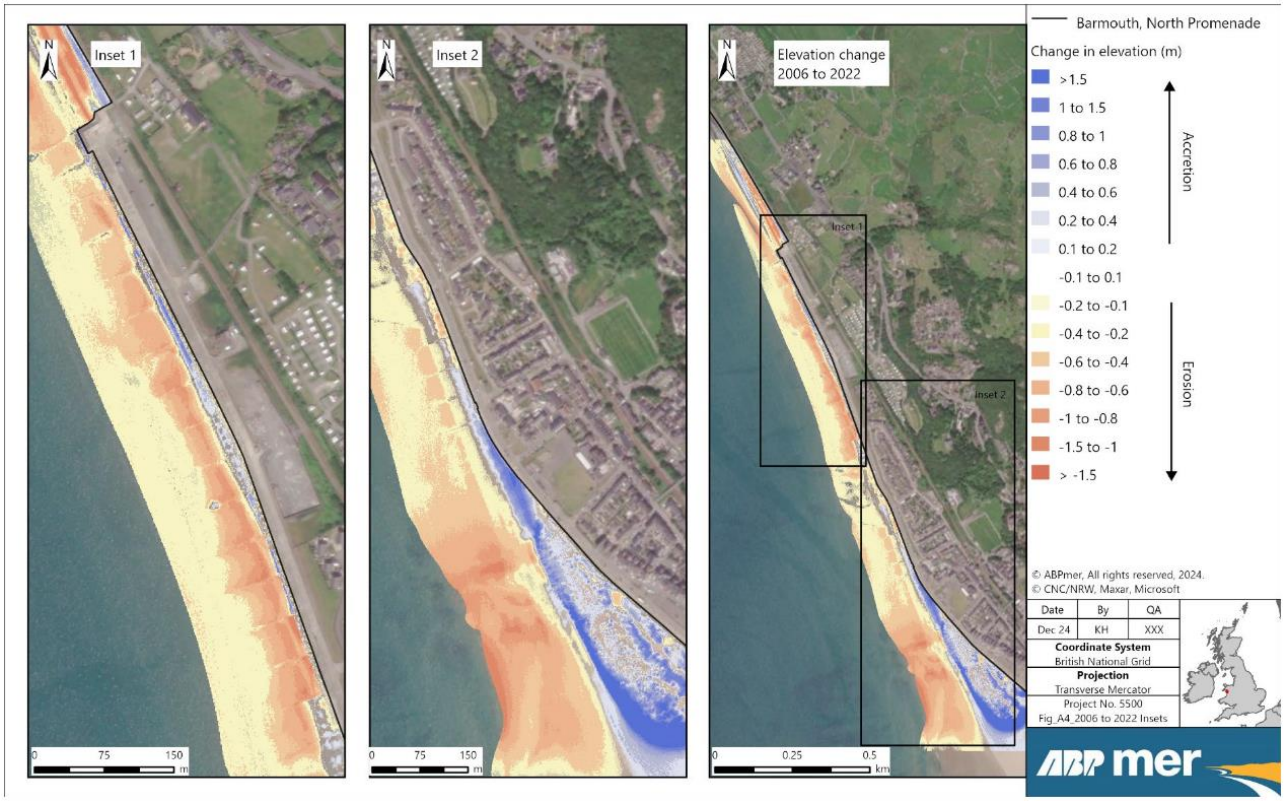
12.9.19 An overview of the historical evolution and changes of the coast along Barmouth and the Mawddach Estuary, based on the analysis of historical documents and photographs can be found in Section 4 of Appendix 12.2.

12.9.20 In summary, it was observed that following the construction of the 48 timber groynes and the sloping concrete structure in the 1930s, the northern part of Barmouth Beach experienced sediment loss and declining beach levels. This was already reported in the decade of the 1950s, leading to the strengthening of some sections of the wall in 1956 through the installation of sheet piles at the base of the structure. The southern part (dunes area) has seen profound changes including sediment accretion and rising beach levels, particularly since the construction of the causeway across the former Bar Bach channel in the early 1970s. This area has then experienced significant dune growth from the early 2000s.

LIDAR Study

12.9.21 Historical LiDAR surveys indicate a general trend of foreshore and beach lowering across North Barmouth Beach between 2006 and 2022. Over this 16-year period, the lower foreshore has decreased by approximately 0.4 m, while the upper foreshore has experienced a more significant reduction of around 0.8 m (Graphic 12-4). This lowering generally occurred around 15-60 m from the sea wall. Inshore and offshore of this bed level, changes are much less pronounced. For detailed figures and analysis, refer to Section 4.1 of Appendix 12.5.

12.9.22 There has been a greater level of erosion along the northern part of Barmouth South Promenade and a significant increase in the dunes. Along the Llanaber frontage, to the north of Barmouth North Promenade, there also appears to be lowering of the lower foreshore with some redistribution of coarse material along the upper beach.



Graphic 12-4 Changes in beach levels between LiDAR surveys in 2006 and 2022 – ABPmer (Appendix 12.5)

Sediment Transport

12.9.23 A baseline sediment transport model was developed by ABPmer in 2019 (refer to Section 3 of appendix 12.3). This was a longshore sediment transport model which modelled only the shingle portion of the beach as mobile material with the objective of assessing the stability of potential beach nourishment at the site. The shoreline evolution modelling predicted changes as a result of longshore sediment drift, and changes as a result of onshore-offshore transport were not represented in the model. This approach is considered appropriate as the study focused on coarse sediment that lies along the upper beach over a shallower slopping sandy foreshore which will be subject to longshore drift. The baseline model was run over a ~10-year period (2007–2016).

12.9.24 The sand flat platform where the shingle sits is subject to constant change as a result of cross-shore transport. There is a loss of sediment predicted in the wider area as part of natural erosion processes. This dynamic process will continue in the future and is not considered to be impacted by the proposed solution when compared with the baseline scenario.

12.9.25 The sediment transport model indicates limited shoreline change, reflecting the observed stability of the upper shingle/cobble beach. Sediment transport rates are generally low in relation to transport rates that can occur along an open coast subject to similar wave heights.

12.9.26 The transport rates for shingle are relatively low with predicted net transport rates less than 500 m³/yr (refer to Section 3 of appendix 12.3). Transport rates along the Llanaber headland and at the northern end of North Promenade are negligible as there is no effective upper shingle/cobble beach in these regions.

North of North Promenade very slight net southerly transport predicted along the shingle/cobble beach fronting the railway. Along the southern end North Promenade and the northern section of Barmouth South frontage the net transport rates is predicted to be northerly.

12.9.27 These low transport rates are influenced by several key factors:

- The wave climate is confined to a narrow, shore-normal sector, with waves becoming nearly perpendicular as they break on the upper beach, limiting longshore drift.
- The shingle/cobble is restricted to the upper beach, making it only susceptible to mobilization during certain tidal conditions.

Coastal Flooding

12.9.28 Coastal Flooding is linked with Marine and Physical Processes as the magnitude of defence overtopping is a function of water levels and wave overtopping. Methodology and results to determine the baseline coastal flooding are described in Chapter 10.

Habitats and Ecology

12.9.29 To the south, the Mawddach Estuary is designated as a Site of Special Scientific Interest (SSSI) and as a Special Area of Conservation (SAC), whilst the whole of Cardigan Bay forms part of the Llŷn Peninsula and Sarnau SAC (see Figure 12.2). The dunes do not have formal nature conservation designation, but the dunes are priority Biodiversity Action Plan (BAP) features which are now relatively scarce in Wales and across Europe. These dunes consist of dynamic foredunes and embryo dunes.

12.9.30 The site comprises predominantly of intertidal habitats, hardstanding structures in contact with the sea (artificial seawall and groynes), and small patches of grassland and scrub. For a detailed description of the other surrounding habitats, ecological networks and biodiversity descriptions, refer to ES Volume 2, Chapter 6 Biodiversity and Protected Sites.

12.9.31 The influence and impacts of marine and coastal processes are assumed to be constrained to the intertidal and hardstanding habitats.

12.9.32 The intertidal habitats within the study area, are predominantly composed of fine sand, supporting low biodiversity and a limited presence of macroinfauna. A detailed understanding of the intertidal biotopes identified is provided in the ES Volume 2, Chapter 6 Biodiversity and Protected Sites.

12.9.33 Of notable importance in the intertidal area, honeycomb worm reefs comprising of *Sabellaria alveolata* were identified in the rocky intertidal area approximately 270m to the north/northwest of the site. This habitat is classified as a UK Biodiversity Action Plan (UKBAP) Priority Habitat and is described as a key feature as part of the Pen Llŷn a'r Sarnau SAC.

12.9.34 An invasive non-native barnacle species (*Austrominius modestus*) was recorded as widespread across the site, particularly on groynes, though it is considered to pose a low ecological risk.

12.9.35 The most biodiverse ecosystems were observed on the timber groynes, which are colonised by various algae, crustaceans, and molluscs. Blue mussels were found in high densities on approximately two-thirds of the timber groynes, serving as an important forage resource for local bird species such as

oystercatchers. This habitat is classified as a Priority Habitat and is described as a key feature as part of the Pen Llŷn a'r Sarnau SAC.

12.9.36 The artificial seawall was not identified as a UKBAP Priority Habitat.

Future Baseline

12.9.37 The Welsh Government, (2022) Guidance "Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales" recommends that coastal risk management scheme appraisals follow sea level rise scenarios from UK Climate Prediction 2018 (UKCP18):

- A higher central allowance RCP8.5 70th %ile for the main assessment.
- An upper end allowance RCP8.5 95th %ile for sensitivity test.

This is where RCP8.5 is a high-emissions scenario used in climate modelling and research. The 70th%ile is used as a higher central estimate, while the 95th%ile is used as a sensitivity test which covers the upper extremes of climate change.

Metocean Conditions

12.9.38 The future water levels referenced in this section are extracted from Consideration of revised water levels estimates by ABPmer which can be found in Appendix 12.4.

Sea Level Rise

12.9.39 Table 12-10 presents the Sea Level Rise (SLR) allowance for 2025, 2075 and 2125 for both the 70th %ile and 95th%ile projections from a base year of 2017.

Table 12-10 SLR allowances using latest Welsh Government (2022) guidance

Scenario	2025	2075	2125
SLR increase from 2017 based on RP8.5, 70th %ile	0.040 m	0.436 m	1.014 m
SLR increase from 2017 based on RP8.5, 95th %ile	0.049 m	0.575 m	1.401 m

Extreme Water Levels and Surge

12.9.40 The extreme still water levels for future epochs were derived by applying the UKCP18 (RCP8.5 70th %ile) SLR scenario to CFBD (2018) dataset. The results can be seen in Table 12-11.

Table 12-11 Extreme Still Water Levels for 2025 and future epochs derived from CFBD (2018) and SLR UKCP18 RC8.5 70th%ile projections (extracted from Appendix 12.4)

Return Period	AEP (%)	Extreme Still Water Level (mODN)			
		Base date 2017	Epoch 2025	Epoch 2075	Epoch 2125
T1	63	3.46	3.50	3.90	4.47
T10	10	3.86	3.90	4.30	4.87
T50	2	4.13	4.17	4.57	5.14
T100	1	4.25	4.29	4.69	5.26

Return Period	AEP (%)	Extreme Still Water Level (mODN)			
		Base date 2017	Epoch 2025	Epoch 2075	Epoch 2125
T200	0.5	4.37	4.41	4.81	5.38
T1000	0.1	4.66	4.70	5.10	5.67

Waves

12.9.41 Following the methodology described in paragraph 12.9.15, the extreme wave levels are derived from national precautionary sensitivity ranges for offshore wind speed and wave heights by the Welsh Government. The increased values for the different epochs can be found in Table 12-12. Refer to Appendix 12.4 for details on the assessment.

Table 12-12 Recommended national precautionary sensitivity ranges for offshore wind speed and wave height (extracted from Appendix 12.4)

Parameter	Sea Level Rise up to 2025 (mm/yr)	Sea Level Rise 2026 to 2055 (mm/yr)	Sea Level Rise 2056 to 2085 (mm/yr)	Sea Level Rise 2085 to 2120 (mm/yr)
Offshore wind speed	+5%		+10%	
Extreme wave height	+5%		+10%	

12.9.42 To assess the sensitivity of the area to wind speed and wave height increases, the conditions at the model boundary were increased by 10% for the 2119 epoch, as suggested in Table 12-12. Model results indicated an average increase in wave height of 8% at the contour level of -7 mODN. It is however to be noted that these uplifts have significant uncertainty associated with them and hence they were only used as a sensitivity test at the initial modelling stage and not adopted in design.

12.9.43 Wave direction is largely unaffected by increases in water level, therefore the direction of waves in the future baseline can be assumed to be unchanged from present day.

Coastal Processes

Beach Evolution Trends

12.9.44 Assuming no active intervention on the existing baseline, erosion is predicted to continue along Barmouth North Beach. The rate of erosion is likely to increase with SLR as larger waves will reach the coastal defences which in turn will likely increase beach erosion.

12.9.45 The SMP2 suggests the rate of erosion could increase by a factor of 1.7 to 2.5 times the existing base rate over the next 100 years. For the area of interest, the predicted 100 year high level erosion range is of 30 to 120m. This corresponds to an estimated high level predicted beach lowering at the toe of the defence of 0.2m by 2069 and 0.7m by 2119 for Barmouth North Beach. More information on future erosion and beach lowering rates is provided in Section 6.3 of Appendix 12.2.

Sediment Transport

12.9.46 Predicting future sediment transport is inherently challenging due to the complex interplay of coastal processes and variability in future climate conditions. The coastal processes report by ABPmer (Appendix 12.2) concluded an overall limited southerly longshore drift direction in the nearshore with strong evidence that there is very limited transport of coarse sediment along the frontage.

12.9.47 Insights can also be drawn from a baseline sediment transport model, which was extended over a 38-year hindcast period (1979–2016) to assess the sensitivity to long-term variability (refer to Section 3 in appendix 12.3). This report utilised a fixed shoreline orientation with no morphological updating and therefore differences in annual rates of transport between years are directly related to differences in wave conditions between the years. The study concludes that both net and gross predicted transport rates are very low, in relation to transport rates along open coasts with similar wave heights, although it highlights the remaining uncertainty associated with the lack of actual measurements of longshore transport rates of the upper/shingle cobble beach. Therefore, although an inherent risk remains that future changes in wave conditions could noticeably change longshore transport rates along the beach, this is not considered to be associated to the implementation of the scheme but rather offshore changes in bathymetry and more general wave directional trends.

12.9.48 The baseline model indicates that annual variations in sediment transport rates are closely linked to fluctuations in wave conditions. Given projections of increased water levels and wave heights, it is expected that a greater volume of upper beach material will therefore be mobilised, particularly during high water events. This will likely lead to higher sediment transport rates. While the baseline model provides a strong foundation for understanding future trends, it is important to acknowledge that future conditions may introduce additional variability not fully captured.

12.9.49 Overall foreshore bed levels along North Promenade seem to be lowering based on historical evidence and this lowering is expected to continue. The overall foreshore has lowered as a result of natural coastal processes derived mainly from storm events combined with the effect of wave energy being reflected from the seawall which have led to progressive lower beach levels over time. This is more evident at the northern end of North Promenade where the wall is being undermined.

Coastal Flooding

12.9.50 The future coastal flooding baseline is described in ES Volume 2, Chapter 10 Flooding and Water Quality.

Limitations and Assumptions

Limitations

12.9.51 ES Volume 3, appendix 12.1 (R3105) summarises the wave modelling, extremes analysis and overtopping assessments that were undertaken to support the OBC. No local bathymetric data or wave measurements were available to construct and validate the wave model, however, the resultant overtopping results were validated against anecdotal evidence from past events.

12.9.52 ES Volume 3, appendix 12.2 (R3096) reviews and summarises the coastal processes regime along the frontage, and the morphological changes that occurred up to the date of the study (2019). The morphological and sediment transport assessment was based on a conceptual understanding of coastal processes derived from the SMP2, wave model by ABPmer and detailed literature review including a composite Digital Surface Model (DSM) which incorporated key information from previous studies including an historical overview developed by Kenneth Pye Associates Ltd (2016).

12.9.53 ES Volume 3, appendix 12.3 describes results of initial shoreline evolution modelling to examine the likely alongshore stability of the shingle beach identified in the OBC preferred option. The modelling had been undertaken using the Coastal Evolution module in the DHI Littoral Processes FM suite of models. The model provides a Shoreline evolution model baseline schematisation which has been used to assess the behaviour of the baseline. However, there remains some uncertainty as to the actual longshore transport rates of the upper shingle/cobble beach.

Assumptions

12.9.54 Previous studies included as appendices to this chapter have concluded that there is very limited variability in wave direction nearshore due to the narrow shore normal sector from which predominant incoming waves approach the coast and that longshore transport rates are expected to be very low. However, it has not been possible to quantify and verify this through numerical modelling as the shoreline baseline modelling, undertaken to assess the beach nourishment option, only considered the transport of the upper mobile shingle/cobble beach. The assessment of wave direction variability could be improved by obtaining local bathymetric data and wave measurements to calibrate and validate existing models, but this would have significant cost and time implications and was considered to provide limited added value to the project. Validation of longshore drift rates by undertaking additional field measurement was considered. However, the difficulties in obtaining reliable sediment transport rates and potential outcomes given the anticipated very low rate of longshore transport deemed this of limited value to the project. Therefore, the level of detail of existing models was deemed appropriate taking into account the information assessed in the desktop study, site characteristics and type of solution.

12.9.55 A set of assumptions is included in ES Volume 2, Chapter 4 EIA approach.

12.10 Embedded Environmental Design Measures

12.10.1 A range of measures have been embedded into the Proposed Development design to avoid or minimise environmental impacts.

12.10.2 The proposed rock revetment has been designed with a shallow slope of (H:V) 3:1 to minimise wave reflection and any potential scour effects. The proposed ramps are surrounded by rock armour and with a buried toe to minimise any potential scour effects.

12.10.3 The proposed revetment will terminate against the west face of the existing seawall. The extent where it protrudes beyond the seawall will be backfilled with shingle to mitigate the risk of becoming a sediment trap until the area is filled up. A range of measures relevant to marine and coastal physical processes are set

within the Outline Construction Environmental Management Plan (CEMP), (document reference- EN.F.15).

12.10.4 The following measures with potential impact on coastal processes will be put in place during construction:

- For both rock armour delivery options (Option 1 by road and Option 2 by sea), temporary stockpiles located on the beach below MHWS will be used to store rocks for the rock revetment prior to placement. All sand/shingle excavated from the beach will be stored on the beach above MHWS to minimise losses before being used for reinstatement along the beach.
- Works will take place “in the dry”, during low tide windows.
- Stockpiled rock armour will be moved to its final location within a limited timeframe.

12.11 Assessment of Effects

12.11.1 This section presents the assessment of effects on marine and coastal physical processes resulting from the construction and operation and maintenance of the Proposed Development (refer to ES volume 2, Chapter 2 for Project Description).

Construction Effects

12.11.2 This section presents the assessment of potential effects on marine and coastal physical processes resulting from the construction of the proposed development. Construction is defined as all the works undertaken to build the Proposed Development. The potential effects are assessed based on design presented in ES volume 2, Chapter 2 Project Description.

Hydrodynamics and sediment transport processes

12.11.3 Stockpiling of rock armour in intertidal areas has the potential to impact hydrodynamics and sediment transport processes, causing localised areas of erosion and accretion in the areas around the stockpile. During construction, stockpiling of rock armour is expected to cause a temporary minor adverse impact or no impact.

Release of sediments

12.11.4 During construction, the excavation of sand and shingle required to construct the works on the beach, and the temporary storage of these materials on the beach could cause a potential release of sediment into the sea. This could cause turbidity in the water column and have implications on marine ecology and sensitive habitats. However, it is expected that this will result in a temporary minor adverse effect on sediment release during construction as the works will take place “in the dry”, and the material will be stockpiled above MHWS.

12.11.5 Removal of existing groynes would involve the removal of groyne piles using an excavator with a grab or chain attachment (or similar). It is expected that these works will take place at low tide “in the dry” so no impact on release of sediments and water turbidity is expected.

Operational and Maintenance Effects

12.11.6 Operation is defined as the post-construction phase of the Proposed Development, including maintenance activities, until there is further development or until the site ceases to operate as a standard of protection against coastal flooding. Refer to ES Volume 2, Chapter 2 Project Description, for the description and period of maintenance activities, and the design life of the proposed development. Some impacts on marine and coastal physical processes may occur during this phase, such as areas of higher variability of beach levels due to localised scour/accretion in front of the rock revetment.

Intertidal and Subtidal Areas

12.11.7 A permanent loss of recreational use of intertidal area will occur as a result of the construction of rock revetment. The loss of beach area for recreational use will be in part offset by the removal of sections of groynes which will improve the amenity value of the beach at lower levels. Permanent loss of recreational use in the footprint of the revetment has been assessed to be minor adverse. This is based on analysing the current situation of the beach which is compartmentalised by the groynes in a series of approximately 45x45m cells. It is considered that it is the seaward-most part of these cells that is predominantly used by beachgoers, with the exception of the access points from the promenade which are adjacent to the existing concrete structure. The width of the proposed revetment will be less than half the length of the groynes and therefore will not encroach into the seaward-most area of these cells. Furthermore, there will be a series of access points integrated into the revetment design to provide access to the beach from the promenade.

Wave - Structure Interaction

12.11.8 The risk of wave overtopping and flooding behind the breakwater is reduced from the baseline, which is considered to be a major beneficial impact.

12.11.9 The rock revetment will reduce wave reflections and increase wave energy absorption compared with the baseline scenario of a concrete seawall, reducing scouring of the toe of the wall, helping the lowering of the foreshore in front of the wall and mitigating against the risk of undermining in this area. These improvements in localised scour and erosion reduction are assessed to be of major beneficial impact.

12.11.10 The rock revetment will reduce the wave loads on the seawall in comparison with the baseline, which will reduce the risk of failure and improve the longevity of the structure. This is assessed as a major beneficial impact.

12.11.11 The rock revetment will induce wave breaking under specific tidal levels. This will modify the hydrodynamics in the areas close to the structure and can increase locally the sediments in suspension.

12.11.12 Negligible changes in currents are expected due to the alignment of the rock revetment, which is parallel to the shoreline.

12.11.13 Changes in wave environment are considered to have negligible impact on the *S.alveolata* reef to the north and dunes to the south since both are located more than 400m away from the proposed rock revetment.

Sediment transport and beach morphology

12.11.14 The rock revetment will contribute to ‘Hold the line’ and mitigate against erosion in front of the seawall, as the rock revetment will dissipate wave energy and reduce wave reflection off the existing wall. Therefore, erosion reduction, potential build-up of the beach in the scheme and future hold the line have been assessed as major beneficial when compared with the baseline which consists of an eroding coastline subject to wave reflections from the seawall.

12.11.15 It is anticipated that the revetment will have minimal effect on longshore sediment transport. Due to its geometry parallel to the shoreline, it does not retain longshore drift in the nearshore, which is assessed to be limited in the baseline. This impact is assessed as negligible.

12.11.16 Waves will diffract around the northern end of the rock revetment at high tide. This may contribute to a localised re-orientation of the beach towards a new equilibrium shape. This effect will overlap with the localised scour and local variability in beach levels. This impact is assessed as minor adverse given the limited extension of the rock revetment in comparison with the existing footprint of the promenade and since it should occur in a short period of time following construction and in a localised area.

12.11.17 The extension of the rock revetment north of the existing seawall will create a limited sheltered area behind. This area will be backfilled such that it does not become a sediment trap. This small area may be subject to wave overtopping. This impact is assessed as minor adverse.

12.11.18 The rock revetment will influence cross-shore transport. The design has taken this into consideration to minimise its impact (see 12.10). However, variability of beach levels (accretion and erosion) immediately in front of the revetment is expected as short-term effects from storm events. This impact is assessed as minor adverse. However, it is expected that this will not interfere with the transport of sediment alongshore or on/offshore at the bed. Given the limited volumes of scour expected over a high timeframe it is not expected that these can cause any turbidity effects when suspended in the water column, therefore, the effect of variability of beach levels in front of the rock revetment on turbidity is negligible. Moreover, the occurrence of this variability in levels over a long timeframe can be monitored and would allow for reactive and proactive beach management measures, as needed.

12.11.19 The proposed rock revetment is unlikely to have a negative impact on the dune system at the south. From the historical review of coastal processes presented in Appendix 12.2, it is understood that the main driver for the dune formation is wind driven (aeolian) sand transport with high rates of windblown sand transport during periods of strong winds from the northwest and west reported in Appendix 12.6. The River Mawddach brings sediment to the coast and deposition has been exacerbated by the construction of the causeway linking the Ynys y Brawd island to the mainland. The causeway effectively blocked off any flow from the estuary towards the north, having a profound effect over time on the coastal processes in the area and leading to accretion of material transported mainly by wind at the southern extents. It is noted that the sandy area to the south of the site (shallow area where sand is mostly above the high tide) is more mobile as it is subject to wind transport while the sandy area to the north is mostly within the tidal range and less prone to aeolian transport. The

dunes and sandy beach south of the site are not affected by the proposed scheme so there will not be changes in aeolian transport. The potential loss of material from the upper intertidal beach as a direct result of the construction of the revetment is unlikely to cause any material reduction in the sand supply to the dunes given the reduced quantity and localised effect.

12.11.20 Overall, the groynes are in a very poor state and providing no significant role on helping to maintain beach levels. Therefore, their removal would generally have limited implications. Only a number of the groynes along the southern end of the frontage are in a slightly better state of repair, in particular, the refurbished groyne at northern end of the coarse sediment upper beach along the southern end of the frontage. Removal of these groynes would result in greater mobility of the upper sediment in the beach as a result of littoral transport and could lead to increased wind driven sand supply which is being currently retained by these. However, the volume of sand currently trapped by the groynes is limited given the status and geometry of the existing groynes. Therefore, the effect of removal of existing groynes is considered negligible.

12.12 Zone of influence

12.12.1 Field blockage (defined as Blockage related changes: changes to wave, current/flow and sediment transport regimes caused by the presence of the project including changes to turbulence and scour development according to GN41) effects due to coastal processes involved at the end of the breakwater affecting adjoining areas include scour effects, and potential variability of beach levels in of the areas surrounding the rock revetment. Field blockage has been assessed as affecting an area up to 15m when taking into account the estimated scour depth against design wave conditions. cour depth has been calculated using an empirical equation for the depth of scour at the toe of a vertical seawall developed using an extensive database of published laboratory data (HR Wallingford 2006b, Sutherland et al. 2006b) including considerations to take into account beneficial effects of the sloping structure [5].

$$\frac{Stmax}{Hs} = 4.5e^{-8\pi\left(\frac{ht}{Lm}+0.01\right)}\left(1 - e^{-6\pi\left(\frac{ht}{Lm}+0.01\right)}\right.$$

Where:

Stmax= maximum toe scour depth (m)

ht = water depth above the beach level at the toe of the structure (m)= 4.3m

Lm= wavelength offshore (-7mODN extraction location).

$$\mathrm{Lm} = \frac{gTm^2}{2\pi} = 225m$$

According to linear theory wavelength based on mean wave period Tm (s) and acceleration due to gravity g (assumed to be 9.81 m/s^2) where design wave conditions and water levels correspond to values used for design of the rock revetment associated to an extreme return period of 200 years for the epoch year 2075 as follows:

Hs= 4m

Tp= 12s

Water level=4.3m

Breaking wave=3.4m

The range of validity of Equation is given in the square brackets in terms of ht and Lm: [-0.013 ≤ ht / Lm ≤ 0.18]

A value of 3.2m is obtained as maximum toe scour depth (m).

Assuming that the scour hole in front of the revetment ties back to the natural seabed at an angle of 15º, a maximum horizontal distance of 12.1m is estimated an rounded conservatively toa 15m.

12.12.2 It is noted that this value is conservative as there is a significant reduction in scour depth for sloping or permeable seawall when compared to vertical walls as found by Powell and Lowe (1994) who showed a reduction in scour depth of almost 65 per cent in a shingle beach when a vertical wall was replaced by a sloping wall of 1:1.25. The scour depth was reduced by about 80 per cent for a 1:2 slope and there was accretion at the structure toe for a 1:3 slope (which is also the slope of the proposed rock revetment). Powell also noted that rock armour revetments generally showed less susceptibility to local scour and may even show accretion.

12.12.3 Variability of beach levels due to wave overtopping on the shingle beach behind the rock revetment section which extends beyond the west face of the existing seawall is limited due to its confinement.

12.12.4 These zones and the combined maximum zone of influence is provided in ES Volume 4, Figure 12.1 The zone of influence and the adjoining protected areas are shown in ES Volume 4, Figure 12.2.

12.13 Mitigation

12.13.1 This section outlines the mitigation required where adverse effects have been identified.

Mitigation of Construction Effects

12.13.2 No construction effects are assessed to be significant adverse.

12.13.3 While stockpiling of rock armour may cause a temporary minor adverse impact on hydrodynamics and sediment transport, measures to manage placement of stockpiled material, together with limitations on duration of stockpiling, have the potential to reduce the impact to negligible.

Mitigation of Operational Effects

12.13.4 No construction effects are assessed to be significant adverse.

12.13.5 Proposed mitigation of operational effects is shown in Table 12-13.

12.14 Residual Effects

12.14.1 Cumulative and in-combination effects are addressed within ES Volume 2, Chapter 14 Cumulative Effects.

No significant effects from construction or operation have been identified and there are therefore no significant residual effects. A summary of effects identified in the main assessment are shown in Table 12-13.

Table 12-13 Summary of effects matrix

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual effect
Hydrodynamics and sediment transport	Localised areas of erosion and accretion in the areas around the stockpile.	Minor adverse or no effect (temporary)	Stockpile management measures and limitation on durations	Negligible
Sediments release	The excavation of sand and shingle and the storage of these materials could cause a potential release sediment into the sea which could cause turbidity in the water column and have implications on marine ecology and sensitive habitats on the reef.	Minor adverse (temporary)	Construction to be planned to maximise working windows during low tide periods to reduce turbidity during excavation. Stockpiling of sand and shingle to be done above MHWS to minimise loss of sediments into the sea.	Minor adverse or no effect (temporary)
Sediment release	Removal of existing groynes and piling works for new timber posts done “in the dry” so no impact on release of sediments is expected.	Negligible (temporary)	Construction planned “in the dry” so no impact on release of sediments is expected.	No effect
Intertidal and Subtidal Areas	Permanent loss of recreational use in the footprint of the revetment	Minor adverse (permanent)	None	Minor adverse (permanent)
Hydrodynamics	Wave overtopping and flooding reduced from the baseline	Major beneficial (permanent)	None	Major beneficial (permanent)
Hydrodynamics	Waves: changes in waves and currents impact on the adjacent *S.alveolata* reef	Negligible	None	Negligible
Sediment transport and beach morphology	Variability of beach levels due to wave overtopping behind the north extent of the rock revetment.	Minor adverse (permanent)	Backfilling with shingle material behind proposed limited extension of revetment will further support a reduction in wave turbulence in the area, helping to reduce variability in beach levels.	Minor adverse (permanent)
Sediment transport and beach morphology – Cross-shore	Scour at the toe of the existing concrete structure and stability risks	Major beneficial (permanent)	The rock revetment will mitigate against risk of scour at the base of the existing concrete structure	Major beneficial (permanent)
Sediment transport and beach morphology – Localised scour	Variability of beach levels in front of the proposed toe of the rock revetment	Minor adverse (permanent)	None	Minor adverse (permanent)

Receptor	Potential Impact	Significance of effect	Mitigation proposed	Residual effect
Sediment transport and beach morphology – Long-shore Transport	Longshore transport along the beach	Negligible	None	Negligible
Dunes (aeolian transport)	Changes in the sand supply to the dunes due to slight loss of upper intertidal beach as a result from the revetment	None	None	None
Sediment transport and beach morphology	Beach changes due to field blockage of sediments	Minor adverse (permanent)	None	Minor adverse (permanent)
Sediment transport and beach morphology	Turbidity impact on the adjacent *S.alveolata* reef	Negligible	None	Negligible
Sediment transport and beach morphology including effects on aeolian transport – Removal of groynes	Greater mobility of the upper sediment in the beach	Negligible	None	Negligible

12.14.2

12.15 Alignment with SMP2

12.15.1 The majority of the Proposed Development is within Policy Unit 11.15 (Barmouth North). For this unit, the policy plan is Hold the Line (HTL) for epoch 1 (to 2025), followed by Managed Realignment (MR) in epochs 2 and 3 (2025-2055 and 2055-2105 respectively). Importantly, the SMP2 also notes that there is significant benefit in continuing to manage the frontage, and that

'in all probability works will be needed to the north Barmouth frontage towards the end of Epoch 1'. [6]

12.15.2 The Proposed Development deviates from the policy framework set out in SMP2 for epoch 2, in that it will essentially continue a HTL policy until 2075 by providing betterment of the existing defences. This was accepted by Welsh Government as part of the approved OBC in 2021.

12.15.3 It should also be noted that the adjacent Policy Units (Llanaber and Barmouth South) have a policy of HTL for all three epochs. Some of the Proposed Development will be carried out in the Llanaber unit.

Shapefile data from https://lle.gov.wales/

Graphic 12-5 SMP2 policy units of Barmouth. Llanaber (11.16), Barmouth North (11.15) and Barmouth South (11.14) (Appendix 12.2)

12.15.4 In September 2024 it was agreed with the West Wales Coastal Group to raise the scheme with the National Coastal Forum as a Major Change, bringing the policy for Epoch 2 to HTL. This process is ongoing, including consultation led by the West Wales Coastal Group.

12.16 Coastal Squeeze

12.16.1 The SMP2 Habitats Regulations Assessment (HRA) proposed MR in Epoch 2; as such, the SMP2 HRA did not require a coastal squeeze assessment for this location.

12.16.2 Therefore a HRA Coastal Squeeze Addendum (doc ref BMTH-ARP-EBD-OFFSH-TN-OE-000003) has been produced to provide a Coastal Squeeze Assessment, considering the proposed policy change. The purpose of this HRA Coastal Squeeze Addendum is to consider the potential for coastal squeeze impacts on the features of the Pen Llyn a'r Sarnau / Lleyn Peninsula and the Sarnau Special Area of Conservation (SAC). This HRA Coastal Squeeze Addendum has been prepared in accordance with Natural Resources Wales (NRW) Operational Guidance Note OGN62 (Assessment of Coastal Squeeze), following the appropriate screening steps to Stage 3: Appropriate Assessment.

12.16.3 Following an assessment of the potential likelihood and impacts of coastal squeeze associated with the Hold the Line scenario for Epoch 2, the HRA Coastal Squeeze Addendum concluded that there will be no adverse effect on the integrity of the Pen Llyn a'r Sarnau / Lleyn Peninsula and the Sarnau SAC site. Overall, the assessment confirms that the proposed Policy Change from

MR to HTL will not result in coastal squeeze impacts on the Annex I SAC features, nor any Section 7 Priority Habitats.

12.16.4 A separate HRA has been undertaken to support the Proposed Development that will deliver the defence requirements in lieu of an approved policy change - Barmouth North Promenade FAS HRA (Document Reference BMTH-ARP-EBD-ZZ-RP-OE-000003).

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

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[2] NRW, “Guidance Note GN19: Completing a coastal or physical processes assessment for small-scale projects,” 2024.

[3] NRW, “Guidance Note GN41: Marine Physical Processes Guidance to inform Environmental Impact Assessment,” 2025.

[4] Met Office, “UKCP18 Marine Report,” 2018.

[5] E. Agency, “Toe structures management manual,” 2012.

[6] West of Wales Coastal Group, “West of Wales SMP2,” June 2012. [Online]. Available: https://www.grwparfordirolgorllewincymru.cymru/sites/default/files/2019-06/4d3%20-%20Section%204%20Coastal%20Area%20D%20PDZ11.pdf. [Accessed 08 August 2025].

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Cyngor Gwynedd

Barmouth North Promenade FAS

ES Chapter 13 Seascape and Landscape and Visual

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Contents

13. Seascape, Landscape and Visual Impact Assessment 1

13.1 Introduction 1

13.2 Legislation, Policy and Guidance 2

13.3 Stakeholder Engagement 4

13.4 Methodology 6

13.5 Seascape and Landscape Baseline 9

13.6 Visual Baseline 23

13.7 Future Baseline 26

13.8 Embedded Environmental Design Measures 27

13.9 Assessment of Likely Significant Effects 29

13.10 Further Mitigation and Enhancement 44

13.11 Residual Effects 44

13.12 Assessment Summary 46

Abbreviations List 49

Glossary 50

References 51

Tables

Table 13-1 Gwynedd Council comments on scope of the SLVIA and the response 4
Table 13-2 Data sources 6
Table 13-3 Seascape and landscape features 11
Table 13-4 LANDMAP Visual and Sensory Aspect Areas 18
Table 13-5 Seascape and landscape receptors 23
Table 13-6 Representative viewpoints and visual receptors 24
Table 13-7 Summary of seascape effects of construction by road 29
Table 13-8 Summary of seascape effects of construction by sea 30
Table 13-9 Summary of seascape effects of operation year 1 (winter) 31
Table 13-10 Summary of seascape effects of operation and maintenance year 15 (Summer) 31
Table 13-11 Summary of landscape effects of construction by road 32
Table 13-12 Summary of landscape effects of construction by sea 33
Table 13-13 Summary of landscape effects of operation year 1 (winter) 34
Table 13-14 Summary of landscape effects of operation and maintenance year 15 (Summer) 35
Table 13-15 Summary of visual effects of construction by road 36
Table 13-16 Summary of visual effects of construction by sea 38
Table 13-17 Summary of visual effects of operation year 1 (winter) 41
Table 13-18 Summary of visual effects of operation and maintenance year 15 (Summer) 43
Table 13-19 Residual effects of operation 45
Table 13-20 Summary of effects matrix 46

13. Seascape, Landscape and Visual Impact Assessment

13.1 Introduction

13.1.1 This chapter provides a Seascape, Landscape and Visual Impact Assessment (SLVIA) of the likely significant effects on the character of the seascape and landscape and on people's views and visual amenity arising from the construction, operation and maintenance of Barmouth North Promenade Flood Defence Scheme (hereafter referred to as the 'Proposed Development'. The approach undertaken for this chapter has been supported by a scoping report submitted by Cyngor Gwynedd (Ymgynghoriaeth Gwynedd Consultancy (YGC)), engagement with statutory consultees, and scoping opinions received from Cyngor Gwynedd and Natural Resources Wales (NRW) on 30 April 2024 and 19 April 2024 respectively.

13.1.2 This chapter details the legislation, policy and guidance that is relevant to the SLVIA, a summary of engagement undertaken, the methodology of assessment, the seascape, landscape and visual baseline, and the embedded environmental design measures. This is followed by an assessment of likely significant effects of the Proposed Development on the seascape, landscape and visual receptors, taking account of the embedded environmental design measures, and the need for any additional mitigation is then considered along with any proposals for enhancement design measures. The chapter concludes with a summary of likely residual effects, and also considers cumulative and in-combination effects, which are discussed further in ES Volume 2, Chapter 15 Cumulative and In-Combination Effects.

13.1.3 There are clear differences between seascape effects, landscape effects and visual effects and the following distinctions have been made in accordance with Guidelines for Landscape and Visual Impact Assessment, 3rd edition (GLVIA3):

- **Seascape effects** relate to changes to the seascape as a resource, including physical changes to the fabric or individual coastal elements of the seascape, its aesthetic or perceptual qualities, and seascape character.
- **Landscape effects** relate to changes to the landscape as a resource, including physical changes to the fabric or individual elements of the landscape, its aesthetic or perceptual qualities, and landscape character.
- **Visual effects** relate to changes to existing views of identified visual receptors ('people'), from the loss or addition of features within their view due to the Proposed Development.

13.1.4 Seascape effects, landscape effects and visual effects will therefore be assessed and reported separately.

13.1.5 This chapter is supported by the following appendices, all contained in ES Volume 3:

- Appendix 13.1 Seascape, Landscape and Visual Impact Assessment Legislation and Policy.
- Appendix 13.2 Seascape, Landscape and Visual Impact Assessment Methodology.

- Appendix 13.3 Seascape baseline effects.
- Appendix 13.4 Landscape baseline effects.
- Appendix 13.5 Visual baseline and effects.

13.1.6 This chapter is supported by the following figures, all contained in ES Volume 4:

- Figure 13.1 Site Location and Study Area.
- Figure 13.2 Published National Seascape Character Areas.
- Figure 13.3 Published Local Seascape Character Areas.
- Figure 13.4 Published National Landscape Character Areas.
- Figure 13.5 Published Local Landscape Character Areas.
- Figure 13.6 Landscape Designations.
- Figure 13.7 Proposed Representative Viewpoints and Zone of Theoretical Visibility.
- Figure 13.8 Photosheets .

13.1.7 This chapter should be read in conjunction with following ES Chapters:

- ES Chapter 2 Project Description.
- ES Chapter 6 Biodiversity and Protected Sites.
- ES Chapter 9 Cultural Heritage.
- ES Chapter 15 Cumulative and In-Combination Effects.

13.2 Legislation, Policy and Guidance

13.2.1 This section identifies the legislation, policy, guidance and other documentation that has informed the SLIVA assessment of likely significant effects. This section is supported by the ES Volume 3, Appendix 1.1 Policy Context, which outlines overarching legislation and policy relevant to the Proposed Development.

13.2.2 This section is also informed by ES Volume 3 Appendix 13.1 Seascape, Landscape, and Visual Impact Assessment Legislation and Policy which provides relevant details pertaining to the Proposed Development.

Legislation

13.2.3 The legislation which relates to this topic is listed below.

13.2.4 Refer to ES Volume 3 Appendix 13.1 Seascape, Landscape and Visual Impact Assessment Legislation and Policy.

- European Landscape Convention 2000 [1].
- Well-being of Future Generation (Wales) Act 2015 [2].

National Policy and Strategies

13.2.5 The National Policy which relates to this topic is listed below.

13.2.6 Refer to ES Volume 3 Appendix 13.1 Seascape, Landscape and Visual Impact Assessment Legislation and Policy for further detail.

- Planning Policy Wales Edition 12: 2024 [3].
- Technical Advice Note (TAN) 5: Nature Conservation and Planning 2009 [4].
- Technical Advice Note (TAN) 12: Design 2016 [5].
- Technical Advice Note (TAN) 14: Coastal Planning [6].
- Technical Advice Note (TAN) The Historic Environment [7].

Local Policy and Strategies

13.2.7 The Local Policy and Strategies which relate to this topic are listed below.

13.2.8 Refer to ES Volume 3 Appendix 13.1 Seascape, Landscape and Visual Impact Assessment Legislation and Policy.

- Anglesey and Gwynedd Joint Local Development Plan 2011 - 2026 (2017) [8]
    - PCYFF 4 Design and landscaping.
    - AGM 2 Special Landscape Areas.
    - AGM 3 Protecting and enhancing features and qualities that are distinctive to the local landscape character.
    - PS 19 Conserving and where appropriate enhancing the natural environment.
    - AT 1 Conservation Areas, World Heritage Sites and Registered Historic Landscapes, Parks and Gardens.
    - PS 6 Alleviating and adapting to the effects of climate change.
    - PCYFF3 Design and place shaping.
    - AGM 4 Coastal Protection.
- Supplementary Planning Guidance: Landscape Character 2009 [9].
- Supplementary Planning Guidance Planning for Sustainable Development 2010 [10].

Standards and Guidance

13.2.9 The guidance and standards which relate to this topic are listed below.

- An Approach to Landscape Character Assessment (2014) [11] – Informs the methodology for defining and describing the landscape character baseline.
- An Approach to Seascape Character Assessment (2012) [12] – Informs the methodology for defining and describing the seascape character baseline.
- Guidelines for Landscape and Visual Impact Assessment, 3rd edition (2013) [13] - Underpins the methodology for undertaking LVIAs.
- Infrastructure, Technical Guidance Note 04/20 (2020) [14] - Background information for the planning and design process for infrastructure projects for landscape.
- Visual Representation of Development Proposals, Technical Guidance Note 06/19 (2019) [15] - Informs the process for producing visualisations and photomontages.

- Assessing landscape value outside national designations, Technical Guidance Note 02/21 [16] – Informs judgements on the value of landscape in the context of the UK Town and Country Planning Act.
- Using LANDMAP in Landscape and Visual Impact Assessments GN46 [17] – Technical guidance on how LANDMAP information should be used in LVIAs.
- Guidance on Coastal Character Assessment (2017) [18]– Informs the methodology for defining and describing the seascape character baseline.
- Guide to Best Practice in Seascape Assessment (2001) [19]- Informs the methodology to undertake a seascape character baseline.

13.3 Stakeholder Engagement

Viewpoint Selection

13.3.1 Viewpoints were submitted to Cyngor Gwynedd for comment prior to undertaking the SLVIA.

EIA Scoping Opinion

13.3.2 An EIA Scoping Opinion was adopted by Cyngor Gwynedd (supported by Ymgynghoriaeth Gwynedd Consultancy (YGC)) and Natural Resources Wales (NRW) on 30 April 2024 and 19 April 2024 respectively. The comments received in relation to the SLVIA are presented in Table 13-1.

Table 13-1 Gwynedd Council comments on scope of the SLVIA and the response

Scoping Opinion Comment	Response
Landscape	
"*The study area lies within two Landscapes of Outstanding Historic Interest (LOHI), Mawddach and Ardudwy. Consultation with Gwynedd Archaeological Planning Service (GAPS) will be required regarding potential impacts on the LOHI, and whether an Assessment of the Significance of Impacts of Development on Historic Landscape (ASIDOHL) and any archaeological assessment will be required*."	Reference to the two Landscapes of Outstanding Historic Interest is made within the SLIVA with regards to landscape designations. Assessment of the effects on the significance and settings of these historic designations is covered within ES Chapter 9 Cultural Heritage.
Seascape	
"The site of proposed works is located within the Cardigan Bay North and Estuaries Marine Character Area (15). The key characteristics of the MCA most applicable to the site of proposed works are shallower water (up to 20m) compared to the southern territory, robust infauna (invertebrates that burrow into the seafloor substrate), important demersal fish spawning and scallop fishing grounds, cetaceans (including bottlenose dolphins) regularly sighted, wave climate increases significantly in the central and northern part of the MCA, open sea affords expansive views, strong maritime backdrop and setting.	The MCA will be considered in the seascape baseline as per the SLIVA methodology. To support this, we have also identified the 'Snowdonia National Park Authority Supplementary Planning Guidance: Landscapes and Seascapes of Eryri (2014)', which provides a more detailed representation of the local seascape character within the context of this SLVIA. The height increase of the sea walls will also be considered as part of the assessment, as per the SLIVA methodology, for all relevant visual receptor groups.

Scoping Opinion Comment	Response
The proposed scheme will be partially carried out from the foreshore, in particular the beach recharge, rock revetment construction and secondary wall construction. Of the above MCA features for the site, impact on the views and strong backdrop and setting cannot be ruled out. The work will increase the height of the sea wall and will limit views out to sea for vehicle travellers. In addition, there will be changes to the beach due to reprofiling. *Whilst the above is considered to be a landscape impact, it is also unavoidable to improve the standard of protection afforded by the structure. The height increase will not affect view out to see for walkers and is considered to be a suitable compromise between improving the standard of protection and landscape impact. This will be considered further through the planning approval process."*	

Non-Statutory Engagement

13.3.3 A public consultation event was held on the 28/01/2025. A summary of engagement undertaken is outlined below.

13.3.4 The promenade and beach as key areas for leisure and fitness, with strong support for placemaking improvements. Preferred enhancements include:

- Dedicated pedestrian and cycle routes
- Shaded seating and meeting areas
- Increased toilet provision
- Improved lighting
- Widened parking lanes and additional parking
- Zebra crossings and traffic calming measures

13.3.5 Beach access is highly valued, with most respondents visiting daily. There is widespread support for reinstating access points and incorporating them into the design. Approximately half of respondents requested improved inclusive access, including wheelchair and pram-friendly routes and handrails at stepped locations.

13.3.6 In relation to flood protection, the community expressed a preference for temporary defences over permanent structures that could restrict access to properties behind the promenade (e.g., Heol Llywelyn and Heol-y-Sarn).

13.3.7 Construction timing was a key concern, with a strong preference for works to be scheduled outside the peak tourism season (Autumn–Spring). While reduced parking during construction was noted, most respondents accepted this as an unavoidable impact.

13.3.8 There is a clear desire for ongoing consultation and transparency, including access to design drawings online. Concerns were raised regarding the visual and safety implications of rock armour, particularly for children, and the potential effects of groyne removal on sediment movement toward the southern beach.

13.3.9 The feedback highlights the importance of maintaining visual connectivity to the sea, ensuring inclusive access, and minimising disruption to recreational use. These considerations have informed the design development and embedded design measures detailed in section 13.7.2.

13.4 Methodology

Study area

13.4.1 This section describes the spatial scope (i.e. the area which is impacted) for the assessment as it applies to the SLVIA.

13.4.2 The study area for the SLVIA is illustrated in ES Volume 4, Figure 13.1 Site Location and Study Area.

13.4.3 A detailed desktop study, including an initial viewshed analysis in Google Earth, was conducted to inform the selection of a 1km study area for this SLVIA given the local topography and elevation gain to the northeast of the region. Fieldwork on 09/12/2024 to 10/12/2024 and a Zone of Theoretical Visibility (ZTV) confirmed the geographical extent of the proposed study area is sufficient to assess potentially significant landscape and visual effects in accordance with GLVIA3. Refer to ES Volume 4 Figure 13.1 Site Location and Study Area.

13.4.4 The SLIVA baseline data for the study area has been obtained from a desktop study and fieldwork survey.

13.4.5 The following information and data sources outlined in table 13-2, have been used to complete the baseline assessment:

Table 13-2 Data sources

Data	Source
1:25,000 Ordnance Survey (OS) Open Data Mapping and Aerial Imagery	Ordnance Survey
Google Earth Aerial Imagery	Google
LiDAR Digital Terrain Map – 1m resolution	Welsh Government
National Marine Character Area 15: Cardigan Bay (north) and estuaries	Natural Resources Wales
Seascape Character Area 22: Mochras to Fairbourne and Sarn Badrig	The National Park Authority
National Landscape Character Area 05 Tremadoc Bay	Natural Resources Wales
Local Landscape Character Area 13: Barmouth	Gwynedd Council
LANDMAP Data guided by visual and sensory database and informed by landscape habitats, geological habitats, historic landscape and cultural landscape services data.	Natural Resources Wales
Barmouth Historic Landscape Character Area	Gwynedd Archaeological Trust
Special Landscape Area 06: Barmouth Bay	Natural Resources Wales
Mawddach and Ardudwy Registered Historic Landscape	Cadw and Welsh Government

Data	Source
Eryri/Snowdonia National Park Designated area	Natural Resources Wales
Ancient Woodland	Natural Resources Wales
Listed Buildings	Cadw
Abermaw Conservation Area	Welsh Government

13.4.6 A qualified Landscape Architect specialist visited the Site between 09/12/2024 and 10/12/2024 to test the assumptions made during the desktop study, confirm viewpoint locations, and conduct viewpoint photography in accordance with GLIVA3. All viewpoints and accompanying photography were captured along publicly accessible routes or on open access land.

13.4.7 Viewpoints were submitted to Cyngor Gwynedd for comment prior to undertaking the SLVIA.

Assessment Methodology

13.4.8 The detailed methodology, including the criteria referred to in making judgements on the sensitivity of seascape, landscape and visual receptors, the magnitude of impact and the significance of effects is set out in ES Volume 3, Appendix 13.2 Seascape, Landscape and Visual Impact Assessment Methodology.

13.4.9 The methodology for the SLVIA involved the following stages:

- A review of published seascape and landscape character assessments, studies, relevant supporting evidence base documents, aerial photography, mapping and fieldwork to define the baseline and to determine the extent of the study area within which there is potential for seascape, landscape and visual effects.
- Define the seascape, landscape and visual receptors and describe the seascape, landscape and visual baseline.
- Review the design to embed mitigation measures into the Proposed Development to avoid or minimise adverse seascape, landscape and visual effects and maximise opportunities for landscape integration and enhancement.
- Determine the sensitivity (nature of the receptor) of seascape, landscape and visual receptors, by considering the value attached to the seascape and landscape or views and susceptibility to change of the receptor.
- Assess the magnitude of impact (nature of effect) of the Proposed Development in relation to size, scale, duration and reversibility.
- Assess the significance of effects resulting by considering the relationship between the sensitivity of the receptor and the magnitude of impact and determine which effects are significant.

13.4.10 The assessment of the likely seascape, landscape and visual effects of the Proposed Development has been undertaken for the following scenarios:

- The peak of construction activity, in winter for transport Option 1 - Delivery by road and Option 2 – Delivery by sea, as discussed in ES Volume 2, Chapter 2 Project Description.

- Year 1 of operation, assuming the Proposed Development is built out and in winter.
- Year 15 of the operation and maintenance, assuming the proposed planting has established, and the season is summer.

Limitations and Assumptions

Limitations

13.4.11 The baseline assessment has been based on information readily available at the time of undertaking the assessment.

13.4.12 Weather conditions, time of day and seasonal factors may affect the assessment and record of the environment during site visits.

Assumptions

13.4.13 The seascape, landscape and visual effects of the Proposed Development would vary through time. The assessment therefore considers the effects on seascape and landscape character and visual amenity arising over the life of the Proposed Development, through its construction, operation and maintenance.

13.4.14 Viewpoint photography was undertaken during winter to capture the most open and exposed views, as trees are out of leaf during this period. Given the limited tree cover both onsite and within the assessed views, seasonal variability is expected to be minimal. As such, the visual effects have been assessed on a 'worse case' basis in terms of visibility. Nonetheless, where relevant, enclosed views, such as those occurring when trees are in full leaf between March and October, have also been considered to ensure a representative and balanced assessment.

13.4.15 It should also be noted that this timing of photography and fieldwork is outside of the peak tourist season. As such, the views captured are likely to underrepresent the level of activity typically experienced during the summer, when pedestrian and vehicular presence along the promenade is expected to be significantly higher. While it is anticipated that seasonal variation will result in busier and more dynamic views during the summer months, the exact level of activity is variable and cannot be predicted with certainty.

13.4.16 All fieldwork has been undertaken from publicly accessible locations. Professional judgement has been used to select representative viewpoints and assess views from nearby residential receptors, added by aerial photography and fieldwork observations.

13.4.17 Tall plant and machinery will be in place for the minimum practicable period of time during construction, as discussed in ES Volume 2, Chapter 2 Project Description, section 2.11. This is expected to include tracked excavators, dumpers, dozers, and piling equipment, as well as scaffolding and cranes.

13.4.18 Throughout the duration of the construction period, temporary lighting will be required to allow work to continue outside of daylight hours, this will mainly occur during the winter months. This includes work lighting which will be installed in the same place throughout the project and task specific lighting which will be in place for specific sections of the works for a shorter length of time. All temporary lighting, including flood lighting, security lights, and any other obtrusive external lighting, will be directed away from the sensitive areas

identified by the Ecological Clerk of Works (ECoW) and risk of nighttime visual impacts especially for residents. For further information with regards to the work lighting locations and type of task lighting refer to ES Volume 2, Chapter 2 Project Description, paragraph 2.12.32 and 2.12.33.

13.4.19 For the construction phase assessment, it is assumed that construction activities will proceed under either Transport Option 1 delivery by road or Option 2 delivery by sea. The construction approaches themselves remain consistent across both options, only the delivery method differs depending on the selected option. For further information with regards to the proposed construction approach for each asset of the Proposed Development refer to Chapter 2 Project Description, section 2.12.

13.4.20 In Option 1 it is assumed that Marine Parade Road will serve as the primary haul road, passing through the town centre. Where rock will then be stockpiled in the site compound area and moved to temporary stockpiles below MHWS. In Option 2, rock will be loaded onto a Self-Discharging Excavator Vessel (SDEV) and anchored 6km offshore of Barmouth for 1-2 weeks per shipment. Supported by shallow draught tipper boat or smaller barge which will transport the rock to the site, where it will be tipped onto shore below the MHWS in a temporary stockpile and placed directly to the revetment footprint.

13.4.21 In relation to the demountable flood defences, the existing stoplogs are proposed to be replaced with either a continuation of the secondary flood wall or new floodgates. Where floodgates are introduced or replaced, they will only be deployed during storm events and periods of elevated flood risk. As such, they will not be assessed in the deployed (raised) position for the purposes of the visual assessment in either operation year 1 or operation and maintenance year 15, as their presence will not form part of the typical day to day view.

13.5 Seascape and Landscape Baseline

13.5.1 This section sets out existing conditions and identifies potential receptors and their value, as per the methodology.

Site Context

Topography, Geology and Hydrology

13.5.2 The study area is located at the interface between Cardigan Bay and Barmouth town. The study area emphasises the interaction of coastal and upland topography. The terrain rises steeply to the northeast into the foothills of the Rhinogydd mountains towards Eryri National Park, with an elevation change of more than +150m AOD, providing long-distance panoramic views of Barmouth town, Mawddach estuary and out towards Llŷn Peninsula.

13.5.3 The Mawddach estuary is a prominent hydrological feature in the area, flowing into Cardigan Bay. It formed during the last glacial retreat when the glaciated valley flooded. The Grade II-listed Barmouth Bridge spans the estuary between Barmouth and Morfa Mawddach. Historically, the region has been important for mineral exploration, with evidence of mining activity in the foothills.

Land cover and habitats

13.5.4 The diverse land cover and habitat reflect the coastal environment through a mix of natural and human-altered landscapes. The urban and built environment is

limited to the Barmouth promenade and town centre, which includes residential housing, commercial buildings, and amenities. There is a strong tourism industry, including hotels, restaurants, and shops.

13.5.5 Sand dunes can be found south of the study area, while timber groyne features along the coast towards the north create a triangular sand and shingle shoreline. Pockets of semi-natural woodland and scrub, some of which is designated Ancient Woodland, are scattered throughout the urban environment, extending to the foothills. Here, the land cover changes to grassland which is used for low-intensity agriculture and sheep grazing.

13.5.6 The main habitats include the sand dune system south of the study area, which is a unique area of botanical and species interest, however its successional system has been impacted by the promenade's construction. Mawddach's intertidal flats are also important for marine biodiversity.

13.5.7 For further information please see ES Volume 2, Chapter 6, Biodiversity and Protected Sites.

Land use and cultural influences

13.5.8 Barmouth's town centre serves as a residential and commercial hub, with hotels, restaurants, and souvenir shops to facilitate tourism. The promenade is a major tourist attraction, offering seasonal attractions such as amusements and markets, as well as a key recreational space for pedestrians and cyclists with direct access to the shoreline.

13.5.9 Barmouth was developed as a seaside resort during the Victorian era, and the promenade reflects this maritime heritage, as does the harbour area, which represents the industrial relationship between the sea and the town.

13.5.10 For further information please see ES Volume 2, Chapter 9 Cultural Heritage.

Movement and connectivity

13.5.11 The A496 is the main road that connects Barmouth to nearby towns and villages like Llanaber and Llanelltyd, secondary roads provide access to rural residential areas. Parking facilities are available along and near the promenade to help visitors arrive. The Cambrian Coast Railway connects Barmouth's town centre and promenade, allowing for regional and national travel throughout Wales. Barmouth Bridge is part of the rail link to Morfa Mawddach, located southeast of the study area. Additionally, local public transport is available, with many bus stops, mostly along the A496.

13.5.12 The promenade serves as a pedestrian and cyclist centre, connecting the coastal and urban environments. The Wales Coastal Path Long Distance Footpath and National Cycle Route 8 both run along the promenade. Public Rights of Way provide access into the Rhinogydd mountains foothills and Eryri National Park, as well as panoramic views of the town centre, coastline and estuary.

Key Seascape and Landscape Features

13.5.13 Key seascape and landscape features that contribute to the character and value attached to the landscape are outlined in Table 13-3. These are features that lie within the Site and are deemed important and/or valuable and may be directly affected by the Proposed Development.

13.5.14 For the purposes of this assessment, the landscape features have been assessed at the level of the local seascape and landscape character areas to which they belong and contribute, as their value is inherently tied to the overall character of the area.

Table 13-3 Seascape and landscape features

Seascape/Landscape feature	Description
Sand and shingle	A broad triangular accumulation of sand and shingle that widens towards the south of the study area towards the Mawddach estuary. Sand and shingle contribute significantly to the local landscape character and are an important feature of the coastal realm, making it popular for recreational activities like walking.
Sand dune system [20]	The bare and vegetated sand dune system is located in close proximity to the south of the study area. Sediment accretion and rising beach levels have favoured vegetation colonisation and dune growth, supporting a diverse range of species contributing to ecological value. The dunes are also a popular destination for recreational activities such as walking.
Timber groynes	Timber groynes are constructed of creosoted pine and run perpendicular to the revetment and primary sea wall. They serve an important role in coastal morphology and shoreline dynamics.
Stone sea walls and rock revetment	The primary wall and rock revetment is constructed of concrete and faced with Welsh granite, providing primary flood protection for the promenade. The secondary wall that separates the promenade from the roadway and is formed of coursed stone rubble and has a distinctive spiked stone top. The walls and revetment create a sharp settlement edge against a broad sandy beach, contributing to the character of the landscape.

Seascape Character

13.5.15 Relevant national and regional scale published Seascape Character Assessments have been reviewed as part of the SLVIA to identify the key features and characteristics of the study area. This information has been used to inform the iterative design.

13.5.16 Seascape is defined within the GLVIA3 as “landscapes with views of the coast or seas, and coasts and the adjacent marine environment. [13]”

13.5.17 Seascape Character assessment is defined within Natural England ‘An Approach to Seascape Character Assessment’ as an

“appropriate way to assess, characterise, map and describe seascape character. The process of Seascape Character Assessment follows the well-established and widely used principles and stages set out in Landscape Character Assessment guidance, with emphasis given to particular issues that need to be considered when assessing coastal and marine environments. [12]”

13.5.18 Refer to paragraph 13.5.19 for further information regarding Landscape Character Assessment.

National Seascape Character

13.5.19 National Marine Character areas (NMCA) define the key natural, cultural and perceptual characteristics of the UK’s coastline and provide a framework for

understanding, managing and conserving the marine environment, as well as providing context for more detailed studies on local landscape character.

13.5.20 The Proposed Development lies within the NMCA 15: Cardigan Bay (north) and estuaries [21] refer to ES Volume 4, Figure 13.2 Published National Seascape Character Areas.

13.5.21 The key characteristics of the NMCA 15 are:

- Coastal and marine frontage to Eryri National Park, the mountains rising behind forming a dramatic backdrop to the MCA.
- Swash-aligned landform with sweeping cobble and boulder beaches, extensive sand dunes, especially at Morfa Dyffryn, and expansive sand/mudflats fringing estuaries.
- Varied coastal habitats of international and national importance, including the estuaries of the Mawddach and Dyfi and the Morfa Dyffryn sand dune system.
- Internationally important and unique sarnau (glacial reefs), extending over 20km from the coast hosting a rich diversity of flora and fauna. Rare 'bubbling' calcium carbonate reefs are also present.
- Openness to prevailing westerlies means the bay can be exposed and dangerous, with strong tidal streams around the sarnau and estuary mouths.
- Exposures of intertidal peats and submerged forest deposits, providing proof of inundated landscapes dating back to the end of the last Ice Age.
- Part falls within the Lleyn Peninsula and the Sarnau SAC, recognised for its varied maritime habitats and species including distinctive sarnau and seals and dolphins.
- The rich marine environment also provides nursery grounds for demersal fish, habitats for invertebrate communities and feeding grounds for sea birds.
- Registered historic landscapes representing extensive evidence of recurrent settlement and land use along the adjacent coast since the prehistoric period.
- Wider area steeped in legend about the lost lands of Cantref y Gwaelod, the ancient kingdom believed to be hidden beneath the waters of the bay.
- Historic ports of Aberdyfi and Barmouth, both expanding in the 18th/19th centuries to trade in primary materials from Eryri. These are now popular tourism destinations.
- Wreck sites associated with the sarnau, including the Protected Wrecks of the Diamond and Bronze Bell.
- Important for commercial and recreational fishing. Hand gathering of mussels and cockles is a feature of the estuaries.
- Long associations with both onshore and offshore military use, including offshore military training areas and nationally important WWII defences at Fairbourne.

- Destination for a range of coastal and marine activities including leisure sailing, chartered sightseeing, fishing and diving trips, beach angling, sea kayaking and walking along the Wales Coast Path.
- Tourism infrastructure such as prominent camping/caravan sites, car parks and golf courses are found along the open coastline.
- Perceptual qualities vary dramatically according to prevailing weather conditions. A calm and peaceful seascape can rapidly change when westerly weather rolls in.
- Expansive views over the whole bay, with the conical hills of the Llŷn National Landscape appearing like islands on northern horizon. Silhouettes of the Preseli Mountains of Pembrokeshire Coast National Park feature in south-west views.
- The ever-changing landscapes and seascapes provide a sense of inspiration to many – attracting visitors, artists and writers for centuries.

13.5.22 This MCA has strong relationships with adjacent MCAs 16 and 17, which cover the southern coastal waters and outer bay respectively.

Local Seascape Character

Snowdonia National Park Authority Supplementary Planning Guidance: Landscapes and Seascapes of Eryri (2014)

13.5.23 The Snowdonia National Park Authority Supplementary Planning Guidance: Landscapes and Seascapes of Eryri (2014) [22], now known as the National Park Authority, identifies the key characteristics of individual Landscape Character Areas (LCAs) and Seascape Character Areas (SCA's). It sets out information on how to manage them in support of the policies contained in the Eryri Local Development Plan.

13.5.24 The Proposed Development lies in SCA 22: Mochras to Fairbourne and Sarn Badrig, refer to ES Volume 4, Figure 13.3 Published Local Seascape Character Areas.

13.5.25 The key characteristics of the SCA are:

- Underlying geology of the coastal plain includes the Mochras Fault, and a long stratigraphy overlain by a thin veneer of Pleistocene sediments. South of Llanaber, Precambrian rocks crop out at the surface, creating a steep hillside inland.
- Glacial features include boulder clay deposits below Morfa Dyffryn, and Sarn Badrig, thought to be a glacial medial moraine.
- Topography comprises a flat coastal plain formed by post-glacial sedimentation and sea-level rise. Inland, land rises into the western foothills of Eryri.
- Tidal and longshore drift processes result in the formation of a swash-aligned landform comprising a long sandy beach backed by dunes, and the deposition of significant numbers of shells. The Artro, Ysgethin and Mawddach flow into the sea in this SCA.
- Uses dominated by recreation and tourism (resort, caravan parks, campsites, recreational boating etc), plus farming, dunes and airfield.

- Habitats include extensive dune systems, grazing marsh, beaches and intertidal areas.
- Onshore historic and cultural features include Llandbedr airfield, Llandanwg Church, the Victorian seaside resort of Barmouth, and Cambrian Coast railway line to Pwllheli.
- Offshore historic and cultural features include Barmouth harbour and the associated historic shipbuilding and fishing industries. Summer ferry from Barmouth to Fairbourne.
- Several small villages located along the A496 coast road. Tourism a strong influence on development, including Barmouth, and numerous 20th Century caravan parks and campsites on flat coastal land.
- A linear landscape, with beach, road and railway forming clear north-south elements. Light colours and regular patterns of the numerous caravan parks contrast with surrounding dunes and farmland.
- Foothills of Eryri form landscape setting in views from land and sea.
- Tremadog Bay forms wide seascape setting, with hills of the Lleyn peninsula visible to the north. Lighthouses contribute to seascape at night.

13.5.26 This SCA also lies in close proximity to SCA 23: Mawddach Estuary, which covers the extent of the estuary and joins at the south-eastern boundary, and SCA 34: Barmouth Bay to the west, refer to ES Volume 4, Figure 13.3 Published Local Seascape Character Areas.

13.5.27 Barmouth is under the jurisdiction of Cyngor Gwynedd Local Authority and outside The National Park Authority, therefore is not included in the Landscape Character Areas outlined in the National Park Authority SGP.

13.5.28 Additional details related to SCA 22: Mochras to Fairbourne and Sarn Badrig are available in ES Volume 3, Appendix 13.4 Seascape baseline and effects.

Landscape Character

13.5.29 Parallel with the Seascape, national and regional scale published Landscape Character Assessments have been reviewed as part of the SLVIA to identify the key features and characteristics of the study area. This information has once again been used to inform the iterative design.

13.5.30 Landscape Character Assessment is defined within the glossary of GLVIA3 as the

"Process of identifying and describing variation in the character of the landscape and using this information to assist in managing change in the landscape. It seeks to identify and explain the unique combination of elements and features that make landscapes distinctive [13]."

13.5.31 Natural England's 'An approach to Landscape Character Assessment' notes the use and purpose of key characteristics, stating:

"Key characteristics are those combinations of elements which help give an area its distinctive sense of place. If these characteristics change, or are lost, there will be important consequences for the current character of the landscape. Key characteristics are particularly important in the development of planning and management policies. They are important for monitoring change and can provide

a useful reference point against which landscape change can be assessed. They can be used as indicators to inform thinking about whether and how the landscape is changing and whether, or not, particular policies – for example - are effective and having the desired effect on landscape character [11].”

13.5.32 NRW’s Using LANDMAP in Landscape and Visual Impact Assessments GN46 states:

“We recommend that LANDMAP is used as the starting point for creating suitably scaled character-based reporting units. Reporting units may be LANDMAP visual and sensory aspect areas, where these are not entirely suitable, other LANDMAP aspect layers can be used to assist with the subdivision or amalgamation of visual and sensory aspect boundaries. Following good practice in landscape character assessment, further detail, refinement, updating and field work should be included when confirming reporting unit boundaries. LANDMAP surveys provide a basic level of detail about the key characteristics, qualities and values of each aspect area. This will be insufficient for the needs of LVIA and further assessment with field work will be required. Good practice in landscape character assessment and in identifying key views and visual resources will be required to gain sufficient understanding at the right scales to make judgements of effects in LVIA [17].”

National Landscape Character

13.5.33 National Landscape Character Areas (NLCA) provide a broad overview of the landscape's distinct characteristics and features, which aids in understanding the regional context and setting, as well as providing context for more detailed studies on local landscape character.

13.5.34 The Proposed Development lies within NLCA 05 Tremadoc Bay [23], as shown on ES Volume 4, Figure 13.4 Published National Landscape Character Areas.

13.5.35 The key characteristics of NLCA 05 are:

- The lowland fringes of northern Cardigan Bay.
- Hemmed in by steeply rising uplands of both Llŷn Peninsula and Eryri.
- Mainly a soft coastline – with only a few rocky headlands. Some substantial sections of sandy beach and dunes.
- West of Criccieth - is a broader, pastoral, coastal landscape, backed by the Rivals.
- East of Criccieth - east the mountains closely constrict estuaries, levels and the well developed dune systems. In places along estuaries the rugged and upland character runs down to sea level.
- The active Dwyryd - Glaslyn Estuary - considered as one of the most outstanding bar built estuaries in Britain.
- Coastal dunes and associated habitat - such as marsh and dune grass form the backdrop to the long sandy beaches at Morfa Harlech and Morfa Dyffryn. There is significant ecological interest and diversity in the terrestrial and marine habitats associated with the Dwyryd Estuary at Morfa Harlech.
- Lowland pastoral and hill sheep grazing – more especially on Llŷn, where there is a more extensive lowland hinterland.

- The castles of Harlech (World Heritage Site) and Criccieth - occupy strategically important coastal promontories and form part of a chain of castles around North Wales.
- Archaeology - The area contains a rich diversity of smaller scale archaeological features dating from the prehistoric period onwards.
- Porthmadog Bar - The upper Glaslyn Estuary was one of the most ambitious 19th century land reclamation schemes in Wales and included the conscious creation of new landscapes including extensive pastoral farmland.
- Portmeirion - The architecturally eclectic 1920's Italianate 'fantasy village' is a significant site and tourist attraction within the area.
- Settlement pattern – principle settlements are along the coastline at river mouths and by castles on defensive headlands. Much smaller, inland villages and hamlets are frequently associated with Early Christian churches. Porthmadog was a slate exporting port.
- Tourism – a very popular but still largely rural coastal landscape, including by contrast a number of very large and conspicuous caravan and chalet parks.
- Cultural identities – a wide range of influences: nearby Llŷn Peninsula and Eryri, coast and upland, rural and resort, agricultural and industrial heritage, functional and inspired architecture, a strong Welsh speaking tradition and a popular visitor destination.

Local Landscape Character

Gwynedd Landscape Strategy – Update 2012

13.5.36 The Gwynedd Landscape Strategy update (2012) [24] is based on the LANDMAP methodology and identifies 16 distinct Landscape Character Areas (LCAs) in the Gwynedd Local Authority Planning area.

13.5.37 The Proposed Development lies within LCA 13: Barmouth, as shown in ES Volume 4, Figure 13.5 Published Local Landscape Character Areas.

13.5.38 The key characteristics of the LCA are:

- Settlement Edge - The two primary settlements of Barmouth and Fairbourne are quite different in scale and form; Barmouth is a linear settlement with attractive Victorian frontage, whereas Fairbourne is a modern, nucleated 'holiday village.
- Historic Landscapes - All of the LCA falls within the Mawddach Landscape of Outstanding Historic Interest, valued for extensive relict evidence of diverse land use and activity from prehistoric and later periods (including the rare wooden viaduct/ trestle bridge crossing the estuary).
- Coastal Landscapes - Open coastal location, particularly north of Barmouth and around Fairbourne, precludes extensive landscape treatment.
- Habitat Management - The area includes a range of habitat type from coastal to upland fringe. A number of these have statutory protection.
- Relationship with Snowdonia National Park - Snowdonia National Park lies immediately adjacent to the LCA, and as such all new development/management proposals within the character area should

consider the landscape's very strong visual and historical links to and from the protected landscape.

Mawddach Historic Landscape Characterisation

13.5.39 The assessment also considers Mawddach Historic Landscape Characterisation.

13.5.40 The Proposed Development is located within the Barmouth Historical Landscape Character Area (HLCA) [25], as shown on ES Volume 4, Figure 13.5 Published Local Landscape Character Areas.

13.5.41 Whilst a non-statutory designation, they can help to understand and assess the landscape's historic and archaeological interest, which includes the physical remains of human activity and exploitation.

13.5.42 A summary of the key characteristics of the HLCA are:

- The towns early layout remains unclear, but known buildings suggest a pattern of vertical property division, likely due to limited space.
- By the mid-18th century, small cottages appeared on the high slopes adhering to regional tradition. Two-storey buildings with slab rubble walls and gable-end chimneys lied on the lower slopes. Some of the buildings incorporated refined architectural elements, reflecting the town's growing prosperity.
- During the early 19th century terraces became common indicating organised building, the railways arrival during this period spurred rapid urban growth introducing taller building with new styles.
- After 1880 growth became sporadic, with mid 20th century public housing expanding to the northwest. Despite this Barmouth remains as a well-preserved resort town.

LANDMAP Visual and Sensory Aspect Areas

13.5.43 For the purpose of this SLVIA, the landscape will be assessed using the most up to date LANDMAP information, discussed in paragraph 13.4.53.

13.5.44 LANDMAP comprises five aspect areas:

- Visual and Sensory - how the landscape is experienced and perceived by people [26].
- Landscape habitats - ecological characteristics of the landscape [27].
- Geological habitats - geological and geomorphological characteristics of the landscape [28].
- Historic landscape - historical and cultural dimensions of the landscape [29].
- Cultural landscape services - cultural and perceptual associations people have with the landscape [30].

13.5.45 The Visual and Sensory Aspect Areas have been used as the primary spatial units for assessing landscape character, as they most directly relate to perceptual and experiential qualities of the landscape. However, the overall landscape value has been determined by considering the LANDMAP evaluations across all five aspect areas, ensuring a holistic understanding of the

landscape's significance. Whilst in accordance with the landscape value criteria outlined in ES Volume 3, Appendix 13.2 Seascape, Landscape and Visual Impact Assessment Methodology.

13.5.46 Table 13.4 summaries and evaluates each of the five LANDMAP aspect areas, presenting their key characteristics and overall landscape value derived from this assessment.

13.5.47 For further details relating to the LANDMAP Aspect Areas refer to ES Volume 3, Appendix 13.4 Landscape baseline and effects.

Table 13-4 LANDMAP Visual and Sensory Aspect Areas

LANDMAP Aspect Area	Summary and Evaluation of each LANDMAP aspect area	Overall value
Barmouth (13290)	*Visual and Sensory - SNPVS130* • Consistent character of broad sandy beaches and spit driven by natural water action. There is a strong sense of place derived from Mawddach estuary/mouth, exposed coastal location and upland context. • Superb, dramatic views to the uplands, to the north and south as well as to Barmouth and up the Mawddach estuary, including the distinctive railway bridge. • Coastal defences are undermined from storm damage and sand scoured from beach. Visual and sensory Value: Outstanding/Condition: Good/ Trend: Declining *Landscape habitat - SNPLH268* • The area contains habitats of internationally and nationally important salt marsh and estuary is present. Including Special Area of Conservation (SAC), Site of Special Scientific Interest (SSSI) designations. • Sand dune grassland appears to be increasing in northern region and should be encouraged to continue. Landscape habitat value: High/ Condition: Unassessed/ Trend: Improving *Cultural landscape services - SNPCLS165* • Attractive views in and out • Perceptual and senary qualities– tranquil, wild and spiritual Limited survey response There are no geological habitats or historic landscape aspect areas associated with Barmouth SNPVS130. The aspect area will, however, share some similarities with Barmouth SNPVS027.	The aspect area holds significant ecological and visual and sensory value, with outstanding landscape and habitats of international importance. However, its declining coastal condition presents a challenge which may undermine its future sustainability, but positive habitat trends highlight opportunities for targeted efforts. **Value: Medium**
Barmouth (4864)	*Visual and Sensory - SNPVS027* • The irregular character of Victorian buildings set on the seafront defines a sharp settlement edge against a broad sandy beach, with a backdrop of steep upland. • There is a moderate sense of place detracted by the modern buildings, pavilion leisure centre and amusement arcade which is at odds with Victorian sea front.	The aspect area holds some historic and geological significance, but its visual and sensory aspects are diminished by modern development, detracting from its historical Victorian

	• Expansive views out to the coast and towards the Mawddach estuary are offered, as well as dramatic sharp views to the uplands. Visual and sensory value: Low/ Condition: Fair/ Trend: Constant *Landscape habitat - encompasses the following aspect areas SNPLH322 and SNPLH260 to varying degrees.* • SNPLH322: The site contains the city of Barmouth as dominating habitat with patches of amenity grassland. The aspect area contains protected sites; SAC, SSSI and local wildlife site. Landscape habitat value: Low/ Condition: Unassessed/ Trend: Constant • SNPLH260: The aspect is dominated by improved grassland interspersed by patches of semi natural broadleaved woodland, marshy grassland and buildings and caravan sites. The aspect area contains protected sites; SAC, SSSI and local wildlife site. Landscape habitat value: Moderate/ Condition: Unassessed/ Trend: Constant *Cultural landscape services - SNPCLS038* • Attractive views out Limited survey response *Geological habitat - GWNDDGL001* • SSSI/GCR designation Barmouth Hillside Geological habitat value: Outstanding/ Condition: Good/ Trend: Constant *Historic landscape - GWNDDHL282* • The aspect area is national importance as a distinctive coastal town with a wide variety of important architecture and building archaeology. Historic landscape value: High / Condition: Good/ Trend: Constant	character. Furthermore, the urban landscape has limited ecological value, despite the presence of several protected sites. **Value: Low**
Barmouth Coastal Hills (4872)	*Visual and Sensory - SNPVS035* • Uniform neutral character of a mixture of rough grazing, woodland clumps bounded by drystone walls. Resulting in a moderate sense of place supported by the strong coastal feel from the borrowed view of the coast. • Open long-distance views are offered across the coast and Mawddach estuary. Visual and Sensory value: High/ Condition: Fair/ Trend: Constant *Landscape habitat –encompasses SNPVS322 referenced in Barmouth (4864) Value: Low and the following aspect areas SNPLH323, SNPLH321, SNPLH279 and SNPLH327 to varying degrees. A summary is given below.* • SNPLH323: The site is dominated by a large area of dry heath acid grassland mosaic and contains a considerable amount of heathland which is priority BAP habitat.	The aspect area has strong visual and sensory appeal, which is attributed to long distance coastal views and sense of place owing to its proximity to the coast. It is also culturally and ecologically significant, with the Snowdonia National Park Dark Sky Reserve and important heathland habitats, some of which are internationally protected. Nationally and regionally significant historic landscapes, as well as

	Landscape habitat value: High/ Condition: Unassessed/ Trend: improving • SNPLH321: The site is dominated by upland oakwood which is a high priority UK BAP habitat. Landscape habitat value: Outstanding/ Condition: Unassessed/ Trend: Constant • SNPLH279: There are no internationally protected or UK BAP habitats within this aspect area and none of the aspect area is located within a designated site. But the diversity of habitats may be of some importance to the aspect. Landscape habitat value: Moderate/ Condition: Unassessed / Trend: Constant • SNPLH327: This aspect area contains a number of significant habitats including internationally protected habitat such as lowland heathland and upland oakwood. About 10% of the aspect is part of a SSSI and SAC. Landscape habitat value: Outstanding/ Condition: Unassessed / Trend: Constant *Cultural landscape services - SNPCLS049* • Attractive views out, the intrinsic qualities of the coastal slopes and urban edge detractor. • Snowdonia National Park Dark Sky Reserve Limited survey response *Geological habitat – encompasses GWNDDGL001, referenced in Barmouth (urban)* Value: Outstanding *Historic landscape - encompasses the following aspect areas GWNDDHL795, GWNDDHL215 and GWNDDHL201 to varying degrees. A summary is given below.* • GWNDDHL795: Of local importance as a landscape with little known archaeology. Historic landscape value: Moderate / Condition: Good / Trend: Constant • GWNDDHL215: Of regional importance as a multi period landscape of considerable potential. Historic landscape value: High / Condition: Good / Trend: Constant • GWNDDHL201: Of national importance as multi-period landscape of great potential. Historic landscape value: Outstanding/ Condition: Good / Trend: Constant	outstanding geological features complement this. However, the overall condition of certain elements remains unassessed, highlighting areas for further evaluation. **Value: High**

13.5.48 The aspect areas Morfa Mawr, Morfa Mawr Coast and Rhinogs-upland, whilst within the study area, as shown on ES Volume 4, Figure 13.5 Published Local Landscape Character Areas, are scoped out from the assessment. This is because the relative size of the aspect area captured within the study area does not represent its scale within the wider context of the landscape.

Landscape Designations

Eryri National Park

13.5.49 Eryri National Park, also known as Snowdonia, lies approximately 14.5 km to the north and east of Barmouth. Barmouth serves as a gateway to the park, with the Mawddach Trail connecting the town to the southern boundary of the park. The National Park is renowned for its outstanding natural beauty, and views into and out of the park. Including those from Barmouth which contribute to the overall experience of the area.

13.5.50 The National Park is excluded from the assessment due to the low lying nature of the Proposed Development in combination with the intervening distance (1km) and lack of invisibility as a result of the local topography of the Rhinogydd mountain foothills between the southern boundary of the park and the Proposed Development.

13.5.51 Nevertheless, the presence and significance of the National Park has been considered. Although direct visibility is limited, the assessment acknowledges the Park's national designation and its high landscape and visual sensitivity. To ensure it respects the Park's setting and avoids adverse effects on its special qualities and character.

Special Landscape Area 06: Barmouth Bay

13.5.52 The Barmouth Special Landscape Area (SLA) is a non-statutory designation and covers the settlement of Barmouth and the Afon Mawddach Estuary on the west coast of Gwynedd, as shown on ES Volume 4, Figure 13.6 Landscape Designations in ES Volume 3, Appendix 13.3 Seascape, Landscape and Visual Impact Assessment Figures. The SLA is defined by the strong coastal character and setting to Snowdonia National Park.

13.5.53 Special qualities of the SLA include:

- Its function as a unique setting and strong, coherent character which provide a coastal gateway to Snowdonia.
- Marked contrast between the broad, open estuary, and the rising valley sides and upland fringe.
- Expansive vistas and long-distance views to the coastline, up and down the estuary and to the prominent mountains of the National Park.
- Its historic and cultural significance, including evidence of diverse land use and activity from prehistoric and later periods (within the Mawddach Landscape of Outstanding Historic Interest).
- The range of nationally and internationally important coastal, estuarine and upland fringe habitats within the Lleyn Peninsula & the Sarnau SAC, Mawddach Estuary SSSI, Barmouth Hillside SSSI and Meirionnydd Oakwoods and Bat Sites SAC.
- Victorian town of Barmouth with attractive Victorian frontages; and
- Its tranquil and scenic qualities [31].

Registered Landscapes of Outstanding Historic Interest

13.5.54 The Proposed Development is sited within two Landscapes of Outstanding Historic Interest (LOHI), Mawddach and Ardudwy, as shown on ES Volume 4, Figure 13.6 Landscape Designations. The designation is non-statutory but recognises the historic value of the landscape with the aim to raise awareness to its importance. Whilst they will not form the basis of assessment their distinct characteristics and perceptual qualities contribute to the landscape baseline, which encompasses the landscape receptors.

13.5.55 The Mawddach LOHI [32] is rich in prehistoric and later remains, including groups of Bronze Age ritual and funerary monuments, prehistoric trackways, and relict settlements and field systems from the Iron Age and medieval periods. These remains extend over the intermediate slopes and plateaux on the south side of the estuary. Barmouth is also sited on the north side at the mouth of the estuary, and there are significant remains of 19th and early 20th centuries gold mining in the valleys and the lower hills to the northeast of the town.

13.5.56 The Ardudwy LOHI [33] is rich in prehistoric to medieval remains, including Neolithic burial chambers, Bronze Age monuments near ancient trackways, and Iron Age hillforts with associated hut and field systems. Stonewalled fields, upland enclosures, and extensive sheep farming illustrate the transformation of the landscape over centuries, with significant changes driven by absentee landlords and enclosure acts. Industrial remnants also remain and include 19th-century woollen mills and manganese quarries.

13.5.57 For further information please see ES Volume 2, Chapter 9 Cultural Heritage.

Other relevant designations

13.5.58 Designated historic assets have also been identified within the study area, including:

- Pockets of restored Ancient Woodland and Ancient Semi Natural Woodland, approximately 0.3-1.5km from the Proposed Development.
- Listed buildings, notably Plas Mynach Grade II building, and the Catholic Church of St Tudwal and attached Presbytery Grade II building, approximately 0.5km and 0.8km respectively from the Proposed Development.
- Abermaw Conservation Area, southeast of the Proposed Development, approximately 2.5km from the Proposed Development.

13.5.59 These historic assets are important features contributing to the perceptual characteristics, quality and overall character of the landscape. It is not within the scope of this SLVIA to assess them as individual receptors, yet their contribution to the landscape is captured within the designated Barmouth Historic Landscape Character Area discussed in section 13.4.55.

13.5.60 For further information please see ES Volume 2, Chapter 9 Cultural Heritage.

Summary of seascape and landscape baseline

13.5.61 Table 13-5 below sets out the seascape and landscape receptors that will form the basis of the assessment of seascape and landscape effects. Each receptor is accompanied by a summary of its value, determined in accordance with the

methodology outlined in ES Volume 3, Appendix 13.2: Seascape, Landscape and Visual Impact Assessment Methodology.

13.5.62 A detailed assessment of seascape and landscape effects, including those that are considered not significant, is reported in ES Volume 3 Appendix 13.5 seascape baseline and effects and ES Volume 3 Appendix 13.6 landscape baseline and effects.

Table 13-5 Seascape and landscape receptors

Seascape and landscape receptor	Value attached to seascape and landscape
Seascape character receptors	
SCA 22: Mochras to Fairbourne and Sarn Badrig	**High**
Landscape character receptors	
Barmouth (13290)	**Medium**
Barmouth (4864)	**Low**
Barmouth Coastal Hills (4872)	**High**
Landscape designated receptors	
Barmouth Special Landscape Area	**High**

13.6 Visual Baseline

13.6.1 This section summaries the visual baseline identified within the Search Area, through a review of Zone of Theoretical Visibility (ZTV) analysis and fieldwork surveys.

Zone of Theoretical Visibility

13.6.2 A Zone of Theoretical Visibility (ZTV) has been used to help identify sensitive visual receptor groups and locate representative viewpoints.

13.6.3 The ZTV was modelled using 1m DTM representing a worst-case scenario in visibility from the Proposed Development. For further information regarding the ZTV methodology and processing, refer to 13.2.3 Assessment of visual effects, in Appendix 13.2 Seascape, Landscape and Visual Impact Assessment Methodology.

13.6.4 The ZTV presented in ES Volume 4, Figure 13.7 Proposed Representative Viewpoints and Zone of Theoretical Visibility. The ZTV is visually contained to the South and Southwest of the study area. This can be attributed to the steep terrain of the foothills of the Rhinogydd mountains towards Eryri (formerly Snowdonia) National Park.

Visual receptor groups and representative viewpoints

13.6.5 Visual receptors likely to experience views of the construction and operation of the Proposed Development were identified through interrogation of the ZTVs and fieldwork, and subsequently categorised into the following types:

- Community Receptors; Residential communities, users of local amenities and business and industrial users.

- Recreational receptors; Users of public open spaces, Public Right of Ways (PRoW), Long Distance Footpaths and National Cycle Network routes.
- Transport receptors; Users of the main trunk roads, local road networks and the railway.

13.6.6 Representative viewpoints, shown on ES Volume 4 Figure 13.7 Proposed Representative Viewpoints and Zone of Theoretical Visibility, have been used to inform the assessment of visual effects. These viewpoints have been selected to represent a range of close, middle and long-distance views from various receptor groups primarily recreational users and people travelling through the area.

13.6.7 Winter annotated photographs of the existing baseline view are included for each representative viewpoint, presented in ES Volume 4, Figure 13.8 Photosheets.

Summary of visual baseline

13.6.8 Table 13-6 below sets out the visual receptors that will form the basis of the assessment of visual effects. Each receptor is accompanied by a summary of the value attached to the view, determined in accordance with the methodology outlined in ES Volume 3, Appendix 13.2: Seascape, Landscape and Visual Impact Assessment Methodology.

13.6.9 A detailed assessment of visual effects, including those that are considered not significant, is reported in ES Volume 3, Appendix 13.6 Visual baseline and effects.

Table 13-6 Representative viewpoints and visual receptors

Viewpoint and location	Viewpoint description	Visual receptors	Value attached to view
Scoped in – Confirmed views			
Viewpoint 1 Barmouth Beach 52.729202 -4.067821	Medium distance views from Barmouth beach at low tide. Set against the backdrop of the Rhinogydd Mountain foothills but detracted by modern development. Orientation: East	Recreational	**Medium**
Viewpoint 2 Heol Llywelyn 52.729549 -4.066549	Short distance views from Heol Llywelyn Road in proximity to residential properties, with expansive coastal views beyond. Orientation: West	Community and transport	**Medium**
Viewpoint 3 Heol-Y-Plas 52.727456 -4.065042	Short distance views along Heol-Y-Plas Road with expansive coastal views beyond. In proximity to residential properties and the PRoW Abermaw Rhif 26 Footpath. Orientation: West	Community and transport	**Medium**
Viewpoint 4 Prince's Avenue 52.724059	Short distance views along Princes Avenue Road, with expansive coastal views beyond. In proximity to residential properties and Ysgol Y Traeth elementary school. Orientation: Northwest	Community and transport	**Medium**

Viewpoint and location	Viewpoint description	Visual receptors	Value attached to view
-4.062005			
Viewpoint 5 Marine Parade Road - North Car Park 52.734622 -4.070708	Short distance views from Marine Parade Road and North Car Park with expansive coastal views beyond. View along the Public Right of Way (PRoW) Abermaw Rhif 24 Byway, Wales Coastal Path Long Distance Footpath and the National Cycle Route 8. In proximity to the Cambrian Railway line and North Promenade Car Park. Orientation: South	Recreation and transport	**High**
Viewpoint 6 Marine Parade Road - Skate Park 52.733093 -4.069348	Short distance views from Barmouth Skate Park with expansive coastal views beyond. With access from the northern car park. Orientation: West	Recreation and transport	**Medium**
Viewpoint 7 Heol Idris 52.725887 -4.063818	Short distance views with expansive coastal views beyond. View along Heol Idris Road in proximity to residential properties. Orientation: West	Community and transport	**Medium**
Viewpoint 8 Centenary Viewpoint 52.722826 -4.052002	Long distance panoramic views out towards the coast at the Centenary Viewpoint along the PRoW Abermaw Rhif 11#2 Footpath. The viewpoint is remnant of Dinas Oleu, Roman-period hill fort. Orientation: Northwest	Recreation	**High**
Viewpoint 9 Welsh Flag Viewpoint 52.729575 -4.055517	Long distance panoramic views out towards the coast at the Welsh Flag Viewpoint in proximity to the PRoW Abermaw Rhif 24 Footpath. Orientation: West	Recreation	**Medium**
Viewpoint 10 PRoW Abermaw Rhif 20 Bridleway 52.738921 -4.065937	Long distance panoramic views out towards the coast from the PRoW Abermaw Rhif 20 Bridleway, at the intersection of the PRoW Abermaw Rhif 19 and 17 footpaths. Orientation: West	Recreation	**Medium**
Viewpoint 11 A496 52.736050 -4.069298	Medium distance views from the A496, in proximity to the intersection of the Wales Coastal Path Long Distance Footpath, residential properties and bus stop. Orientation: South	Community and transport	**Medium**
Viewpoint 12 Hendre Mynach Caravan Park 52.733124	Medium distance views along the A496 in proximity to residential properties and the Hendre Mynach Caravan and Camping Park. Orientation: West	Recreation, community and transport	**Medium**

Viewpoint and location	Viewpoint description	Visual receptors	Value attached to view
-4.066129			
Viewpoint scoped out – no view			
Viewpoint 13 52.740103 -4.054285	View from a local public access route in proximity to the Ffridd Fechan Hillfort Scheduled Monument and Eryri (formerly Snowdonia) National Park. Orientation: Southwest	Recreation	Scoped out as no view due to intervening landform.
Viewpoint 14 52.724578 -4.059696	View from the PRoW Abermaw Rhif 28 Footpath at the intersection of the Cambrian railway line. Orientation: Northwest	Recreational and transport	Scoped out as no view due to intervening built form within the town centre.
Viewpoint 15 52.723274 -4.055019	View from St Johns Church along Church Road. Orientation: Northwest	Community and transport	Scoped out as no view due to intervening built form along the waterfront.
Viewpoint 16 52.721454 -4.050422	View from Dinas Oleu and circular walk, in proximity to the PRoW Abermaw Rhif 6 and Rhif 3#2 Footpath and the Cambrian Way Long Distance Footpath. Orientation: Northwest	Recreational	Scoped out as no view due to intervening landform and built form.
Viewpoint 17 52.718674 -4.053028	View from Marine Parade Road along the Wales Coastal Path Long Distance Footpath and National Cycle Route 8. Located in the Aberman Conservation Area and in proximity to the Barmouth Heritage Trail. Orientation: Northwest	Recreational and transport	Scoped out as no view due to intervening built form within the town centre.
Viewpoint 18 52.716558 -4.052302	View from the Barmouth Pier. Orientation: Northwest	Recreational	Scoped out as no view due to intervening built form along the waterfront.
Viewpoint 19 52.712542 -4.052186	View from the PRoW Abermaw Rhif 13#1 Footpath along the Fairbourne Railway line in proximity to the Barmouth Ferry stop. Orientation: Northwest	Recreational and transport	Scoped out as no view due to intervening built form along the waterfront.

13.7 Future Baseline

13.7.1 The likely effects of climate change are expected to cause sea level rise, increased frequency and extremes of storm surge events, changes in local wave climate and extreme wave conditions. The future baseline assumes continued coastal erosion and overtopping in the absence of new coastal defences. Furthermore, the existing revetment and sea walls are expected to deteriorate progressively as a result of these combined pressures.

13.7.2 As the coastal defences degrade, the boundary between land and sea is likely to become more irregular, altering the perceived form and scale of the coastal

edge. The resulting loss of land and infrastructure would contribute to a shift in the character of both the seascape and landscape, as natural processes increasingly dominate. This transition from a managed, recreational seafront to a more exposed and dynamic coastal environment may diminish the area's visual appeal and functional value.

13.7.3 Degradation of the public realm along the promenade is also anticipated, with the potential loss or deterioration of key access routes including national recreational routes, as well as seating, surfacing, and other amenities. These changes may result in a landscape that appears neglected, under maintained, or potentially unsafe for public use.

13.7.4 Visual degradation is expected to occur due to the presence of temporary structures, storm debris, and visible damage to sea walls, promenade and adjacent residential properties. The overall visual experience may become discordant, characterised by the juxtaposition of deteriorating infrastructure and encroaching natural elements.

13.7.5 Refer to ES Volume 2, Chapter 4 EIA Approach for more information around the future baseline.

13.7.6 The only confirmed coastal defence scheme scheduled for implementation during the construction period and in year 1 of operation is the coastal management works associated with the Marine Licence DEMLI2375, located in front of the northern end of the promenade. This is considered to be a cumulative project. For further details, refer to ES Volume 2, Chapter 15 Cumulative and In-Combination Effects.

13.7.7 There are no other known relevant projects either consented or under construction that would alter the baseline for this assessment.

13.8 Embedded Environmental Design Measures

13.8.1 The design includes a range of measures that have been embedded into the Proposed Development design to avoid or minimise seascape, landscape and visual effects are described for embedded measures and construction good practice measures.

Embedded environmental design measures

13.8.2 The Proposed Development is currently evolving through an iterative design process. Embedded design measures relevant to the SLVIA committed in the current design to minimise effects on seascape and landscape character, views and visual amenity include:

- The Proposed Development will be aligned with the existing coastal form to reduce abrupt transitions between the built and natural elements.
- The height of the secondary sea wall will be designed to be approximately 1.55m above ground level. Where feasible, the height will vary to balance effective flood protection and preserve key views and visual connectivity.
- The rear vertical face of the secondary sea wall will be finished textured concrete pattern and natural stone cladding to improve the appearance to complement the coastal setting and existing wall materials.

- New raised planters, street furniture and lighting will be integrated with the promenade and central balustrade at key nodes along the promenade to improve its recreational function and inclusive access.
- The demountable flood defences will be finished textured concrete pattern and natural stone cladding to match the secondary sea wall and designed where possible as visually permeable structures to reduce their visual mass.
- Improved wayfinding will be implemented along the promenade, and access along PRoWs, including Wales Coastal Path Long Distance Footpath and National Cycle Route 8 will be maintained, ensuring continued connectivity along the Promenade and wider recreational links.
- Existing light columns will be replaced along the promenade; these will be designed to increase illumination and reduce the light spill which currently occurs.
- Existing access points to the beach and promenade will be retained and improved across the promenade. These routes are aligned at key nodes with views towards the sea and inland to the foothills.
- Raised planters featuring low-growing vegetation will be introduced, along with larger amenity green spaces surrounding the northern car park. All proposed planting will use native, coastal, and climate-resilient species sourced from appropriate UK provenance zones.

Construction good practice measures

13.8.3 Good construction practices are set out with the contractors. A Construction Environmental Management Plan (CEMP) (document reference- EN.F.15) , produced by the contractor contains management measures for effects of construction on seascape, landscape and visual receptors.

13.8.4 The following measures are of particular importance during construction:

- Construction lighting will be positioned and directed so as not to unnecessarily intrude the surrounding environment and risk of nighttime visual impacts especially for local residents.
- Where possible, an appropriate buffer will be maintained between residential receptors and the construction compound.
- Construction will be limited to the hours scheduled to be between 07:00 and 19:00, with work undertaken outline daylight hours, primarily in the winter months and dependant on tidal patterns.
- Temporary lighting will be required during construction to allow works to continue outside of daylight hours. All lighting will be positioned and directed away from sensitive locations identified by the Ecological Clerk of Works (ECoW) to minimise light spill.
- Access along the Wales Coastal Wales Coastal Path Long Distance Footpath and National Cycle Route 8 will be maintained during construction activities along the promenade.

13.9 Assessment of Likely Significant Effects

13.9.1 This section presents the assessment of likely significant effects on seascape, landscape and visual receptors. The assessment is undertaken against the construction and operation and maintenance of the Proposed Development.

13.9.2 For full details of the effects on seascape, landscape and visual receptors refer to ES Volume 3, Appendix 13.5 to 13.7.

13.9.3 The likely significant effects of the Proposed Development have been identified considering the developing design which includes embedded environmental design measures outlined in Section 13.7. Further mitigation may be proposed as a result which is presented in Section 13.9.

Seascape Effects

13.9.4 This section presents a summary of the assessment of effects on seascape character that would result from the construction of the Proposed Development by both option 1 and 2 transport methods, operation in year 1 and operation and maintenance year 15 of the Proposed Development.

Construction Option 1 – Delivery by road

13.9.5 Seascape impacts related to the construction of the Proposed Development by road transportation likely arise from:

- Increased traffic and presence of HGVs along Marine Parade Road, and associated noise and dust.
- Temporary site compound area.
- Main stockpile area in the site compound and temporary stockpiles on the beach below MHWS.
- Sand and shingle excavation in the footprint of the proposed rock revetment and subsequent storage on the upper beach above MHWS.
- Tall construction equipment including excavators, cranes and piling rigs to construct the rock revetment, beach access steps and secondary wall.
- Removal of the groyne sections within the rock revetment and in a 5m buffer from the rock revetment toe.
- Temporary lighting and task specific lighting.

13.9.6 Table 13-7 provides a summary of the seascape effects that would result from the construction of the Proposed Development by road transportation.

Table 13-7 Summary of seascape effects of construction by road

Seascape Receptor	Sensitivity	Magnitude of impact	Significance of effect
Seascape Character Area 22: Mochras to Fairbourne and Sarn Badrig	Medium	Low	Minor adverse

13.9.7 Option 1 construction works associated with the Proposed Development will introduce temporary changes to the eastern edge of the SCA, primarily through increased HGV movements, a site compound, and tall machinery. These elements will locally disrupt the contrast between natural and built features, reduce openness in views toward the Llŷn Peninsula, and temporarily affect the

visual continuity of the beach and dune system. These effects are short-term (approx. 24 months), localised, and reversible. With a low magnitude of impact and medium sensitivity, the significance of effect is **minor adverse**.

Construction Option 2 – Delivery by sea

13.9.8 Seascape impacts related to the construction of the Proposed Development by sea transportation likely arise from:

- Presence of a Self-Discharging Excavator Vessel (SDEV) and shallow-draught tipper boat or smaller vessel operating offshore.
- Increased traffic and presence of HGVs along Marine Parade Road, and associated noise and dust.
- Temporary site compound area.
- Temporary stockpiles on the beach below MHWS.
- Sand and shingle excavation in the footprint of the proposed rock revetment and subsequent storage on the upper beach above MHWS.
- Tall construction equipment including excavators, cranes and piling rigs to construct the rock revetment, beach access steps and secondary wall.
- Removal of the groyne sections within the rock revetment and in a 5m buffer from the rock revetment toe.
- Temporary lighting and task specific lighting.

13.9.9 Table 13-8 provides a summary of the seascape effects that would result from the construction of the Proposed Development by sea transportation.

Table 13-8 Summary of seascape effects of construction by sea

Seascape Receptor	Sensitivity	Magnitude of impact	Significance of effect
Seascape Character Area 22: Mochras to Fairbourne and Sarn Badrig	Medium	Low	Minor adverse

13.9.10 Option 2 construction works associated with the Proposed Development will introduce temporary changes to the eastern edge of the SCA, extending westward. While this approach reduces disruption along Marine Parade Road, it introduces offshore vessels and tall machinery that will alter the visual composition of the seascape and reduce the perceived openness of views toward the Llŷn Peninsula. Shoreline works will further disrupt the visual continuity of the beach and dune system. These effects are short-term (approx. 24 months), localised, and reversible. With a low magnitude of impact and medium sensitivity, the significance of effect is **minor adverse.**

Operation Year 1 (Winter)

13.9.11 Seascape impacts related to the operation of the Proposed Development in year 1 likely arise from:

- Form, scale and materiality of the rock revetment, central balustrade and secondary sea walls.
- Raised planters with low growing vegetation and increase in amenity green areas around the northern car park.

- Removal of the groyne sections within the rock revetment and in a 5m buffer from the rock revetment toe.
- Extended access ramps 1.7m below beach level.

13.9.12 Table 13-9 provides a summary of the seascape effects that would result from the operation of the Proposed Development in year 1.

Table 13-9 Summary of seascape effects of operation year 1 (winter)

Seascape Receptor	Sensitivity	Magnitude of impact	Significance of effect
Seascape Character Area 22: Mochras to Fairbourne and Sarn Badrig	Medium	Very low	Neutral

13.9.13 In Year 1 of operation, the Proposed Development will be integrated into the seascape, helping to re-establish the balance between natural and built elements within the SCA. Open views toward the Llŷn Peninsula and the seascape's perceptual qualities will be restored. New features such as the rock revetment, sea walls, access ramps and northern car park will form part of the developed frontage, though they may slightly reduce the visual continuity of the beach and dunes. Raised planters will soften the built form, and the absence of groynes may enhance the natural shoreline. Given the very low magnitude of impact and the medium sensitivity of the SCA, the significance of effect is **neutral.**

Operation and Maintenance Year 15 (Summer)

13.9.14 Seascape impacts related to the operation and maintenance of the Proposed Development in year 15 likely arise from:

- Form, scale and materiality of the rock revetment, central balustrade and secondary sea wall.
- Raised planters with low growing vegetation and increase in amenity green areas around the northern car park.
- Removal of the groyne sections within the rock revetment and in a 5m buffer from the rock revetment toe.
- Extended access ramps 1.7m below beach level.

13.9.15 Table 13-10 provides a summary of the seascape effects that would result from the operation and maintenance of the Proposed Development in year 15.

Table 13-10 Summary of seascape effects of operation and maintenance year 15 (Summer)

Seascape Receptor	Sensitivity	Magnitude of impact	Significance of effect
Seascape Character Area 22: Mochras to Fairbourne and Sarn Badrig	Medium	Very Low	Neutral

13.9.16 By Year 15, the Proposed Development will be fully integrated into the SCA, with all construction infrastructure removed. Open views toward the Llŷn Peninsula and the perceptual qualities of the seascape will be preserved. The rock revetment, sea walls, and access ramps will appear as established shoreline features, reinforcing the developed frontage. Mature planting will soften the built form, while the absence of groynes may enhance the natural

beach character. Given the very low magnitude of impact and the medium sensitivity of the SCA, the significance of effect is **neutral.**

Landscape Effects

13.9.17 This section presents a summary of the assessment of effects on landscape character that would result from the construction of the Proposed development by both road and sea transport methods, operation in year 1 and operation and maintenance year 15 of the Proposed Development.

Construction Option 1 – Delivery by road

13.9.18 Landscape impacts related to the construction of the Proposed Development by road transportation likely arise from:

- Increased traffic and presence of HGVs along Marine Parade Road, and associated noise and dust.
- Temporary site compound area.
- Main stockpile area in the site compound and temporary stockpiles on the beach below MHWS.
- Sand and shingle excavation in the footprint of the proposed rock revetment and subsequent storage on the upper beach above MHWS.
- Tall construction equipment including excavators, cranes and piling rigs to construct the rock revetment, beach access steps and secondary wall.
- Removal of the groyne sections within the rock revetment and in a 5m buffer from the rock revetment toe.
- Night-time light pollution from work lighting including temporary and task specific.
- Restricted public access and recreation.

13.9.19 Table 13-11 provides a summary of the landscape effects that would result from the construction of the Proposed Development by road transportation.

Table 13-11 Summary of landscape effects of construction by road

Landscape Receptor	Sensitivity	Magnitude of impact	Significance of effect
Barmouth (13290)	Medium	Low	Minor adverse
Barmouth (4864)	Low	Low	Minor adverse
Barmouth Coastal Hills (4872)	Medium	Low	Minor adverse
Barmouth Special Landscape Area	Medium	Low	Minor adverse

13.9.20 Option 1 construction works associated with the Proposed Development will introduce temporary visual and physical changes across several landscape receptors. Key effects include the presence of tall construction machinery, increased HGV traffic, material stockpiles, and temporary lighting, all of which contrast with the natural and tranquil character of the area. The most notable impact occurs in the Barmouth (13290) aspect area, due to the disruption to the natural shoreline character and upland open views. Yet, still results in a **minor adverse effect**, due to its temporary and reversible nature.

13.9.21 All other areas, including Barmouth (4864), Barmouth Coastal Hills (4872), and the Barmouth Bay SLA, experience **minor adverse effects**, due to low sensitivity or indirect influence.

Construction Option 2 – Delivery by sea

13.9.22 Landscape impacts related to the construction of the Proposed Development by sea transportation likely arise from:

- Presence of a Self-Discharging Excavator Vessel (SDEV) and shallow-draught tipper boat or smaller vessel operating offshore.
- Increased traffic and presence of HGVs along Marine Parade Road, and associated noise and dust.
- Temporary site compound area.
- Temporary stockpiles on the beach below MHWS.
- Sand and shingle excavation in the footprint of the proposed rock revetment and subsequent storage on the upper beach above MHWS.
- Tall construction equipment including excavators, cranes and piling rigs to construct the rock revetment, beach access steps and secondary wall.
- Removal of the groyne sections within the rock revetment and in a 5m buffer from the rock revetment toe.
- Night-time light pollution from work lighting including temporary and task specific.
- Restricted public access and recreation.
- Noise associated with construction activities.

13.9.23 Table 13-12 provides a summary of the landscape effects that would result from the construction of the Proposed Development by sea transportation.

Table 13-12 Summary of landscape effects of construction by sea

Landscape Receptor	Sensitivity	Magnitude of impact	Significance of effect
Barmouth (13290)	Medium	Low	Minor adverse
Barmouth (4864)	Low	Low	Minor adverse
Barmouth Coastal Hills (4872)	Medium	Low	Minor adverse
Barmouth Special Landscape Area	Medium	Low	Minor adverse

13.9.24 Construction activities associated with Option 2 of the Proposed Development will extend across both onshore and offshore areas. The striking presence of SDEV and shallow-draught tipper boat or smaller vessel, tall construction equipment, material stockpiles, and temporary lighting will contrast with the expansive coastal landscape and its natural features. The most notable impact occurs in Barmouth (13290), where the combined onshore and offshore activity temporarily disrupt the natural shoreline character and the scenic quality of upland open views. However, due to the short-term and reversible nature of these works, the overall effect is considered **minor adverse**.

13.9.25 In Barmouth (4864), Barmouth Coastal Hills (4872), and the Barmouth Bay SLA, effects are **minor adverse**, due to low sensitivity or indirect influence.

Operation Year 1 (Winter)

13.9.26 Landscape impacts related to the operation of the Proposed Development in year 1 likely arise from:

- New permanent lighting.
- Form, scale and materiality of the rock revetment, flood gates, central balustrade and secondary sea wall.
- Raised planters with low growing vegetation and increase in amenity green areas around the northern car park.
- Removal of the groyne sections within the rock revetment and in a 5m buffer from the rock revetment toe.
- New and extended access ramps.

13.9.27 Table 13-13 provides a summary of the landscape effects that would result from the operation of the Proposed Development in year 1.

Table 13-13 Summary of landscape effects of operation year 1 (winter)

Landscape Receptor	Sensitivity	Magnitude of impact	Significance of effect
Barmouth (13290)	Medium	Low	Minor adverse
Barmouth (4864)	Low	Low	Minor adverse
Barmouth Coastal Hills (4872)	Medium	Very Low	Neutral
Barmouth Special Landscape Area	Medium	Low	Neutral

13.9.28 By Year 1, construction activities will have ceased, any remaining elements are expected to be low in profile and visually assimilated into the coastal setting. Across all landscape receptors, views and access will be largely restored, and new features such as the new rock revetment, sea walls, access ramps and associated amenity features will be visually integrated into the coastal landscape. While permanent lighting and urban built form introduce subtle changes, they are designed to reflect the coastal character and improve public amenity. The most noticeable change occurs in Barmouth (13290), where new infrastructure slightly contrasts with the natural shoreline, resulting in a **minor adverse effect.**

13.9.29 In Barmouth (4864), Barmouth Coastal Hills (4872), and the Barmouth Bay SLA, the changes are well-integrated and in cases enhance visual coherence, leading to **minor adverse** or **neutral effects**.

Operation and Maintenance Year 15 (Summer)

13.9.30 Landscape impacts related to the operation and maintenance year of the Proposed Development in year 15 likely arise from:

- New permanent lighting.
- Form, scale and materiality of the rock revetment, central balustrade and secondary sea wall.
- Raised planters with low growing vegetation and increase in amenity green areas around the northern car park.

- Removal of the groyne sections within the rock revetment and in a 5m buffer from the rock revetment toe.
- Extended access ramps.

13.9.31 Table 13-14 provides a summary of the landscape effects that would result from the operation and maintenance of the Proposed Development in year 15.

Table 13-14 Summary of landscape effects of operation and maintenance year 15 (Summer)

Landscape Receptor	Sensitivity	Magnitude of impact	Significance of effect
Barmouth (13290)	Medium	Very Low	Neutral
Barmouth (4864)	Low	Very Low	Neutral
Barmouth Coastal Hills (4872)	Medium	Very Low	Neutral
Barmouth Special Landscape Area	Medium	Very Low	Neutral

13.9.32 By Year 15, the development will be fully integrated into the coastal landscape. Across all landscape receptors, open views and access will be maintained, with infrastructure such as the new rock revetment, sea walls, access ramps and associated amenity features appearing well embedded and visually cohesive from weathering over time. While some elements like permanent lighting and the absence of groynes remain perceptible, they are either subtle or contribute positively to the natural shoreline character. The most notable ongoing contrast is in Barmouth (13290), where the revetment and ramps slightly diverge from the area's natural shoreline character. Nevertheless, this results in a **neutral effect.**

13.9.33 In Barmouth (4864), Barmouth Coastal Hills (4872), and the Barmouth Bay SLA, the changes are well-assimilated and enhance visual unity, leading to **neutral effects**, all of which are not significant.

Visual Effects

13.9.34 This section presents a summary of the assessment of effects on visual amenity and changes to views that would result from the construction of the Proposed development by both road and sea transport methods, operation in year 1 and operation and maintenance in year 15 of the Proposed Development.

Construction Option 1 – Delivery by road

13.9.35 Visual impacts related to the construction of the Proposed Development by road transportation likely arise from:

- Increased traffic and presence of HGVs along Marine Parade Road, and associated noise and dust.
- Temporary site compound area.
- Tall construction equipment including excavators, cranes and piling rigs to construct the rock revetment, beach access steps and secondary wall.
- Main stockpile area in the site compound and temporary stockpiles on the beach below MHWS.
- Sand and shingle excavation in the footprint of the proposed rock revetment and subsequent storage on the upper beach above MHWS.

- Removal of the groyne sections within the rock revetment and in a 5m buffer from the rock revetment toe.
- Construction of rock revetment and the deconstruction and reconstruction of the central and secondary sea walls.
- Targeted repairs to the primary sea wall.
- Temporary nighttime construction task and security light pollution from the works
- Removal of existing street furniture and signage along the existing central wall.

13.9.36 Table 13-15 provides a summary of the visual effects that would result from the construction of the Proposed Development by road transportation.

Table 13-15 Summary of visual effects of construction by road

Visual Receptor		Sensitivity	Magnitude of impact	Significance of effect
Viewpoint 1 Barmouth Beach	Recreational – People using Barmouth Beach	High	Medium	**Moderate adverse (significant)**
Viewpoint 2 Heol Llywelyn	Community – Residents of Heol Lywelyn Road	High	Medium	**Moderate adverse (significant)**
	Transport – People travelling along Heol Llywelyn Road.	Medium	Medium	Minor adverse
Viewpoint 3 Heol-Y-Plas	Community – Residents of Heol-Y-Plas area	High	Medium	**Moderate adverse (significant)**
	Transport – People travelling along Heol-Y-Plas Road	Medium	Medium	Minor adverse
Viewpoint 4 Prince's Avenue	Community – Residents of Princes Avenue Road and local students of Ysgol Y Traeth elementary school	High	Medium	**Moderate adverse (significant)**
	Transport – People travelling along Princes Avenue Road	Medium	Medium	Minor adverse
Viewpoint 5 Marine Parade Road - North Car Park	Recreation – People using the PRoW Abermaw Rhif 24 Byway, Wales Coastal Path Long Distance Footpath and the National Cycle Route 8	High	Medium	**Moderate adverse (significant)**
	Transport - People traveling along Marine Parade Road and north car park	Medium	Medium	Minor adverse
Viewpoint 6 Marine Parade	Recreation - People using the Barmouth Skatepark	Medium	Medium	Minor adverse

Visual Receptor		Sensitivity	Magnitude of impact	Significance of effect
Road - Skate Park	Transport – People using the northern car park	Medium	Medium	Minor adverse
Viewpoint 7 Heol Idris	Community – residents of Heol Idris road	High	Medium	**Moderate adverse (significant)**
	Transport – People travelling along Heol Idris road	Medium	Medium	Minor adverse
Viewpoint 8 Centenary Viewpoint	Recreation - People at Centenary Viewpoint using the PRoW Abermaw Rhif 11#2 Footpath	High	Low	Minor adverse
Viewpoint 9 Welsh Flag Viewpoint	Recreation - People at the Welsh flag viewpoint and using the PRoW Abermaw Rhif 24 Footpath	High	Low	Minor adverse
Viewpoint 10 PRoW Abermaw Rhif 20 Bridleway	Recreation - People using the PRoW Abermaw Rhif 20 Bridleway, PRoW Abermaw Rhif 19 and 17 footpaths	High	Low	Minor adverse
Viewpoint 11 A496	Community - Residents along the A496	High	Low	Minor adverse
	Transport - People travelling along the A496	Medium	Low	Minor adverse
Viewpoint 12 Hendre Mynach Caravan Park	Community - Residents along the A496	High	Medium	**Moderate adverse (significant)**
	Recreation - People using Hendre Mynach Caravan Park	High	Medium	**Moderate adverse (significant)**
	Transport- People travelling along the A496	Medium	Medium	Minor adverse

13.9.37 Under Construction Option 1, where materials are delivered by road, visual impacts across the viewpoints are characterised by the presence of tall construction machinery, site compound area, material stockpiles, and frequent HGV movements along Marine Parade Road. These elements introduce temporary visual clutter and movement in both foreground and middle-distance views, particularly at sensitive community and recreational viewpoints. The increased traffic and construction activity disrupt open coastal vistas and intensify the built character of the landscape.

13.9.38 Onshore works, including sand and shingle excavation, groyne removal, construction of the rock revetment and sea walls, are prominent and visually intrusive due to their scale and proximity. Temporary lighting, restricted to operational hours, may also be perceptible from nearby viewpoints and contributes to short-term visual disturbance.

13.9.39 Overall, the magnitude of impact varies from **low** to **medium**. High sensitivity receptors, such as community and recreational users at locations like Viewpoint 1 Barmouth Beach and Viewpoint 2 Heol Llywelyn experience **moderate**

adverse effects, which are considered **significant**. Transport receptors, with medium sensitivity, generally experience **minor adverse effects.**

13.9.40 Seasonal construction pauses and phased wall construction help mitigate disruption, but the perceptual change across the landscape remains evident throughout the 24-month construction period.

Construction Option 2 – Delivery by sea

13.9.41 Visual impacts related to the construction of the Proposed Development by sea transportation likely arise from:

- Presence of a Self-Discharging Excavator Vessel (SDEV) and shallow-draught tipper boat or smaller vessel operating offshore.
- Increased traffic and presence of HGVs along Marine Parade Road, and associated noise and dust.
- Temporary site compound area.
- Temporary stockpiles on the beach below MHWS.
- Tall construction equipment including excavators, cranes and piling rigs to construct the rock revetment, beach access steps and secondary wall.
- Sand and shingle excavation in the footprint of the proposed rock revetment and subsequent storage on the upper beach above MHWS.
- Removal of the groyne sections within the rock revetment and in a 5m buffer from the rock revetment toe.
- Construction of rock revetment and the deconstruction and reconstruction of the central and secondary sea walls.
- Targeted repairs to the primary sea wall.
- Nighttime light pollution from work lighting including temporary and task specific.
- Removal of existing street furniture and signage along the existing central wall.

13.9.42 Table 13-16 provides a summary of the visual effects that would result from the construction of the Proposed Development by sea transportation.

Table 13-16 Summary of visual effects of construction by sea

Visual Receptor		Sensitivity	Magnitude of impact	Significance of effect
Viewpoint 1 Barmouth Beach	Recreational – People using Barmouth Beach	High	Medium	**Moderate adverse (significant)**
Viewpoint 2 Heol Llywelyn	Community – Residents of Heol Lywelyn Road	High	Medium	**Moderate adverse (significant)**
	Transport – People travelling along Heol Llywelyn Road.	Medium	Medium	Minor adverse
Viewpoint 3 Heol-Y-Plas	Community – Residents of Heol-Y-Plas area	High	Medium	**Moderate adverse (significant)**
	Transport – People travelling along Heol-Y-Plas Road	Medium	Medium	Minor adverse

Visual Receptor		Sensitivity	Magnitude of impact	Significance of effect
Viewpoint 4 Prince's Avenue	Community – Residents of Princes Avenue Road and local students of Ysgol Y Traeth elementary school	High	Medium	**Moderate adverse (significant)**
	Transport – People travelling along Princes Avenue Road	Medium	Medium	Minor adverse
Viewpoint 5 Marine Parade Road - North Car Park	Recreation – People using the PRoW Abermaw Rhif 24 Byway, Wales Coastal Path Long Distance Footpath and the National Cycle Route 8	High	Medium	**Moderate adverse (significant)**
	Transport - People traveling along Marine Parade Road and north car park	Medium	Medium	Minor adverse
Viewpoint 6 Marine Parade Road - Skate Park	Recreation - People using the Barmouth Skatepark	Medium	Medium	Minor adverse
	Transport – People using the northern car park	Medium	Medium	Minor adverse
Viewpoint 7 Heol Idris	Community – residents of Heol Idris road	High	Medium	**Moderate adverse (significant)**
	Transport – People travelling along Heol Idris road	Medium	Medium	Minor adverse
Viewpoint 8 Centenary Viewpoint	Recreation - People at Centenary Viewpoint using the PRoW Abermaw Rhif 11#2 Footpath	High	Low	Minor adverse
Viewpoint 9 Welsh Flag Viewpoint	Recreation - People at the Welsh flag viewpoint and using the PRoW Abermaw Rhif 24 Footpath	High	Low	Minor adverse
Viewpoint 10 PRoW Abermaw Rhif 20 Bridleway	Recreation - People using the PRoW Abermaw Rhif 20 Bridleway, PRoW Abermaw Rhif 19 and 17 footpaths	High	Low	Minor adverse
Viewpoint 11 A496	Community - Residents along the A496	High	Low	Minor adverse
	Transport - People travelling along the A496	Medium	Low	Minor adverse
Viewpoint 12 Hendre Mynach Caravan Park	Community - Residents along the A496	High	Medium	**Moderate adverse (significant)**
	Recreation - People using Hendre Mynach Caravan Park	High	Medium	**Moderate adverse (significant)**

Visual Receptor		Sensitivity	Magnitude of impact	Significance of effect
	Transport- People travelling along the A496	Medium	Medium	Minor adverse

13.9.43 Under Construction Option 2, where materials are delivered by sea, visual impacts across the viewpoints remain broadly similar to those experienced under road delivery, but with some notable differences. The use of sea-based delivery methods reduces the volume of HGV traffic along Marine Parade Road, easing visual clutter and movement in the middle distance. However, the introduction of marine vessels, such as SDEV, shallow-draught and smaller support vessels, adds temporary visual elements to long distance views, particularly during mooring and unloading operations. These vessels, while small and short-term in presence, may momentarily draw attention away from the natural horizon and coastal character.

13.9.44 Onshore construction activities, including the use of tall machinery and material stockpiles, remain prominent in foreground views, especially at sensitive recreational and community locations. Temporary lighting, restricted to operational hours, may be perceptible from nearby viewpoints, contributing to short-term visual disturbance.

13.9.45 Overall, the magnitude of impact remains l**ow** to **medium**. High sensitivity receptors, such as community and recreational users at locations like Viewpoint 1 Barmouth Beach and Viewpoint 2 Heol Llywelyn still experience **moderate adverse effects**, which are considered significant. Whilst transport receptors, with medium sensitivity, still experience **minor adverse effects.**

Operation Year 1 (Winter)

13.9.46 Visual impacts related to the operation of the Proposed Development in year 1 likely arise from:

- Height, scale and materiality of the rock revetment, flood gates, central balustrade and secondary sea wall (1.55m).
- Removal of the groyne sections within the rock revetment and in a 5m buffer from the rock revetment toe.
- Raised planters with low growing vegetation and increase in amenity green areas around the northern car park.
- New street furniture and permanent lighting.
- Improved wayfinding along the promenade.
- Extended access ramps.
- Defined area for commercial activities within the northern car park.

13.9.47 Table 13-17 provides a summary of the visual effects that would result from the operation of the Proposed Development in year 1.

Table 13-17 Summary of visual effects of operation year 1 (winter)

Visual Receptor		Sensitivity	Magnitude of impact	Significance of effect
Viewpoint 1 Barmouth Beach	Recreational – People using Barmouth Beach	High	Low	Minor adverse

Visual Receptor		Sensitivity	Magnitude of impact	Significance of effect
Viewpoint 2 Heol Llywelyn	Community – Residents of Heol Lywelyn Road	High	Low	Minor adverse
	Transport – People travelling along Heol Llywelyn Road.	Medium	Low	Minor adverse
Viewpoint 3 Heol-Y-Plas	Community – Residents of Heol-Y-Plas area	High	Low	Minor adverse
	Transport – People travelling along Heol-Y-Plas Road	Medium	Low	Minor adverse
Viewpoint 4 Prince's Avenue	Community – Residents of Princes Avenue Road and local students of Ysgol Y Traeth elementary school	High	Low	Minor adverse
	Transport – People travelling along Princes Avenue Road	Medium	Low	Minor adverse
Viewpoint 5 Marine Parade Road - North Car Park	Recreation – People using the PRoW Abermaw Rhif 24 Byway, Wales Coastal Path Long Distance Footpath and the National Cycle Route 8	High	Low	Minor adverse
	Transport - People traveling along Marine Parade Road and north car park	Medium	Low	Minor adverse
Viewpoint 6 Marine Parade Road - Skate Park	Recreation - People using the Barmouth Skatepark	Medium	Medium	Minor adverse
	Transport – People using the northern car park	Medium	Medium	Minor adverse
Viewpoint 7 Heol Idris	Community – residents of Heol Idris road	High	Low	Minor adverse
	Transport – People travelling along Heol Idris road	Medium	Low	Minor adverse
Viewpoint 8 Centenary Viewpoint	Recreation - People at Centenary Viewpoint using the PRoW Abermaw Rhif 11#2 Footpath	High	Very low	Minor adverse
Viewpoint 9 Welsh Flag Viewpoint	Recreation - People at the Welsh flag viewpoint and using the PRoW Abermaw Rhif 24 Footpath	High	Very low	Minor adverse
Viewpoint 10 PRoW Abermaw Rhif 20 Bridleway	Recreation - People using the PRoW Abermaw Rhif 20 Bridleway, PRoW Abermaw Rhif 19 and 17 footpaths	High	Very low	Minor adverse
Viewpoint 11 A496	Community - Residents along the A496	High	Very Low	Minor adverse
	Transport - People travelling along the A496	Medium	Very Low	Minor adverse

Visual Receptor		Sensitivity	Magnitude of impact	Significance of effect
Viewpoint 12 Hendre Mynach Caravan Park	Community - Residents along the A496	High	Low	Minor adverse
	Recreation - People using Hendre Mynach Caravan Park	High	Low	Minor adverse
	Transport- People travelling along the A496	Medium	Low	Minor adverse

13.9.48 By the first year of operation, the Proposed Development is fully integrated into the landscape. Across all viewpoints, new coastal infrastructure such as the rock revetment, sea walls, street furniture and lighting introduce permanent but reversible changes. These features are designed to reflect the coastal character through materials and form, helping them blend into the setting.

13.9.49 While some features, including the new secondary sea wall obstruct long-distance views and reduce visual depth, others, such as the raised planters and improved amenity areas, enhance the foreground composition of views. However, the removal of groyne sections, previously a defining shoreline feature, is a noticeable change that alters the visual character of the coast and contributes to the overall visual impact.

13.9.50 The magnitude of impact is **very low** to **low**, resulting in **minor adverse effects** across all receptor groups. Nighttime lighting is perceptible but designed to minimise glare, and vegetation reinstatement contributes to softening the built form over time.

Operation and Maintenance Year 15 (Summer)

13.9.51 Visual impacts related to the operation and maintenance of the Proposed Development in year 15 likely arise from:

- Height, scale and materiality of the rock revetment, central balustrade and secondary sea wall (1.55m).
- Removal of the groyne sections within the rock revetment and in a 5m buffer from the rock revetment toe.
- Demountable flood defences.
- Raised planters with low growing vegetation and increase in amenity green areas around the northern car park.
- New street furniture and permanent lighting.
- Improved wayfinding along the promenade.
- Extended access ramps 1.7m below beach level.
- Defined area for commercial activities within the northern car park.

13.9.52 Table 13-18 provides a summary of the visual effects that would result from the operation and maintenance of the Proposed Development in year 15.

Table 13-18 Summary of visual effects of operation and maintenance year 15 (Summer)

Visual Receptor		Sensitivity	Magnitude of impact	Significance of effect
Viewpoint 1 Barmouth Beach	Recreational – People using Barmouth Beach	High	Low	Minor adverse
Viewpoint 2 Heol Llywelyn	Community – Residents of Heol Lywelyn Road	High	Low	Minor adverse
	Transport – People travelling along Heol Llywelyn Road.	Medium	Low	Minor adverse
Viewpoint 3 Heol-Y-Plas	Community – Residents of Heol-Y-Plas area	High	Low	Minor adverse
	Transport – People travelling along Heol-Y-Plas Road	Medium	Low	Minor adverse
Viewpoint 4 Prince's Avenue	Community – Residents of Princes Avenue Road and local students of Ysgol Y Traeth elementary school	High	Low	Minor adverse
	Transport – People travelling along Princes Avenue Road	Medium	Low	Minor adverse
Viewpoint 5 Marine Parade Road - North Car Park	Recreation – People using the PRoW Abermaw Rhif 24 Byway, Wales Coastal Path Long Distance Footpath and the National Cycle Route 8	High	Low	Minor adverse
	Transport - People traveling along Marine Parade Road and north car park	Medium	Low	Minor adverse
Viewpoint 6 Marine Parade Road - Skate Park	Recreation -People using the Barmouth Skatepark	Medium	Low	Minor adverse
	Transport – People using the northern car park	Medium	Low	Minor adverse
Viewpoint 7 Heol Isdris	Community – residents of Heol Idris road	High	Low	Minor adverse
	Transport – People travelling along Heol Idris road	Medium	Low	Minor adverse
Viewpoint 8 Centenary Viewpoint	Recreation - People at Centenary Viewpoint using the PRoW Abermaw Rhif 11#2 Footpath	High	Very low	Minor adverse
Viewpoint 9 Welsh Flag Viewpoint	Recreation - People at the Welsh flag viewpoint and using the PRoW Abermaw Rhif 24 Footpath	High	Very low	Minor adverse
Viewpoint 10 PRoW Abermaw	Recreation - People using the PRoW Abermaw Rhif 20 Bridleway, PRoW	High	Very low	Minor adverse

Visual Receptor		Sensitivity	Magnitude of impact	Significance of effect
Rhif 20 Bridleway	Abermaw Rhif 19 and 17 footpaths			
Viewpoint 11 A496	Community - Residents along the A496	High	Very low	Minor adverse
	Transport - People travelling along the A496	Medium	Very low	Minor adverse
Viewpoint 12 Hendre Mynach Caravan Park	Community - Residents along the A496	High	Low	Minor adverse
	Recreation - People using Hendre Mynach Caravan Park	High	Low	Minor adverse
	Transport- People travelling along the A496	Medium	Low	Minor adverse

13.9.53 By Year 15, the visual effects of the Proposed Development have largely stabilised and become more integrated into the landscape. Weathering of materials and maturation of vegetation contribute to a softened appearance, reducing the perceptual dominance of the new coastal infrastructure. While permanent changes such as the removal of groyne sections and the presence of the rock revetment and sea walls remain visible, they are less intrusive and more in keeping with the coastal character.

13.9.54 Across all viewpoints, the magnitude of impact remains **very low** to **low**, with **minor adverse effects** for all receptor groups. The landscape retains its scenic quality, and the infrastructure is perceived as a coherent part of the developed coastal frontage, marking a transition from disruption to long-term visual assimilation.

13.10 Further Mitigation and Enhancement

13.10.1 For seascape, landscape and visual matters, all measures relating to construction and operational effects are considered to be embedded (primary). Section 13.7 of this chapter explains this further and summarises key changes to the design of the Proposed Development, which have been informed by the SLVIA as part of the iterative design process. This is approach is explained further Appendix 13.2 Seascape, landscape and Visual Impact Assessment Methodology. Therefore, no further (secondary) mitigation measures are currently proposed.

13.11 Residual Effects

13.11.1 Cumulative and in-combination effects are addressed within ES Volume 2, Chapter 15 Cumulative and In-Combination Effects. All significant effects identified from construction and early operation are assessed in ES Volume 3, Appendices 13.4 and 13.5 and summarised in Section 13.108 above taking account of embedded design measures.

13.11.2 No further (secondary) mitigation is currently proposed and therefore will not reduce the effects of the construction and operational phases on seascape, landscape and visual receptors. Therefore, residual effects for all seascape, landscape and visual receptors are considered the same as identified in Section

13.8. A summary of the residual effects that will persist beyond year 15 are summarised below in Table 13-19.

Table 13-19 Residual effects of operation

Receptor		Significance of effect	Mitigation proposed	Residual significance of effect
Seascape receptors				
Seascape Character Area 22: Mochras to Fairbourne and Sarn Badrig		Neutral	n/a	Neutral
Landscape receptors				
Barmouth (13290)		Neutral	n/a	Neutral
Barmouth (4864)		Neutral	n/a	Neutral
Barmouth Coastal Hills (4872)		Neutral	n/a	Neutral
Barmouth Special Landscape Area		Neutral	n/a	Neutral
Visual receptors				
Viewpoint 1 Barmouth Beach	Recreational – People using Barmouth Beach	Minor adverse	n/a	Minor adverse
Viewpoint 2 Heol Llywelyn	Community – Residents of Heol Lywelyn Road	Minor adverse	n/a	Minor adverse
	Transport – People travelling along Heol Llywelyn Road.	Minor adverse	n/a	Minor adverse
Viewpoint 3 Heol-Y-Plas	Community – Residents of Heol-Y-Plas area	Minor adverse	n/a	Minor adverse
	Transport – People travelling along Heol-Y-Plas Road	Minor adverse	n/a	Minor adverse
Viewpoint 4 Prince's Avenue	Community – Residents of Princes Avenue Road and local students of Ysgol Y Traeth elementary school	Minor adverse	n/a	Minor adverse
	Transport – People travelling along Princes Avenue Road	Minor adverse	n/a	Minor adverse
Viewpoint 5 Marine Parade Road - North Car Park	Recreation – People using the PRoW Abermaw Rhif 24 Byway, Wales Coastal Path Long Distance Footpath and the National Cycle Route 8	Minor adverse	n/a	Minor adverse
	Transport - People traveling along Marine Parade Road and north car park	Minor adverse	n/a	Minor adverse
Viewpoint 6 Marine Parade Road - Skate Park	Recreation -People using the Barmouth Skatepark	Minor adverse	n/a	Minor adverse
	Transport – People using the northern car park	Minor adverse	n/a	Minor adverse
Viewpoint 7 Heol Idris	Community – residents of Heol Idris road	Minor adverse	n/a	Minor adverse
	Transport – People travelling along Heol Idris road	Minor adverse	n/a	Minor adverse
Viewpoint 8 Centenary Viewpoint	Recreation - People at Centenary Viewpoint using the PRoW Abermaw Rhif 11#2 Footpath	Minor adverse	n/a	Minor adverse

Receptor		Significance of effect	Mitigation proposed	Residual significance of effect
Viewpoint 9 Welsh Flag Viewpoint	Recreation - People at the Welsh flag viewpoint and using the PRoW Abermaw Rhif 24 Footpath	Minor adverse	n/a	Minor adverse
Viewpoint 10 PRoW Abermaw Rhif 20 Bridleway	Recreation - People using the PRoW Abermaw Rhif 20 Bridleway, PRoW Abermaw Rhif 19 and 17 footpaths	Minor adverse	n/a	Minor adverse
Viewpoint 11 A496	Community - Residents along the A496	Minor adverse	n/a	Minor adverse
	Transport - People travelling along the A496	Minor adverse	n/a	Minor adverse
Viewpoint 12 Hendre Mynach Caravan Park	Community - Residents along the A496	Minor adverse	n/a	Minor adverse
	Recreation - People using Hendre Mynach Caravan Park	Minor adverse	n/a	Minor adverse
	Transport- People travelling along the A496	Minor adverse	n/a	Minor adverse

13.12 Assessment Summary

13.12.1 A summary of effects is provided in Table 13-20 to present a clear overview of the predicted seascape, landscape and visual impacts arising from the Proposed Development.

Table 13-20 Summary of effects matrix

Receptor		Significance of construction effects Option 1	Significance of construction effects Option 2	Significance of operation effect yr 1	Significance of Residual effect yr 15
Seascape receptors					
Seascape Character Area 22: Mochras to Fairbourne and Sarn Badrig		Minor adverse	Minor adverse	Neutral	Neutral
Landscape receptors					
Barmouth (13290)		Minor adverse	Minor adverse	Minor adverse	Neutral
Barmouth (4864)		Minor adverse	Minor adverse	Minor adverse	Neutral
Barmouth Coastal Hills (4872)		Minor adverse	Minor adverse	Neutral	Neutral
Barmouth Special Landscape Area		Minor adverse	Minor adverse	Neutral	Neutral
Visual receptors					
Viewpoint 1 Barmouth Beach	Recreational – People using Barmouth Beach	**Moderate adverse (significant)**	**Moderate adverse (significant)**	Minor adverse	Minor adverse
Viewpoint 2 Heol Llywelyn	Community – Residents of Heol Lywelyn Road	**Moderate adverse (significant)**	**Moderate adverse (significant)**	Minor adverse	Minor adverse
	Transport – People travelling along	Minor adverse	Minor adverse	Minor adverse	Minor adverse

Receptor		Significance of construction effects Option 1	Significance of construction effects Option 2	Significance of operation effect yr 1	Significance of Residual effect yr 15
	Heol Llywelyn Road.				
Viewpoint 3 Heol-Y-Plas	Community – Residents of Heol-Y-Plas area	**Moderate adverse (significant)**	**Moderate adverse (significant)**	Minor adverse	Minor adverse
	Transport – People travelling along Heol-Y-Plas Road	Minor adverse	Minor adverse	Minor adverse	Minor adverse
Viewpoint 4 Prince's Avenue	Community – Residents of Princes Avenue Road and local students of Ysgol Y Traeth elementary school	**Moderate adverse (significant)**	**Moderate adverse (significant)**	Minor adverse	Minor adverse
	Transport – People travelling along Princes Avenue Road	Minor adverse	Minor adverse	Minor adverse	Minor adverse
Viewpoint 5 Marine Parade Road - North Car Park	Recreation – People using the PRoW Abermaw Rhif 24 Byway, Wales Coastal Path Long Distance Footpath and the National Cycle Route 8	**Moderate adverse (significant)**	**Moderate adverse (significant)**	Minor adverse	Minor adverse
	Transport - People traveling along Marine Parade Road and north car park	Minor adverse	Minor adverse	Minor adverse	Minor adverse
Viewpoint 6 Marine Parade Road - Skate Park	Recreation -People using the Barmouth Skatepark	Minor adverse	Minor adverse	Minor adverse	Minor adverse
	Transport – People using the northern car park	Minor adverse	Minor adverse	Minor adverse	Minor adverse
Viewpoint 7 Heol Idris	Community – residents of Heol Idris road	**Moderate adverse (significant)**	**Moderate adverse (significant)**	Minor adverse	Minor adverse
	Transport – People travelling along Heol Idris road	Minor adverse	Minor adverse	Minor adverse	Minor adverse
Viewpoint 8 Centenary Viewpoint	Recreation - People at Centenary Viewpoint using the PRoW Abermaw Rhif 11#2 Footpath	Minor adverse	Minor adverse	Minor adverse	Minor adverse

Receptor		Significance of construction effects Option 1	Significance of construction effects Option 2	Significance of operation effect yr 1	Significance of Residual effect yr 15
Viewpoint 9 Welsh Flag Viewpoint	Recreation - People at the Welsh flag viewpoint and using the PRoW Abermaw Rhif 24 Footpath	Minor adverse	Minor adverse	Minor adverse	Minor adverse
Viewpoint 10 PRoW Abermaw Rhif 20 Bridleway	Recreation - People using the PRoW Abermaw Rhif 20 Bridleway, PRoW Abermaw Rhif 19 and 17 footpaths	Minor adverse	Minor adverse	Minor adverse	Minor adverse
Viewpoint 11 A496	Community - Residents along the A496	Minor adverse	Minor adverse	Minor adverse	Minor adverse
	Transport - People travelling along the A496	Minor adverse	Minor adverse	Minor adverse	Minor adverse
Viewpoint 12 Hendre Mynach Caravan Park	Community - Residents along the A496	**Moderate adverse (significant)**	**Moderate adverse (significant)**	Minor adverse	Minor adverse
	Recreation - People using Hendre Mynach Caravan Park	**Moderate adverse (significant)**	**Moderate adverse (significant)**	Minor adverse	Minor adverse
	Transport- People travelling along the A496	Minor adverse	Minor adverse	Minor adverse	Minor adverse

Abbreviations List

AGC	Alun Griffiths Contractors
AOD	Above Ordnance Datum
ASIDOHL	Assessment of the Significance of Impacts of Development on Historic Landscape
BAP	Biodiversity Action Plan
CEMP	Construction Environmental Management Plan
D&B	Design and Build
DTM	Digital Terrain Model
ECI	Early Contractor Involvement
ECoW	Ecological Clerk of Works
EIA	Environmental Impact Assessment
ES	Environmental Statement
FAS	Flood Alleviation Scheme
GIS	Geographic Information System
GLVIA3	Guidelines for Landscape and Visual Impact Assessment (3rd Edition)
HLCA	Historic Landscape Character Area
HGV	Heavy Goods Vehicle
LCA	Landscape Character Area
LANDMAP	Landscape Assessment and Decision-Making Mapping Tool (Wales)
LOHI	Landscape of Outstanding Historic Interest
MCA	Marine Character Area
MHWS	Mean High Water Springs
NLCA	National Landscape Character Area
NMCA	National Marine Character Area
NRW	Natural Resources Wales
OS	Ordnance Survey
PRoW	Public Right of Way
SAC	Special Area of Conservation
SCA	Seascape Character Area
SDEV	Self-Discharging Excavator Vessel
SLA	Special Landscape Area
SLVIA	Seascape, Landscape and Visual Impact Assessment
SSSI	Site of Special Scientific Interest
TAN	Technical Advice Note

Glossary

Aspect Area	A spatial unit used in LANDMAP to describe landscape characteristics across five themes: visual & sensory, habitat, geology, historic, and cultural.
Character area	The distinct and recognisable pattern of elements that occur consistently in a particular type of area
Magnitude of Impact	A measure of the size, scale, duration, and reversibility of an effect.
Perceptual Qualities	The experiential attributes of a landscape or seascape, such as tranquillity, openness, or drama.
Receptor	A landscape, seascape, or visual entity that may be affected by the Proposed Development.
Sensitivity	The degree to which a receptor can accommodate change without adverse effects.
Significance of Effect	A judgement of the importance or gravity of an impact, based on sensitivity and magnitude.
Viewpoint	A location from which visual impacts are assessed, often representing key receptor groups.
Zone of Theoretical Visibility (ZTV)	A computer-generated map showing areas from which the Proposed Development may be visible.

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Cyngor Gwynedd

Barmouth North Promenade FAS

ES Chapter 14 Cumulative and In-Combination Effects

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Contents

14. Cumulative Effects **4**
14.1 Introduction 4
14.2 Legislation, policy and guidance 4
14.3 Stakeholder Engagement 8
14.4 Study area 9
14.5 Assessment Methodology 10
14.6 Limitations and assumptions 13
14.7 Assessment of effects 14
14.8 Mitigation and residual effects 18
Abbreviations List **20**

Tables

Table 14-1 List of relevant National Policy 5
Table 14-2 Zone of influence summary table 9
Table 14-3 Stages of Cumulative Effects Assessment 11
Table 14-4 Criteria used to identify which projects were progressed to the short list for further assessment 12

14. Cumulative Effects

14.1 Introduction

14.1.1 This chapter provides an assessment of the cumulative and in-combination effects that may be experienced by common receptors during the construction and operation of Barmouth North Promenade (hereafter referred to as the 'Proposed Development').

- **Cumulative effects** from the interrelationship between the Proposed Development with other developments (inter-project).
- **In-combination effects** from the interaction between individual effects of the Proposed Development, i.e. the interrelationship between different environmental topics (intra-project).

14.1.2 Cumulative effects, or inter-project effects, occur when a resource, receptor or group of receptors are potentially affected by more than one development at the same time. For example, two visually intrusive developments proposed within a sensitive landscape or Conservation Area may result in more significant landscape and visual effects than just one development considered in isolation.

14.1.3 In-combination effects, or intra-project effects, occur when a resource, receptor or group of receptors are potentially affected by more than one source of environmental impact resulting from the same development. For example, a community may be affected by noise and dust effects resulting from the construction phase activities of a single development.

14.1.4 This chapter details the legislation, policy and guidance that is relevant to a cumulative and in-combination effects assessment, summarises the engagement undertaken to date, and sets out the scope and methodology of assessment. Following this, the preliminary likely significant cumulative residual effects are assessed taking account of embedded environmental design measures, with the need for further (secondary) mitigation considered. Resultant residual effects are then identified. The chapter also sets out the effects that may be experienced by common receptors that may potentially result in in-combination effects.

14.1.5 This chapter should be read in conjunction with ES Volume 2- Chapter 2 Project Description and the topic assessments presented in ES Volume 2- Chapters 4-13.

14.2 Legislation, policy and guidance

Legislation and Policy

14.2.1 This section identifies the legislation, policy and other documentation that has informed the cumulative and in-combination effects assessment. This section is supported by the ES Volume 3, Appendix 1.1 Policy Context, which outlines overarching legislation and policy relevant to the Proposed Development.

14.2.2 The requirement for cumulative effects assessment (CEA) is set out in Schedule 4 of the EIA Regulations, which states that the EIA should include an assessment of "the direct effects and any indirect, secondary, cumulative,

transboundary, short-term, medium-term and long-term, permanent and temporary, positive and negative effects of the development."

14.2.3 The legislation relevant to the in-combination assessment is set out in Paragraph 2 of Regulation 5 which states that an Environmental Impact Assessment must describe and assess (e) the interaction between factors (i.e. population and human health, biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC2, land, soil, water, air and climate, material assets, cultural heritage and the landscape.)

14.2.4 Table 15.1 sets out sections from National Policy of relevance to the Proposed Development, in regard to cumulative effects.

Table 14-1 List of relevant National Policy

Relevant section	Policy requirement	Where addressed in chapter
Planning Policy Wales		
6.4.3	Safeguard protected species and species of principal importance and existing biodiversity assets from direct, indirect or **cumulative adverse impacts** that affect their nature conservation interests and compromise the resilience of ecological networks and the components which underpin them, such as water, air and soil, including peat.	Section 15.7 (Biodiversity and Protected Sites)
6.6.25	Development should reduce, and must not increase, flood risk arising from river and/or coastal flooding on and off the development site itself. The priority should be to protect the undeveloped or unobstructed floodplain from development and to prevent the **cumulative effects** of incremental development.	Section 15.7 (Flooding and Water Quality)
6.7.12	Planning authorities must consider current and future sources of air and noise pollution as part of developing their strategies for locating new development. The pattern of proposed development should be informed by the sensitivity of, and compatibility of, uses in relation to the sources of airborne pollution and the importance of ensuring appropriate soundscapes. Green infrastructure provision will be an important means of addressing the **cumulative impacts** of air and noise pollution and soundscapes on individuals and society and provide benefits for social and ecosystems resilience.	Section 15.7 (Air Quality and Noise and Vibration)
6.7.16	Relevant considerations in making planning decisions for potentially polluting development are likely to include: effect on biodiversity and ecosystem resilience, including where there may be **cumulative impacts** on air or water quality which may have adverse consequences for biodiversity and ecosystem resilience.	Section 15.7
Wales National Marine Plan		
Policy GOV_01: Cumulative effects	Under this policy, proposals should demonstrate that they have considered any multiple and **cumulative effects** of proposals including those associated with other (including known, planned) projects and	Section 15.7

Relevant section	Policy requirement	Where addressed in chapter
	activities. It is not sufficient to consider the effects of individual developments in isolation.	
Policy GOV_02: Cross-border and plan compatibility	Development proposals on both the marine and terrestrial environments, and both within Wales and further afield, should be assessed in a collective and **cumulative manner**.	Section 15.7

14.2.5 Further detail of the policy context of the Proposed Development is set out in ES Volume 3, Appendix 1.1.

Guidance and standards

14.2.6 There is currently no standard methodology for CEA although there is a range of guidance available. Whilst the proposed development is not classified as a Nationally Significant Infrastructure Project under the Planning Act 2008, it is considered that the Planning Inspectorate Advice Note 17: 'Cumulative effects assessment relevant to nationally significant infrastructure projects' is the most relevant guidance available relating to the cumulative and in-combination assessment.

14.3 Stakeholder Engagement

14.3.1 An EIA Scoping Report was prepared by YGC and submitted to Cyngor Gwynedd and NRW on 06 February 2024 and 09 February 2024 respectively. Please refer to ES Volume 3, Appendix 1.4. The Scoping Report set out the proposal for cumulative effects to be scoped into the EIA.

14.3.2 An EIA Scoping Opinion was issued by Cyngor Gwynedd and NRW on 30 April 2024 and 19 April 2024 respectively. Please refer to ES Volume 3, Appendix 1.5 and 1.6.

14.3.3 Regarding Cumulative and In-Combination effects, Cyngor Gwynedd's EIA Scoping Opinion states that:

"The assessment reports prepared for each of the topics identified in the ES should be in defined sections including a baseline study detailing:

*…Assessment as to the effects of the development directly, indirectly, secondary, **cumulative**, short, medium and long term, permanent, temporary, positive and negative effects…"*

14.3.4 Regarding Cumulative and In-Combination effects, NRW's EIA Scoping Opinion states that:

"We have not considered potential effects on other matters and do not rule out the potential for the proposed development to affect other interests."

14.3.5 Further detail regarding the EIA Screening and Scoping process for the Proposed Development can be found in ES Volume 2- Chapter 1 Introduction, section 1.7.

14.3.6 Engagement has also been undertaken with Cyngor Gwynedd regarding major developments and cumulative effects. The following response was received from a Senior Planning Officer on 17th March 2025:

"We are not aware of any other approved / pending major developments within the vicinity that would lead to cumulative effects."

14.3.7 Consultation has been undertaken with key statutory stakeholders and is detailed within relevant topic chapters- refer to ES Volume 2, Chapters 5-13.

14.4 Study area

14.4.1 This section describes the spatial scope for the CEA. The study area for the CEA is defined as the Zone of Influence (ZoI) and varies for each topic. The ZoI is primarily based on the study areas for each topic as set out within each ES topic chapter (ES Chapters 6 to 19). A summary is presented in Table 14-2.

Table 14-2 Zone of influence summary table

Environmental topic	Proposed zone of influence
ES Chapter 5 Air Quality	250m for construction dust assessment
ES Chapter 6 Biodiversity and Protected Sites	15km internationally designated sites (marine mammals, fish, otter, with hydrological connections) 10km internationally designated sites (including where bats are a qualifying species) 2km nationally and locally designated sites 2km habitats and species 0.5km standing waterbodies
ES Chapter 7 Climate Change	ZoI not considered applicable (refer to paragraph 15.7.5)
ES Chapter 8 Community Considerations	Study area has been created to inform the Transport Assessment (1.2km2) Lower Super Output Area (LSOA) Gwynedd 016F (approximately 1.5km)
ES Chapter 9 Cultural Heritage	1km for designated heritage assets and 500m for non-designated heritage assets.
ES Chapter 10 Flooding and Water Quality	250m
ES Chapter 11 Noise and Vibration	300m from any construction activity and 50m from any public roads with a large increase in traffic during construction.
ES Chapter 12 Marine and Coastal Physical Processes	100m north-east and south-west extents of the revetment 15m in front of the revetment and in the rear area of the north-east extent of the revetment
ES Chapter 13 Seascape and Landscape	1km

14.5 Assessment Methodology

14.5.1 Consistent with the distinction between in-combination effects and cumulative effects, as outlined above, the assessment for the ES is split into two sections:

- CEA: comprising an assessment of cumulative effects of the Proposed Development with other developments within the defined ZoIs on a range of resources/receptors.
- In-combination effects assessment: comprising an aggregation of effects by common single resource/receptor or receptor groups that may result in in-combination effects from the Proposed Development.

14.5.2 There is currently no standard methodology for CEA therefore the Planning Inspectorate Advice Note 17 has been adopted. Advise Note 17 provides a systematic approach to CEA which can be split into four distinct phases. The methodology set out in the advice note has been adapted and is relevant to the Proposed Development (accepting that it is not a Nationally Significant Infrastructure Project in the terms defined within the Planning Act 2008).

Cumulative Effects Assessment

14.5.3 The four key stages of the cumulative effects assessment are explained below in Table 14-3. The guidance notes that the recommended process focuses on cumulative effects with 'other developments'.

Table 14-3 Stages of Cumulative Effects Assessment

CEA Stage	Key activities
Stage 1: Establish the ZoI and identify long list of 'other developments'	Identify the ZOI for each of the environmental topics covered by the ES; Identify a long list of 'other developments' in the vicinity of the proposed development which may have cumulative effects in consultation with Cyngor Gwynedd and other LPA's which fall within the ZOI; and Undertake desktop review of available environmental information for identified cumulative developments.
Stage 2: Identify short list of 'other developments'	Identify which of the identified 'other developments' from Stage 1 has the potential to give rise to significant cumulative effects by virtue of overlaps in ZOI, temporal scope, the scale and nature of the 'other development'/receiving environment; or any other relevant factors.
Stage 3: Information gathering	Information related to the shortlisted 'other developments' is gathered and reviewed.
Stage 4: Assessment	CEA of shortlisted 'other developments' is undertaken. Each individual 'other development' is reviewed in turn to identify whether there is potential for significant cumulative effects; Mitigation measures are identified.

Stage 1: Establishing the long list of 'other developments'

14.5.4 The criteria to establish a long list of development considers major projects which are:

a) major development proposals within the local plan.

b) major development under construction.

c) permitted applications but not yet implemented.

d) submitted applications but not yet determined.

14.5.5 The Cyngor Gwynedd planning portal was reviewed for developments within the above criteria.

14.5.6 Band 2 and Band 3 Marine licensable developments were also considered, using the NRW Marine Licensing register.

14.5.7 Nationally Significant Infrastructure projects were also considered, using Welsh Government Planning Casework Developments of National Significance Applications list and the National Infrastructure Planning Register of Applications in Wales.

14.5.8 Gwynedd and Anglesey Joint Local Development Plan designated sites were also reviewed.

14.5.9 The less information that is available for future projects (i.e. environmental impacts predicted, project definition), the less likely it is that the CEA will be able to make any robust assessment in relation to these projects.

14.5.10 Assessment of cumulative effects is limited by the level of information that is available for each of the topic assessments. When consideration is given to effects that may arise as a result of impacts from other developments, the assessment becomes limited by the amount of information that is made publicly available.

Stage 2: Identifying short list of 'other developments'

14.5.11 The residual environmental effects identified in the ES (Chapters 5 to 13 of this ES) have been used in this cumulative assessment to determine how and when other developments could affect the same receptors as the proposed development.

14.5.12 The long list of other developments which has been identified under Stage 1 has been subject to a further assessment using criteria to identify a proportionate 'shortlist' of developments to be assessed within the CEA. The threshold and criteria considered in shortlisting 'other developments' is outlined below.

Table 14-4 Criteria used to identify which projects were progressed to the short list for further assessment

Criteria	Description
The temporal scope of 'other development' potential for interaction.	Consideration of relative construction, operation and decommissioning programmes of the 'other development' identified in the ZOI with the proposed development's programme, to establish whether there is overlap, or similar temporal scope for construction and operation phases, and any potential for interaction.
The scale and nature of 'other development'	Consideration of whether the scale and nature of the developments identified in the ZOI are likely to interact with the proposed development and to result in a cumulative effect. Characteristics of 'other developments' in relation to use of natural resources, pollution and nuisances, and risks to human health.
Any other relevant factors	Nature and/or capacity of the receiving environment that would make a significant cumulative effect with 'other development'. The sensitivity of the receiving environment includes whether the sites are within 10km of a European site. The likely significance of effects where environmental assessments have been undertaken for the 'other developments' as having moderate to large significance.

Stage 3: Information gathering

14.5.13 Information on the ‘other developments’ has been compiled from publicly available documents on the Cyngor Gwynedd, NRW and Planning Inspectorate websites and through direct liaison with Cyngor Gwynedd Local Authority.

14.5.14 The following Local Plans have also been reviewed for relevant allocation sites:

- Anglesey and Gwynedd Joint Local Development Plan.
- Gwynedd Local Development Plan (the new Plan).

Stage 4: Assessment

14.5.15 For the purposes of this CEA, the value of a resource and magnitude of impact is determined according to the criteria set out within the preceding topic chapters of this ES (Chapters 5 to 13). The significance of effect was then carried forward from preceding chapters to enable an ‘on-balance’ assessment of combined significance upon environmental receptors, as well as to identify the significance of cumulative effects with ‘other developments’.

14.5.16 Where significant cumulative effects beyond those identified as residual effects from the proposed development in isolation are identified, an assessment of the need for additional mitigation (further to that already set out in the preceding chapters) has been undertaken.

14.5.17 The CEA does not aim to assign significance levels to any of the cumulative effects identified. Rather, a judgement has been made on whether the cumulative effects are likely to be more or less significant than the effects identified for the proposed development alone.

In-combination effects assessment

14.5.18 There is currently no standard methodology for the in-combination effects assessment, therefore the Planning Inspectorate Advice Note 17 has been adopted. Advice Note 17 notes that the assessment of interrelationships between topics are typically assessed as part of specialist topic chapters of an ES. The methodology set out in the advice note has been adapted and is relevant to the proposed development (accepting that it is not a nationally significant infrastructure project in the terms defined within the Planning Act 2008).

14.5.19 Where the in-combination effects for topics are inherently assessed within topic assessments (for example, the outcomes of noise effects have been assessed within the ecology assessment to assess the in-combination of effects on the adjacent national designated sites), these are reported within the assessment section of the individual topic chapters of the ES for effects during construction, and operation.

14.5.20 However, there is also the potential for in-combination effects to be experienced by receptors/receptor groups (human and non-human) shared by more than one topic that have not been inherently assessed within the topic chapters. The aggregation of these effects by receptor/receptor group is presented in this chapter, with further consideration of their interaction and the potential for likely significant in-combination effects to be reported in the ES.

14.6 Limitations and assumptions

14.6.1 Assessment of cumulative effects has been limited by the level of information that was available for each of the topic assessments. When consideration was given to effects that may arise as a result of impacts from other developments, the assessment was limited by the amount of information that was made publicly available.

14.7 Assessment of effects

Air Quality

14.7.1 Based on the information available, there is no overlap among the construction periods of other developments and the Proposed Development.

14.7.2 Ongoing works for the Barmouth Beach Management Scheme (subject of Marine License DEML2375) are planned at Barmouth Beach from 11th April 2024 to 10th April 2029, which would slightly overlap with the construction period of the Proposed Development. These works will involve depositing sand at the northern end of the promenade using 20-tonne dumpers, which will transport the sand along the highway to a designated area. An excavator will then move the sand from the stockpile over the sea wall onto the beach, where it will be spread both north and south.

14.7.3 Although these activities may generate dust, best practice dust mitigation measures are designed to ensure there are no significant effects on nearby receptors within and beyond 250 metres. With best practice mitigation likely to be implemented, any cumulative dust-related impacts are expected to be negligible and therefore not significant.

Biodiversity and Protected Sites

14.7.4 The only development identified as relevant to the biodiversity and protected sites cumulative assessment is that permitted through Barmouth Beach Management Scheme Marine Licence DEML2375, which relates to ongoing beach management works in the vicinity of the Proposed Development.

14.7.5 This licence permits temporary works to periodically deposit sand at the northern end of the promenade, near the northern car park, with material redistributed both north and south along the foreshore using temporary machinery. These operations are scheduled to occur twice annually and form part of a long-term strategy to maintain beach levels and protect the shoreline from erosion. The beach nourishment works are expected to overlap temporarily with the construction phase and Year 1 of operation of the Proposed Development, covering the period from April 2024 to April 2029.

14.7.6 Cumulatively, the coastal management and the Proposed Development are not expected to give rise to any significant cumulative effects on biodiversity or protected sites. While there will be a short-term overlap in construction and early operation, the coastal management work is minor in scale and duration and are consistent with established coastal management practices. The planned management work primarily requires traffic access along the highway where biodiversity is either absent or very limited and is therefore unlikely to impact any sensitive ecological receptors.

14.7.7 Together, both developments support the stability and function of the coastline. Overall, the cumulative effects on biodiversity and protected sites is assessed as **neutral**, with potential long-term benefits for biodiversity through the preservation of beach form and coastal resilience.

Climate Change

14.7.8 Climate impacts (that is those as a consequence of global heating) are observable at a national and global scale. Assessment of significance is based on whether a project's Greenhouse Gas (GHG) emissions cumulatively represent a considerable contribution to the global atmosphere. The net GHG effect of the Proposed Development has been assessed and reported within the context of baseline local and regional GHG emissions, as well as future carbon budgets. As such, the approach to climate assessment within the IEMA Guidance: "Assessing Greenhouse Gas Emissions and Evaluating their Significance" is inherently cumulative as consideration of the Proposed Development against the Wales's carbon budgets allows the LPA to take a holistic view of all other development carbon contributions against the Proposed Development's and the carbon budgets. As such, the GHG emissions are not discussed further from a cumulative effects perspective in this chapter. Rather, the significance of the Proposed Development's GHG emissions can be found in ES Volume 2, Chapter 7, Climate Change.

Community Considerations

14.7.9 There are ongoing beach management works at Barmouth Beach, permitted under Barmouth Beach Management Scheme Marine Licence DEML2375, conducted twice a year, from 2024 to 2029, which would have minor overlap with the construction period of the proposed development. The ongoing beach management works would see the deposition of sand at the northern end of the promenade by 20 tonne dumpers which would haul the sand along the highway, prior to deposition on a designated area on the surface of the promenade. Another excavator would collect sand from the stockpile and deposit onto the beach over the sea wall. This sand would be spread by an excavator to the north and south.

14.7.10 While this process may have visual effects and impact amenity of the beach, the impact of these works is expected to be negligible due to the short-term nature of the works. Thus, the works are not expected to result in any significant cumulative effects on health and wellbeing, nor will result in any cumulative effects on transport. It is recommended that the contractors carrying out the works liaise with sensitive stakeholders, such as the Coastguard Station located on Marine Parade, that may experience visual impacts that would disrupt their view of the seascape during the works.

14.7.11 Based on the information available, there is no overlap among the construction periods of other developments and the Proposed Development. Therefore, the proposed development is not likely to result in any construction related cumulative effects on transport, movement and access, or health and wellbeing.

Cultural Heritage

14.7.12 The Proposed Development may remove or alter buried archaeological remains below the beach sands. This would result in a direct impact to archaeological remains. This effect is to be mitigated through a program of archaeological

monitoring of ground disturbance and through the use of track matting or other suitable material at areas that are to be heavily trafficked

14.7.13 The ongoing Barmouth Beach Management Scheme (Marine Licence DEML2375), which would deposit accumulated sand from the area directly in front of the southern promenade sea wall in Barmouth twice a year, would have a temporal overlap with the construction period of the proposed development.

14.7.14 The ongoing beach management works would see the deposition of sand at the northern end of the promenade by 20 tonne dumpers which would haul the sand along the highway, prior to deposition on a designated area on the surface of the promenade. Another excavator would collect sand from the stockpile and deposit onto the beach over the sea wall. This sand would be spread by an excavator to the north and south.

14.7.15 As the ongoing beach management works require depositing and spreading sand, with primary traffic access along the highway, these works are unlikely to impact archaeological remains. While the proposed sea defence works are likely to have an archaeological impact through excavation and plant movement on the beach, this impact is to be mitigated through archaeological monitoring and use of track matting or similar. Therefore, the ongoing beach management works would not result in cumulative effects on Cultural Heritage.

Flooding and Water Quality

14.7.16 The only development identified as relevant to the flooding and water quality cumulative assessment are works permitted under Barmouth Beach Management Scheme Marine Licence DEML2375, relating to ongoing beach management works, to be conducted in the vicinity of the Proposed Development.

14.7.17 The ongoing beach management works anticipate movement of beach deposits, which has the potential to impact upon water quality and could give rise to cumulative effects if undertaken at the same time as construction of the Proposed Development.

14.7.18 The ongoing beach management works are expected to overlap temporarily with the construction phase and Year 1 of operation of the Proposed Development, covering the period from April 2024 to April 2029. However, implementation of good working practices, as detailed in the Outline CEMP, would mean that the cumulative effects of the ongoing beach management works and the Proposed Development would not be expected to give rise of any significant cumulative effects on sensitive water environment receptors.

Noise and Vibration

14.7.19 The only development identified as relevant to the noise and vibration cumulative assessment is the Barmouth Beach Management Scheme marine licence DEML2375, which relates to ongoing beach management works in the vicinity of the Proposed Development.

14.7.20 The coastal management works involve the periodic deposition of sand at the northern end of the promenade, near the northern car park, with material redistributed both north and south along the foreshore using temporary machinery. These operations are scheduled to occur twice annually and form part of a long-term strategy to maintain beach levels and protect the shoreline from erosion. The ongoing beach management works are expected to overlap

temporarily with the construction phase and Year 1 of operation of the Proposed Development, covering the period from April 2024 to April 2029.

14.7.21 The cumulative noise and vibration effects of the coastal management works, and the Proposed Development Scheme is not expected to give rise of any significant cumulative effects on noise and vibration sensitive receptors. While there will be a short-term overlap in construction, coastal management works are relatively minor in scale, short in duration and consistent with established coastal management practices. Together, both developments support the stability and function of the coastline.

Marine and Coastal Physical Process

14.7.22 The only development identified as relevant to the marine and coastal physical processes cumulative assessment is that permitting by Barmouth Beach Management Scheme Marine Licence DEML2375, which relates to ongoing beach management works in the vicinity of the Proposed Development.

14.7.23 The 'Option B' dune deposit site location proposed for these works will overlap spatially with the revetment. The construction of the rock revetment will also reduce the issue of scour affecting the promenade. The addition of material would still be beneficial in this area, but in an updated location, on the seaward side of the revetment.

14.7.24 Overall, the cumulative effects on marine and coastal physical processes are assessed as **neutral**, with potential long-term benefits to coastal resilience.

Seascape, Landscape and Visual

14.7.25 The only development identified as relevant to the seascape, landscape and visual cumulative assessment is that permitted under Barmouth Beach Management Scheme Marine Licence DEML2375, which relates to ongoing beach management works in the vicinity of the Proposed Development.

14.7.26 This scheme involves temporary works to periodically deposit sand at the northern end of the promenade, near the northern car park, with material redistributed both north and south along the foreshore using temporary machinery. These operations are scheduled to occur twice annually and form part of a long-term strategy to maintain beach levels and protect the shoreline from erosion. The beach nourishment works are expected to overlap temporarily with the construction phase and Year 1 of operation of the Proposed Development, covering the period from April 2024 to April 2029.

14.7.27 The cumulative effects of the licenced ongoing beach management works, and the Proposed Development is not expected to give rise of any significant cumulative effects. While there will be a short-term overlap in construction and early operation, coastal management works are relatively minor in scale, short in duration and consistent with established coastal management practices. Together, both developments support the stability and function of the coastline. Overall, the cumulative effects on seascape, landscape, and visual receptors are assessed as **neutral**, with potential long-term benefits through the preservation of beach form and coastal resilience.

In-Combination effects

14.7.28 No significant in-combination effects besides those described in ES Volume 2, Chapters 5-13 have been identified.

14.8 Mitigation and residual effects

14.8.1 As identified in section 5.7, works proposed under Barmouth Beach Management Scheme Marine Licence DEML2375 relating to ongoing beach management works are the main temporally and spatially overlapping development. This is not anticipated to give rise to significant cumulative effects. Effects are expected to be mitigated as far as practicable via consideration of construction timings.

14.8.2 The assessments of all other cumulative effects confirms that no mitigation above that proposed within the individual ES chapters is considered to be necessary.

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

Cyngor Gwynedd

Barmouth North Promenade FAS

ES Chapter 15 Summary

Reference: BMTH-ARP-EGN-ZZ-RP-OE-000008

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Contents

15. Summary **1**
15.1 Introduction 1
15.2 Construction Effects 1
15.3 Operation and Maintenance Effects 10

Tables

Table 15-1 Construction effects summary table 1
Table 15-2 Operation and Maintenance effects summary table 10

15. Summary

15.1 Introduction

15.1.1 This chapter presents a summary of the environmental topic chapter assessment findings undertaken as part of the Environmental Impact Assessment (EIA). These findings are summarised below. Table 15-1 details the summary of construction effects and Table 15-2 outlines the summary of operation and maintenance effects.

15.2 Construction Effects

Table 15-1 Construction effects summary table

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
Chapter 5 Air Quality				
Human receptors and Ecological receptors	Construction dust impacts	Not significant	None proposed	Not significant
Chapter 6 Biodiversity and Protected Sites				
Designated sites	Damage and or degradation to sensitive habitats (reefs, *Salicornia* and other annuals colonizing mud and sand, and Atlantic salt meadows)	Negative (significant)	Vessel routing as agreed within a Marine Vessel Management Plan (MVMP)	Negligible (not significant)
Designated sites	Disturbance (to bottlenose dolphin, harbour porpoise and grey seal).	Negative (significant)	Vessel routing as agreed within a MVMP	Negligible (not significant)
Intertidal ecology	Loss of blue mussel habitat, and a Priority Habitat within the Site.	Negative (significant)	Bespoke intertidal mitigation including *Sabellaria alveolata* habitat creation. Increase in extent of subtidal blue mussel beds	Positive (not significant)
Subtidal ecology	Damage and / or degradation to sensitive habitats (blue mussel beds)	Negative (significant)	MVMP	Negligible (not significant)
Dunes	Negligible	Negligible	Mitigation for habitat loss and enhancement proposed	Positive
Running water	Negligible	Negligible (not significant)	None proposed	Negligible (not significant)

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
Bats	Negligible	Negligible (not significant)	None proposed	Negligible (not significant)
Badger	Negligible	Negligible (not significant)	None proposed	Negligible (not significant)
Otter	Negligible	Negligible (not significant)	None proposed	Negligible (not significant)
Marine mammals	Disturbance (to all marine mammals present locally, but particularly grey seal at the nearby pupping sites)	Negative (significant)	MVMP	Negligible (not significant)
Birds	Negligible	Negligible (not significant)	None proposed	Negligible (not significant)
Reptiles	Negligible	Negligible (not significant)	None proposed	Negligible (not significant)
Invertebrates (Marine)	Negligible	Negligible (not significant)	None proposed	Negligible (not significant)
Fish	Negligible	Negligible (not significant)	MVMP	Negligible (not significant)
Chapter 7 Climate Change				
Global Climate	Increase in GHG emissions	Not significant	None proposed	Not significant
Chapter 8 Community Considerations				
Transport and accessibility – local study area community	Localised, temporary increases in journey times to local services and amenities due to construction traffic impacts, affecting community wellbeing	Temporary, minor adverse (not significant)	Impacts on parking at the Pen-y-Gogledd car park during construction should be reduced where possible.	Temporary, minor adverse (not significant)
Community safety – local study area community	Effect on operation of the Coastguard Station and Lifeboat Station due to construction activities. Effect on safety of beach users	Temporary, minor adverse (not significant)	None proposed	Temporary, minor adverse (not significant)
Active travel – local study area community (vulnerable groups)	Potential reduction in active travel, particularly for vulnerable groups, due to construction traffic and impacts on the Promenade	Temporary, minor adverse (not significant)	None proposed	Temporary, minor adverse (not significant)
Environmental amenity – local study area community	Combined noise and visual effects, reducing perceptions of neighbourhood amenity and affecting wellbeing	Temporary, minor adverse (not significant)	None proposed	Temporary, minor adverse (not significant)

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
Open space, leisure and play – local and wider study area community	Impacts on quality and accessibility of the beach, Promenade and Skate Park. Reduction in health and wellbeing benefits gained from these resources	Temporary, moderate adverse (significant)	None proposed	Temporary, moderate adverse (significant)
Tourism and business – local and wider study area community	Disruption of tourism businesses and resources due to construction activities. Adverse effects on wellbeing due to reduced income from tourism	Temporary, minor adverse (not significant)	None proposed	Temporary, minor adverse (not significant)
Community and social infrastructure – local study area community (vulnerable groups)	Change in access to, and amenity of, care homes and schools. Effects on wellbeing of users	Temporary, minor adverse (not significant)	None proposed	Temporary, minor adverse (not significant)
Chapter 9 Cultural Heritage				
Unrecorded archaeological remains within the Site	Total or partial removal or disturbance of below ground archaeological, deposits, remains, and/or features	Slight to large adverse effect (permanent)	Programme of archaeological survey, monitoring, and recording	Neutral to slight adverse (not significant)
Known archaeological remains within the Site: rail tracks and associated finds eroding out of the sand (PRN: 100450) and a track and landing place shown on 1st edition OS mapping (NPRN: 525439)	Total or partial removal or disturbance of below ground archaeological, deposits, remains, and/or features	Slight adverse (permanent)	Programme of archaeological survey, monitoring, and recording	Neutral (not significant)
Registered Historic Landscapes Mawddach and Ardudwy	Construction of new defences and modifications to existing within the registered landscapes	Neutral	None proposed	Neutral (not significant)
Chapter 10 Flooding and Water Quality				
WFD surface water bodies: Cardigan Bay North coastal waterbody Mawddach WFD transitional waterbody	Water pollution from oil or fuel spills from plant and equipment movement on the beach	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
	Introduction of additional organic material and INNS	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
	During construction: increase in turbidity and discoloration in the WFD waterbodies	Slight adverse (not significant)	None proposed	Slight adverse (not significant)

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
	During construction: remobilisation of contaminants due to groyne removal	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
Lleyn Peninsula and the Sarnau SAC	Water pollution from oil or fuel spills from plant and equipment movement on the beach	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
	Introduction of additional organic material and INNS	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
	During construction: increase in turbidity	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
Barmouth bathing water area	Water pollution from oil or fuel spills from plant and equipment movement on the beach	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
	Introduction of additional organic material and INNS	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
	During construction: increase in turbidity around sampling point 20014	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
Blue mussel beds WFD higher sensitivity habitat	Water pollution from oil or fuel spills from plant and equipment movement on the beach	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
	Introduction of additional organic material and INNS	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
	During construction: increase in turbidity	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
WFD lower sensitivity habitats within or adjacent to Site	Water pollution from oil or fuel spills from plant and equipment movement on the beach	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
	Introduction of additional organic material and INNS	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
	During construction: increase in turbidity	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
Defended area (properties)	During construction: flood risk	Neutral	None proposed	Neutral
Chapter 11 Noise and Vibration				
Barmouth Beach Club	Construction noise	Temporary adverse (significant)	Best Practicable Means (BPM), community liaison, monitoring	Temporary adverse (significant)

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
Dwellings adjacent to Barmouth Beach Club	Construction noise	Temporary adverse (significant)	BPM, community liaison, monitoring	Temporary adverse (significant)
Barmouth Skate Park	Construction noise	Temporary adverse (significant)	BPM, community liaison, monitoring	Temporary adverse (significant)
Promenade Café	Construction noise	Temporary adverse (significant)	BPM, community liaison, monitoring	Temporary adverse (significant)
Hendre Mynach Caravan Park	Construction noise	Temporary adverse (significant)	BPM, community liaison, monitoring	Temporary adverse (significant)
Dwellings on Tai'r Heli	Construction noise	Temporary adverse (significant)	BPM, community liaison, monitoring	Temporary adverse (significant)
Dwellings on Heol-Y-Llan	Construction noise	Temporary adverse (significant)	BPM, community liaison, monitoring	Temporary adverse (significant)
Dwellings on Heol-Llywelyn	Construction noise	Temporary adverse (significant)	BPM, community liaison, monitoring	Temporary adverse (significant)
Dwellings on Heol-Y-Plas and Heol-Y-Sarn	Construction noise	Temporary adverse (significant)	BPM, community liaison, monitoring	Temporary adverse (significant)
Min-Y-Mor Hotel	Construction noise	Temporary adverse (significant)	BPM, community liaison, monitoring	Temporary adverse (significant)
Dwellings adjacent to Min-Y-Mor Hotel	Construction noise	Temporary adverse (significant)	BPM, community liaison, monitoring	Temporary adverse (significant)
Ysgol Y Traeth School	Construction noise	Temporary adverse (significant)	BPM, community liaison, monitoring	Temporary adverse (significant)
Dwellings north of Princess Avenue that are setback more than 70m from Marine Parade	Construction noise	Not significant	BPM	Not significant
Barmouth Beach Club	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
Dwellings adjacent to Barmouth Beach Club	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Barmouth Skate Park	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Promenade Café	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Hendre Mynach Caravan Park	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Dwellings on Tai'r Heli	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Dwellings on Heol-Y-Llan	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Dwellings on Heol-Llywelyn	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Dwellings on Heol-Y-Plas and Heol-Y-Sarn	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Dwellings north of Princess Avenue that are setback more than 70m from Marine Parade	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Min-Y-Mor Hotel	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Dwellings adjacent to Min-Y-Mor Hotel	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Ysgol Y Traeth School	Construction vibration and construction traffic noise and vibration	Not significant	BPM	Not significant
Chapter 12 Marine and Coastal Physical Processes				
Hydrodynamics and sediment transport	Localised areas of erosion and accretion in the areas close to the stockpile	Minor adverse (temporary) (not significant)	Stockpile management measures and limitation on durations	Negligible (not significant)
Sediments release	The excavation of sands and shingle and the storage of these materials could cause a potential release sediment into the sea which could cause	Minor adverse (temporary) (not significant)	Construction to be planned to maximise working windows during low tide periods to reduce	Minor adverse (not significant)

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
	turbidity in the water column		turbidity during excavation. Stockpiling of sand and shingle to be done above MHWS to minimise loss of sediments into the sea	
Sediment release	Removal of existing groynes “in the dry” so no impact on release of sediments is expected.	Negligible (temporary)	Construction planned “in the dry” so no impact on release of sediments is expected.	No effect (not significant)
Chapter 13 Seascape and Landscape and Visual				
Seascape Character Area 22: Mochras to Fairbourne and Sarn Badrig	Effects on seascape character resulting from construction by both road and sea transport methods	Minor adverse (not significant)	None proposed	Minor adverse (not significant)
Barmouth (13290) Landscape Character Area	Effects on landscape character resulting from construction by both road and sea transport methods	Minor adverse (not significant)	None proposed	Minor adverse (not significant)
Barmouth (4864) Landscape Character Area	Effects on landscape character resulting from construction by both road and sea transport methods	Minor adverse (not significant)	None proposed	Minor adverse (not significant)
Barmouth Coastal Hills (4872) Landscape Character Area	Effects on landscape character resulting from construction by both road and sea transport methods	Minor adverse (not significant)	None proposed	Minor adverse (not significant)
Barmouth Special Landscape Area	Effects on landscape character resulting from construction by both road and sea transport methods	Minor adverse (not significant)	None proposed	Minor adverse (not significant)
Viewpoint 1 Barmouth Beach: Recreational – People using Barmouth Beach	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Moderate adverse (significant)	None proposed	Moderate adverse (significant)
Viewpoint 2 Heol Llywelyn: Community – Residents of Heol Lywelyn Road	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Moderate adverse (significant)	None proposed	Moderate adverse (significant)

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
Viewpoint 2 Heol Llywelyn: Transport – People travelling along Heol Llywelyn Road	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Minor adverse (not significant)	None proposed	Minor adverse (not significant)
Viewpoint 3 Heol-Y-Plas: Community – Residents of Heol-Y-Plas area	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Moderate adverse (significant)	None proposed	Moderate adverse (significant)
Viewpoint 3 Heol-Y-Plas: Transport – People travelling along Heol-Y-Plas Road	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Minor adverse (not significant)	None proposed	Minor adverse (not significant)
Viewpoint 4 Prince's Avenue: Community – Residents of Princes Avenue Road and local students of Ysgol Y Traeth elementary school	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Moderate adverse (significant)	None proposed	Moderate adverse (significant)
Viewpoint 4 Prince's Avenue: Transport – People travelling along Princes Avenue Road	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Minor adverse (not significant)	None proposed	Minor adverse (not significant)
Viewpoint 5 Marine Parade Road - North Car Park: Recreation – People using the PRoW Abermaw Rhif 24 Byway, Wales Coastal Path Long Distance Footpath and the National Cycle Route 8	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Moderate adverse (significant)	None proposed	Moderate adverse (significant)
Viewpoint 5 Marine Parade Road - North Car Park: Transport - People traveling along Marine Parade Road and north car park	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Minor adverse (not significant)	None proposed	Minor adverse (not significant)
Viewpoint 6 Marine Parade Road - Skate Park: Recreation - People using the Barmouth Skatepark	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Minor adverse (not significant)	None proposed	Minor adverse (not significant)
Viewpoint 6 Marine Parade Road - Skate Park: Transport – People using the northern car park	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Minor adverse (not significant)	None proposed	Minor adverse (not significant)

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
Viewpoint 7 Heol Idris: Community – residents of Heol Idris road	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods.	Moderate adverse (significant)	None proposed	Moderate adverse (significant)
Viewpoint 7 Heol Idris: Transport – People travelling along Heol Idris road	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Minor adverse (not significant)	None proposed	Minor adverse (not significant)
Viewpoint 8 Centenary Viewpoint: Recreation - People at Centenary Viewpoint using the PRoW Abermaw Rhif 11#2 Footpath	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Minor adverse (not significant)	None proposed	Minor adverse (not significant)
Viewpoint 9 Welsh Flag Viewpoint: Recreation - People at the Welsh flag viewpoint and using the PRoW Abermaw Rhif 24 Footpath	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Minor adverse (not significant)	None proposed	Minor adverse (not significant)
Viewpoint 10 PRoW Abermaw Rhif 20 Bridleway: Recreation - People using the PRoW Abermaw Rhif 20 Bridleway, PRoW Abermaw Rhif 19 and 17 footpaths	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Minor adverse (not significant)	None proposed	Minor adverse (not significant)
Viewpoint 11 A496: Community - Residents along the A496	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Minor adverse (not significant)	None proposed	Minor adverse (not significant)
Viewpoint 11 A496: Transport - People travelling along the A496	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Minor adverse (not significant)	None proposed	Minor adverse (not significant)
Viewpoint 12 Hendre Mynach Caravan Park: Community - Residents along the A496	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Moderate adverse (significant)	None proposed	Moderate adverse (significant)
Viewpoint 12 Hendre Mynach Caravan Park: Recreation - People using Hendre Mynach Caravan Park	Effects on visual amenity and changes to views resulting from construction by both road and sea transport methods	Moderate adverse (significant)	None proposed	Moderate adverse (significant)
Viewpoint 12 Hendre Mynach Caravan Park:	Effects on visual amenity and changes to views	Minor adverse (not significant)	None proposed	Minor adverse (not significant)

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
Transport- People travelling along the A496	resulting from construction by both road and sea transport methods			
Chapter 14 Cumulative and In-Combination Effects				
Various	Short-term temporal overlap of ongoing beach management works (Marine Licence DEML2375), and spatial overlap for Marine and Coastal Physical Process	No significant cumulative effects (not significant)	None proposed	No significant cumulative effects (not significant)

15.3 Operation and Maintenance Effects

Table 15-2 Operation and Maintenance effects summary table

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
Chapter 5 Air Quality				
N/A				
Chapter 6 Biodiversity and Protected Sites				
N/A				
Chapter 7 Climate Change				
Global Climate	Increase in GHG emissions	Not significant	None proposed	Not significant
Chapter 8 Community Considerations				
Active travel – local study area community	Improved wayfinding, amenity, safety and comfort for pedestrians and cyclists on the Promenade and Marine Parade. Supports active travel and associated health benefits	Permanent, minor beneficial (not significant)	None proposed	Permanent, minor beneficial effect (not significant)
Open space, leisure and play – local study area community (including vulnerable groups)	Improvements to the Promenade and beach access points. Increased health benefits of access to open space, leisure and play, particularly for people with impaired mobility	Permanent, moderate beneficial (significant)	None proposed	Permanent, moderate beneficial (significant)
Tourism and business – local and wider study area community	Improvements to the north Promenade and beach access, supporting the growth of the tourism economy in	Permanent, moderate beneficial (significant)	None proposed	Permanent, moderate beneficial (significant)

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
	Barmouth. Health benefits associated with improved incomes			
Climate and flooding (local community, particularly in north Barmouth)	Reduction in flood risk and associated risks to health and safety	Permanent, major beneficial (significant)	None proposed	Permanent, major beneficial (significant)
Chapter 9 Cultural Heritage				
Abermaw Conservation Area and the designated assets within it.	Changes to setting	Neutral (not significant)	None proposed	Neutral (not significant)
Parish Church of Saint Mary and Saint Bodfan (Grade I listed building, RN: 4906).	Changes to setting	Neutral (not significant)	None proposed	Neutral (not significant)
Plas Mynach (Grade II* listed building, RN: 5244), Porth Mynach (Grade II listed building, RN: 15499) and Plas Mynach Lodge (Grade II listed building, RN: 15498).	Changes to setting	Neutral (not significant)	None proposed	Neutral (not significant)
Former Domestic Stable Block at Hendre Coed Isaf (Grade II listed building, RN: 15501) and Barn At Hendre Coed Isaf (Grade II listed building, RN: 15500).	Changes to setting	Neutral (not significant)	None proposed	Neutral (not significant)
Catholic Church of St Tudwal and attached Presbytery (Grade II listed building, RN: 87924).	Changes to setting	Neutral (not significant)	None proposed	Neutral (not significant)
Chapter 10 Flooding and Water Quality				
WFD surface water bodies: Cardigan Bay North coastal waterbody and Mawddach WFD transitional waterbody	Discolouration of materials and loose sediment into the sea	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
Lleyn Peninsula and the Sarnau SAC	Discolouration of materials and loose sediment into the sea	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
Barmouth bathing water area	Discolouration of materials and loose sediment into the sea	Slight adverse (not significant)	None proposed	Slight adverse (not significant)

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
Blue mussel beds WFD higher sensitivity habitat	Discolouration of materials and loose sediment into the sea	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
WFD lower sensitivity habitats within or adjacent to Site	Discolouration of materials and loose sediment into the sea	Slight adverse (not significant)	None proposed	Slight adverse (not significant)
Defended area (properties)	During operation: reduction in flood risk	Large beneficial	None proposed	Large beneficial
Chapter 11 Noise and Vibration				
N/A				
Chapter 12 Marine and Coastal Physical Processes				
Intertidal and Subtidal Areas	Permanent loss of recreational use in the footprint of the revetment	Minor adverse (permanent) (not significant)	None proposed	Minor adverse (permanent) (not significant)
Hydrodynamics	Wave overtopping and flooding behind the breakwater is reduced from the baseline	Major beneficial (permanent) (not significant)	None proposed	Major beneficial (permanent) (not significant)
Hydrodynamics	Waves: changes in waves and currents impact on the adjacent *S.alveolata* reef	Negligible (not significant)	None proposed	Negligible (not significant)
Sediment transport and beach morphology	Variability of beach levels due to wave overtopping behind the north extent of the rock revetment	Minor adverse (permanent) (not significant)	Backfilling with shingle material behind proposed extension of revetment will further support a reduction in wave turbulence in the area, helping to reduce variability in beach levels	Minor adverse (not significant)
Sediment transport and beach morphology	Variability of beach levels due to wave overtopping behind the north extent of the rock revetment.	Minor adverse (permanent)	Backfilling with shingle material behind proposed extension of revetment will further support a reduction in wave turbulence in the area, helping to reduce variability in beach levels.	Minor adverse (permanent) (not significant)

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
Sediment transport and beach morphology – Cross-shore	Scour at the toe of the existing concrete structure and stability risks	Major beneficial (permanent)	The rock revetment will mitigate against risk of scour at the base of the existing concrete structure	Major beneficial (permanent) (not significant)
Sediment transport and beach morphology – Localised scour	Variability of beach levels in front of the proposed toe of the rock revetment and around new ecological mitigation structures	Minor adverse (permanent)	None	Minor adverse (permanent) (not significant)
Sediment transport and beach morphology – Long-shore Transport	Longshore transport along the beach	Negligible	None	Negligible (not significant)
Sediment transport and beach morphology	Beach changes due to far field blockage of sediments	Minor adverse (permanent)	None	Minor adverse (permanent) (not significant)
Sediment transport and beach morphology	Turbidity impact on the adjacent *S.alveolata* reef	Negligible	None	Negligible (not significant)
Sediment transport and beach morphology – Removal of groynes	Greater mobility of the upper sediment in the beach	Negligible	None	Negligible (not significant)
Chapter 13 Seascape and Landscape and Visual				
Seascape Character Area 22: Mochras to Fairbourne and Sarn Badrig	Effects on seascape character resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Neutral (yr 1 and yr 15) (not significant)	None proposed	Neutral (yr 1 and yr 15) (not significant)
Barmouth (13290) Landscape Character Area	Effects on landscape character resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1) Neutral (yr 15) (not significant)	None proposed	Minor adverse (yr 1) Neutral (yr 15) (not significant)
Barmouth (4864) Landscape Character Area	Effects on landscape character resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1) Neutral (yr 15) (not significant)	None proposed	Minor adverse (yr 1) Neutral (yr 15) (not significant)

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
Barmouth Coastal Hills (4872) Landscape Character Area	Effects on landscape character resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Neutral (yr 1 and yr 15) (not significant)	None proposed	Neutral (yr 1 and yr 15) (not significant)
Barmouth Special Landscape Area	Effects on landscape character resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Neutral (yr 1 and yr 15) (not significant)	None proposed	Neutral (yr 1 and yr 15) (not significant)
Viewpoint 1 Barmouth Beach: Recreational – People using Barmouth Beach	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 2 Heol Llywelyn: Community – Residents of Heol Lywelyn Road	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 2 Heol Llywelyn: Transport – People travelling along Heol Llywelyn Road	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 3 Heol-Y-Plas: Community – Residents of Heol-Y-Plas area	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 3 Heol-Y-Plas: Transport – People travelling along Heol-Y-Plas Road	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 4 Prince's Avenue: Community – Residents of Princes Avenue Road and local students of Ysgol	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
Y Traeth elementary school	15 of the Proposed Development			
Viewpoint 4 Prince's Avenue: Transport – People travelling along Princes Avenue Road	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 5 Marine Parade Road - North Car Park: Recreation – People using the PRoW Abermaw Rhif 24 Byway, Wales Coastal Path Long Distance Footpath and the National Cycle Route 8	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 5 Marine Parade Road - North Car Park: Transport - People traveling along Marine Parade Road and north car park	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 6 Marine Parade Road - Skate Park: Recreation - People using the Barmouth Skatepark	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 6 Marine Parade Road - Skate Park: Transport – People using the northern car park	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 7 Heol Idris: Community – residents of Heol Idris road	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 7 Heol Idris: Transport – People travelling along Heol Idris road	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
Viewpoint 8 Centenary Viewpoint: Recreation - People at Centenary Viewpoint using the PRoW Abermaw Rhif 11#2 Footpath	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 9 Welsh Flag Viewpoint: Recreation - People at the Welsh flag viewpoint and using the PRoW Abermaw Rhif 24 Footpath	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 10 PRoW Abermaw Rhif 20 Bridleway: Recreation - People using the PRoW Abermaw Rhif 20 Bridleway, PRoW Abermaw Rhif 19 and 17 footpaths	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 11 A496: Community - Residents along the A496	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 11 A496: Transport - People travelling along the A496	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 12 Hendre Mynach Caravan Park: Community - Residents along the A496	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 12 Hendre Mynach Caravan Park: Recreation - People using Hendre Mynach Caravan Park	Effects on visual amenity and changes to views resulting from operation in year 1 and operation and maintenance year 15 of the Proposed Development	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)
Viewpoint 12 Hendre Mynach Caravan Park: Transport- People	Effects on visual amenity and changes to views resulting from operation in year 1 and operation	Minor adverse (yr 1 and yr 15) (not significant)	None proposed	Minor adverse (yr 1 and yr 15) (not significant)

Receptor	Potential Impact	Significance of effect	Mitigation and enhancement	Residual effects
travelling along the A496	and maintenance year 15 of the Proposed Development			
Chapter 14 Cumulative and In-Combination Effects				
Various	Short-term temporal overlap during Year 1 of operation with ongoing beach management works (Marine Licence DEML2375)	No significant cumulative effects (not significant)	None proposed	No significant cumulative effects (not significant)
Various	In-Combination effects	No significant in-combination effects	None proposed	No significant in-combination effects

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