

Conwy County Borough Council
**Penrhyn Bay Coastal Defence
Improvements**
Intertidal Biotope Survey Report

For issue | 12 October 2021

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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1 Introduction

Conwy County Borough Council (CCBC) commissioned Ove Arup and Partners Limited (Arup) to undertake an Ecological Impact Assessment (EclA). Surveys to inform the EclA, included an Extended Phase 1 Habitat Survey and Intertidal Biotope Survey as part of the Penrhyn Bay Coastal Defence Improvements Scheme.

The proposed works are located with Penrhyn Bay adjacent to existing sea defences and bounded on either side by rocky promontories. The surveys will identify the principal habitats and key species, likely environmental constraints and initial recommendations for mitigation measures that may need to be taken into account in the development of the preferred solution(s) and potential opportunities for enhancement.

The Study Area extends from Mean High Water Springs (MHWS) down to Mean Low Water Springs (MLWS) delineating by a breakwater to the west (NGR: SH 82431 81981) and a smaller breakwater to the east (SH 82966 81587); refer to Appendix A Figure 1: Intertidal Biotope Plan. The Intertidal Biotope Survey was undertaken on the 25th June 2021 to target lower tides enabling survey of a greater extent of eulittoral (lower shore) habitats; low water was at 05:58 (BST) with a low water level of 0.44m above Chart Datum [Llandudno]. Marine Habitat (Biotope) photos are provided in Appendix B.

The purpose of this report is to provide baseline information on intertidal habitats to inform the detailed design stage of the project and provide the requisite information as referenced in the NRW EIA Screening Opinion.

Arup submitted Environmental Impact Assessment (EIA) Screening Opinion Requests to CCBC under the Town & Country Planning (EIA) (Wales) Regulations 2017 and to Natural Resources Wales (NRW): Marine Licensing Team (MLT) under the Marine Works (EIA) Regulations 2007 (as amended) in December 2020. NRW MLT subsequently issued a Screening Opinion [Ref SC2007] on 29th March 2021. In Section 4.1.2: *Marine and Intertidal Ecology*, NRW provided comments reproduced below.

'Sabellaria alveolata (honeycomb worm) reef is listed as a Priority Habitat under Section 7 of the Environment (Wales) Act 2016 within the category of 'Littoral Rock'. This habitat is present within the site and is likely to be affected by the project. We recognise that measures for this habitat have been proposed to be investigated further as part of the detailed design stage and that these will be informed by a site-specific intertidal biotope survey, which will enable the S. alveolata reef location and extent to be mapped. NRW TE confirm an intertidal biotope surveys would be required along with discussion with NRW TE with regard to the approach of the design in avoidance or mitigation of any effects.'

2 Project Background

Penrhyn Bay is a coastal embayment in the county of Conwy, North Wales. The Shoreline Management Plan states that the policy for Penrhyn Bay is to ‘Hold the Line’; whilst the Conwy Local Development Plan (LDP) emphasises the importance of preserving the county’s unique natural beauty, safeguarding public rights of way and allowing tourism to continue to make a vital contribution to the economy.

The existing defences provide coastal erosion and tidal flooding protection to over 300 residential and commercial properties, utilities infrastructure (including a Dŵr Cymru Welsh Water (DCWW) pumping station, a Wastewater Treatment Works (WwTW) sea outfall and SP Energy Networks assets), the adjacent promenade, A547 highway, Wales Coast Path, National Cycle Route, and the Rhos-on-Sea Golf Club. The present beach and promenade also form a key part of the local community’s well-being and recreation space, whilst adding to the area’s wider tourist attractions.

In the absence of the continuing beach management works, regularly undertaken by CCBC, the sea wall and revetment are highly likely to fail through the on-going drawdown of the foreshore exposing the corroded and structurally weak sheet piled toe foundations.

The present regime of maintenance activities is unsustainable and is likely to increase in frequency over time, as the mobility of the beach increases due to the beach material particle attrition and the increasing severity of storm events and sea level rise associated with climate change.

The objectives for the project are to:

1. Manage the effects of flood risk and coastal erosion to people and property.
2. Reduce the on-going capital maintenance costs experienced as part of the present beach maintenance regime to safeguard the public backshore assets.
3. Meet the objectives of the Shoreline Management Plan (SMP2) for Penrhyn Bay, which include:
 - Hold the Line.
 - Maintaining and widening the beach.
 - Acting in an environmentally acceptable way.
4. Incorporate wider benefits and added amenity value into project design and construction (including consideration of Welsh Government’s Community Benefits Policy and the Well-Being of Future Generations (Wales) Act 2015). To maintain and, where possible, enhance the natural environment.
5. Maintain and improve the local area – with an awareness of the amenity value presently provided by Colwyn Bay and Llandudno (neighbouring towns).

3 Project Description

To achieve the above objectives, a T-shaped rock groyne and associated beach nourishment with commonly designated shingle (pebbles and cobbles in Wentworth scale) are proposed.

The rock groyne is approx. 100m long by 90m in width. The rock groyne is suited to the local area, which already comprises a number of rock groynes and the beach nourishment will comprise similar material to existing beach deposits.

The planned shape of the capital beach nourishment was determined from numerical modelling as the equilibrium position resulting from the incident wave direction and wave diffraction behind the groyne structure.

The minimum beach width is 10m, the crest level is between +5mODN and +6mODN, to be confirmed, and the beach nourishment slope is proposed at (V:H) 1:8. These design parameters are discussed further in the following sections of the report. Figure 1 shows an indicative plan of the proposed works in Penrhyn Bay at a high tide (Figure 1a) and outline at low tide (Figure 1b).



Figure 1a – Plan of Proposed Works (High Tide)



Figure 1b – Plan of Proposed Works (Low Tide).

A limited degree of flexibility exists in the location of the rock groyne to achieve the requisite design parameters and project objectives. The baseline data presented within this report will inform potential intertidal biodiversity constraints that may facilitate micro-siting of the proposed coastal defences.

4 Methodology

4.1 Intertidal Biotope Survey

An Intertidal Biotope Survey was undertaken by an experienced marine ecologist on 25th June 2021 between a Study Area delineating by two breakwaters (NGR: SH 82431 81981 to SH 82966 81587); refer to Figure 1. Survey also comprised the potential access point at SH 82941 81468 and the habitats above MHWS, including habitats to the rear of the cobble ridge (SH 82880 81493) that forms part of the North Wales Coast Important Bird Area¹. At this location the area is an important breeding area for ringed plover (*Charadrius hiaticula*); three individuals were present foraging on the adjacent foreshore and alighting atop the cobble ridge during the survey.

The survey was 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. The survey was timed to target spring tides at low water to maximise the extent of accessible intertidal habitat. The Intertidal Biotope Survey was undertaken one hour either side of low water, which occurred at 05:58 BST at a tidal height of 0.44m Above Chart Datum [Llandudno].

The survey was undertaken in accordance with the JNCC's Marine Nature Conservation Review (MNCR) methodology, which was developed to provide a comprehensive baseline of information on marine habitats and species, to aid coastal zone and marine management and to contribute to the identification of areas of marine natural heritage importance throughout Great Britain. MNCR focussed on benthic habitats and their associated communities, which together are described as 'biotopes' in inshore areas. The MNCR developed methods for survey, assessment and recording to enable systematic and consistent descriptions of the character of habitats present and the abundance of species in them so that comparisons between sites could be undertaken. The MNCR survey methodology was employed for the intertidal survey.

In accordance with MNCR guidance an intermediate-level survey was considered appropriate to describe baseline conditions. This enabled a rapid assessment of habitats and conspicuous fauna, between MHWS and MLWS, in addition to physical characteristics of the site and potential modifiers. Quadrat survey, core sampling, sieving and sediment size analysis were not considered necessary to inform this assessment. Abundances are described according to the MNCR SACFOR scale, which in summary is as follows: Superabundant (>80%), Abundant (40-79%), Common (20-39%), Frequent (10-19%), Occasional (5-9%), Rare (1-5%) and Present (<1%).

¹ CCBC Barbara Owsianka / Kate Surry [County Ecologists] pers. comms.20210628.

4.2 Limitations

The survey was undertaken within the recommended months of April to October. The advisory survey period typically permits suitable daylight hours around spring tides, better weather and greater floristic density and diversity. At the time of survey (25th June 2021) the weather was warm (11°C) and overcast with moderately heavy rain. The survey was timed to take advantage of lower tides (0.44m) with the biotopes in the vicinity of MLWS assessed at low tide (05:58 BST). Access to the full extent of the eulittoral to MLWS was not possible due to the tidal state; however, the majority of habitats were accessible at the time of survey. It is therefore considered that the biotopes and species identified are representative.

5 Results

5.1 Marine Desk Study

Mussel beds (presumed *Mytilus edulis*), a WFD Higher Sensitivity Habitat, are recorded over much of Penrhyn Bay on the MAGIC website. However, during the biotope survey no evidence of mussel beds were noted along the foreshore; neither in-situ nor washed up in the strandline. No further higher sensitivity WFD habitats are recorded within the study area; however, kelp beds are recorded at and below MLWS to the west and east of the site respectively.

The MAGIC records for WFD Lower Sensitivity Habitat are relatively consistent with habitats observed on site: intertidal soft sediment (sand and muddy sand), a cobble bank at MWHS and intertidal rocky habitats.

The MAGIC website does not have any records for Shellfish Areas or Classified Bivalve Mollusc Harvesting Areas within Penrhyn Bay; however, the Rhos-on-Sea Shellfish Area is located to the east of Penrhyn Bay and may coincide with potential access modifications.

5.2 Priority Habitats

The following Priority Habitats listed under Section 7 of the Environment (Wales) Act (2016) are present within the site.

- Intertidal boulder communities.
- *Sabellaria alveolata* (honeycomb worm) reefs.

It should be noted that, whilst *Sabellaria alveolata* have been identified within the proposed works area, the status of 'reefs' remains to be determined.

5.3 Intertidal Biotope Survey

5.3.1 Upper Shore Habitats

The promenade parallels the sea defences comprising parking areas, pedestrian access via the Wales Coast Path and the National Cycle Route No. 5 with accesses to the beach at intervals, seating and bike storage. Above the sea defence, coastal flora are influenced by their location within the 'splash zone' [Supralittoral Fringe], comprising a variety of coastal halophytic plants including: sea thrift (*Armeria maritima*), red valerian (*Cetranthus ruber*), red fescue (*Festuca rubra*), seaside daisy / seaside fleabane (*Erigeron glaucus*), sea campion (*Silene uniflora*) and sea beet (*Beta vulgaris*).

The beach is backed by a concrete sea defence with a wave return wall and stepped access down to the beach. In certain locations, erosion has resulted in a drop in levels and a fall risk from the lowest step to the beach. The seawall and concrete steps are inundated at high water; the former colonised by *Verrucaria maura* (tar lichen) and with grey / yellow lichens sporadic along the wave return

wall, whilst the concrete steps are colonised by patches of green alga (indet.), particularly adjacent to highway drainage outfalls.

Further westwards, sections of locally managed (residential) sea defences are present lacking the wave return wall or stepped concrete toe and comprise vertical bricked / concrete walls. To the east, the sea defence is enveloped by a cobble ridge that protects the defences in this location adjacent to the flood gate and highway access (proposed construction access) through the defence from Glan-y-Mor Road / Marine Drive. The rear of the cobble ridge is populated with sea beet, accompanied by yellow-horned poppy (*Glaucium flavum*), tree mallow (*Lavatera arborea*), wild carrot (*Daucus carota*), sea campion and red valerian. The main hardstanding on the shore side of the main flood gate is relatively devoid of mature flora.

5.3.2 Lower Shore (Beach) Habitats

The upper beach comprises a circa 5m wide shallow layer of shingle / cobble with scattered boulders and a sparse strandline. Below this much of the beach is dominated by fine to medium coarse sand with a predominantly deep anoxic layer with locally abundant *Lanice conchilega* (sand mason) and *Arenicola marina* (lugworm).

To the east of the bay, an above ground sewerage outfall extends halfway down the beach from the sea defence equidistant between MHWS and MLWS. Cracks in the pipework reflect changes in biodiversity as freshwater inputs create local variations. Further down the pipeline, the assemblage resembles the adjacent boulders, but with lower densities of *Sabellaria* and higher fucoid abundance.

A large extent of intertidal boulders with intermittent sand and rockpools create habitat complexity and increased biodiversity in the mid- to lower eulittoral. Much of the cobble area is stabilised by aggregations of tube-building polychaete worms: *Sabellaria alveolata* (honeycomb worm - hereafter referred to as 'Sabellaria') that may denote presence of Section 7 Priority Habitat. A general distribution of *Sabellaria* was noted (refer to Table 1 and Figure 1 within Appendix A), whereby the westernmost c. 50m width of boulder habitat is devoid of *Sabellaria*. In general, the southerly limit extends to c. 120m northwards of the sea defence (approximate northerly extent of the rock groyne); however, an outlier is present as indicated in Table 1 [see Ref. 5], where a narrow band of *Sabellaria* extends further south and overlaps with the proposed groyne footprint.

Isolated boulders recorded aggregations of *Sabellaria*, whereas 'crusts' of more extensive *Sabellaria* were recorded where larger substrate was denser forming a conglomerate of biogenic reef comprised of clusters of polychaete tubes that create a complex structure for other organisms to adhere to, creating a localised biodiversity 'hot spot'. 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. *Sabellaria alveolata* reefs are also a Priority Habitat in Wales; listed under Section 7 of the Environment (Wales) Act 2016.

Sabellaria quality is much higher in the eastern boulder habitat nearer to the pipeline and more so inshore. Here a dense thick crust has developed and may be reflective of previous extent and quality across the area. The *Sabellaria* is so extensive that it forms the predominant habitat having enveloped most of the underlying boulders and stabilising the habitat. Further west, and to a degree seaward, the quality of the *Sabellaria* decreases. Here much of the *Sabellaria* is eroded with only the underlying cementation obvious, tubes have broken off or been worn down, tube margins absent, open opercula limited and no indication of recent larval settlement.

Good quality aggregations were recorded on the eastern breakwater amongst the rock armour; and to a lesser extent at the western breakwater. The location of these aggregations suggests that exposure is a limiting factor at Penrhyn Bay and may account for the absence on the western boulder area and poorer quality *Sabellaria* westwards and seaward. *Sabellaria* is dependent on a degree of exposure to maintain planktonic food supply and sediment supply to enable tube building. However, overly exposed habitats risk erosion. Erosion of the *Sabellaria* crusts and aggregations may be due to both natural (erosion by smothering, storm damage, cobble movements, etc.) and potentially by anthropogenic factors (trampling).

Table 1: Southerly extent of *Sabellaria alveolata*; refer to Figure 1 in Appendix A (southerly extent mapped to reflect potential overlap with proposed groyne).

Ref.	Latitude / Longitude	National Grid Reference (NGR)	Eastings / Northings
1	53.320572, -3.763149	SH 82652 81855	282652 / 381855
2	53.319501, -3.761922	SH 82731 81734	282731 / 381734
3	53.319356, -3.761664	SH 82747 81717	282747 / 381717
4	53.319324, -3.761511	SH 82758 81713	282758 / 381713
5	53.318897, -3.7613861	SH 82765 81666	282765 / 381666
6	53.318808, -3.7613278	SH 82768 81656	282768 / 381656
7	53.318667, -3.761525	SH 82755 81640	282755 / 381640
8	53.318996, -3.761618	SH 82750 81677	282750 / 381677
9	53.318583, -3.7614056	SH 82763 81631	282763 / 381631
10	53.318764, -3.7611389	SH 82781 81651	282781 / 381651

Ref.	Latitude / Longitude	National Grid Reference (NGR)	Eastings / Northings
11	53.318557, -3.761677	SH 82744 81628	282744 / 381628
12	53.318752, -3.760881	SH 82798 81649	282798 / 381649

A relatively broad range of commonly occurring species were observed; including the following, SACFOR abundance denoted as [#]:

Algae – Chlorophyta (green seaweeds): *Ulva lactuca* [C] (sea lettuce), *Ulva intestinalis* (gutweed) [C].

Algae – Ochrophyta: Phaeophyceae (brown seaweeds): *Fucus serratus* [C] (serrated wrack), *Fucus spiralis* [C] (spiral wrack), *Saccharina latissima* (sugar kelp) [R], *Laminaria digitata* [P] (oarweed).

Algae – Rhodophyta (red seaweeds): *Porphyra* sp. [C] (laver), *Mastocarpus stellatus* [F] (grape-pip weed), *Corallina officinalis* [R] (coral weed), encrusting Rhodophycota (indet.) (*Lithothamnium* or similar) [R], *Palmaria palmata* [P] (dulse).

Bryozoa – *Flustra foliacea* (hornwrack) [P], epiphytic bryozoa (indet. on *F. serratus*) [P].

Cnidaria – *Actinia equina* [R] (beadlet anemone), *Urticina felina* (Dahlia anemone) [R].

Chordata: Aves (birds) - *Charadrius hiaticula* (ringed plover), *Larus argentatus* (herring gull), *Larus marinus* (great black-backed gull), oystercatcher (*Haematopus ostralegus*). **Pisces: Osteichthyes (fish) – *Lipophrys pholis*** (shanny), *Gaidropsarus mediterraneus* (shore rockling).

Crustacea: *Semibalanus balanoides* [C] (acorn barnacle), *Chthamalus* sp. [R] (stellate barnacle), *Porcellana platycheles* (broad-clawed porcelain crab), *Carcinus maenas* (green shore crab).

Mollusca: *Littorina littorea* [O] (common periwinkle), *Nucella lapillus* [O] (dog whelk), *Steromphala umbilicalis*² (flat top shell) [O], *Patella depressa* [O] (black-footed limpet), *Patella vulgata* [R] (common limpet), *Steromphala cineraria* (grey top shell) [R], *Littorina obtusata* (flat periwinkle) [P].

Polychaeta (worms): *Sabellaria alveolata* [O] (honeycomb worm), *Lanice conchilega* (sand mason) [F], *Arenicola marina* (lugworm) [F], *Spirorbinae* (tube worms) [O], *Spionidae* (*Pygospio elegans* [?]) / juv. *L. conchilega* [O].

Porifera (sponge): Porifera sp. (indet. sponge) [P].

² *Steromphala* previously *Gibbula*.

5.3.3 Western Breakwater

In the lee of the western breakwater, muddy sand dominates with a freshwater inflow at low water that carves sections of the sand revealing *Lanice conchilega* (sand mason) tubes. The muddy sand is predominantly anoxic and also maintains a covering of algal ‘flotsam’. *Arenicola marina* (lugworm) still persist in the muddy sand with patches of green alga (*Ulva intestinalis* – gutweed).

The western breakwater maintains a typical seaweed zonation from *Ascophyllum nodosum* (egg wrack) at the base, *Fucus spiralis* (spiral wrack) above and *Pelvetia canaliculata* (channelled wrack) at the top. In the more exposed sections, *Fucus serratus* (serrated wrack) takes over from *F. spiralis*, amongst small crusts and colonies of *Sabellaria alveolata* (honeycomb worm), occasional *Laminaria digitata* (kelp - oarweed), in a complex of red and green seaweeds: *Porphyra umbilicalis* (laver), *Ulva lactuca* (sea lettuce), *U. intestinalis*, etc. Juvenile *Lanice* occur in high abundance in discrete locations. A generally higher biodiversity is encountered at the breakwater.

5.3.4 Eastern Breakwater

The rock armour of the eastern breakwater appears to be at a lower elevation than the western breakwater and maintains a more eulittoral community than the zonation present in the former. Fucooids, red and green algae cover all aspects and elevations of the rock armour, comprising *F. serratus*, *U. lactuca*, *U. intestinalis*, *P. umbilicalis* and *P. palmata*, most likely obscuring assemblages of cryptic fauna. In the more sheltered sections between rock armour units, *Sabellaria* colonies have grown to decent size and remain in good quality with crisp and open apertures. The smaller boulders are largely dominated by *Ulva* spp., whilst a strandline of detached seaweed lies amongst and below the smaller rock units. Beyond this and between the eastern breakwater and the DCWW pipeline is fine to medium sand with *Arenicola marina* and foraging ringed plover.

5.3.5 Intertidal Biotopes

Species zonation, distribution and abundance varied throughout the Study Area. The key biotopes have been identified in Table 2 below. No marine Invasive and Non-Native Species (INNS) were recorded during the survey.

Table 2: Intertidal Biotopes Recorded

Zonation	Biotope Code	Biotope	Locality
Supralittoral Fringe	LS.LCS.Sh	Shingle (pebble) and gravel shores	Cobble ridge
Supralittoral Fringe	LR.FLR.Lic.YG	Yellow and grey lichens on supralittoral rock	Wave return wall and vertical concrete surfaces.
Upper Littoral Fringe	LR.FLR.Lic.Ver.Ver	<i>Verrucaria maura</i> on littoral fringe rock	Concrete sea defence wall.
Upper Littoral Fringe	LR.FLR.Eph.Ent	<i>Ulva</i> [<i>Enteromorpha</i>] spp. on freshwater-influenced and/or unstable upper eulittoral rock	Concrete stepped access; locally abundant in vicinity of surface water outfalls.
Lower Littoral Fringe	LS.LSa.Mo.Sa.BarSa	Barren Littoral Coarse Sand	Upper shore adjacent to sea defences.
Lower Littoral Fringe	LR.MLR.BF.PeIB	<i>Pelvetia canaliculata</i> and barnacles on moderately exposed littoral fringe rock	Upper elevations of western breakwater
Upper- / Mid-Eulittoral	LR.LLR.F.Asc.FS	<i>Ascophyllum nodosum</i> on full salinity mid eulittoral rock	Lower elevations of western breakwater
Mid-Eulittoral	LS.LSa.MuSa.MacAre	<i>Macoma balthica</i> and <i>Arenicola marina</i> in littoral muddy sand	Sheltered lee of western breakwater
Mid-Eulittoral	LR.LLR.F.Fspi	<i>Fucus spiralis</i> on moderately exposed to very sheltered upper eulittoral rock	South-western boulder habitats devoid of <i>Sabellaria</i> .
Mid- / Lower Eulittoral	LS.LSa.MuSa.Lan	<i>Lanice conchilega</i> in Littoral Sand	Sandy areas throughout Study Area.

Zonation	Biotope Code	Biotope	Locality
Lower Eulittoral	LR.MLR.BF.Fser.Bo	<i>Fucus serratus</i> and under-boulder fauna on lower eulittoral boulders	North-western boulder habitats devoid of <i>Sabellaria</i> / eastern breakwater.
Mid- / Lower-Eulittoral	LS.LBR.Sab	Littoral <i>Sabellaria</i> honeycomb worm reefs	Intertidal boulder habitat – eastern and northern sections. Lower elevations of western and eastern breakwaters.

6 Impact Assessment

Broadly, the marine habitats and species present are commonly occurring and of lower importance; however, intertidal reefs of encrusting worm tubes (*Sabellaria alveolata* reefs) and intertidal boulder communities comprise Priority Habitats in Wales. Regardless, measures should be adopted to avoid direct and indirect effects, e.g. pollution incidents, on all intertidal habitats throughout the development area.

6.1 Direct Effects

Sabellaria alveolata colonies are listed as a Priority Habitat and will require sensitive consideration as the key intertidal feature during detailed design and integration of mitigation and enhancement measures. *Sabellaria* colonies are ephemeral features, as such their distribution can change markedly from year to year resulting from natural and / or anthropogenic impacts. *Sabellaria* are resilient to inundation by sand for short to medium periods or annual decimation by winter storms. As an R-selected species³ that relies on reproduction and larval settlement to maintain populations, significant losses naturally occur with often rapid recruitment to re-establish local populations⁴.

The extent of the *Sabellaria alveolata* reef at Penrhyn Bay confers high value, considered to be of County importance for its own inherent value and the benefits it provides in stabilising habitat, creating habitat complexes and locally increasing diversity.

The modelled groyne design (refer to Figure 1b and Appendix A) encroaches on circa 0.5ha of intertidal boulder habitat. Approximately 0.15ha is considered to encroach on the *Sabellaria* biotope.

Consideration had been given to modelling a westward shift of the structure by 20m. A shift of the structure west to reduce direct impact on *Sabellaria* area means that additional volume of beach nourishment is required in the western embayment to maintain a stable beach against predominant wave conditions. The predominant wave conditions determine the shape of the beach.

Repositioning the groyne 15-20m west has little impact on the *Sabellaria* habitat loss, reducing footprint overlap by only 0.03ha; i.e. a 0.12ha overlap remains. The additional beach nourishment material required to maintain a stable beach is estimated at 10,000m³ and would cover an additional 0.12ha of sandy beach amenity. This change would increase the overall cost by £400,000 making it unviable. Shifting the groyne structure 40m west to reduce almost entirely the direct impact on *Sabellaria* would likely result in more than twice the additional

³ Typical characteristics of an 'r-selected' species include: rapid reproduction, short lifespan and high dispersal potential (Krönke, 1990; Niermann et al., 1990). 'r-selected species', also called r-strategist, species whose populations are governed by their biotic potential (maximum reproductive capacity, r). The production of numerous small offspring followed by exponential population growth is the defining characteristic of r-selected species.

⁴ JNCC, 2016. UK Biodiversity Action Plan Priority Habitat Descriptions. *Sabellaria alveolata* Reefs

volume of beach nourishment and cost, but more importantly would not be effective as coastal defence and not achieve the necessary objectives.

Considering *Sabellaria* density and quality is poorer in the affected location, a significant impact on the population of the species is not considered likely. Furthermore, the best quality habitats to the east of the boulder habitats will remain unaffected by direct effects of the scheme.

No *Sabellaria* will be affected by the proposed beach nourishment as this activity is proposed beyond the southerly limit of *Sabellaria*. Commonly occurring species will be affected by the beach nourishment; an estimated 4,000m² of habitat may be lost to beach nourishment.

6.2 Indirect Effects

The risk of a pollution incident during construction will require mitigation and integration into the appointed Contractor's Construction Environmental Management Plan (CEMP). Similarly, measures will be required to prevent the tracking of vehicles or storage of materials on or near sensitive habitats.

Changes to coastal process following installation of the groyne are considered to be beneficial in managing existing sediment budgets and reducing the exposed nature of the site, which is considered will support more robust growth of *Sabellaria* through reduced erosion. During the operational phase, trampling, littering and fouling effects would need to be addressed to avoid increased visitor numbers leading to a deterioration in habitat quality.

7 Preliminary Mitigation

7.1 Direct Effects

Noting the inclusion of *Sabellaria* on the Priority Habitats list, and the duties imposed on CCBC to conserve and enhance biodiversity, impacts on *Sabellaria alveolata* are to be mitigated in accordance with the mitigation hierarchy: avoid, cancel, reduce or offset adverse effects.

It was apparent that rock armour (eastern and western breakwaters) provides suitable attachment material and hydrological conditions to support the active growth of *Sabellaria alveolata* colonies. The breakwaters were also observed to support better quality aggregations than the more exposed boulder area. The addition of hard substrate in the form of the extant breakwaters has already increased local biodiversity and actively manage local coastal processes to favour increased intertidal biodiversity.

Direct loss of *Sabellaria* and Intertidal Boulder Habitat is considered to be directly offset by the provision of the rock armour units which create new attachment substrate for colonisation with similar habitat complexity. Without mobility, reduced exposure, abrasion and smothering risk, the rock armour habitat is likely to lead to enhanced abundance and support the growth of robust and healthy *Sabellaria* aggregations that will increase local fecundity, supporting natural regeneration of *Sabellaria* in locations benefiting from the improved coastal processes delivered by the groyne. In time, the cobbles installed as beach nourishment may support further colonisation by *Sabellaria*, extending the reach of the boulder habitat.

Given the ephemeral nature of *Sabellaria* colonies, a pre-construction condition survey is advised prior to construction (including temporary works) to enable pre- and post-construction monitoring of *Sabellaria* extent and condition, in addition to wider biotopes, to inform subsequent coastal defence schemes.

7.2 Indirect Effects

Adherence to the Guidelines for Pollution Prevention⁵ will be essential to avoid impacts on sensitive marine habitats in the event of a pollution incident. Mitigation measures are also recommended to avoid access to sensitive habitats where trafficking of vehicles may directly impact *Sabellaria alveolata* colonies or the Intertidal Boulder communities; consideration of appropriate fencing may be required pending design details.

A Coastal Water Framework Directive (WFD) Compliance Assessment will be undertaken to confirm the design and construction methods will not lead to a deterioration in WFD status or prolong the attainment of targeted objectives.

⁵ <http://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/>

Operationally, information boards are recommended to inform local residents and visitors of the presence, importance and fragile nature of the *Sabellaria alveolata* reefs. Education should reduce trampling effects and combined with the provision of additional refuse (including dog waste) and recycling bins, will support an improvement of local habitat quality.

Since works are proposed within the marine environment, it is recommended that a Biosecurity Risk Assessment is prepared in advance to avoid the risk of introduction of marine INNS.

A section of the North Wales Important Bird Area is located behind the existing cobble ridge. Temporary hoarding is recommended during any construction works required between the ringed plover breeding season of May – August inclusive to avoid disturbance. Where practicable, all activities required in the vicinity of the breeding area are to be scheduled outside the breeding season. Permanent screening is recommended to be integrated into the scheme design to avoid disturbance from promenade users, and appropriate exclusion and signage on the beach-side breeding area. Enhancement of the breeding habitat should be integrated into the design and landscaping solutions following advice from an experienced ornithologist.

7.3 Enhancement

It is strongly recommended that enhancement measures are considered for integration into the detailed design.

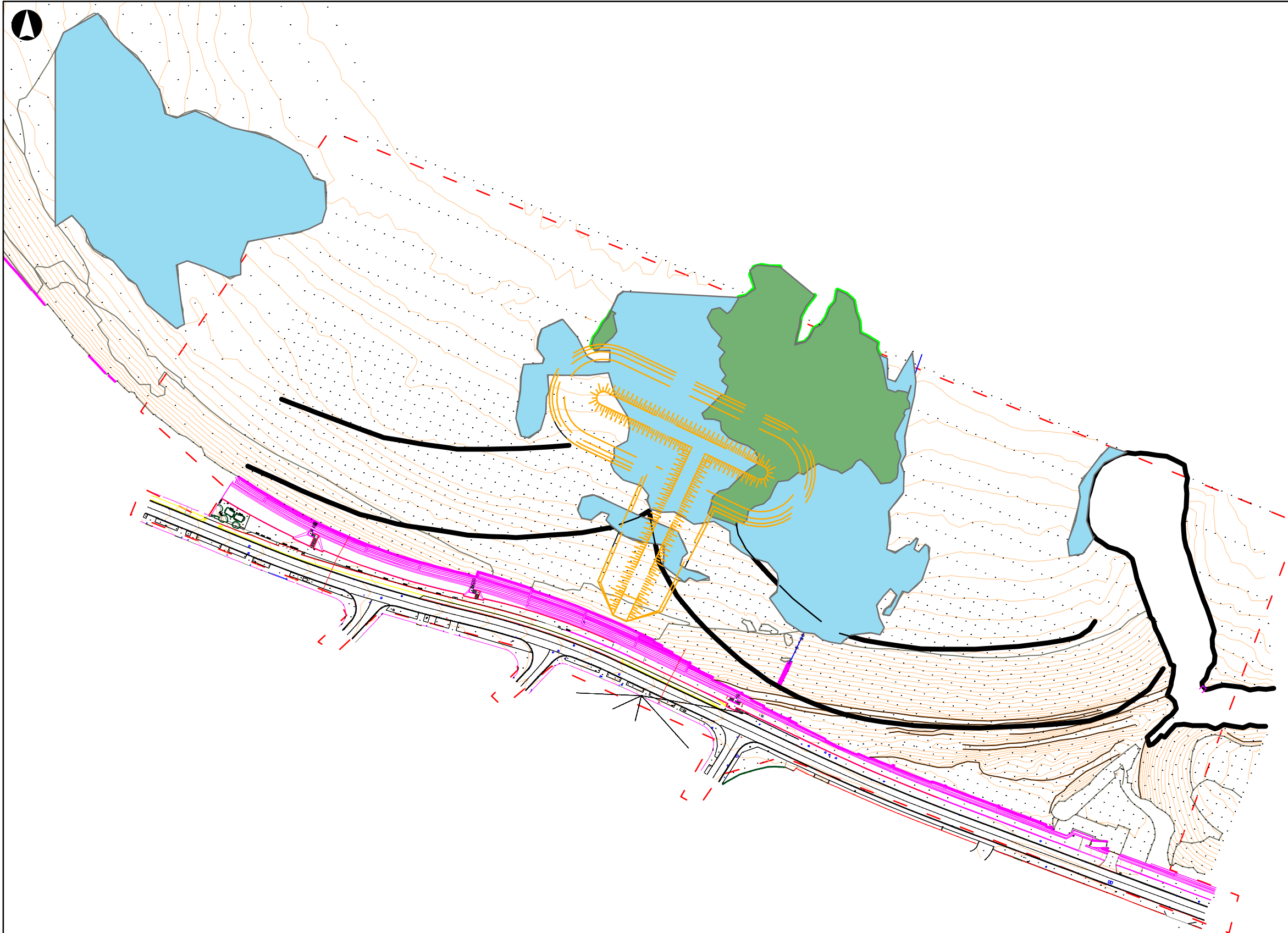
Six tidal pools are to be created at the toe of the groyne at the low tide area. These concrete tidal pools will retain water at low tide and improve the biodiversity of the groyne through an increase in habitat heterogeneity. Integration of units such as Econcrete: Tide Pool Armour or similar are recommended as they can be integrated into the detailed design whilst concomitantly delivering marine biodiversity enhancement. Should beach nourishment levels allow, installation of Vertipools (or similar) on the front face of the stepped concrete revetment would provide additional offsetting / enhancement. Installation in groups of five spaced at c. 50m intervals would provide clusters of biodiversity enhancement further up the beach and provide an educational interest and resource for beach users.

Whilst operational impacts are scoped out from this assessment, noting that no maintenance activities are proposed, it is worth noting that changes to coastal process following installation of the groyne are considered to be beneficial in managing existing sediment budgets and reducing the exposed nature of the site, which is considered will support more robust growth of *Sabellaria* through reduced erosion.

Appendix A

Intertidal Biotope Plan

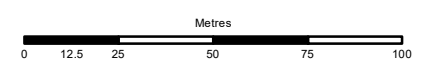
A1 *Sabellaria alveolata* and Intertidal Boulder Biotope Plan



- Legend
- Proposed Groyne Outline
 - Proposed Beach Nourishment Outline
 - COVER
 - Sabellaria alveolata (honeycomb worm) reefs
 - Intertidal boulder communities
 - - - Works Area

001	2021-09-21	VS	SC	GM
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Issue	Date	By	Chkd	Appd



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Client
CONWY COUNTY BOROUGH COUNCIL

Job Title
PENRHYN BAY COASTAL DEFENCE IMPROVEMENTS

SABELLARIA ALVEOLATA & INTERTIDAL BOULDER COMMUNITIES, PENRHYN BAY

Scale at A3
1:2,000

Job No 282129-50	Drawing Status FINAL
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Drawing No 001	Issue 001
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Appendix B

Intertidal Biotope Survey Photographs



Figure 1: Top Left: Sea defence and wave return wall; view west. Top Right: Sea defence and wave return wall; view east. Bottom Left: Core scheme area, boulder habitat (darker habitat) seaward. Bottom Right: Intertidal boulder habitat with *Sabellaria* crust; beyond groyne footprint, view east.



Figure 2: Top Left: Intertidal boulder habitat with *Sabellaria*; beyond groyne footprint, view south. Top Right: Intertidal Boulder habitat; main area of groyne encroachment (not foreground), largely devoid of *Sabellaria* except for narrow band north to south. Bottom Left: Sewerage Pipeline / Outfall. Bottom Right: Eastern extent of rock groyne.



Figure 3: Eroded *Sabellaria alveolata* aggregations.



Figure 4: Higher Quality *Sabellaria alveolata* aggregations eastwards. Top Left: Eastern Boulder Area adjacent to pipeline. Top Right: Quality colonies in lee of pipeline. Bottom Left: Encrusted Boulder. Bottom Right: Aggregations in Eastern Breakwater rock armour.



Figure 5: Top Left: Important Bird Area – Breeding Ringed Plover. Bottom Left: Ringed Plover Foraging. Top Right: Main access via Glan-y-Mor Road / Marine Drive. Bottom Right: Likely construction access route to beach.