Eastern Green Link 3

Marine Environmental Appraisal

Chapter 7 - Intertidal and Subtidal Benthic Ecology

Prepared for: Scottish Hydro Electric Transmission plc (SHE-T)

Scottish & Southern Electricity Networks
TRANSMISSION

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Abbreviations/Glossary

BGS	British Geological Survey
Biotope	An area of uniform environmental conditions and a specific assemblage of plant and animal species
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CEMP	Construction Environmental Management Plan
CSEMP	Clean Seas Environmental Monitoring Programme
CIEEM	Chartered Institute for Ecology and Environmental Management
DDV	Drop-down video
Defra	Department for Environment, Food and Rural Affairs
EC	European Commission
EGL	Eastern Green Link
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EMODnet	European Marine Observation Data Network
Epifauna	Animals living on the surface of the seabed
EUNIS	European Union Nature Identification System
FeAST	Feature Activity Sensitivity Tool
FMMP	Fisheries Management and Mitigation Plan
Habitat	A habitat is the natural environment in which a particular species or community of organisms lives, grows, and reproduces. It provides the physical and biological conditions necessary to sustain life, including food, shelter, water, and space.
HDD	Horizontal Directional Drilling
HRA	Habitats Regulations Appraisal
HVDC	High Voltage Direct Current
Infauna	Animals living in the seabed
Intertidal	Area of seabed between MHWS and MLWS which is periodically covered by the sea and exposed to the air.
JNCC	Joint Nature Conservation Committee
km	Kilometre
KP	Kilometre Point
LAT	Lowest Astronomical Tide
m	Metres
MarESA	Marine Evidence-based Sensitivity Assessment
MarLIN	Marine Life Information Network
MARPOL	Prevention of Pollution at Sea
MD-LOT	Marine Directorate – Licensing Operations Team
MEA	Marine Environmental Assessment
MEAp	Marine Environmental Appraisal
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMMP	Marine Mammal Mitigation Plan
MPA	Marine Protected Area
MPCP	Marine Pollution Contingency Plan

NCMPA	Nature Conservation Marine Protected Area
NM	Nautical Mile
NMPI	National Marine Plan Interactive
OSPAR	Oslo and Paris Convention
PLGR	Pre-Lay Grapnel Run
PMF	Priority Marine Feature
PSA	Particle Size Analysis
RLB	Red Line Boundary
SAC	Special Area of Conservation
SACFOR	Semi-quantitative estimation of abundance Superabundant, Abundant, Common, Frequent, Occasional, Rare.
SFF	Scottish Fishermen's Federation
SOLAS	Safety of Life at Sea
SSC	Suspended Sediment Concentrations
SSSI	Site of Special Scientific Interest
Subtidal	Area of seabed below MLWS which is permanently below water
UK	United Kingdom
UKASH	United Kingdom Atlas of Seabed Habitats
UKBF	United Kingdom Biodiversity Framework
UKOOA	United Kingdom Offshore Operations Association
USA	United States of America
UXO	Unexploded ordnance
ZoI	Zone of Influence

7. Intertidal and Subtidal Benthic Ecology

7.1. Introduction

This chapter of the Marine Environmental Appraisal (MEAp) describes the potential impacts arising from the construction, operation and maintenance, and decommissioning of the Proposed Development on intertidal and subtidal benthic ecology. For the purposes of seeking the necessary consents, the Eastern Green Link (EGL) 3 Project has been split into different 'Schemes' i.e. English Onshore Scheme, English Offshore Scheme, Scottish Onshore Scheme and the Scottish Offshore Scheme (with the latter herein after referred to as 'the Proposed Development'). Collectively all components of EGL 3 are referred to as "the Project".

A description of the works expected to be undertaken during construction, operation and maintenance and decommissioning of the Proposed Development is provided in **Chapter 3: Project Description**. The Proposed Development, defined spatially by the Red Line Boundary (RLB), includes approximately 145 kilometres (km) of subsea High Voltage Direct Current (HVDC) cables. The RLB extends from mean high water springs (MHWS) at the proposed landfall at Sandford Bay, Scotland, to the boundary with adjacent English waters and is nominally 700 metres (m) wide. This width is considered adequate to micro-route around a sensitive seabed feature or habitat, or to allow for the footprint of installation vessels and is the maximum extent of seabed in which construction and operation of the Proposed Development may take place. The RLB is shown in **Figure 7-1 (Drawing reference C01494-EGL3-MEA-GEO-007-F)**.

As set out in **Chapter 1: Introduction**, cable installation and some associated activities beyond 12 nautical miles (NM) are exempt from the requirement to obtain a Marine Licence under the Marine and Coastal Access Act 2009 as well as repair of the installed cable in onshore and offshore waters. This chapter presents an assessment of the effects of the Proposed Development from MHWS at the Sandford Bay landfall to the border with English adjacent waters. This is to provide a holistic view of the Proposed Development and any associated impacts. However, consent is not being sought for the exempt cable (either installation or repair) and only cable protection would be included in the Marine Licence beyond 12 NM.

Kilometre Points (KPs) are used throughout this chapter to provide context as to where within the Study Area a feature lies (see **Section 7.1.1** for definition of Study Area). KP 436 is defined at the border with adjacent English waters, while KP 580 is defined at the proposed landfall in Sandford Bay, Peterhead.

Benthic receptors include the organisms living in (infauna) or on (epifauna) the seabed and their supporting habitats, but excludes shellfish except ocean quahog, which are covered in **Chapter 8: Fish and Shellfish**. Where appropriate, the chapter identifies proportionate measures to avoid, reduce or offset any predicted adverse effects.

This chapter should be read in conjunction with:

- **Chapter 3: Project Description;**
- **Chapter 4: Marine Environmental Appraisal Scope and Methodology**;
- **Chapter 6: Marine Physical Processes** which identifies the spatial extent of potential impacts from temporary sediment suspension and subsequent redeposition; and
- **Chapter 8: Fish and Shellfish** which identifies the potential impacts on fish and shellfish species many of which rely on specific benthic ecological habitats for prey or breeding habitat.

This chapter is also supported by the following appendices:

- **Appendix 2A: National Marine Plan Compliance Assessment**
- **Appendix 3A: Electric and Magnetic Field Assessment**
- **Appendix 3B: Outline Construction Environmental Management Plan (CEMP)**
- **Appendix 3C: Heat Calculations**
- **Appendix 5A: Habitats Regulations Appraisal (HRA) Stage 1 Screening**
- **Appendix 5C: Marine Protected Area (MPA) Assessment Stage 1 Initial Screening**
- **Appendix 7A: Scotland Environmental Baseline Report – EGL 3**

7.1.1. Study Area

The Proposed Development will route from MHWS at Sandford Bay, Peterhead, to the border between Scottish and English adjacent waters. The Study Area for intertidal and subtidal benthic ecology, relevant to the Marine Environmental Assessment (MEA), includes the RLB to MHWS plus an additional 15 km buffer on either side (hereafter in this chapter referred to as the "Study Area"). **Chapter 6: Marine Physical Processes** establishes 15 km as a precautionary zone of influence (ZoI) within which the deposition of suspended sediments would occur. This therefore represents the maximum ZoI for direct and indirect impacts on intertidal and subtidal benthic ecology. The Study Area is shown in **Figure 7-1 (Drawing reference C01494-EGL3-MEA-GEO-007-F)**.

7.2. Data Sources

The intertidal and subtidal benthic ecology baseline characterisation has been determined based on a review of publicly available information, project-specific survey data and consultation with relevant organisations. This provides a robust, up-to-date characterisation of the benthic environment within the Study Area in accordance with relevant guidance for this topic.

7.2.1. Benthic Characterisation Survey Data

Marine characterisation surveys were undertaken in 2023 and 2024 to provide a baseline and habitat assessment of the intertidal and subtidal areas within the Proposed Development; from the proposed landfall in Sandford Bay, Peterhead to the boundary with English adjacent waters. The survey area encompassed a 500 m wide area along the length of the Proposed Development, including the landfall up to MHWS.

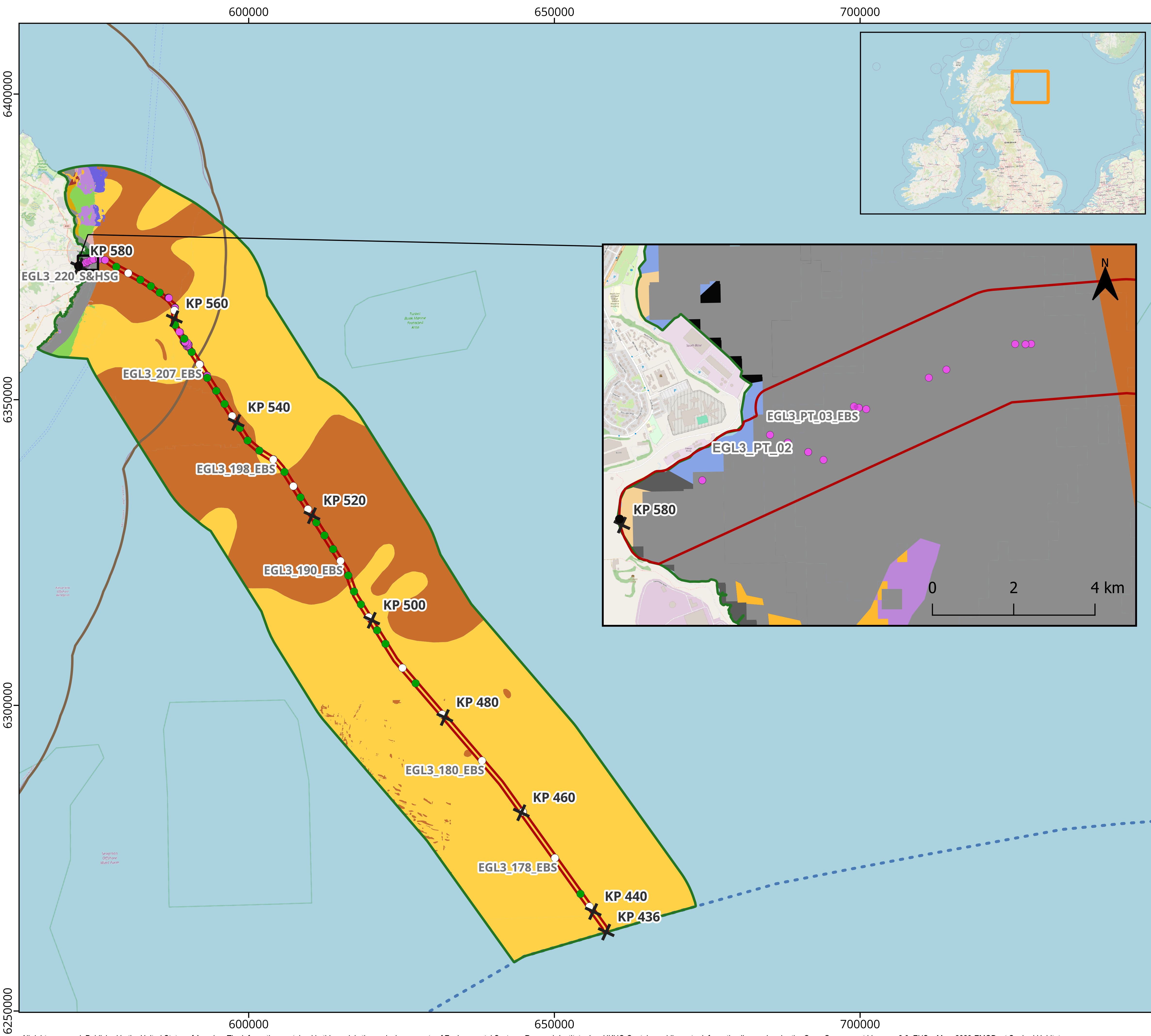
An intertidal survey was undertaken in October/November 2023. This included shore inspections along 13 transects, to identify habitats and species presence, and the collection of nine grab samples between MHWS and Mean Low Water Springs (MLWS).

Subtidal geotechnical, geophysical and seabed sampling was carried out in three operational phases between December 2023 – November 2024, August 2023 – June 2024 and June 2024 - September 2024, respectively. The geophysical survey involved the acquisition of bathymetry data via multibeam echosounder, side scan sonar, sub-bottom profiler and magnetometry to establish the presence of any seabed features that may be of conservation interest.

Seabed sampling included grab sampling using a Dual Van Veen or a Mini Hamon grab at 47 locations to characterise sediment composition and infaunal and epifaunal communities. Of these 47 stations, 6 were positioned within Peterhead nearshore; due to the presence of rocky substrate no grab sample was acquired at station EGL3_PT_01_EBS within Peterhead nearshore, reducing the number of grab samples acquired to five in the nearshore and 46 in total. This was supplemented by drop-down video (DDV) and photography at 63 transect locations to characterise baseline habitats further and establish the potential presence of sensitive habitats and species and/or protected features. All sediment samples were assessed for Particle Size Analysis (PSA) and sediment chemistry (except SB_INT_ENV_04 due to underlying geology), and macro-invertebrate analysis was conducted at 20 of the 47 stations. Grab sampling stations and camera transect locations are shown in **Figure 7-1 (Drawing reference C01494-EGL3-MEA-GEO-007-F)**.

The benthic characterisation survey data were used to produce intertidal and subtidal habitat maps and to determine biotope classifications where feasible. Habitats and biotopes were identified to the lowest classification possible as determined by the European Nature Information System (EUNIS) (EUNIS, 2022) and the Joint Nature Conservation Committee (JNCC) Marine Habitat Classification for Britain and Ireland (JNCC, 2022).

Further details of the benthic characterisation survey methodologies can be found in **Appendix 7A: Scotland Environmental Baseline Report – EGL 3.**



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Subtidal Sampling Stations, Camera Transects and Predicted Intertidal and Subtidal Broadscale Benthic Habitats within the Study Area

C01494-EGL3-MEA-GEO-007-F

Legend

- Red Line Boundary
- Study Area (15km Buffer)
- Sandford Bay Landfall
- Indicative KP (labelled at 20km intervals)

Sample/ Survey Type

- EBS/ Camera Transect
- PSA
- Camera Transect

Intertidal predicted benthic habitat (EUSeaMap, 2023)

- Boulders/ loose rock
- Gravel
- Made ground (man-made)
- Not present
- Rock platform
- Rock platform with boulders/ loose rock
- Sand
- Sand & gravel
- Unspecified

Subtidal predicted benthic habitat (BGS, 2006)

- MB12: Atlantic infralittoral rock
- MB32: Atlantic infralittoral coarse sediment
- MB52: Atlantic infralittoral sand
- MC12: Atlantic circalittoral rock
- MC32: Atlantic circalittoral coarse sediment
- MC52: Atlantic circalittoral sand
- MD12: Atlantic offshore circalittoral rock
- MD32: Atlantic offshore circalittoral coarse sediment
- MD52: Atlantic offshore circalittoral sand
- Na
- Scottish Adjacent Waters
- 12NM Limit

0 10 20 30 KM
0 5 10 15 NM

N

Date	07/07/2025
Coordinate System	WGS 84 / UTM zone 30N
Projection	Universal Transverse Mercator (UTM)
Unit	meters
Scale at A3	1:600,000
Created	JC
Reviewed	AN/RC
Authorised	JDM

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7.2.2. Publicly Available Data

A desk-based review of publicly available data has also been undertaken to supplement benthic characterisation survey information and to describe the wider environment within the Study Area. **Table 7-1** lists the key data sources which have been used to characterise the intertidal and subtidal benthic ecology baseline.

Table 7-1: Key publicly available data sources for intertidal and subtidal benthic ecology

Data source	Description	Reference
European Marine Observation and Data Network (EMODnet) Predicted Habitat Distributions	Broad-scale seabed habitat maps developed from long-term European marine data from national and international monitoring programmes. These broad-scale seabed habitat maps provide a predictive delineation of habitats within all European seas to the EUNIS classification system (EUNIS, 2022).	EMODnet (2025)
JNCC Marine habitat data product: Habitats Directive Annex I marine habitats	Map showing indicative distribution and extent of Annex I habitats classified under the Habitats Directive.	JNCC (2024a)
British Geological Survey (BGS) Marine Sediment Particle Size Dataset	A national dataset sourced from the BGS GeoIndex Offshore portal. Provides full coverage of intertidal and subtidal areas of the Study Area.	BGS (2025)
JNCC United Kingdom Atlas of Seabed Habitats (UKASH)	Includes the UKASH mosaic of localised maps, UKSeaMap and UKASH Combined Map, which provide the most comprehensive coverage of subtidal habitats in the United Kingdom (UK).	JNCC (2025)
Centre of Environment, Fisheries and Aquaculture Science (Cefas) OneBenthic Portal and Tools	Collation of benthic data sets, including infaunal and macrofaunal assemblages and non-native species distributions across the UK.	Cefas (2023)
Department for Environment, Food and Rural Affairs (Defra) Intertidal Substrate Foreshore	Collation of beach composition information for the intertidal foreshore in England and Scotland.	Defra (2025)
NatureScot's SiteLink and Spatial Data Hub	Provides information on Scottish designated sites and Priority Marine Features (PMFs).	NatureScot (2023; 2024; 2025a)
Environmental assessments for other relevant marine infrastructure projects	Historical baseline information for the Study Area produced to support environmental assessments for other relevant marine infrastructure projects within the Study Area, including Eastern Green Link 2 (EGL 2).	Multiple sources – see references herein
Marine Scotland National Marine Plan Interactive (NMPI)	Provides information on Scottish designated sites and PMFs.	Marine Scotland (2025)
EUNIS for classifying benthic habitats.	Provides a background on the EUNIS classification system for defining intertidal and sub-tidal habitats found in European waters	EUNIS (2022)
JNCC Marine Protected Area (MPA) Habitat Mapper	Provides details and locations of offshore (>12 NM) MPAs.	JNCC (2024b)
PMFs	List of habitats and species considered as PMF in Scottish Waters	Nature Scot (2020)
Defining and managing *Sabellaria spinulosa* reefs	Method for assessing and defining the quality of potential Annex I reef feature formed by *S. spinulosa*	Gubbay, (2007)
The identification of the main characteristics of Annex I	Method for assessing and defining the quality of potential Annex I reef feature formed by cobbles/boulders and bedrock exposures	Irving (2009)

Data source	Description	Reference
stony reef habitats under the Habitats Directive		
Refining the criteria for defining areas with a 'low resemblance' to Annex I stony reef	Refinement of the method for assessing and defining the quality of low resemblance Annex I reef features formed by cobbles/boulders and bedrock exposures	Golding, Albrecht, & McBreen (2020)
United Kingdom Offshore Operators Association (UKOOA) sediment quality guidelines for the UK North Sea	Guidelines for assessing sediment quality in the UK North Sea. Primarily focused on the oil and gas industry but relevant to other industries	UKOOA (2001)

7.3. Consultation

7.3.1. Non-Statutory Scoping

In January 2024, a MEA Non-Statutory Scoping Report was submitted to the Scottish Government Marine Directorate – Licensing Operations Team (MD-LOT) as part of a pre-application consultation exercise for the Proposed Development. Responses from consultees were received on 15 July 2024. Responses which are relevant to this chapter were received from the following stakeholders:

- NatureScot;
- Scottish Fishermen's Federation (SFF);
- JNCC; and
- Aberdeenshire Council.

The feedback received broadly confirmed that consultees were content with the proposed scope of the intertidal and subtidal benthic ecology MEA as set out in the MEA Non-Statutory Scoping Report. **Table 7-2** summarises the comments received, and the regard given to these in preparing this chapter.

Table 7-2: Summary of consultee responses on the MEAp Non-Statutory Scoping Report

Consultee	Comments	Response
NatureScot	The Study Area has been defined using the same approach as **Chapter 6: Marine Physical Processes**. We note that the Study Area will be reviewed and refined based on the sediment dispersion modelling. We agree with this approach.	This comment is noted. The Study Area (see **Section 7.1.1**) has been validated by sediment dispersion modelling conducted as part of the **Chapter 6: Marine Physical Processes** assessment. 15 km is a precautionary maximum ZoI.
	We broadly agree with the proposed approach for this topic but disagree with the conclusion that electromagnetic field (EMF) should be scoped out at this stage. Whether it is appropriate to include in this chapter or within **Chapter 8: Fish and Shellfish Ecology**, we advise that EMF should be given consideration within the MEAp. EMF levels from the cable should be modelled and consideration given to the fish and shellfish species that are present and may be affected by EMF.	Impacts of electromagnetic changes/barriers to species movements from the presence of subsea cables to benthic species have been assessed in **Section 7.8.4** of this chapter. This includes consideration of predicted effects on species of mollusc and crustacean which can detect electric and magnetic fields and therefore may be sensitive to EMF exposure. **Appendix 3A: Electric and Magnetic Field Assessment** presents the assessment of the maximum design scenario of EMF impacts for the Proposed Development.
	Once baseline surveys have been completed, we will be happy to advise further on any issues that may be seen as environmental constraints and require further consideration. Broadscale habitat that are also PMF features need to be considered further within the MEAp.	This comment is noted and welcomed. Scottish PMFs, including broadscale habitats present within the Study Area, have been identified in **Section 7.4.4** and considered in the assessment (**Section 7.8)** where appropriate.
	We welcome the addition of decommissioning phase into the scoping assessment of impacts. Given the increasing shared nature of the marine space, further consideration should be given for the removal of cable and cable protection within the design phase of this project to allow for future removal.	This is noted. A high level assessment of decommissioning effects has been incorporated into the assessment presented in **Section 7.8**.
JNCC	**Benthic characterisation survey data** JNCC agrees with the applicant's approach of extending the survey from 500 m wide to 1 km where sensitive features are found as this will allow more options with micro-routing. We also agree with the applicant's approach to grab sample survey design having flexibility and spacing intervals being based on geophysical survey outputs. However, we would recommend that the applicant does not limit their anticipated survey spacing to every 5-10 km before they have reviewed the outputs of the geophysical survey. If the applicant finds sensitive habitat throughout the survey area, we would recommend adequate video surveillance sampling is used to map the extent of the feature in order to understand the potential to micro-route around these features.	The RLB has been increased from the area surveyed by the marine reconnaissance survey and is generally nominally 700 m. This width is considered adequate to accommodate any potential need for micro-siting around a seabed feature or habitat, or to allow for the footprint of installation vessels. DDV was used at several transect locations along the RLB where review of geophysical data identified potentially sensitive features (see **Section 7.2.1**).
	Protected features and features within the Scottish study area JNCC recognise that the cable scoping boundary does not intersect with any Scottish offshore sites and so there will likely be no impact pathway to the features of these sites. However, we agree with the applicant considering other sensitive features such as burrowed mud and ocean quahog. We encourage the applicant to identify and map the presence of PMFs throughout the scoping area and endeavouring to avoid these features where possible.	Sensitive intertidal and subtidal features, including those classified as PMFs, are outlined in **Section 7.4.4** and associated pressure-receptor pathways are assessed in **Section 7.8**. Where required, mitigation measures to avoid sensitive features have been identified and outlined in **Section 7.9**. Sensitive intertidal and subtidal features present within the Study Area have been mapped and are presented in **Figure 7-2**. The presence of subtidal sands and gravels within the RLB are presented in **Figure 3-75** to **Figure 3-79** in **Appendix 7A: Scotland Environmental Baseline Report – EGL 3**.
	Scope of assessment JNCC disagrees with some of the scoping assessments presented by the applicant. There are some impacts that could be scoped out when occurring outside of designated sites**. Table 5.3** and **7.3** identify which sites are within or outside the scoping boundary however this has not been clearly defined in the scoping. Additionally, these impacts are not clearly defined for the offshore and inshore, or English and Scottish waters, we therefore suggest the activities which have been scoped out that produce temporary habitat loss / seabed disturbance to subtidal broadscale habitats (boulder clearance, Pre-Lay Grapnel Run (PLGR), pre-sweeping of sand waves; cable burial and trenching; anchoring/jack-up foundations; and deposit of external cable protection) are scoped in or considered on a site by site basis. Whilst we recognise that there are no designated sites in offshore Scottish waters, there are broadscale habitat PMFs for which these impacts are relevant and should be scoped in. For other sites designated for benthic features within the inshore area we defer to NatureScot. JNCC consider these activities to have a physical impact to subtidal broadscale habitats that requires assessment, most particularly where features rely on such habitats (e.g., the PMF ocean quahog), and are sensitive to disturbance. JNCC does not consider there to be sufficient evidence to support the assumption boulder clearance ploughs or pre-sweeping activities have a temporary impact on broadscale habitat PMFs and features reliant on these habitats and we therefore recommend these activities are scoped into the MEA.	The Study Area for intertidal and subtidal benthic ecology, relevant to the MEA, includes the RLB plus an additional 15 km buffer on either side, representative of one tidal excursion. This Study Area incorporates the area within which there is potential for indirect impacts associated with the deposition of suspended sediments and is consistent with the conclusions reached in **Chapter 6: Marine Physical Processes**. The Study Area acts as a precautionary maximum ZoI. The designated sites that fall within the Study Area are listed in **Table 7-4** and shown in **Figure 7-2 (Drawing reference C01494-EGL3-MEA-GEO-008-G)** below. As identified by JNCC, there are no designated sites in the offshore environment which fall within the Study Area although two have been identified within the inshore environment, including Southern Trench Nature Conservation Marine Protected Area (NCMPA) and Buchan Ness to Collieston Special Area of Conservation (SAC). Scottish PMFs, including broadscale habitats present within the Study Area, have been identified in **Section 7.4.4** and considered in the assessment (**Section 7.8)** where appropriate.
	Permanent habitat loss from deposition of external cable protection with regards subtidal broadscale habitats has been scoped out. Any external cable protection will require licensing and therefore an assessment of the impact of permanent deposits on the local environment is required and therefore this impact should be scoped in. We would expect this assessment to include the reduction and/or change in natural habitat available for utilisation.	The impacts associated with the placement of cable protection has been presented in **Section 7.8.2**. Cable protection requirements will be further informed by a Cable Burial Risk Assessment.
	Temporary increase and deposition of suspended sediments from: boulder clearance, PLGR, pre-sweeping of sand waves; cable burial and trenching; anchoring/jack-up foundations; and deposit of external cable protection with regards broadscale habitats and Annex I *Sabellaria spinulosa* reefs has been scoped out. Noting the EGL 3 environmental survey programme has not yet been undertaken, therefore there is the possibility of sensitive habitats being present within the survey corridor. JNCC recommend these potential impacts remain scoped in. Following project-specific survey data, a refined approach may be taken within the MEAp which links to the scoping report and confirms habitat presence across the project. We would also like clarification that 'subtidal habitats' listed as the sensitive receptor to temporary increase and deposition of suspended sediments from pre-sweeping activities includes Annex I habitat and priority marine feature habitat.	Impacts of temporary increase and deposition of suspended sediments have been included in the MEA and the conclusions are presented in **Section 7.8.3.** The assessment includes Annex I habitats and PMFs that have been identified to be present within the RLB by the benthic characterisation survey (see **Appendix 7A: Scotland Environmental Baseline Report – EGL 3**).
	Electromagnetic changes/barrier to species movement from presence of cables with regards subtidal species has been scoped out in Section 7, Subtidal and Benthic Ecology. JNCC consider the justification for this to be relevant and adequate however in reviewing Chapter 8 Fish and Shellfish we noted this impact has been scoped in. JNCC consider this to be a clash of scoping requirements and therefore recommend a precautionary approach is taken where this impact is scoped in for both or signposted to the assessment	Electromagnetic changes/barriers to benthic invertebrate species movements from the presence of subsea cables has been assessed in **Section 7.8.4**. This includes consideration of predicted effects on species of Mollusca and Crustacea which can detect electromagnetic fields and therefore may be sensitive to EMF exposure. Impacts of EMF to fish species are covered in **Chapter 8: Fish and Shellfish.**

Consultee	Comments	Response
SFF	SFF notes from the Table 7-6: Scoping assessment of impacts on intertidal and subtidal benthic ecology, (p101), that the “temperature increase” and “Electromagnetic changes / Barrier to species movement” would be scoped out assuming that the trenched and buried cables would cause minor increase in the water temperature above the cable route and the EMF will not impact the benthic ecology. However, as any temperature change in the invertebrate’s habitat would have adverse effects on their behaviour and increase their mortality rate, and there is no scientific proofs to show that increase in temperature and EMF effect do not have any impact on the benthic ecology; therefore, SFF would like to see the impacts to benthic invertebrates and other benthic ecology and structures due to thermal emissions and EMF effect from subsea power cables to be scoped in.	Impacts of EMF and thermal emissions on benthic species have been assessed in **Section 7.8.4** and **Section 7.8.5** respectively.
Aberdeenshire Council	Aberdeenshire Council, as a terrestrial authority, are generally only concerned with the potential effects upon the intertidal zone between MHWS and MLWS with offshore infrastructure projects like this. The Planning Service has no comment on the provided information at this stage.	This comment is acknowledged.

7.3.2. Other Consultations

No further non-statutory consultation, outside of scoping, has been undertaken for intertidal and subtidal benthic ecology.

7.4. Baseline Characterisation

7.4.1. Overview

This section covers the intertidal and subtidal benthic ecology baseline for the Study Area, with regard to the diversity, abundance, and function of epifaunal (living on the seabed) and infaunal (living in the seabed) communities. Physical factors such as seabed or sediment type, water depth and associated level of available light and supply of organic matter determine the habitats present, and therefore the composition of benthic communities. Characterisation of the physical baseline environment as reported in **Chapter 6: Marine Physical Processes** but has been considered in this chapter where relevant.

7.4.2. Intertidal Zone

The intertidal environment at the proposed landfall in Sandford Bay on the Aberdeenshire coast is moderately to very highly exposed and characterised by high-energy infralittoral seabed and high-energy circalittoral seabed (EMODnet, 2025). In the central and southern portions of the bay, substrates are dominated by sand and gravel, with rock platforms occurring along the northern extent (Defra, 2025). The intertidal survey found the proposed landfall to be moderately diverse, with 19 EUNIS habitats identified within the intertidal survey area.

The central area of the intertidal zone was characterised by coastal habitats, including sand dunes and vegetated sea-cliffs at the top of the shore, which transitioned to a mixture of mobile substrates, including sand, boulders, cobbles and pebbles towards the low water mark. The more exposed northern extent of the bay was characterised by rocky substrate with typical species zonation present, including barnacles (Cirripedia) and common limpets (*Patella vulgata*) on the upper shore and multiple species of fucoid on the mid to lower shore, as well as kelp in the subtidal zone. The southern extent of the bay represented a moderately exposed rocky shore characterised by mobile substrates including sand, boulders, cobbles and pebbles. Similar fucoid and red algae species were observed, as well as barnacles and common limpets. Rockpools were present throughout the survey area and were found to support encrusting algae, coral weed (*Corallina officinalis*), periwinkles (*Littorina littorea*), beadlet anemones (*Actinia equina*) and the blue mussel (*Mytilus edulis*).

Sediment sampling found a dominance of sand and gravel in differing proportions within the intertidal zone (see **Appendix 7A: Scotland Environmental Baseline Report – EGL 3**). The risso snail (*Rissoa parva*) was the only infaunal species identified from the intertidal grab samples. Of the nine intertidal stations sampled, two individuals of risso snail were recorded at station SB_INT_ENV_03, five stations were afaunal (no macrofauna present), and only colonial epifauna were recorded at the remaining three stations. Denuded intertidal communities are not uncommon in exposed and moderately exposed intertidal areas where variable conditions, such as fluctuations in temperature, salinity and exposure to air, can limit species diversity.

Of the habitats observed at the proposed landfall, two protected coastal habitats were identified, including 'Atlantic and Baltic shifting coastal dune' (N13) and 'Atlantic and Baltic soft sea cliffs' (N34). These habitats are listed as UK Biodiversity Framework (UKBF) (formerly the UK Biodiversity Action Plan Priority Habitat and UK Post-2010 Biodiversity Framework descriptions) habitats, are included on the Scottish Biodiversity List and are European Commission (EC) Habitats Directive Annex I habitats. In addition, rockweed (*Fucus distichus*), a brown algal species which is included on the Scottish Biodiversity List and is a UKBF species, was also recorded during the intertidal survey. Further information regarding protected habitats and species within the Study Area is provided in **Section 7.4.4** below.

7.4.3. Subtidal Zone

The subtidal zone represents the area of the seabed below the Lowest Astronomical Tide (LAT). Publicly available benthic habitat mapping data is presented in **Figure 7-1 (Drawing reference C01494-EGL3-MEA-GEO-007-F)** and shows the EUNIS habitats predicted to occur within the Study Area.

Benthic characterisation surveys demonstrated the presence of six broadscale habitat complexes within the RLB, including: Atlantic infralittoral rock (MB12); Atlantic circalittoral rock (MC12); Atlantic infralittoral coarse sediment (MB32); Atlantic circalittoral coarse sediment (MC32); Atlantic circalittoral sand (MC52) and Atlantic offshore circalittoral sand (MD52).

Survey data confirmed that the Proposed Development is characterised by primarily sand with moderate proportions of gravel and negligible fines. Based on analysis of geophysical survey data, grab sampling and DDV ground-truthing, a total of 14 EUNIS habitats were identified within the RLB for the subtidal zone. These are presented in **Table 7-3** and summarised below. The extent of subtidal habitats is shown in **Figure 3-75** to **Figure 3-79** in **Appendix 7A: Scotland Environmental Baseline Report – EGL 3**.

At the Peterhead nearshore, water depths at the surveyed stations ranged from approximately 5 – 60 m below LAT. The shallowest areas were predominantly characterised by EUNIS habitat 'Kelp and seaweed communities on Atlantic infralittoral rock' (MB121). At deeper locations (>10 m below LAT), habitats such as 'Kelp and seaweed communities on sediment-affected or disturbed Atlantic infralittoral rock' (MB123), 'Faunal turf communities on Atlantic circalittoral rocks' (MC121), and 'Faunal communities of Atlantic circalittoral coarse sediment' (MC321) were identified. Infralittoral rock habitats were characterised by the presence of macrophytes, hydrozoan and bryzoan turf as well as mobile species such as common starfish (*Asterias rubens*), whilst infralittoral coarse sediments were characterised by a high abundance of amphipods and Polychaeta.

With progress south along the RLB, toward the border adjacent with English waters (from KP 563 to KP 528), and in water depths of approximately 35 m to 105 m LAT, habitats transitioned to 'Faunal communities of Atlantic circalittoral sand' (MC521). A total of 55 taxa were observed in association with this biotope complex, and whilst infauna-dominated, also included various mobile taxa such as common starfish (*A. rubens*), common sea urchin (*Echinus esculentus*), sand stars (*Astropecten irregularis*), Crustacea, Mollusca including the ocean quahog (*Arctica islandica*) and great scallop (*Pecten maximus*), fish species, Annelida and sessile taxa such as sea anemones (Actinaria), bryozoans and Astrorhiza.

Between KP 562 to KP 541, there were occurrences of '*Sabellaria spinulosa* on Atlantic circalittoral rock' (MC128) forming 'bommie' habitats amongst a relatively flat sand-dominated seabed, along a 21 km stretch. Water depths in this region ranged from approximately 85 m to 95 m. A total of 53 taxa were observed in association with this habitat, including hydrozoan, Polychaeta (e.g. *S. spinulosa*), bryozoan, common sun star (*Crossaster papposus*) and mobile fish and crabs. Observations of '*Sabellaria spinulosa* on Atlantic circalittoral rock' (MC128) were consistent with findings from historical surveys within the region carried out for EGL 2 (NextGeosolutions, 2022).

By KP 540, the *S. spinulosa* habitat decreased, leading back into 'Faunal communities of Atlantic circalittoral coarse sediment' (MC321) and 'Faunal communities of Atlantic circalittoral sand' (MC521), with variable mud and gravel compositions (between KP 540 and KP 500). These habitats supported conspicuous faunal assemblages. Further south to KP 436 (the border adjacent with English waters), habitats were typically sandier, characterised by 'Faunal communities in Atlantic offshore circalittoral sand' (MD521). Of the 63 taxa observed across the sand and muddy sand-dominated habitats, 35 taxa were associated with this biotope complex.

Overall, macrofaunal surveys identified a total of 1,535 individuals (infauna and solitary epifauna) representing 205 taxa. Of the 205 taxa recorded, 21 were colonial epifauna (10.2 % of total individuals), three were solitary epifauna (2.9 % of total individuals), 94 were Annelida (50.7 % of total individuals), 34 were Mollusca (9.2 % of total individuals), 35 were Crustacea (8.2 % of total individuals), eight species were Echinodermata (12.9 % of total individuals) and ten species classified as 'Other' (Nemertea and Nematoda etc.) (16.1 % of total individuals).

Table 7-3: Summary of subtidal habitats recorded during environmental surveys

EUNIS Broad-scale Habitat Name/Code (Level 3)	EUNIS Biotope Complex or Biotope Name/Code (Level 4 and 5)	JNCC Marine Habitat Classification Code (Level 4 and 5)	Geophysical Seabed Features
Atlantic Infralittoral Rock (MB12)	Kelp and seaweed communities on Atlantic infralittoral rock (MB121)	IR.MIR.KR	Bedrock
	Laminaria hyperborea on tide-swept Atlantic infralittoral rock (MB1218)	IR.MIR.KR.LhypT	Bedrock and gravel
	Kelp and seaweed communities on sediment-affected or disturbed Atlantic infralittoral rock (MB123)	IR.HIR.KSed	Till, Sand and Gravel, and Sand and Gravel with Cobbles/Boulders
	Polyides rotundus, Ahnfeltia plicata and *Chondrus crispus* on sand-covered Atlantic infralittoral rock (MB1237)	IR.HIR.KSed.ProtAhn	Bedrock and Gravel
Atlantic infralittoral coarse sediment (MB32)	*Faunal communities in full salinity Atlantic infralittoral coarse sediment (MB323)*	SS.SCS.ICS	Sand and Gravel, Sand and Gravel
	Glycera lapidum in impoverished Atlantic infralittoral mobile gravel and sand (MB3235)	SS.SCS.ICS.Glap	Sand and Gravel, Sand and Gravel

EUNIS Broad-scale Habitat Name/Code (Level 3)	EUNIS Biotope Complex or Biotope Name/Code (Level 4 and 5)	JNCC Marine Habitat Classification Code (Level 4 and 5)	Geophysical Seabed Features
	Nephtys cirrosa and Bathyporeia spp. in Atlantic infralittoral sand (MB5233)	SS.SSa.IFiSa.NcirBat	Sand and Gravel, Sand and Gravel
Atlantic circalittoral rock (MC12)	*Faunal turf communities on Atlantic circalittoral rocks (MC121)*	CR.HCR.XFa	Sand and Gravel with Cobbles/Boulders
	Flustra foliacea and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock (MC1216)	CR.HCR.XFa.FluCoAs	Sand and Gravel with Cobbles/Boulders
	Sabellaria on Atlantic Circalittoral Rock (MC128)	CR.MCR.CSab	Sand and Gravel
	Sabellaria spinulosa encrusted Atlantic circalittoral rock (MC1281)	CR.MCR.CSab.Sspi	Sand and Gravel
Atlantic circalittoral coarse sediment (MC32)	*Faunal communities of Atlantic circalittoral coarse sediment (MC321)*	SS.SCS.CCS	Sand and Gravel with Cobbles/Boulders
	Mediomastus fragilis, Lumbrineris spp. and venerid bivalves in Atlantic circalittoral coarse sand or gravel (MC3212)	SS.SCS.CCS.MedLumVen	Sand and Gravel with Cobbles/Boulders
	Branchiostoma lanceolatum in Atlantic circalittoral coarse sand with shell gravel (MC3215)	SS.SCS.CCS.Blan	Sand and Gravel with Cobbles/Boulders
Atlantic circalittoral sand (MC52)	*Faunal communities of Atlantic circalittoral sand (MC521)*	SS.SSa.CFiSa/ SS.SSa.CMuSa	Sand
	Echinocyamus pusillus, Ophelia borealis and Abra prismatica in circalittoral fine sand (MC5211)	SS.SSa.CFiSa.EpusOborApri	Sand
Atlantic offshore circalittoral sand (MD52)	*Faunal communities in Atlantic offshore circalittoral sand (MD521)*	SS.SSa.OSa	Sand, Sand and Gravel with Cobbles/Boulders
	Owenia fusiformis and Amphiura filiformis in deep circalittoral sand or muddy sand (MD5212)	SS.SSa.Osa.OfusAfil	Sand, Sand and Gravel with Cobbles/Boulders

Marine non-native invasive species

Marine non-native species are of particular concern when they become invasive and thus are detrimental to native species. Invasive species have the potential to displace native species, modify habitats, cause the loss of native species, alter community structure, affect ecosystem processes, disrupt the provision of ecosystem services, negatively impact human health and cause substantial economic losses (Cinar *et al.,* 2014).

DDV data from benthic characterisation surveys identified no conspicuous invasive species present within the RLB. A single non-native polychaete species, *Goniadella gracilis,* was, however, identified from macrofaunal samples, with 24 individuals recorded across four stations between KP 500 and KP 564. This species is originally found in northeastern United States of America (USA) and South Africa, but has been found within UK waters, with the first recorded sighting in 1970 at Liverpool Bay. Research into the species is limited, with its impact on the marine environment less well-known.

7.4.4. Designated Sites and Protected Features

Figure 7-2 (Drawing reference C01494-EGL3-MEA-GEO-008-G) presents sites designated for benthic habitats or species within the Study Area, with further information provided in **Table 7-4**.

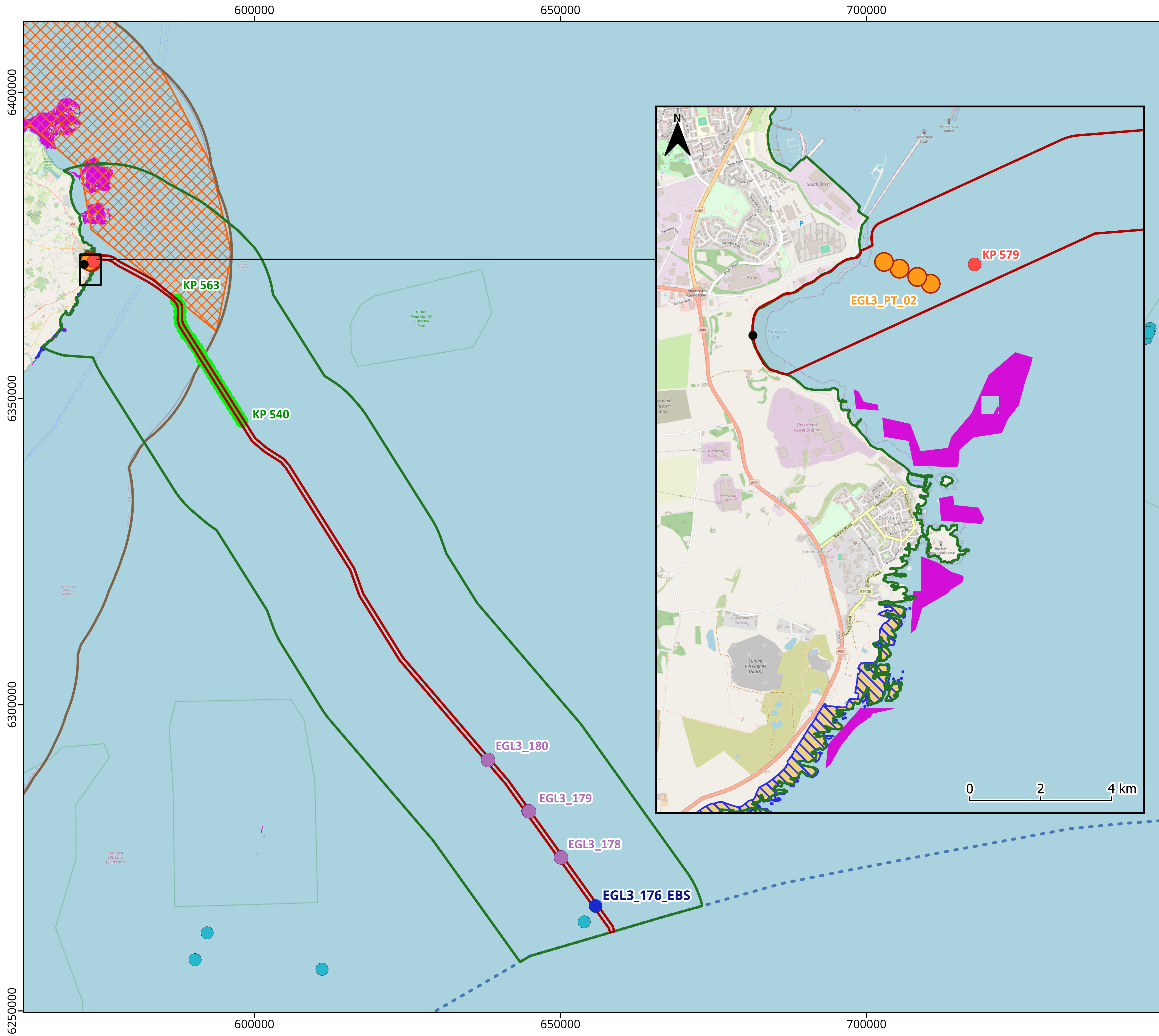
Table 7-4 Sites designated in Scotland for benthic habitats and species within the Study Area

Site Name and Code	Distance to RLB at its nearest point (km)	Benthic Protected Features	Feature Condition	Conservation Objectives
Southern Trench NCMPA	0.001	Burrowing mud	Favourable	The Conservation Objectives of the Southern Trench NCMPA, are that the protected features: • so far as already in favourable condition, remain in such condition. • so far as not already in favourable condition, be brought into such condition, and remain in such condition. "Favourable condition", with respect to a marine habitat, means that: a) its extent is stable or increasing; and b) its structures and functions, its quality, and the composition of its characteristic biological communities are such as to ensure that it is in a condition which is healthy and not deteriorating. Any temporary deterioration in condition is to be disregarded if the habitat is sufficiently healthy and resilient to enable its recovery from such deterioration.
		Fronts Shelf deeps	Favourable	The Conservation Objectives of the Southern Trench NCMPA, are that the protected features: • so far as already in favourable condition, remain in such condition. • so far as not already in favourable condition, be brought into such condition, and remain in such condition. "Favourable condition", with respect to a large-scale feature, means that: a) the extent, distribution and structure of thatfeature is maintained; b) the function of the feature is maintained so as to ensure that it continues to support its characteristic biological communities and their use of the site including, but not restricted to, feeding, spawning, courtship or use as nursery grounds; and c) the processes supporting the feature are maintained. For the purpose of determining whether a protected feature is in favourable condition any alteration to that feature brought about entirely by natural processes is to be disregarded.
		Quaternary of Scotland Submarine Mass Movement	Favourable	The Conservation Objectives of the Southern Trench NCMPA, are that the protected features: • so far as already in favourable condition, remain in such condition. • so far as not already in favourable condition, be brought into such condition, and remain in such condition. "Favourable condition", with respect to a feature of geomorphological interest, means that: a) its extent, component elements and integrity are maintained; b) its structure and functioning are unimpaired; and c) its surface remains sufficiently unobscured for the purposes of determining whether the criteria in paragraphs (a) and (b) are satisfied. For the purpose of determining whether a feature of geomorphological interest is sufficiently unobscured under paragraph (3)(c), any obscuring of that feature entirely by natural processes is to be disregarded.
Buchan Ness to Collieston SAC	1.77	Vegetated sea cliffs of the Atlantic and Baltic coasts	Favourable declining	Conservation Objectives for vegetated sea cliffs: 1. To ensure that the qualifying feature of Buchan Ness to Collieston SAC is in favourable condition and makes an appropriate contribution to achieving favourable conservation status. 2. To ensure that the integrity of Buchan Ness to Collieston SAC is maintained by meeting objectives 2a, 2b and 2c. 2a. Maintain the extent and distribution of the habitat within the site. 2b. Maintain the structure, function and supporting processes of the habitat. 2c. Maintain the distribution and viability of typical species of the habitat.
Bullers of Buchan Coast Site of Special Scientific Interest (SSSI)	1.77	Coastal geomorphology of Scotland and maritime cliff	Favourable maintained	Conservation Objectives of the coastal geomorphology of Scotland and the maritime cliff: 1. Ensure the continued natural evolution of the system. 2. Maintain the physical and visual integrity of the landforms for educational and research purposes. 3. Maintain cliff habitats - crevice and ledge vegetation, heaths, brackish flushes, and maritime grasslands - in favourable condition.

A number of habitats and species of conservation interest have been identified from benthic characterisation surveys as being present within the RLB or are known to occur in the wider Study Area. These are shown in **Figure 7-2 (Drawing reference C01494-EGL3-MEA-GEO-008-G)** and summarised in Table 7-5. The locations of subtidal sands and gravels within the RLB are presented in **Figure 3-75** to **Figure 3-79** in **Appendix 7A: Scotland Environmental Baseline Report – EGL 3**. Further information on key features of conservation interest is also provided in the following sub-sections.

Table 7-5: Habitats and species of conservation importance identified within the Study Area

Protected Feature (EUNIS classification)	EC Habitats Directive Annex I	Oslo and Paris Conventions (OSPAR) threatened and/or declining habitat or species	UKBF Species/Habitat	Scottish Biodiversity List	Scottish Priority Marine Feature	Summary details
Rockweed (*Fucus distichus*)			✓	✓		Recorded at the proposed landfall during benthic characterisation surveys and historical surveys for EGL 2 (National Grid Electricity Transmission and Scottish Hydro Electric Transmission plc, 2022). This alga is restricted to the exposed northern shores of Scotland and north Ireland and is found in the mid to upper eulittoral zone.
Atlantic and Baltic Shifting Dunes (N13)	✓		✓	✓		Recorded at the proposed landfall during benthic characterisation surveys.
Atlantic and Baltic Soft Sea Cliff (N34)	✓		✓	✓		Recorded at the proposed landfall during benthic characterisation surveys.
Subtidal sands and gravels			✓	✓	✓ (Offshore)	Broad-scale habitat that occurs in a wide variety of marine environments. Recorded during benthic characterisation surveys as being present within the RLB and likely to occur more widely in the Study Area.
Ross worm (*Sabellaria spinulosa*) biogenic reef	✓	✓	✓			Known to occur in the Study Area and 'Low reef' structures (classified in accordance with Gubbay (2007)), were identified from benthic characterisation surveys as being present within the RLB.
Bedrock and stony reef	✓					Known to occur in the Study Area and confirmed during the benthic characterisation surveys to be present intertidally (stony reef only) and subtidally at isolated locations within the RLB.
Ocean quahog (*Arctica islandica*)		✓			✓	Known to occur in the Study Area and confirmed during the benthic characterisation surveys to be present at isolated locations within the RLB.
Laminaria hyperborea on tide-swept Atlantic infralittoral rock (MB1218)					✓	Recorded in the nearshore area at the proposed landfall during benthic characterisation surveys.
Burrowed mud		✓			✓	A designated feature of the Southern Trench NCMPA. Not identified during benthic characterisation surveys as being present within the RLB.



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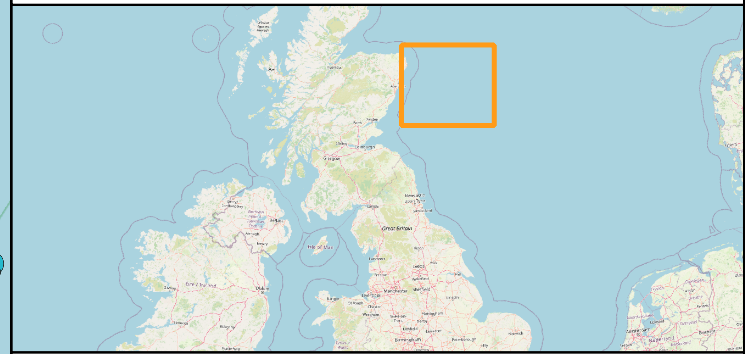
Benthic Designated Sites and Protected Features within the Study Area

C01494-EGL3-MEA-GEO-008-G



Legend

- Red Line Boundary
- Study Area (15km Buffer)
- Sandford Bay Landfall
- Ocean Quahog Siphon
- Ocean Quahog (GEMS)
- Ocean Quahog (2 Juveniles)
- Annex I Sabellaria spinulosa low reef structures
- Annex I rocky reef with high biodiversity
- Annex I stony medium reef structures
- Annex I -Bedrock and/or Stony Reef
- Bullers Of Buchan (SSSI)
- Buchan Ness to Collieston (SAC)
- Southern Trench Nature Conservation Marine Protected Area (NCMPA)
- Scottish Adjacent Waters
- 12NM Limit

0 10 20 30 KM
0 5 10 15 NM
N

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Projection	Universal Transverse Mercator (UTM)
Unit	meters
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Authorised	JDM

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7.4.4.1. Subtidal sands and gravels

Subtidal sands and gravel habitats are classified as UKBF habitats, PMFs and featured on the Scottish Biodiversity List under Section 2(4) of the Nature Conservation (Scotland) Act 2004. The subtidal sands and gravels habitat is widespread, occurring along the east coastline of the UK and the wider North Sea area in a range of environments from sheltered to very exposed conditions. The habitat supports a variety of species including polychaetes, crustaceans and fish, which rely on the habitat for breeding, feeding and shelter (JNCC, 2022). It supports internationally important fish and shellfish fisheries and provides important ecosystem services by improving water quality and acting as a carbon sink. This habitat is at risk from pollutants in riverine discharge, trawling and dredging activities and aggregate extraction.

Benthic characterisation surveys identified six Level 5 biotopes that met the criteria for subtidal sands and gravels habitat within the RLB. These included:

- *Glycera lapidum* in impoverished Atlantic infralittoral mobile gravel and sand (MB3235) (present within Atlantic infralittoral coarse sediment)
- *Nephtys cirrosa* and *Bathyporeia spp.* in Atlantic infralittoral sand (MB5233) (present within Atlantic infralittoral coarse sediment)
- *Mediomastus fragilis, Lumbrineris spp.* and venerid bivalves in Atlantic circalittoral coarse sand or gravel (MC3212) (present with Atlantic circalittoral coarse sediment)
- *Branchiostoma lanceolatum* in Atlantic circalittoral coarse sand with shell gravel (MC3215) (present with Atlantic circalittoral coarse sediment)
- *Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (MC5211) (present within Atlantic circalittoral sand)
- *Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand (MD5212) (present within Atlantic offshore circalittoral sand)

7.4.4.2. Biogenic reef

The ross worm (*S. spinulosa*) is a tube-building polychaete worm which occurs as isolated individuals, small aggregations, thin crust-like veneers, or, when in large numbers, can form hard reef-like structures which can act to stabilise the surrounding seabed (Gibb *et al*., 2014). As their tubes are built of sand, areas of sandy sediment with a high suspended sediment content are considered essential for the growth of reef-like structures. If an area of these aggregations is of suitable extent and elevation, these can be classified as biogenic reefs and are listed as an Annex I habitat under the EC Habitats Directive, OSPAR threatened and/or declining habitat and UKBF habitat.

Previous surveys on the east coast of Scotland have identified ross worm aggregations (Pearce and Kimber, 2020) that have the potential to qualify as reef based on the criteria proposed by Gubbay (2007). The best examples of reef were found at the Rattray Head and Southern Trench sites; outside of any designated sites.

A *S. spinulosa* reef assessment of data from 27 transects between KP 562 and KP 541 was undertaken to assess whether any areas within the RLB had the potential to be classified as Annex I biogenic reef. Details of this assessment are provided in **Appendix 7A: Scotland Environmental Baseline Report – EGL 3**. When considering the average reefiness (i.e., patchiness, elevation and extent) in accordance with Gubbay (2007), 30 patches of ‘low reef’ structures were identified between KP 563 and KP 540 (**Figure 7-2 (Drawing reference C01494-EGL3-MEA-GEO-008-G)**), encompassing the area where *S. spinulosa* ‘bommie’ habitat was observed (KP 548 to KP 561). No ‘medium reef’ or ‘high reef’ structures were identified. These findings are broadly consistent with those from benthic characterisation surveys undertaken for EGL 2, which identified the presence of ‘low to medium reef’ structures within the proposed marine installation corridor for EGL 2 (National Grid Electricity Transmission and Scottish Hydro Electric Transmission plc, 2022).

7.4.4.3. Bedrock and stony reef

Bedrock is typically an unbroken solid rock found in underlying sediments in the marine environment. When exposed as an outcrop on the seabed, it is classed as a subtidal bedrock reef and can often be found in matrices of cobbles and boulders (Parry, 2015). Subtidal bedrock communities can vary according to factors such as rock type, topographical features (e.g. vertical rock walls, gully and canyon systems and outcrops from sediment) and exposure to wave action and tidal currents (Parry, 2015).

A bedrock and stony reef assessment of survey data was undertaken based on the Golding *et al.* (2020) and Irving (2009) criteria. This identified bed outcrops within Peterhead nearshore (at EGL3_PT_02), which were further classified as Annex I rocky reef with high biodiversity. Annex I stony medium reef structures were also found to be present within Peterhead nearshore (at KP 579, as demonstrated by **Figure 7-2** (**Drawing reference C01494-EGL3-MEA-GEO-008-G)**). The extent of Annex I stony medium reef structures within the RLB at Peterhead nearshore are presented in **Figure 7-3 (Drawing reference C01494-EGL3-MEA-GEO-009-A)**. No 'high reef' patches of Annex I stony reef were observed.

Figure 3-110 and **Figure 3-111** in **Appendix 7A: Scotland Environmental Baseline Report – EGL 3** displays the presence of 'low reef' structures between KP 535 and 540 and at KP 525, respectively. The low reef structures observed between KP 525 (associated with camera transect EGL3_196) were categorised as 'Possible Low Reef' under Golding *et al.* (2020) criteria, due to the low abundance of key reef species. However, as displayed on **Figure 3-111** in **Appendix 7A: Scotland Environmental Baseline Report – EGL 3**, this area of seabed is also associated with 'Preferred' sandeel habitat. Sandeel 'Preferred' habitats require a high composition percentage of sand, which is not present within stony reefs. Therefore, a high confidence level can be assigned when assuming that there is no Annex I stony reef present at KP 525. The 'low reef' structures shown to be present between KP 535 and KP 540 is present amongst a series of identified 'Preferred' sandeel habitat. Additionally, this patch of low reef was not identified as a sensitive habitat in need of ground truthing with camera transects during geophysical surveys. Therefore, it is assumed there is no Annex I stony reef between KP 535 and KP 540.

Figure 3-112 in **Appendix 7A: Scotland Environmental Baseline Report – EGL 3** shows an area of low-risk sensitivity reef associated with camera transect EGL3_179. **Appendix 7A: Scotland Environmental Baseline Report – EGL 3** reports distinct aggregations within this patch that were of sufficient 'Reefiness' and extent (>25 m²). However, the composition and elevation of the aggregations were insufficient to be low reef structures. Additionally, **Figure 3-112** in **Appendix 7A: Scotland Environmental Baseline Report – EGL 3** demonstrates the presence of ocean quahog siphons and 'Preferred' sandeel habitat at this camera transect. As ocean quahog and 'Preferred' sandeel habitat are not associated with stony reefs, it is assumed that there is no Annex I stony reef present.

The assumptions that there are no instances of Annex I low stony reef structures within the RLB are further supported by the conclusions drawn by the benthic survey report, whereby the report states 'only the 'rocky reef with high biodiversity' and 'Medium stony Reef' structures at the northern extent demonstrated resemblance to Annex I habitats under the EC Habitats Directive' (see **Section 3.11.2.11 Overall Sensitive Subtidal Habitat Assessments** in **Appendix 7A: Scotland Environmental Baseline Report – EGL 3**).

7.4.4.4. Ocean quahog

The ocean quahog is a priority in the OSPAR List of Threatened and/or Declining Species in the greater North Sea area (OSPAR, 2023) and a PMF in Scotland. Ocean quahog is a slow-growing species which lives vertically within the top few centimetres of sediments. They typically form aggregations in association with a range of sediments from sand and muddy sands to fine and coarse gravels. There are no designated sites within the Study Area where ocean quahog aggregations are listed as a protected feature.

No adult individuals were recorded during benthic characterisation surveys; however, two juveniles were identified from station EGL3_176_EBS, and ocean quahog siphons were observed along three camera transects (EGL3_178, EGL3_179 and EGL3_180) between KP 471 and KP 450 (**Figure 7-2 (Drawing reference C01494-EGL3-MEA-GEO-008-G)**), with densities classified as 'Frequent' on the SACFOR scale.

7.4.4.5. *Laminaria hyperborea* on tide-swept Atlantic infralittoral rock (MB1218)

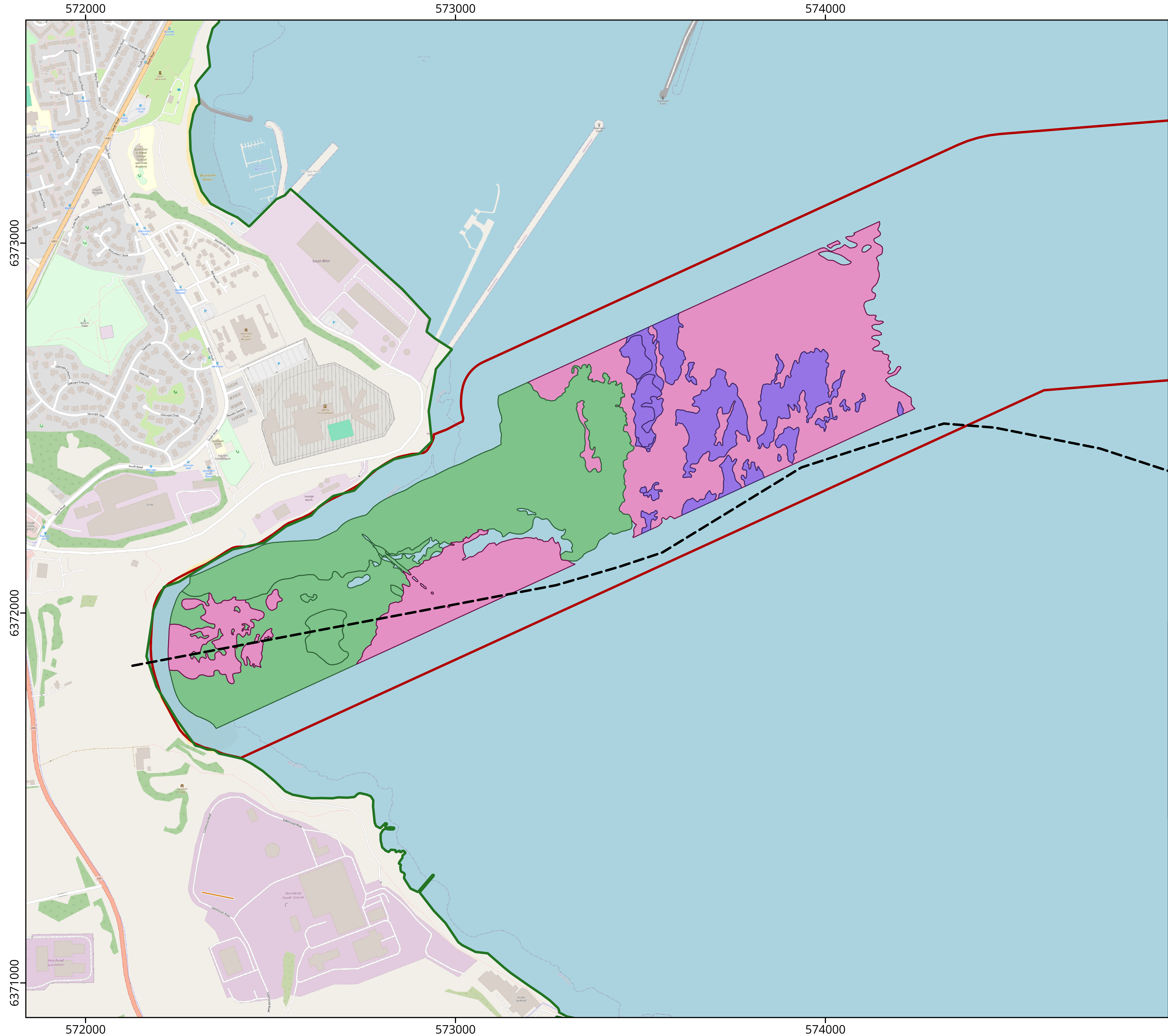
Laminaria hyperborea on tide-swept Atlantic infralittoral rock (MB1218) is a Scottish PMF, characterised by wave-exposed to moderately wave-exposed bedrock and boulders inhabited by the kelp *Laminaria hyperborea.* Kelp biotopes provide a large source of primary productivity within the North Atlantic; in Scotland, kelp biotopes cover approximately 8000 km² and contribute to 45 % of the primary production within UK waters.

The benthic characterisation survey identified that Peterhead nearshore (defined by transects EGL3_PT_02 and EGL3_PT_03 respectively) was characterised by the PMF *Laminaria hyperborea* on tide-swept Atlantic infralittoral rock (MB1218) (**Figure 7-3 (Drawing reference C01494-EGL3-MEA-GEO-009-A)**). It is important to note that the MB1218 polygon plotted on **Figure 7-3 (Drawing reference C01494-EGL3-MEA-GEO-009-A)** does not reach the northern edges of the RLB, as the RLB has been extended past the marine reconnaissance survey corridor (see **Table 7-2**). It is assumed that this biotope is also present to the northern extent of the RLB.

7.4.4.6. Burrowed mud

Burrowed mud is a Scottish PMF and OSPAR threatened and declining habitat (seapens and burrowing megafauna communities). It is a protected feature of the Southern Trench NCMPA, which overlaps with the Study Area. Burrowed mud habitats are highly sensitive to physical disturbance caused by a range of activities that result in penetration, abrasion or removal of the seabed as well as changes to water flow, wave exposure and siltation rates. Such activities can be highly damaging to both mobile and sessile epifaunal and infaunal species that characterise the habitat type. Burrowed mud habitats are also particularly vulnerable to pollution. High fluxes of nutrients or organic material can cause hypoxia and physical burial, leading to defaunation, alteration of species composition and changes to ecosystem functioning. Burrowing species do have the capacity to recover from such impacts (albeit this may be slowly) provided that the habitat has not been permanently changed, pressures that they are sensitive to are removed/avoided, suitable environmental conditions are maintained and that there are undisturbed neighbouring burrowed mud communities which can recolonise the area.

Benthic characterisation surveys did not identify the presence of this habitat within the RLB (**Appendix 7A: Scotland Environmental Baseline Report – EGL 3**).



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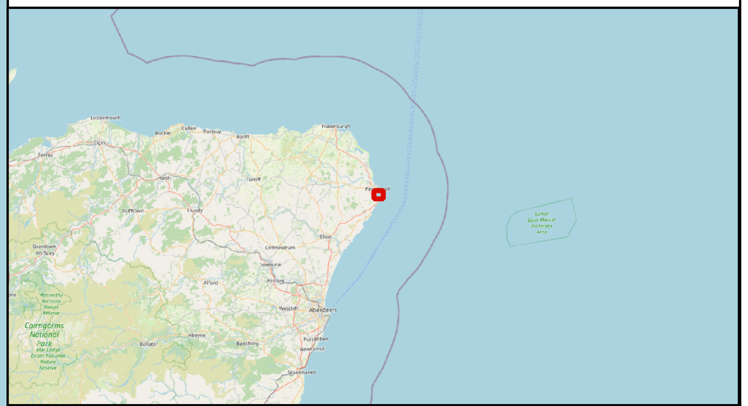
Sensitive Habitats within Peterhead Nearshore

C01494-EGL3-MEA-GEO-009-A

Legend

- Red Line Boundary
- Study Area (15km Buffer)
- EGL 2 Route
- Annex I Medium Stony Reef
- Laminaria hyperborea on Tide-swept Atlantic Infralittoral Rock (MB1218)
- Nephtys cirrosa and Bathyporeia spp. in Atlantic Infralittoral Sand (MB5233)



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7.4.5. Summary of Key Receptors

Table 7-6 outlines the key receptors identified from the baseline information above. These key receptors have been taken forward for assessment.

Table 7-6: Summary of key receptors

Type of Receptor Scoped in for Assessment	Receptor Present within RLB	Level 4 and Level 5 Biotopes Present within RLB Associated with Receptor
Subtidal broadscale habitats	Atlantic infralittoral rock	*Polyides rotundus, Ahnfeltia plicata* and *Chondrus crispus* on sand-covered Atlantic infralittoral rock (MB1237)
		Kelp and seaweed communities on Atlantic infralittoral rock (MB121).
	Atlantic circalittoral rock	*Flustra foliacea* and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock (MC1216)
		Sabellaria spinulosa encrusted Atlantic circalittoral rock (MC1281),
	Atlantic infralittoral coarse sediment	N/A
	Atlantic circalittoral coarse sediment	N/A
	Atlantic circalittoral sand (MC52)	N/A
	Atlantic offshore circalittoral sand (MD52)	N/A
Subtidal Annex I habitats	*Sabellaria spinulosa reefs*	N/A
	Stony reefs	N/A
PMFs	Subtidal sands and gravels	*Glycera lapidum* in impoverished Atlantic infralittoral mobile gravel and sand (MB3235)
		Nephtys cirrosa and *Bathyporeia spp.* in Atlantic infralittoral sand (MB5233)
		Mediomastus fragilis, Lumbrineris spp. and venerid bivalves in Atlantic circalittoral coarse sand or gravel (MC3212)
		Branchiostoma lanceolatum in Atlantic circalittoral coarse sand with shell gravel (MC3215)
		Echinocyamus pusillus, Ophelia borealis and *Abra prismatica* in circalittoral fine sand (MC5211)
		Owenia fusiformis and *Amphiura filiformis* in deep circalittoral sand or muddy sand (MD5212)
	Ocean quahog	N/A
	Kelp beds	*Laminaria hyperborea* on tide-swept Atlantic infralittoral rock (MB1218).

7.5. Potential Pressure Identification and Zone of Influence

7.5.1. Spatial Scope

The Study Area for intertidal and subtidal benthic ecology includes the RLB plus an additional 15 km buffer on either side, representative of one tidal excursion. This is consistent with **Chapter 6: Marine Physical Processes** and acts as a precautionary maximum ZoI. The ZoI incorporates the area within which there is potential for indirect impacts associated with the deposition of suspended sediments.

7.5.2. Temporal Scope

The temporal scope of the assessment of intertidal and subtidal benthic ecology is consistent with the period over which the Proposed Development would be carried out. It assumes construction of the Proposed Development would commence at the earliest in 2028 with the latest possible completion by 2033. Within this window, construction (including pre-lay activity) is expected to take 55 months.

Operation would commence in 2033 with periodical maintenance required during the operational phase. It is assumed that maintenance and repair activities could take place at any time during the life span of the Proposed Development.

The Proposed Development is expected to have a life span of more than 40 years. If decommissioning requires cessation of operation and removal of infrastructure at this point in time, then activities and effects associated with the decommissioning phase are expected to be of a similar level to those during the construction phase works albeit with a lesser duration of two years. Acknowledging the complexities of completing a detailed assessment for decommissioning works up to 40 years in the future, based on the information available, the Applicant has concluded that impacts from decommissioning would be no greater than those during the construction phase. Furthermore, should decommissioning take place, it is expected that an assessment in accordance with the legislation and guidance at the time of decommissioning would be undertaken and a separate Marine Licence would be sought for decommissioning activities.

7.5.3. Identification of Pressure-Receptor Pathways

Table 7-7 provides a summary of the receptors scoped into the assessment and the potential impacts assessed. The scoping in of these impacts are based on the potential impacts identified within the MEA Non-Statutory Scoping Report and subsequent stakeholder consultation responses.

Of the potential impacts identified: underwater noise changes; introduction of marine invasive non-native species; electromagnetic changes/barrier to species movement; temperature increase, and accidental spills were scoped out for all phases of the Proposed Development within the MEA Non-Statutory Scoping Report. Following stakeholder consultation, electromagnetic changes/barrier to species movement and temperature increase has been scoped back in for further assessment in the MEA.

Since publication of the MEA Non-Statutory Scoping Report and consultation, a further two potential pressure-receptor pathways have been scoped out of the MEA due to a refinement of the Proposed Development's design parameters and environmental baseline. The Proposed Development construction would use a trenchless solution such as Horizontal Directional Drilling (HDD) at the proposed landfall, avoiding intrusive works in the intertidal area. The exit point for the HDD, where the cables transition from the cable ducts to seabed burial, would be entirely in the subtidal environment; thus, there would be no direct impacts to intertidal benthic ecology receptors from temporary habitat loss/seabed disturbance. However, intertidal benthic ecology receptors would be subject to temporary increase and deposition of suspended sediment in the event of drilling fluid breakout (frac-out) and therefore, this pressure-receptor pathway has been scoped in for assessment. Following the benthic characterisation surveys, it was identified that there were no Annex I *Modiolus modiolus* and *Mytilus edulis* beds present within the RLB, thus any associated pressures have been scoped out for this receptor.

The benthic characterisation surveys identified three PMFs within the RLB that had not previously been considered at scoping: subtidal sands and gravels, ocean quahog and *Laminaria hyperborea* on tide-swept Atlantic infralittoral rock (MB1218). The pressure-receptor pathways for these PMFs have been identified and incorporated into this assessment.

In addition to the previous justification for the Study Area (**Section 7.1.1**), the Proposed Development and associated RLB have been carefully routed through a robust route selection process to minimise ecological impacts. The RLB does not cross any designated sites and as a result no pressure-receptor pathways were identified between designated sites and associated project activities.

The potential pressure-receptor pathways which have been scoped in to the MEA are outlined in **Table 7-7.**

Table 7-7: Justification for the zone of influence assigned to potential impacts scoped in for the intertidal and subtidal benthic ecology assessment

Potential Impact	Associated Project Activity	Project Phase	Receptor	Zone of Influence	Reason for Consideration
Temporary habitat loss/seabed disturbance	Boulder clearance, PLGR, pre-sweeping of sand waves. Trenchless solution and duct excavation. Cable burial and trenching. Anchoring/jack-up leg. Deposit of external cable protection.	All phases	Subtidal broadscale habitats	Within RLB	The RLB contains commonly occurring infralittoral and circalittoral habitats that are widely distributed within the North Sea region. Associated activities of the Proposed Development could cause abrasion of the seabed surface or penetration of the substrate below the surface.
			Subtidal Annex I habitats		The RLB contains Annex I *S. spinulosa* reefs and Annex I stony reefs. Associated activities of the Proposed Development could cause abrasion of the seabed surface or penetration of the substrate below the surface.
			PMFs		The RLB contains PMFs. Associated activities of the Proposed Development could cause abrasion of the seabed surface or penetration of the substrate below the surface.
Permanent habitat loss	Deposition of external cable protection.	Construction and Operation	Subtidal broadscale habitats	Within RLB	The RLB contains commonly occurring infralittoral and circalittoral habitats that are widely distributed within the North Sea region. External cable protection could change the type of sediment and subsequently habitat present.
			Subtidal Annex I habitats		The RLB contains Annex I *S. spinulosa* reefs and Annex I stony reefs. External cable protection could remove Annex I reefs or change the type of sediment and subsequently habitat/species present.
			PMFs		The RLB contains PMFs. External cable protection could change the type of sediment and subsequently habitat/species present.
Temporary increase and deposition of suspended sediments	HDD	Construction	Intertidal habitats	15 km	Whilst the majority of direct impacts would be avoided as a trenchless technique will be used at the Sandford Bay Landfall, intertidal habitats would be impacted if there is a drilling fluid breakout.
	Boulder clearance, PLGR. Trenchless solution and duct excavation. Cable burial and trenching. Anchoring/jack-up foundations. Deposit of external cable protection.	All phases	Subtidal broadscale habitats	15 km	The RLB contains commonly occurring infralittoral and circalittoral habitats that are widely distributed within the North Sea region. Associated activities of the Proposed Development could cause increases suspended sediments, affecting feeding and respiration of marine organisms, and smothering of benthic habitats.
			Subtidal Annex I habitats		The RLB contains Annex I *S. spinulosa* reefs and Annex I stony reefs. Associated activities of the Proposed Development could cause increases suspended sediments, affecting feeding and respiration of marine organisms, and smothering of Annex I benthic habitats.
			PMFs		The RLB contains PMFs. Associated activities of the Proposed Development could cause increases suspended sediments, affecting feeding and respiration of marine organisms, and smothering of PMFs.
	Pre-sweeping	Construction and Decommissioning	Subtidal broadscale habitats	15 km	The RLB contains commonly occurring infralittoral and circalittoral habitats that are widely distributed within the North Sea region. Pre-sweeping could cause increases suspended sediments, affecting feeding and respiration of marine organisms, and smothering of benthic habitats.
			Subtidal Annex I habitats		The RLB contains Annex I *S. spinulosa* reefs and Annex I stony reefs. Pre-sweeping could cause increases suspended sediments, affecting feeding and respiration of marine organisms, and smothering of Annex I benthic habitats.
			PMFs		The RLB contains PMFs. Pre-sweeping could cause increases suspended sediments, affecting feeding and respiration of marine organisms, and smothering of PMFs.
Electromagnetic changes/barrier to species movement	Presence of cables	Operation	Subtidal species	Within RLB	During the operation of an HVDC cable electromagnetic fields (EMF) are generated. EMF has the potential to affect the behaviour of infaunal species.
Temperature increase	Presence of cables	Operation	Subtidal species	Within RLB	During the operation of an HVDC cable, heat losses occur because of the resistance in the cable/conductor. This can cause localised heating of the surrounding environment (i.e., sediment for buried cables, or water in the interstitial spaces of external cable protection).

7.5.4. Guidance

The intertidal and subtidal benthic ecology assessment has been undertaken in accordance with relevant guidance and has been compiled in accordance with professional standards. The guidance and standards which relate to this assessment are:

- Chartered Institute for Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in Britain and Ireland – Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018, and updated April 2022);
- Nature conservation considerations and environmental best practice for subsea cables for English Inshore and UK offshore waters (Natural England and JNCC, 2022);
- Guidance for the Conduct of Benthic Studies at Marine Aggregate Extraction Sites (Ware & Kenny, 2011);
- The identification of the main characteristics of Annex I stony reef habitats under the Habitats Directive (Irving, 2009);
- Refining the criteria for defining areas with a 'low resemblance' to Annex I stony reef (Golding *et. al.*, 2020)
- Defining and managing *Sabellaria spinulosa* reefs (Gubbay, 2007);
- Marine Evidence-based Sensitivity Assessment (MarESA) (MarLIN, 2021;Tyler-Walters *et al.* 2023);
- Nature Scot Conservation Advice for MPAs (Nature Scot, 2024); and
- UKOOA Sediment quality guidelines for UK North Sea (UKOOA, 2001)

7.6. Key Parameters for Assessment

7.6.1. Realistic Worst-Case Design Scenario

The assessment has followed the Rochdale Envelope approach as outlined **Chapter 3: Project Description.** The assessment of effects has been based on the description of the Proposed Development and parameters outlined in **Chapter 3: Project Description**. Where there is uncertainty regarding a particular design parameter, the realistic worst-case design parameters are provided in **Table 7-8** below with regards to intertidal and subtidal benthic ecology receptors along with the reasons why these parameters are considered worst-case. The assessment for intertidal and subtidal benthic ecology has been undertaken on this basis. Effects of greater adverse significance are not likely to arise should any other development scenario (e.g., different infrastructure layout within the RLB), to that assessed here, be taken forward in the final design plan, provided the development scenario is within the Rochdale Envelope parameters set out.

With regards to temporary habitat disturbance specifically from unexploded ordnance (UXO) identification and clearance, it is assumed that UXO clearance would be undertaken under a separate Marine Licence and subject to its own environmental assessments and is therefore not considered within this assessment.

Table 7-8: Worst-case scenario

Impact Pathway	Construction	Operation	Decommissioning	Most Sensitive Location
Temporary habitat loss/seabed disturbance	4.35 km^2 – width of the PLGR 30 m x length of 145 km	To be determined if maintenance is required	Similar footprint as is disturbed during construction and operation combined.	Within Annex I reef or PMF habitat
Permanent habitat loss from the deployment of cable protection	0.135 km^2 (including 0.035 km^2 from infrastructure crossings)	To be determined if maintenance is required	No new deposits but assumes cable protection remains in place.	Within Annex I reef or PMF habitat
Temporary increase and deposition of suspended sediment in the nearshore and offshore subtidal	Project specific data presented in **Chapter 6: Marine Physical Processes,** concludes coarse sediment will settle within the RLB and fine sediment plumes can travel up to 13.6 km and will cause light surface smothering of <1 mm.			Smothering will occur on *Laminaria hyperborea* on tide-swept Atlantic infralittoral rock (MB1218)
Electromagnetic changes / barrier to species movement	N/A	EMF generated by the bundled cables will fall to 67.5 μT within 1 m of the cables, and to 57.5 μT within 2 m of the cables. Please see **Appendix 3A: Electric and Magnetic**	N/A	Subtidal species within Annex I reef or PMF habitat

Impact Pathway	Construction	Operation	Decommissioning	Most Sensitive Location
		Field Assessment or further information.		
Temperature increase	N/A	Assuming an ambient seabed temperature of 12 °C, seabed temperatures at 0.2 m immediately above the cables are estimated to be 13 - 14 °C, with the cables operating at maximum operating temperatures. Please see **Appendix 3C: Heat Calculations** for further information.	N/A	Subtidal species within Annex I reef or PMF habitat

7.7. Embedded Mitigation Measures

As set out in **Chapter 4: Marine Environmental Appraisal Scope and Methodology**, embedded mitigation measures form part of the design for which consent is sought and can be characterised as 'design measures' or 'control and management measures.' This embedded mitigation would be implemented as part of the Proposed Development and secured by way of condition in the Marine Licence as relevant.

Several management plans would be provided to discharge Marine Licence conditions prior to the start of construction. These would include a Construction Environmental Management Plan (CEMP), Marine Pollution Contingency Plan (MPCP), Marine Mammal Mitigation Plan (MMMP) and a Fisheries Management and Mitigation Plan (FMMP). These documents will outline measures to be implemented to comply with legislation, such as Prevention of Pollution at Sea (MARPOL) and Safety of Life at Sea (SOLAS), and the mitigation commitments proposed within this MEAp (Embedded Mitigation Measure OMT08). An Outline CEMP is provided as **Appendix 3B: Outline Construction Environmental Management Plan**. In addition, design measures identified through the MEA process have been applied to avoid or reduce potential significant effects as far as possible.

Table 7-9 outlines the embedded mitigation measures that would be implemented for the Proposed Development that have been considered by the intertidal and subtidal benthic ecology MEA.

Embedded mitigation that was proposed at scoping to justify why a potential impact pathway was not significant has also been included in **Table 7-9**, along with the impact pathway that it was addressing (i.e. introduction or spread of marine invasive non-native species).

Table 7-9: Embedded mitigation measures used for intertidal and subtidal benthic ecology assessment

Impact Pathway	Receptor	Embedded Mitigation Measures
Temporary habitat loss/seabed disturbance	Intertidal habitats	OMT01 - Intertidal zone would be crossed by HDD to avoid disturbance to surface sediments and habitats.
Temporary increase and deposition of suspended sediment	Intertidal habitats	OMT02 - Drilling fluids required for trenchless operations will be carefully managed to minimise the risk of breakouts into the marine environment. Specific avoidance measures would include: ▪ the use of biodegradable drilling fluids (pose little or no risk (PLONOR) substances) where practicable, ▪ drilling fluids will be tested for contamination to determine possible reuse or disposal; and ▪ if disposal is required drilling fluids would be transported by a licensed courier to a licensed waste disposal site. ▪ Chemicals will be chosen from the list of chemicals approved under the Offshore Chemical Notification Scheme. https://www.cefas.co.uk/data-and-publications/ocns/ and a chemical risk assessment will be provided as part of the CEMP.
Temporary habitat loss/seabed disturbance	Subtidal habitats	OMT03 - The intention is to bury the cables in the seabed, except in areas where burial is not possible e.g. where ground conditions do not allow burial or at infrastructure crossings.
		OMT10 - Designated (and as minimal as possible) anchoring areas and protocols shall be employed during marine operations to minimise physical disturbance of the seabed.
		MPP01 - Detailed route development and micro-routeing will be undertaken within the RLB, informed by pre-construction data evaluation to avoid or minimise localised engineering and environmental constraints.
Permanent habitat loss due to the deposit of external cable protection	Subtidal habitats	OMT04 - Cable protection features would only be installed where considered necessary for the safe operation of the Proposed Development. This includes the repair of cables due to accidental damage, where depth of lowering is not achieved and at infrastructure crossings.
		OMT05 - Where possible, cable protection materials will be selected to match the environment (e.g., when cables are installed in areas of cobbles or other natural rock features, rock of similar diameter and material as the receiving environment should be used).
Introduction or spread of marine invasive non-native species	Subtidal species	OMT11 - Project vessels will follow all relevant guidelines with respect to avoiding the introduction of and minimising the spread of marine invasive non-native species (GB Non-native Species Secretariat, 2015). This includes using vessel cleaning facilities and the use of anti-fouling paint. Project vessels and contractors will comply with the International Convention for the Control and Management of Ships' Ballast water and sediments. All seabed deposits will be inert with no biologically active material. Project vessels will complete a biosecurity risk assessment prior to arriving on site which will include factors such as origins of the vessels and ensuring that relevant equipment is cleaned before use.
Electromagnetic changes	Subtidal species	OMT06 - HVDC poles will be bundled to minimise the effects of EMF for electrosensitive receptors.

7.8. Significance Assessment

The generic project-wide approach to the assessment methodology is set out in **Chapter 4: Marine Environmental Appraisal Scope and Methodology**. The criteria for characterising the value and sensitivity and magnitude for intertidal and subtidal benthic ecology are outlined in **Table 7-10** and

Table 7-11, respectively. The significance of an effect, either adverse or beneficial, has been determined using a combination of the magnitude of the impact and the sensitivity of the receptor based on a matrix approach (see **Table 7-12**) which is used throughout all topic areas to ensure a consistent approach within the assessment. This assessment has used available benthic characterisation survey data and background scientific literature, professional judgement and knowledge of benthic ecology and behaviour to determine the level of impact.

The assessment of sensitivity has been made with consideration of the vulnerability of the receptor to an impact and its ability to recover and adapt. Vulnerability can differ between different groups and species of benthic invertebrates and will also vary depending on the impact pathway. For example, sessile species are more sensitive to smothering than mobile species. Additionally, all protected habitats and species within an internationally or nationally designated site are likely to be considered as high value. This also extends to protected species and habitats outside of the boundary of a designated site. Reference has been made to the MarESA published by the Marine Life Information Network (MarLIN) (Tyler-Walters *et al.* 2023) and site, habitat and species designation to aid in the categorisation of sensitivity. The Feature Activity Sensitivity Tool (FeAST) (Nature Scot, 2025b) used by NatureScot is based on MarESA, and therefore MarESA is applicable to Scottish waters.

A screening assessment is provided in **Appendix 5C: Marine Protected Area (MPA) Assessment Stage 1 Initial Screening**, whereby it was concluded there are no significant adverse effects from project activities on sites designated for benthic features.

The assessment of magnitude has been made with consideration of the extent of the area impacted, the duration and frequency of the impact and the scale of the change (severity) i.e., whether it has an effect at an individual or population level. When determining the magnitude of impacts the life history and ecology of the receptors is important. Factors such as seasonality of presence or whether specific areas are required for a certain life stage which the species may be unwilling or unable to move away from are considered.

The magnitude criteria in

Table 7-11 has been simplified from that provided in the MEA Non-Statutory Scoping Report based on advice received during the Development Consent Order (DCO) application for the English Offshore Scheme received from Statutory Nature Conservation Bodies. The magnitude criteria has been used throughout the assessment, with justified professional judgement applied, to assign impacts to an appropriate magnitude classification.

Table 7-10: Criteria for characterising the sensitivity of receptors

Sensitivity	Description of Criteria
High	Value: The receptor is a designated feature of a protected site. Sensitivity: Equivalent to MarLIN MarESA sensitivity category High. Receptor has low tolerance to change i.e., recovery will take longer than 10 years following the cessation of activity or will not occur.
Medium	Value: The receptor is valued or is considered rare or unique. Sensitivity: Equivalent to MarLIN MarESA sensitivity category Medium. Receptor has intermediate tolerance to change i.e., recovery to pre-impact conditions is possible between 5 and 10 years.
Low	Value: Common and widespread habitats/species of no specific conservation value. Sensitivity: Equivalent to MarLIN MarESA sensitivity category Low. Receptor has high tolerance to change with recovery to pre-impact conditions between 1 and 5 years.
Negligible	Value: Low importance and rarity, local scale. Artificial, highly modified, and/or degraded benthic habitats/species of low/no conservation interest. Sensitivity: Equivalent to MarLIN MarESA sensitivity category Not Sensitive. The receptor has some tolerance to change without detriment to its character. Recovery expected to be relatively rapid, i.e., less than approximately six months following cessation of activity.

Table 7-11: Criteria for characterising the magnitude of an impact

Magnitude	Description of Criteria
High	Impacts last >15 years on a regional or population/habitat level or are a major alteration to key elements/features of the baseline condition such that post-impact baseline character will be fundamentally changed. Natural recruitment will not return the population/habitat to the baseline condition.
Medium	Impacts are of medium term (7-15 years) duration on a local level (wider than project footprint) or alter an element of the baseline conditions such as that post-impact the damage to the baseline is above that experienced under natural conditions but with no permanent effect on integrity.

Magnitude	Description of Criteria
Low	Impacts are temporary (<1 year) or short term (1-7 years) in duration on a site-specific level. Impacts limited to discrete areas within the project footprint. Negligible contribution to cumulative effects.
Negligible	Very little or no detectable change from baseline conditions, for any length of time. Disturbance is within the range of natural variability or is a highly localised impact that the alteration to the key characteristics and features of the particular receptor does not affect ecological function. Negligible contribution to cumulative effects.

Table 7-12: Significance matrix

		Sensitivity			
		High	**Medium**	**Low**	**Negligible**
Adverse magnitude	**High**	Major	Major	Moderate	Minor
	Medium	Major	Moderate	Minor	Minor
	Low	Moderate	Minor	Minor	Negligible
	Negligible	Minor	Minor	Negligible	Negligible
Beneficial magnitude	**Negligible**	Minor	Minor	Negligible	Negligible
	Low	Moderate	Minor	Negligible	Negligible
	Medium	Major	Moderate	Minor	Negligible
	High	Major	Major	Moderate	Minor

7.8.1. Temporary Habitat Loss/Seabed Disturbance – All Phases

Two of the pressures established by the FeAST (Nature Scot, 2025b) have been considered under this overarching category, namely: abrasion/penetration of the substrate on the surface of the seabed and penetration and/or disturbance of the substratum below the surface of the seabed including abrasion.

Aspects of the Proposed Development that physically disturb the seabed e.g., seabed preparation (including UXO identification and pre-sweeping of sandwaves), cable burial, cable repair, and eventual cable removal, have the potential to disturb subtidal habitats and species and cause temporary habitat loss. Typically, the extent of this disturbance will be a maximum of 30 m wide along the entire Proposed Development, although noting for the most part not all of this area will be disturbed. Beyond this footprint, low intensity physical disturbance may also occur from vessel anchoring or UXO identification. The worst-case installation footprint for temporary habitat loss is presented below:

- Construction: 4.35 km^2
- Operation: to be determined if maintenance is required
- Decommissioning: equal to the total footprint of construction

Most activities that penetrate the seabed will present a temporary impact i.e., will only be undertaken for a short period and the seabed will be able to recover after the activity. Some activities will occur in the same footprint and will be separated by several months e.g., seabed clearance followed by trenching. Abrasion and penetration of the substrate could result in the localised loss of damage to sediment habitats but does not directly remove habitats. However, a change in the habitat, even temporarily, could lead to an impact on species biodiversity and abundance within the area.

Sensitivity to the impact of seabed disturbance and temporary habitat loss varies between habitats and species, depending upon the stability of the habitat and its resilience to disturbance and the vulnerability of an individual species to mechanical disturbance. For example, mobile species such as crabs are able to avoid construction activities whereas less mobile benthic species, such as bivalves and echinoderms, and sessile species, such as barnacles, can be subject to injury.

The following section has been sub-divided to consider each receptor, providing an assessment that provides justification for the assigned receptor values/sensitivities and the magnitude of the impact. A summary of the assessment conclusions is provided in **Table 7-13** for ease of reference. Where receptors share a common sensitivity/value, magnitude and significance of effect they have been grouped together.

Table 7-13: Summary of assessment conclusions for temporary habitat loss and seabed disturbance

Receptor		Sensitivity/Value	Magnitude	Significance of Effect
Subtidal broadscale habitats	Atlantic infralittoral rock	Low	Low	Minor
	Atlantic infralittoral coarse sediment			
	Atlantic circalittoral coarse sediment			
	Atlantic circalittoral rock	Medium	Low	Minor
Subtidal Annex I habitats	*Sabellaria spinulosa reefs*	Medium	Low	Minor
	Stony reefs			
PMFs	Subtidal sands and gravels	Medium	Low	Minor
	Ocean quahog	High	Negligible	Minor
	Kelp beds	Medium	Negligible	Minor

7.8.1.1. Subtidal Broadscale Habitats

There are six broadscale habitat complexes within the Proposed Development including: Atlantic infralittoral rock (MB12); Atlantic circalittoral rock (MC12); Atlantic infralittoral coarse sediment (MB32); Atlantic circalittoral coarse sediment (MC32); Atlantic circalittoral sand (MC52) and Atlantic offshore circalittoral sand (MD52). The assessment for each habitat complex follows.

<u>Atlantic infralittoral rock (MB12)</u>

Atlantic infralittoral rock habitats within the RLB comprise of bedrock, boulders, cobbles, gravel and sand and are characterised by brown and red algae and seaweeds. These epifauna are unable to relocate to avoid the effects of cable construction, operation and maintenance and decommissioning activities and could be at risk of frond damage or substrate detachment during ploughing activities. Infralittoral rock habitats within the RLB consist of two Level 5 biotopes: '*Laminaria hyperborea* on tide-swept Atlantic infralittoral rock' (MB1218); and '*Polyides rotundus, Ahnfeltia plicata* and *Chondrus crispus* on sand-covered Atlantic infralittoral rock' (MB1237), and one Level 4 biotope 'Kelp and seaweed communities on Atlantic infralittoral rock' (MB121). MB1218 is a PMF and has been assessed in **Section 7.8.1.3** under the subheading kelp beds. MB1237 is present at two sampling stations at Peterhead nearshore, at approximately KP 580.

The characteristic red algae of biotope MB1237 typically grows in areas of high scour rates (due to the resuspension and transport of sand particles), thus demonstrates a natural level of tolerance to seabed abrasion. More specifically, Irish moss (*Chondrus crispus*) is a flexible red alga (Dixon & Irvine, 1977) and is capable of regenerating if its holdfast remains undamaged (Dudgeon & Johnson, 1992). For these reasons MarESA has assessed the resistance of MB1237 to a single abrasion event as medium and recovery as high (Tillin and Rayment, 2015). Atlantic infralittoral rock is not sensitive to seabed penetration due to the presence of hard bedrock. The **sensitivity** of Atlantic infralittoral rock to temporary habitat loss/seabed disturbance has been assessed as **low**.

Atlantic infralittoral rock is only present at one small area at Peterhead nearshore within the Proposed Development. Due to spatial constraints with EGL 2, a high density of shipping vessels and engineering constraints, such as cable trajectory, within Peterhead nearshore, HDD punch out is likely to be positioned within adjacent sand habitats; thus, any temporary habitat loss as a result of HDD punch out is unlikely to interact with Atlantic infralittoral rock present at Peterhead nearshore. For Atlantic infralittoral rock occurring past the point of HDD punch out, where possible, the submarine cable would micro-route around areas of bedrock, and smaller rocks and boulders would be relocated using grabs to reduce the risk of injury to epifauna. Where ploughing of larger boulders is required, a narrow footprint of 20 m at each clearance site would be disturbed. Additionally, seabed abrasion would be temporary and occur as a single event, allowing time for the epifauna present to recover and regenerate. Any temporary habitat loss/seabed disturbance within areas of Atlantic infralittoral rock within the RLB would be isolated and would not affect the wider distribution of this habitat within the North Sea. Thus, the **magnitude** of this effect on Atlantic infralittoral rock has been assessed as **low**.

The overall significance of the effect of temporary habitat loss and seabed disturbance to Atlantic infralittoral rock habitats has been assessed as **Minor** and **Not Significant.**

<u>Atlantic circalittoral rock (MC12)</u>

Atlantic circalittoral rock habitats host a highly diverse stable community of sessile benthic macrofauna that live on pebbles, rocks, cobbles and boulders and are unable to relocate to avoid the effects of construction, operation and maintenance and decommissioning.

Consequently, epifauna present in these habitats and within the RLB, such as sponges (Porifera), Bryozoa and Cnidaria, could be at risk of crushing or substrate detachment during ploughing activities.

Atlantic circalittoral rock habitats found within the RLB consist of one Level 4 biotope 'faunal turf communities on Atlantic circalittoral rocks' (MC121), and two Level 5 biotopes: '*Flustra foliacea* and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock' (MC1216), present at two sampling stations at Peterhead nearshore; and '*Sabellaria spinulosa* encrusted Atlantic circalittoral rock' (MC1281), present at 18 sampling stations across the RLB. Biotope MC1216 is an Annex I habitat and demonstrates low sensitivity to seabed abrasion; hornwrack (*F. foliacea*) is a flexible bryozoan that possesses the ability to regenerate damaged fronds (if the holdfast is undamaged), thus a significant proportion of the hornwrack colonies within this biotope would survive seabed disturbance. MC1216 is also not sensitive to seabed penetration due to the presence of hard rock within the habitat (Readman, Lloyd and Watson, 2023). MC1281 demonstrates medium sensitivity to seabed abrasion and penetration (*Tillin et al., 2024b*). Surface abrasion and penetration has the potential to severely damage or remove ross worm tubes, resulting in sub-lethal and lethal damage to the worms. For example, anchor trawling in the Wadden Sea in the 1950s caused a decline in ross worm reef presence on areas of circalittoral rock (Reise and Schubert, 1987).

Due to the increased presence of MC1281 compared to MC1216 and its greater sensitivity to seabed disturbance, a precautionary approach has been taken in this assessment and the sensitivity of Atlantic circalittoral rock to temporary habitat loss and seabed disturbance has been based on the habitat sensitivity of MC1281. Therefore, **sensitivity** of Atlantic infralittoral rock to temporary habitat loss/seabed disturbance has been assessed as **medium**.

All instances of Atlantic circalittoral rock within the Proposed Development are present in small, isolated patches, thus any temporary habitat loss as a result of seabed disturbance would be isolated and would not affect the wider distribution of these habitats within the North Sea. Additionally, boulder clearance through ploughing has a narrow footprint of 20 m at each clearance site and, where possible, the submarine cable would be micro-route around boulders whilst smaller rocks and boulders would be relocated using grabs, reducing the risk of injury to epifauna. Thus, the **magnitude** of this effect on Atlantic circalittoral rock has been assessed as **low**.

The overall significance of the effect of temporary habitat loss and seabed disturbance to Atlantic circalittoral rock habitats has been assessed as **Minor** and **Not Significant**.

<u>Atlantic infralittoral (MB32) and circalittoral (MC32) coarse sediment</u>

In general, Atlantic infralittoral and circalittoral coarse sediment habitats are comprised of coarse sand, gravel and shingle and are subject to seabed disturbance from wave action. These habitats are characterised by robust infauna such as the sand mason worm (*Lanice conchilega*), mobile crustacea such as cumaceans and amphipods and venerid bivalves (Connor et. al. 2004).

Atlantic infralittoral coarse sediment habitats present within the RLB comprise of sand and gravel and consist of two Level 5 biotopes: '*Glycera lapidum* in impoverished Atlantic infralittoral mobile gravel and sand' (MB3235) and '*Nephtys cirrosa* and *Bathyporeia spp.* in Atlantic infralittoral sand' (MB5233). These biotopes are categorised under the habitat 'subtidal sands and gravels'. Subtidal sands and gravels are PMFs, thus MB3235 and MB5233 are assessed in **Section 7.8.1.3.**

Atlantic circalittoral coarse sediment habitats present within the RLB comprise of sand, gravel, cobbles and boulders, and are dominant across the Proposed Development, occurring between approximately KP 490 to KP 570. These habitats consist of two Level 5 biotopes: '*Mediomastus fragilis, Lumbrineris spp.* and venerid bivalves in Atlantic circalittoral coarse sand or gravel' (MC3212); and '*Branchiostoma lanceolatum* in Atlantic circalittoral coarse sand with shell gravel' (MC3215), occurring at 21 and 11 sampling stations respectively. Both biotopes are classified as UKBF habitats. These biotopes are also categorised under the habitat 'subtidal sands and gravels'. Subtidal sands and gravels are PMFs, thus MC3212 and MC3215 are assessed in **Section 7.8.1.3**.

Collie *et al.* (1997) reported that abrasion and disturbance of coarse gravels and sands caused a reduction in the abundance and biomass of organisms and a reduction in species diversity, when compared to undisturbed areas. It was further reported that undisturbed sites contained more epifauna and fragile organisms, such as small polychaetes and brittle stars compared to the disturbed sites. However, thick-shelled bivalves, hermit crabs and gastropods were unaffected by disturbance. The mobile infauna present within coarse sediment habitats can temporarily relocate as sediments are displaced, but return once cable construction, operation and maintenance and decommissioning activities are complete. Whereas the sessile epifauna present is likely to become damaged from associated project activities. Coarse sediment habitats demonstrate a **low sensitivity** to temporary habitat loss/seabed disturbance.

The dynamic nature of the habitat and temporary nature of the associated project activities suggests there would be very little change from baseline conditions during cable construction, operation and maintenance and decommissioning and the effects of temporary habitat loss/seabed disturbance would be short term. Therefore, the **magnitude** has been assessed as **low.**

The overall significance of the effect of temporary habitat loss/seabed disturbance to Atlantic infralittoral and Atlantic circalittoral coarse sediment has been assessed as **Minor** and **Not Significant.**

<u>Atlantic circalittoral sand (MC52)</u>

Atlantic circalittoral sand within the RLB is comprised of sand and consists of the Level 5 biotope '*Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand' (MC5211). This biotope is categorised under the habitat 'subtidal sands and gravels'. Subtidal sands and gravels are PMFs, thus MC5211 has been assessed in **Section 7.8.1.3**.

Atlantic offshore circalittoral sand (MD52)

Atlantic offshore circalittoral sand within the RLB is comprised of sand, gravel, cobbles and boulders and consists of the Level 5 biotope '*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand' (MD5212). This biotope is categorised under the habitat 'subtidal sands and gravels'. Subtidal sands and gravels are PMFs, thus MD5212 has been assessed in **Section 7.8.1.3**.

7.8.1.2. Subtidal Annex I Habitats

Annex I *Sabellaria spinulosa* reefs

The presence of individual or small aggregations of ross worm were commonly found in areas defined as Atlantic circalittoral rock. Benthic survey analysis demonstrated the presence of 30 patches of 'low reef' structures between KP 563 and KP 540, encompassing the area where ross worm 'bommie' habitat was observed (KP 548 to KP 561). No 'medium reef' or 'high reef' structures were identified. The RLB does not cross any sites designated for benthic habitats therefore any temporary habitat loss/seabed disturbance as a result of associated project activities would not occur on habitat designated as part of a site.

Ross worm are "r" strategists and are adapted to live in frequently disturbed environments, subject to regular covering and exposure by sediment and natural disruption from storm events. These reefs are particularly affected by dredging or trawling, particularly if the activity or disturbance is prolonged (Tillin et al., 2024a). However, Vorberg (2020) demonstrated that Annex I *S. spinulosa* reefs can recover quite quickly from short-term or intermediate levels of disturbance. Despite this, due to its high ecological value, the **sensitivity** of Annex I *S. spinulosa* reefs to temporary habitat loss/seabed disturbance has been assessed as **medium**.

The **magnitude** of the effect has been assessed as **low** due to the common presence of Annex I *S. spinulosa* reefs in the North Sea, the localised and temporary nature of the project associated seabed disturbance and to reflect that the impact is likely to also occur under natural conditions, from which Annex I *S. spinulosa* reefs can recover. Additionally, where possible, the submarine cable would be micro-routed within the RLB to avoid interaction with Annex I *S. spinulosa* reef.

The overall significance of the effect of temporary habitat loss/seabed disturbance to Annex I *S. spinulosa* reefs has been assessed as **Minor** and **Not Significant**.

Annex I stony reefs

The benthic characterisation survey identified Annex I rocky reef with high biodiversity and Annex I stony medium reef structures at Peterhead nearshore. No 'high reef' patches of Annex I stony reef were observed. The RLB does not cross any sites designated for benthic habitats therefore any temporary habitat loss/seabed disturbance as a result of associated project activities would not occur on habitat designated as part of a site.

Annex I stony and rocky reefs are associated with sessile assemblages that are unable to relocate to avoid the effects of construction, operation and maintenance and decommissioning of marine cables, and may experience smothering and mortality if boulders and rocks are rotated during boulder clearance. For example, dead man's fingers (*Alcyonium digitatum),* present within the RLB, is a characterising sessile species of Annex I stony and rocky reefs and can be subject to mechanical interference, crushing and physical blows or erosion of its surface as a result of abrasion and seabed disturbance (Budd, 2008). Due to its high ecological value, the **sensitivity** of Annex I stony reefs to temporary habitat loss/seabed disturbance has been assessed as **medium**.

Due to spatial constraints with EGL 2, a high density of shipping vessels and engineering constraints, such as cable trajectory, within Peterhead nearshore, HDD punch out is likely to be positioned within sand habitats adjacent to Annex I rocky reef with high biodiversity habitat (**Figure 7-2** (**Drawing reference C01494-EGL3-MEA-GEO-008)**); thus, any temporary habitat loss as a result of HDD punch out is unlikely to interact with Annex I rocky reef with high biodiversity habitat. Annex I medium stony reef occurs at KP 579 within the RLB, which is situated further offshore than HDD punch out (**Figure 7-3 (Drawing reference C01494-EGL3-MEA-GEO-009-A)**).

Temporary habitat loss from seabed disturbance may occur in areas of Annex I stony medium reef structures; to reduce the risk of injury to epifauna, smaller rocks and boulders would be relocated using grabs. Where ploughing of larger boulders is required, a narrow footprint of 20 m at each clearance site would be disturbed. Additionally, seabed abrasion would be temporary and occur as a single event, allowing time for the epifauna present to recover, and be limited to discrete areas within the RLB. Therefore, the **magnitude** of this effect on Annex I stony reefs has been assessed **low.**

The overall significance of the effect of temporary habitat loss/seabed disturbance to Annex I stony reefs has been assessed as **Minor** and **Not Significant**.

7.8.1.3. PMFs

Subtidal sands and gravels

Subtidal sands and gravel habitats are classified as UKBF habitats, PMFs and featured on the Scottish Biodiversity List under Section 2(4) of the Nature Conservation (Scotland) Act 2004. Within the RLB, there are six Level 5 biotopes that fall under the category of a subtidal sands and gravels habitat. These include:

- *Glycera lapidum* in impoverished Atlantic infralittoral mobile gravel and sand (MB3235) (present within Atlantic infralittoral coarse sediment)
- *Nephtys cirrosa* and *Bathyporeia spp.* in Atlantic infralittoral sand (MB5233) (present within Atlantic infralittoral coarse sediment)
- *Mediomastus fragilis, Lumbrineris spp.* and venerid bivalves in Atlantic circalittoral coarse sand or gravel (MC3212) (present with Atlantic circalittoral coarse sediment)
- *Branchiostoma lanceolatum* in Atlantic circalittoral coarse sand with shell gravel (MC3215) (present with Atlantic circalittoral coarse sediment)
- *Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (MC5211) (present within Atlantic circalittoral sand)
- *Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand (MD5212) (present within Atlantic offshore circalittoral sand)

MB3235, MB5233, MC3212 and MC3215 demonstrates low sensitivity to seabed abrasion and penetration (Tillin and Watson, 2023 and Tillin *et al.,* 2023 and Tillin and Watson, 2024a and Tillin and Watson, 2024b). The catworm *Nephtys cirrosa,* a characterising species of biotope MB3235 and MB5233 and present within the RLB, is adapted to inhabit unstable sediments and can rapidly burrow to avoid seabed abrasion. Biotope MB5233 occurs in areas of mobile sands, and the associated fauna are generally present in low abundances. These characterising species are adapted to tolerate frequent disturbance, suggesting a high resistance to surface abrasion. For example, the amphipod and isopod species present within MB5233 are known for their ability to withstand sediment disturbance (Elliott *et al.* 1998). Bergman and Santbrink (2000) reported a 28 % mortality rate of gammarid amphipods after beam trawling in silty sediments and Constantino *et al.* (2009) report a 25 % reduction in abundance of sand digger shrimp (*Bathyporeia spp*.) after clam dredging in shallow, wave exposed areas. Abundance was reported to have recovered after one day. Some of the characterising fauna of biotopes MC3212 and MC5211, which are also present within the Proposed Development include: Bivalvia such as the dog cockle (*Glycymeris glycymeris*), the oval venus (*Timoclea ovata*), the striped venus clam (*Chamelea striatula*) and the hatchet shell (*Lucinoma borealis);* Echinodermata such as the pea urchin (*Echinocyamus pusillus*) and Polychaeta such as the bloodworm (*Glycera lapidum)*. Capasso *et al.* (2010) suggested the fauna present within these biotopes demonstrate tolerance to seabed abrasion and penetration; the species present are either burrowing organisms (such as the bloodworm and Bivalvia listed above) so can avoid seabed abrasion or are adapted to inhabit areas frequently disturbed by natural wave energy. For example, Gilkinson *et al.* (1998) reported the striped venus clam and hatchet shell remained undamaged, with potential to reburrow, following laboratory simulations of seabed disturbance. Species present within this biotope are thought to rapidly recruit and recover following disturbance.

MC3215 demonstrates low sensitivity to seabed abrasion but medium sensitivity to seabed penetration (Tillin and Watson, 2023). The European lancelet (*Branchiostoma laceolatum*) is a burrowing species, that can swim fast for a short distance when disturbed. Thus, can avoid seabed abrasion from project activities. MarESA does not provide evidence for assigning medium sensitivity to seabed penetration.

MD5212 demonstrates medium sensitivity to seabed abrasion and penetration (De-Bastos, 2023). The brittlestar *Amphiura filiformis*, a characterising species of this biotope and present within the RLB, is a burrowing species. This burrowing characteristic provides brittlestars with some protection from seabed abrasion, but brittlestars extend their arms into the water column for feeding where they become vulnerable to seabed abrasion from associated project activities. However, Bergman & Hup (1992) demonstrated beam trawling had no significant effect on brittlestar abundance and Ramsey, Kaiser and Hughes (1998) suggested *Amphiura spp.* are less susceptible to beam trawl damage than other Echinodermata or tube-building Polychaeta; this can be attributed to their regenerative capabilities whereby brittlestars can withstand damage to their arms and disks without experiencing mortality (Sköld, 1998). *Owenia fusiformis* is a tube-building worm that can reach up to 10 cm in length (Hayward & Ryland, 1990) and its tubes up to 30 cm in length (Rouse & Pleijel, 2001). Therefore, it is likely seabed disturbance would cause damage to portions of the tube and the worm inside, which can regenerate (Gibbs *et al.,* 2000).

Due to the increased sensitivity of MD5212, a precautionary approach has been taken in this assessment and the **sensitivity** of subtidal sands and gravels to temporary habitat loss and seabed disturbance has been assessed as **medium**.

Subtidal sands and gravels are found extensively across the wider North Sea. Temporary habitat loss/seabed disturbance is therefore likely to have negligible effects on the wider distribution and extent of these benthic habitats. Additionally, the associated fauna present within subtidal sands and gravels demonstrate rapid recruitment and recolonisation following seabed disturbance. This, coupled with the dynamic nature of the habitat and temporary nature of the associated project activities, suggests there would be very little change from baseline conditions during cable construction, operation and maintenance and decommissioning and the effects of temporary habitat loss/seabed disturbance would be short term. Considering this, the **magnitude** of any temporary habitat loss/seabed disturbance to subtidal sands and gravels has been assessed as **low**.

The overall significance of the effect of temporary habitat loss/seabed disturbance to subtidal sands and gravels has been assessed as **Minor** and **Not Significant.**

Ocean quahog

Two juvenile individuals of ocean quahog were identified from station EGL3_176_EBS, and ocean quahog siphons were observed along three camera transects (EGL3_178, EGL3_179 and EGL3_180) between KP 471 and KP 450, with densities classified as 'Frequent' on the SACFOR scale. The RLB does not cross any sites designated for benthic habitats, therefore any temporary habitat loss/seabed disturbance as a result of associated project activities would not affect ocean quahog designated as part of a site.

Ocean quahog is an infaunal species with limited mobility, splitting its time between the seabed surface and burying vertically within the top few centimetres of the seabed with its siphons placed at the surface for respiration. Taylor (1976) reported that ocean quahog can remain buried for one to seven days. Like other marine bivalves, ocean quahog is at risk of injury and mortality from shell damage through seabed penetration and the siphon of ocean quahog is at risk of physical damage from abrasion. The **sensitivity** of ocean quahog to temporary habitat loss/seabed disturbance is **high** (Tyler-Walters and Sabatini, 2017**)**.

Abundance of ocean quahog varies between location within the North Sea. For example, there are 28,600 individuals per 100 / m^2 within the Northern North Sea (juvenile dominance), 7 adults (>10 mm in length) per 100 / m^2 in Southern North Sea and 21 adults (>10 mm in length) per 100 / m^2 in Central North Sea (Tyler-Walters and Sabatini, 2017). Few individuals of ocean quahog were found within macrofauna grab samples and therefore any mortality that occurs as a result of the Proposed Development would have little effect to the wider population and abundance within the North Sea. Therefore, the **magnitude** of this effect has been assessed as **negligible**.

The overall significance of the effect of temporary habitat loss/seabed disturbance to ocean quahog has been assessed as **Minor** and **Not Significant**.

Kelp beds

The benthic characterisation survey identified that Peterhead nearshore (defined by transects EGL3_PT_02 and EGL3_PT_03 respectively) was characterised by the PMF *Laminaria hyperborea* on tide-swept Atlantic infralittoral rock (MB1218). The kelp *L. hyperborea* is unable to re-attach itself to substrate once removed, and temporary habitat loss or seabed disturbance could remove germlings and gametophytes within these areas (Tyler-Waters, 2007). However, Christie, Fredriksen and Rinde (1998) suggested kelp habitats are tolerant of *L. hyperborea* canopy removal and observed *L. hyperborea* habitat regeneration following trawling in south Norway. Trawling removed all large canopy-forming adult *L. hyperborea,* but sub-canopy recruits were largely unaffected, and within six years associated holdfast communities had recovered, and a new canopy had formed. However, after six years the community of plants living on the stems of *L. hyperborea* had not fully recovered. MB1218 demonstrates **medium sensitivity** to seabed abrasion. MB1218 is not sensitive to seabed penetration due to the presence of bedrock (Stamp *et al.,* 2023).

Due to spatial constraints with EGL 2, a high density of shipping vessels and engineering constraints, such as cable trajectory, within Peterhead nearshore, HDD punch out is likely to be positioned within adjacent sand habitats to this PMF; thus, any temporary habitat loss as a result of HDD punch out is unlikely to interact with biotope MB1218. Following HDD punch out, where possible, the submarine cable would be micro-routed around the PMF. Where this is not possible, permanent habitat loss would occur and this has been assessed in **Section 7.8.2.3**. Temporary habitat loss would not occur within this PMF. The **magnitude** of this effect has been assessed as **negligible.**

The overall significance of the effect of temporary habitat loss/seabed disturbance to kelp beds has been assessed as **Minor** and **Not Significant**.

7.8.2. Permanent Habitat Loss – Construction and Operation

Permanent habitat loss arises from the permanent change of one marine habitat type to another marine habitat type through the change in substratum including to artificial material (e.g., concrete). Associated activities include the installation of cables within the seabed (and eventual decommissioning if they remain in-situ) and the deposition of external cable protection. Introduction of hard substrate into a habitat via marine cables and external cable protection would replace other natural substrates, leading to permanent loss of these habitats and associated species. External cable protection would be used in the construction of infrastructure crossings and for burial remediation where full cable burial into sediment has not been achieved. Whilst most external cable protection would be installed during construction, it would also be required during the operation phase, either for the maintenance of infrastructure crossings or for remedial burial e.g., associated with a cable repair, or if the cables become exposed. The worst-case installation footprint for permanent habitat loss is presented below:

- Construction: 0.135 km^2
- Operation: to be determined if maintenance is required

The following section has been sub-divided to consider each receptor, providing an assessment that provides justification for the assigned receptor values/sensitivities and the magnitude of the impact. A summary of the assessment conclusions is provided in **Table 7-14** for ease of reference. Where receptors share a common sensitivity/value, magnitude and significance of effect they have been grouped together.

Table 7-14: Summary of assessment conclusions for permanent habitat loss

Receptor		Sensitivity	Magnitude	Significance of Effect
Subtidal broadscale habitats	Atlantic infralittoral rock	Medium	Negligible	Minor
	Atlantic circalittoral rock			
	Atlantic circalittoral coarse sediment	High	Negligible	Minor
	Atlantic infralittoral coarse sediment			
Subtidal Annex I habitats	*Sabellaria spinulosa reefs*	Medium	Low	Minor
	Stony reefs			
PMFs	Subtidal sands and gravels	High	Negligible	Minor
	Ocean quahog			
	Kelp beds	Medium	Low	Minor

7.8.2.1. Subtidal Broadscale Habitats

There are six broadscale habitat complexes within the Proposed Development including: Atlantic infralittoral rock (MB12); Atlantic circalittoral rock (MC12); Atlantic infralittoral coarse sediment (MB32); Atlantic circalittoral coarse sediment (MC32); Atlantic circalittoral sand (MC52) and Atlantic offshore circalittoral sand (MD52). The assessment for each habitat complex follows.

<u>Atlantic infralittoral rock (MB12) and Atlantic circalittoral rock (MC12)</u>

Rock habitats host a highly diverse stable community of sessile epifauna and are highly sensitive to habitat loss as a result of change in seabed composition. Where possible, external cable protection materials would be selected to match the receiving environment (e.g., rock of similar diameter and material as the receiving environment will be used) (see **Section 7.7**), thus, where possible, there would not be a change in substrate type within areas of infralittoral and circalittoral rock. However, it is acknowledged that mortality of epifauna can occur during external cable protection installation, thus the **sensitivity** of rock habitats to permanent habitat loss has been assessed as **medium**.

The use of matching external cable protection would increase the availability of hard substrate and encourage the attachment and settlement of sessile invertebrates within these habitats; a review of literature by Wallingford (2025) reports that external rock protection is colonised by primary and secondary users, with amphipods, hydroids and anemones demonstrating colonisation of artificial rock protection within subtidal habitats in the North Sea. Primary colonisers, such as tubeworms and hydroids, initially colonise the artificial rock; these are then displaced between two and four years later by secondary colonisers, such as anemones, which can dominate the artificial rock for up to 11 years post construction. The rock protection also provides additional hard substrate for mobile demersal megafauna such as lobsters and crabs. Furthermore, *S. spinulosa,* as present within areas of Atlantic circalittoral rock (biotope '*Sabellaria spinulosa* encrusted Atlantic circalittoral rock' (MC1281)) within the RLB, has been observed to rapidly colonise subsea pipelines in Northeast Scotland (Braithwaite *et al.,* 2006).

Sheehan *et al.* (2018) reported colonisation of rock protection overlying circalittoral rock in the northeast coast of Cornwall; within five years the benthic fauna colonising the rock protection was similar to that of the surrounding bedrock, and there was no significant difference in faunal abundance. Taxa abundance was reported to be significantly lower than that of the natural environment, however monitoring surveys (one, four and five years post-installation) showed evidence of ecological succession and community growth, which indicates habitat recovery potential. Sherwood *et al.* (2016) and Taormina *et al.* (2018) also reported the presence of comparable benthic communities on external cable protection (to that of the surrounding habitat) 3.5 years post installation.

This evidence suggests there would be a limited level of permanent habitat loss within these habitats and therefore the **magnitude** of the effect has been assessed as **negligible**.

The overall significance of the effect of permanent habitat loss to Atlantic infralittoral rock and Atlantic circalittoral rock has been assessed as **Minor** and **Not Significant**.

<u>Atlantic infralittoral (MB32) and circalittoral (MC32) coarse sediment</u>

In general, Atlantic infralittoral and circalittoral coarse sediment habitats are comprised of coarse sand, gravel and shingle.

Atlantic infralittoral coarse sediment habitats present within the RLB comprise of sand and gravel and consist of two Level 5 biotopes: '*Glycera lapidum* in impoverished Atlantic infralittoral mobile gravel and sand' (MB3235) and '*Nephtys cirrosa* and *Bathyporeia spp.* in Atlantic infralittoral sand' (MB5233). These biotopes are categorised under the habitat 'subtidal sands and gravels'. Subtidal sands and gravels are PMFs, thus MB3235 and MB5233 are assessed in **Section 7.8.2.3**.

Atlantic circalittoral coarse sediment habitats present within the RLB comprise of sand, gravel, cobbles and boulders, and are dominant across the Proposed Development, occurring between approximately KP 490 to KP 570. These habitats consist of two Level 5 biotopes: '*Mediomastus fragilis, Lumbrineris spp.* and venerid bivalves in Atlantic circalittoral coarse sand or gravel' (MC3212); and '*Branchiostoma lanceolatum* in Atlantic circalittoral coarse sand with shell gravel' (MC3215), occurring at 21 and 11 sampling stations respectively. Both biotopes are classified as UKBF habitats. These biotopes are also categorised under the habitat 'subtidal sands and gravels'. Subtidal sands and gravels are PMFs, thus MC3212 and MC3215 and are assessed in **Section 7.8.2.3**.

The placement of external cable protection in Atlantic infralittoral and circalittoral coarse sediment habitats would result in the irreversible conversion of sands and gravels to hard substrate, permanently altering the ecological composition and function of the affected area. Such changes can lead to shifts in benthic community structures, favouring sessile species adapted for hard substrates while displacing infaunal organisms, such as bivalves and polychaetes, who live within softer sediments. The **sensitivity** of Atlantic infralittoral and circalittoral coarse sediment habitats to permanent habitat loss as a result of seabed composition conversion is **high**.

External cable protection would be a permanent addition to coarse sediment habitats within the RLB, and it is assumed that it would not be removed following decommissioning of the Proposed Development. However, external cable protection would only be installed across a maximum area of 0.13 km^2. Cable protection would be installed only where considered necessary for the safe operation of the Proposed Development and, where possible, cable protection materials would be selected to match the receiving environment (e.g., when cables are installed in areas of cobbles or other natural rock features, rock of similar diameter and material as the receiving environment will be used) (see **Section 7.7**). Atlantic infralittoral and circalittoral coarse sediment habitats are common throughout the North Sea. Thus, permanent habitat loss of small sections of these habitats within the RLB would have little effect on their wider distribution. Therefore, the **magnitude** of permanent habitat loss has been assessed as **negligible**.

The overall significance of the effect of permanent habitat loss to Atlantic infralittoral coarse sediment and Atlantic circalittoral coarse sediment has been assessed as **Minor** and **Not Significant.**

<u>Atlantic circalittoral sand (MC52)</u>

Atlantic circalittoral sand within the RLB is comprised of sand and consists of the Level 5 biotope '*Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand' (MC5211). This biotope is categorised under the habitat 'subtidal sands and gravels'. Subtidal sands and gravels are PMFs, thus MC5211 has been assessed in **Section 7.8.2.3**.

<u>Atlantic offshore circalittoral sand (MD52)</u>

Atlantic offshore circalittoral sand within the RLB is comprised of sand, gravel, cobbles and boulders and consists of the Level 5 biotope '*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand' (MD5212). This biotope is categorised under the habitat 'subtidal sands and gravels'. Subtidal sands and gravels are PMFs, thus MD5212 has been assessed in **Section 7.8.2.3**.

7.8.2.2. Subtidal Annex I Habitats

<u>Annex I *Sabellaria spinulosa* reefs</u>

Benthic survey analysis demonstrated the presence of 30 patches of 'low reef' structures between KP 563 and KP 540, encompassing the area where ross worm 'bommie' habitat was observed (KP 548 to KP 561). No 'medium reef' or 'high reef' structures were identified. The RLB does not cross any sites designated for benthic habitats therefore any permanent habitat loss as a result of associated project activities would not occur on habitat designated as part of a site. Annex I *S. spinulosa* reefs have a high sensitivity to permanent habitat loss and to the conversion of one sediment type to another. Where possible, external cable protection materials would be selected to match the environment (e.g., when cables are installed in areas of natural rock features, rock of similar diameter and material as the receiving environment will be used) (see **Section 7.7**). Consequently, there would not be a shift in seabed composition in areas of rock and boulders where Annex I *S. spinulosa* reefs are present within the RLB. However, due to its high ecological value and the acknowledgement that mortality of epifauna is likely to occur during construction activities, the **sensitivity** of Annex I *S. spinulosa* reefs to permanent habitat loss has been assessed as **medium**.

An area of 0.005 km^2 of external cable protection would be required with an area of Annex I *S. spinulosa* reef at KP 560.5, where the Proposed Development crosses two active pipelines (Forties C to Cruden Bay PL721 and Forties C to Cruden Bay PL8) and an active telecom cable (Tampnet CNSFTC). These three infrastructures are in close proximity, situated within 130 m, thus it is likely one rock berm would be used to cover all three crossings. One rock berm is 500 m in length and 10 m wide. An inactive telecom cable is also present at approximately KP 562. This telecom cable would be cut to reduce the need for further external cable protection.

The presence of individual or small aggregations of ross worm were commonly found in areas defined as Atlantic circalittoral rock. Where possible, external cable protection materials would be selected to match the environment (e.g., when cables are installed in areas of natural rock features, rock of similar diameter and material as the receiving environment will be used) (see **Section 7.7**). Consequently, there would not be a shift in seabed composition in areas of rock and boulders where Annex I *S. spinulosa* reefs are present within the RLB.

Ross worm is noted to colonise bedrock and artificial structures (Karlsson *et al.,* 2021); for example, the rapid colonisation of subsea cables by *Sabellaria spinulosa* has been observed in the northeast of Scotland (Braithwaite *et al.,* 2006). Therefore, Annex I *S. spinulosa* reefs have the potential for quick recovery following habitat loss and there may be opportunities with the deployment of hard substrate (external cable protection) within the RLB which allows further settlement of this species and potentially provides an increase in reef structures. Therefore, the **magnitude** of the effect has been assessed as **low.**

The overall significance of the effect of permanent habitat loss to Annex I *S. spinulosa* reef has been assessed as **Minor** and **Not Significant**.

<u>Annex I stony reefs</u>

The benthic characterisation survey identified Annex I rocky reef with high biodiversity and Annex I stony medium reef structures at Peterhead nearshore. No 'high reef' patches of Annex I stony reef were observed. The RLB does not cross any sites designated for benthic habitats therefore any permanent habitat loss as a result of associated project activities would not occur on habitat designated as part of a site.

Annex I stony reefs are highly sensitive to habitat loss as a result of change in seabed composition. Where possible, external cable protection materials would be selected to match the receiving environment (e.g., rock of similar diameter and material as the receiving environment will be used) (see **Section 7.7**), thus, where possible, there would not be a change in substrate type within this habitat. However, due to its high ecological value and the acknowledgement that mortality of epifauna is likely to occur during construction activities, the **sensitivity** of Annex I stony reefs to permanent habitat loss has been assessed as **medium**.

Due to the patchy nature of the Annex I medium stony reef within Peterhead nearshore, where possible, the submarine cable would be micro-routed around areas of Annex I medium stony reef. However, due to spatial constraints with EGL 2, routing to the south of the Annex I habitat is unfeasible (**Figure 7-3 (Drawing reference C01494-EGL3-MEA-GEO-009-A)**). Additionally, a high density of shipping vessels at Peterhead and engineering constraints, such as cable trajectory, prevents routing north of the Annex I medium stony reef. Thus, bypassing the entirety of the Annex I habitat is unavoidable. A worst-case scenario of 0.00375 km^2 of external cable protection would be required to cross the stony reef; this is equivalent to 3.75 % of the total habitat present within this area of the RLB. As a worst-case scenario, it is assumed areas of stony reef would be cut and removed to allow for cable trenching, and the subsea cable would be covered with external rock cable protection.

The use of matching external cable protection would increase the availability of hard substrate and encourage the attachment and settlement of sessile invertebrates within these habitats; a review of literature by Wallingford (2025) reports that external rock protection is colonised by primary and secondary users, with amphipods, hydroids and anemones demonstrating colonisation of artificial rock protection within subtidal habitats in the North Sea. Primary colonisers, such as tubeworms and hydroids, initially colonise the artificial rock; these are then displaced between two and four years later by secondary colonisers, such as anemones, which can dominate the artificial rock for up to 11 years post construction. The rock protection also provides additional hard substrate for mobile demersal megafauna such as lobsters and crabs.

Sheehan *et al.* (2018) reported colonisation of rock protection overlying circalittoral rock in the northeast coast of Cornwall; within five years the benthic fauna colonising the rock protection was similar to that of the surrounding bedrock, and there was no significant difference in faunal abundance. Taxa abundance was reported to be significantly lower than that of the natural environment, however monitoring surveys (one, four and five years post-installation) showed evidence of ecological succession and community growth, which indicates habitat recovery potential. Sherwood *et al.* (2016) and Taormina *et al.* (2018) also reported the presence of comparable benthic communities on external cable protection (to that of the surrounding habitat) 3.5 years post installation. This evidence suggests fauna associated with Annex I stony reef has the potential to colonise external rock protection. Therefore, the **magnitude** of this effect has been assessed as **low**. The overall significance of the effect of permanent habitat loss to Annex I stony reefs has been assessed as **Minor** and **Not Significant**.

7.8.2.3. PMFs

<u>Subtidal sands and gravels</u>

Subtidal sands and gravel habitats are classified as UKBF habitats, PMFs and featured on the Scottish Biodiversity List under Section 2(4) of the Nature Conservation (Scotland) Act 2004. Within the RLB, there are six Level 5 biotopes that fall under the category of a subtidal sands and gravels habitat. These include:

- *Glycera lapidum* in impoverished Atlantic infralittoral mobile gravel and sand (MB3235) (present within Atlantic infralittoral coarse sediment)

- *Nephtys cirrosa* and *Bathyporeia spp.* in Atlantic infralittoral sand (MB5233) (present within Atlantic infralittoral coarse sediment)
- *Mediomastus fragilis, Lumbrineris spp.* and venerid bivalves in Atlantic circalittoral coarse sand or gravel (MC3212) (present with Atlantic circalittoral coarse sediment)
- *Branchiostoma lanceolatum* in Atlantic circalittoral coarse sand with shell gravel (MC3215) (present with Atlantic circalittoral coarse sediment)
- *Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (MC5211) (present within Atlantic circalittoral sand)
- *Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand (MD5212) (present within Atlantic

All six Level 5 biotopes demonstrate **high sensitivity** to permanent habitat loss as a result of change of substrate type. The placement of external cable protection in subtidal sands and gravels habitats would result in the irreversible conversion of sands and gravels to hard substrate, permanently altering the ecological composition and function of the affected area. Such changes can lead to shifts in benthic community structures, favouring sessile species adapted for hard substrates while displacing infaunal organisms, such as bivalves and polychaetes, who live within softer sediments.

External cable protection would be a permanent addition to subtidal sands and gravels habitats within the RLB, and it is assumed that it would not be removed following decommissioning of the Proposed Development. However, external cable protection would only be installed across a maximum area of 0.13 km^2. Additionally, cable protection would be installed only where considered necessary for the safe operation of the Proposed Development. Although a PMF, subtidal sands and gravels habitats are common throughout the North Sea. Thus, permanent habitat loss of small sections of these habitats within the RLB would have little effect on their wider distribution. Therefore, the **magnitude** of permanent habitat loss has been assessed as **negligible**.

The overall significance of the effect of permanent habitat loss to subtidal sands and gravels has been assessed as **Minor** and **Not Significant.**

<u>Ocean quahog</u>
No adult individuals of ocean quahog were recorded during benthic characterisations surveys; however, two juveniles were identified from station EGL3_176_EBS, and ocean quahog siphons were observed along three camera transects (EGL3_178, EGL3_179 and EGL3_180) between KP 471 and KP 450, with densities classified as 'Frequent' on the SACFOR scale. The RLB does not cross any sites designated for benthic habitats, therefore any permanent habitat loss as a result of associated project activities would not affect ocean quahog designated as part of a site.

Ocean quahog is an infaunal species, commonly occurring in mud and sand habitats. A change to natural or artificial hard substratum through external cable protection would remove the sedimentary habitat required by the species, causing individual mortality and population decline. Therefore, the **sensitivity** of ocean quahog to permanent habitat loss is **high**.

Abundance of ocean quahog varies between location within the North Sea. For example, there are 28,600 individuals per 100 / m^2 within the Northern North Sea (juvenile dominance), 7 adults (>10 mm in length) per 100 / m^2 in Southern North Sea and 21 adults (>10 mm in length) per 100 / m^2 in Central North Sea (Tyler-Walters and Sabatini, 2017). Few individuals of ocean quahog were found within macrofauna grab samples and therefore any mortality that occurs as a result of the Proposed Development would have little effect to the wider population and abundance within the North Sea. Therefore, the **magnitude** of this effect has been assessed as **negligible**.

The overall significance of the effect of permanent habitat loss to ocean quahog has been assessed as **Minor** and **Not Significant**.

<u>Kelp beds</u>
The benthic characterisation survey identified that Peterhead nearshore (defined by transects EGL3_PT_02 and EGL3_PT_03 respectively) was characterised by the PMF *Laminaria hyperborea* on tide-swept Atlantic infralittoral rock (MB1218). MB1218 is highly sensitive to habitat loss as a result of change in seabed composition. Where possible, external cable protection materials would be selected to match the receiving environment (e.g., rock of similar diameter and material as the receiving environment will be used) (see **Section 7.7**), thus, where possible, there would not be a change in substrate type within this habitat. However, due to its high ecological value and the acknowledgement that mortality of epifauna is likely to occur during construction activities, the **sensitivity** of biotope MB1218 has been assessed as **medium**.

Due to spatial constraints with EGL 2 to the south of this PMF habitat within Peterhead nearshore, micro-routing around this habitat in its entirety is not possible (**Figure 7-3 (Drawing reference C01494-EGL3-MEA-GEO-009-A))**; the HVDC cable may be surface laid over biotope MB1218 within the RLB for approximately 220 m; a worst-case scenario of 0.0022 km^2 of external rock protection would be required to cover the HVDC cable, which is equivalent to approximately 0.56 % of the total area of biotope. The mitigation hierarchy has been followed, however, during routing decisions, ensuring a short route is taken through this PMF habitat to reduce the area of required external cable rock protection, and subsequently reduce the area of permanent habitat loss.

The use of matching external cable protection would increase the availability of hard substrate and encourage the attachment and settlement of sessile invertebrates within this habitat; a review of literature by Wallingford (2025) reports that external rock protection is colonised by primary and secondary users, with amphipods, hydroids and anemones demonstrating colonisation of artificial rock protection within subtidal habitats in the North Sea. Primary colonisers, such as tubeworms and hydroids, initially colonise the artificial rock; these are then displaced between two and four years later by secondary colonisers, such as anemones, which can dominate the artificial rock for up to 11 years post construction. The rock protection also provides additional hard substrate for mobile demersal megafauna such as lobsters and crabs. Although no specific reference to *Laminaria hyperborea* or other kelp species, Wallingford (2025) reports colonisation of rock protection by algae within two years of rock protection placement.

Sheehan *et al.* (2018) reported colonisation of rock protection overlying circalittoral rock in the northeast coast of Cornwall; within five years the benthic fauna colonising the rock protection was similar to that of the surrounding bedrock, and there was no significant difference in faunal abundance. Taxa abundance was reported to be significantly lower on the rock protection than that of the natural environment, however monitoring surveys (one, four and five years post-installation) showed evidence of ecological succession and community growth, which indicates habitat recovery potential. Sherwood *et al.* (2016) and Taormina *et al.* (2018) also reported the presence of comparable benthic communities on external cable protection (to that of the surrounding habitat) 3.5 years post installation.

Furthermore, grazing sea urchins graze on juvenile *L. hyperborea*, reducing the growth rate and success of recolonisation of the species in areas of no adult individuals (Sjotun, Christie and Fossa, 2006); camera transects and grab samples collected during the benthic characterisation survey did not identify the presence of urchins within the RLB at Peterhead nearshore. This suggests a greater potential of recovery for the habitat following rock protection placement.

This evidence suggests biotope MB1218 has the potential to recover post rock protection installation, potentially experiencing only short-term habitat loss. Therefore, the **magnitude** of this effect has been assessed as **low**.

The overall significance of the effect of permanent habitat loss to kelp beds has been assessed as **Minor** and **Not Significant**.

7.8.3. Temporary Increase and Deposition of Suspended Sediments – All Phases

The construction, operation and maintenance and decommissioning of the Proposed Development has the potential to temporarily increase suspended sediments. This can create sediment plumes within the water column that can travel away from the Proposed Development before the sediment is deposited on the seabed. Additionally, once deposited, these plumes can cause smothering of habitats and features.

Sensitivity to the impact of temporary increase and deposition of suspended sediments varies between habitats and species, depending upon the sediment composition of the habitat and the vulnerability of an individual species to turbidity and smothering. For example, fine particulate sediments such as silt and clay remain suspended in the water column longer than heavier sediments such as sand and gravel. These fine sediments can in turn travel further distances away from the Proposed Development.

Once deposited on the seabed, fine particulate sediments can cause light smothering (<5 cm) of habitats and species whereas heavier sediments can cause heavy smothering (5-30 cm). Gooding *et al.* (2012) reported that fine sediment plumes created by ploughing rapidly dilute and disperse within the water column, settling in 1 mm thick layers once deposited on the seabed. Increased sediment suspension and smothering by sediment plumes can affect the biological process of marine organisms. This includes:

- Reduced photosynthesis due to increased turbidity, resulting in reduced primary production in algae;
- Smothering of invertebrate species and clogging of respiratory and feeding apparatus; and,
- Indirect effects of the release of contaminants, such as heavy metals and hydrocarbons, during sediment mobilisation, on benthic species.
- Epifauna, less mobile organisms and suspension/filter feeders are the most vulnerable organisms to temporary increase and deposition of suspended sediments.

Project specific data presented in **Chapter 6: Marine Physical Processes** demonstrates that coarse sediment plumes, created from seabed preparation and cable trenching activities, would settle from the water column within the RLB. In most cases this coarse sediment would cause light surface smothering of <5 cm, but at KP 548 smothering from medium sand can cause smothering of up to 9.5 cm and at KP 575 coarse sand can cause smothering of up 17.9 cm. In both instances, this occurs within 100 m of the source of activity. Fine sediment particulate plumes can travel up to 13.6 km from trenching activities and would cause light surface smothering of <1 mm.

Sediment disturbed by construction activities would result in very high sediment concentrations within 5-10 m of the activity, which would last the duration of the activity. The maximum distance from construction activities where suspended sediment concentrations exceed 5 mg/l is 4.6 km at KP 548. Any exceedances of more than 5 mg/l would be of short duration beyond the RLB.

The following section has been sub-divided to consider each receptor, providing an assessment that provides justification for the assigned receptor values/sensitivities and the magnitude of the impact. A summary of the assessment conclusions for construction, which is considered to be the worst-case scenario, is provided in **Table 7-15** for ease of reference. Where receptors share a common sensitivity/value, magnitude and significance of effect they have been grouped together. The magnitude of temporary increase and deposition of suspended sediments from operation and maintenance is expected to be significantly less than that for construction. Temporary increase and deposition of suspended sediments would directly affect intertidal and subtidal benthic receptors during the operational phase. However, the impact is predicted to be of local spatial extent (restricted to within the benthic ecology Study Area and in close proximity to the source), short-term duration (any suspended sediment would disperse quickly) and highly intermittent. It is not anticipated that impacts from decommissioning would be any greater than impacts from the construction phase.

Table 7-15: Summary of assessment conclusions for temporary increase and deposition of suspended sediments

Receptor		Sensitivity	Magnitude	Significance of Effect
Intertidal habitats		Negligible	Negligible	Negligible
Subtidal broadscale habitats	Atlantic infralittoral rock	Low	Negligible	Negligible
	Atlantic infralittoral coarse sediment			
	Atlantic circalittoral coarse sediment			
	Atlantic circalittoral rock	Medium	Low	Minor
Subtidal Annex I habitats	*Sabellaria spinulosa reefs*	Medium	Low	Minor
	Stony reefs	Low	Negligible	Negligible
PMFs	Subtidal sands and gravels	Medium	Low	Minor
	Kelp beds			
	Ocean quahog	Negligible	Negligible	Negligible

7.8.3.1. Intertidal Habitats

The Proposed Development would use a trenchless technique such as HDD at the proposed landfall, avoiding intrusive works in the intertidal area. The exit point for the cable ducts would be entirely in the subtidal environment. There would be no direct impacts to intertidal benthic ecology receptors, except in the event of drilling fluid breakout (frac-out), where clean-up activities may be required. A frac-out can occur if drilling occurs within unconsolidated sediment. In this situation a pathway can form between the drilling bore and the surface (e.g., the ground or seabed). The bentonite used within the bore can travel through this pathway to the surface, causing a temporary increase of suspended sediment. Lessons learnt from analogous projects have been reviewed and considered when undertaking preliminary HDD designs for the Proposed Development.

Bentonite is an inert, clay-like lubricant listed on the Cefas list of notified chemicals as posing little or no risk and has been proven to have no long-lasting effects on the marine environment. Due to its clay-like nature, bentonite consists of very fine particulates that would remain within the water column. Thus, no smothering would occur. The **sensitivity** of the habitats present within the intertidal zone to increased suspended sediment from a bentonite plume is **negligible**.

If a frac-out occurs, a bentonite plume would be visible within the marine environment for the length of the tidal cycle over which the release occurred and would be completely diluted in seawater after two tidal cycles. The Construction Environment Management Plan for the Proposed Development includes mitigation plans to ensure frac-outs are managed appropriately should a pollution event occur; this involves the use of an absorbent matt to remove the bentonite from the marine environment. The **magnitude** of increased suspended sediments on intertidal habitats is therefore assessed as **negligible**.

The overall significance of the effect of temporary increase and deposition of suspended sediments to intertidal habitats has been assessed as **Negligible** and **Not Significant.**

7.8.3.2. Subtidal Broadscale Habitats

There are six broadscale habitat complexes within the Proposed Development including: Atlantic infralittoral rock (MB12); Atlantic circalittoral rock (MC12); Atlantic infralittoral coarse sediment (MB32); Atlantic circalittoral coarse sediment (MC32); Atlantic circalittoral sand (MC52) and Atlantic offshore circalittoral sand (MD52). The assessment for each habitat complex follows.

<u>Atlantic infralittoral rock (MB12)</u>

Atlantic infralittoral rock habitats within the RLB comprise of bedrock, boulders, cobbles, gravel and sand and are characterised by brown and red algae and seaweeds. These epifauna are unable to relocate to avoid the effects of temporary increase and deposition of suspended sediments. Infralittoral rock habitats within the RLB consist of two Level 5 biotopes: '*Laminaria hyperborea* on tide-swept Atlantic infralittoral rock' (MB1218); and '*Polyides rotundus, Ahnfeltia plicata* and *Chondrus crispus* on sand-covered Atlantic infralittoral rock' (MB1237), and one Level 4 biotope 'Kelp and seaweed communities on Atlantic infralittoral rock' (MB121). MB1218 is a PMF and has been assessed in **Section 7.8.3.4** under the subheading Kelp beds. MB1237 is present at two sampling stations at Peterhead nearshore, at approximately KP 580.

Increased suspended sediment concentrations (SSC) can reduce photosynthetic activity by reducing the amount of available light. The characteristic red algae of biotope MB1237 typically grows in areas of high scour and turbidity, with Irish moss typically occurring below the canopies of larger macroalgae and landlady's wig (*Ahnfeltia plicata*) occurring below canopies of *Laminaria spp*., thus demonstrating a tolerance of low-level light conditions. The rock on which these red algae occur are often overlain with coarse sediment which are subject to movement during high tidal energy. Consequently, the epifauna present on these rocks are subject to periodic burial. Irish moss, discoid fork weed (*Polyides rotunda*) and landlady's wig are erect species of red algae that can grow >20 cm in height. Therefore, adult individuals would be unaffected by light smothering. Juveniles and regenerating holdfasts below 5 cm in height would be subject to adverse effects of light smothering, including the inability to photosynthesise. The Dahlia anemone (*Urticina felina*) is another species present within this biotope and the RLB. The Dahlia anemone occurs in areas of high tidal energy, thus is exposed to naturally high levels of suspended sediment, scour and periodic light smothering. Atlantic infralittoral rock demonstrates **low sensitivity** to temporary increase and deposition of suspended sediments (Tillin and Rayment, 2015).

Project specific data presented in **Chapter 6: Marine Physical Processes** demonstrates that coarse sediment plumes in areas of Atlantic infralittoral rock, created from seabed preparation and cable trenching activities, would settle from the water column within the RLB. This coarse sediment would cause temporary light surface smothering of <5 cm and whilst sediment disturbed by construction activities would result in very high sediment concentrations within 5-10 m of the activity, this would not persist past the duration of the activity. The maximum distance from construction activities where suspended sediment concentrations exceed 5 mg/l is 4.6 km at KP 548. Any exceedances of more than 5 mg/l would be of short duration beyond the RLB. Any sedimentation on Atlantic infralittoral rock habitats outside of the RLB would be <1 mm and indistinguishable from background levels. Therefore, the **magnitude** of effect has been assessed **negligible.**

The overall significance of the effect of temporary increase and deposition to Atlantic infralittoral rock has been assessed as **Minor** and **Not Significant**.

<u>Atlantic circalittoral rock (MC12)</u>

Atlantic circalittoral rock habitats host a highly diverse stable community of sessile benthic macrofauna that live on pebbles, rocks, cobbles and boulders and are unable to relocate to avoid the effects of temporary increase and deposition of suspended sediments. Consequently, epifauna present in these habitats and within the RLB, such as sponges (Porifera), Bryozoa and Cnidaria, could be at risk of smothering, clogging of feeding or respiratory apparatus and reduced photosynthetic activity.

Atlantic circalittoral rock habitats found within the RLB consist of one Level 4 biotope 'faunal turf communities on Atlantic circalittoral rocks' (MC121*)*, and two Level 5 biotopes: '*Flustra foliacea* and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock' (MC1216), present at two sampling stations at Peterhead nearshore; and '*Sabellaria spinulosa* encrusted Atlantic circalittoral rock' (MC1281), present at 18 sampling stations across the Proposed Development.

Due to the high tidal energy in areas of Atlantic circalittoral rock, neither biotope demonstrates sensitivity to increased SSC. More specifically, hornwrack and a variety of encrusting sponges are tolerant of high levels of suspended sediment (Readman, Lloyd and Watson, 2023), and the ross worm thrives in areas of increased SSC, using the suspended sediment for tube formation and suspension feeding (Tillin *et al.,* 2024).

MC1216 demonstrates low sensitivity to light smothering; light smothering can clog the feeding and respiration apparatus of bryozoans, subsequently reducing growth and reproduction rates. MC1281 is also not sensitive to light smothering; ross worm can tolerate 5 cm of smothering for several weeks, suggesting a high adaptability to light sediment deposition. For example, Last *et al.* (2011) demonstrated that ross worm can survive for up to 32 days buried in depths of 2 cm, 5 cm and 7 cm of sand.

However, at KP 548 cable construction and installation is predicted to cause medium sand to settle in thicknesses of up to 9.5 cm. MC1281 is present within the RLB at KP 548 and demonstrates medium sensitivity to heavy smothering. The benchmark for heavy smothering outlined by MarESA is 'deposition of up to 30 cm of fine material added to the seabed in a single discrete event' (Tillin *et al.,* 2024b) and a medium sensitivity was assigned to this biotope as a precautionary assessment, under the assumption of long-term smothering in an area of low tidal energy. The heavy smothering caused by construction of the Proposed Development would be temporary, and in areas of high wave action. Additionally, sedimentation would be from coarse sediment which would settle in a nonhomogeneous mosaic, allowing for gaps between sand particles and reduced clogging of respiration apparatus. Therefore, the smothering that would occur on Atlantic circalittoral rock would be significantly less than the MarESA benchmark of heavy smothering. It is also important to note that there is no evidence available for duration of time that ross worm can survive 30 cm of sediment smothering. However, as a precautionary approach, the **sensitivity** of Atlantic circalittoral rock to temporary increase and deposition of suspended sediment has been appraised as **medium**.

Project specific data presented in **Chapter 6: Marine Physical Processes** demonstrates that coarse sediment plumes in areas of Atlantic circalittoral rock, created from seabed preparation and cable trenching activities, would settle from the water column within the

RLB. This coarse sediment would cause temporary light surface smothering of <5 cm (except at KP 548, where smothering can reach up to 9.5 cm in thickness) and whilst sediment disturbed by construction activities would result in very high sediment concentrations within 5-10 m of the activity, this would not persist past the duration of the activity. As previously mentioned, Atlantic circalittoral rock demonstrates no sensitivity to increased SSC. Any sedimentation on Atlantic circalittoral rock habitats outside of the RLB would be <1 mm and indistinguishable from background levels.

MC1281 occurs in wave exposed areas (JNCC, 2022). Increased deposition of suspended sediments is a temporary effect of cable construction activities. However, this high-water movement known to occur in areas of MC1281 would further decrease the exposure time of the habitat to heavy smothering at KP 548. Additionally, evidence suggests that recovery from burial events in this habitat is high, as ross worm larval dispersal is not interrupted by smothering and new ross worm can establish over old, buried tubes (Fariñas-Franco *et al.*, 2014). Furthermore, Pearce *et al.* (2007) and Pearce *et al.* (2011) suggest that ross worm present adjacent to aggregate dredging sites are not impacted by smothering from dredging operations and Earll and Erwin (1983) reported that the congener *Sabellaria alveolata* survived sediment burial for several weeks following a storm that changed sand levels by 2 m. MarESA also assigns a resilience value of medium from heavy smothering to this habitat. Medium resilience is described as 2-10 years, which is significantly longer than the duration of smothering from project associated activities (Tillin *et al.,* 2024b). Therefore, the **magnitude** of effect has been assessed **low**.

The overall significance of the effect of temporary increase and deposition of suspended sediments to Atlantic circalittoral rock has been assessed as **Minor** and **Not Significant**.

<u>Atlantic infralittoral (MB32) and circalittoral (MC32) coarse sediment</u>

In general, Atlantic infralittoral and circalittoral coarse sediment habitats are comprised of coarse sand, gravel and shingle and are subject to seabed disturbance from wave action. These habitats are characterised by robust infauna such as the sand mason worm, mobile crustacea such as cumaceans and amphipods and venerid bivalves (Connor *et al.,* 2004).

Atlantic infralittoral coarse sediment habitats present within the RLB comprise of sand and gravel and consist of two Level 5 biotopes: '*Glycera lapidum* in impoverished Atlantic infralittoral mobile gravel and sand' (MB3235) and '*Nephtys cirrosa* and *Bathyporeia spp.* in Atlantic infralittoral sand' (MB5233). These biotopes are categorised under the habitat 'subtidal sands and gravels'. Subtidal sands and gravels are PMFs, thus MB3235 and MB5233 are assessed in **Section 7.8.3.4.**

Atlantic circalittoral coarse sediment habitats present within the RLB comprise of sand, gravel, cobbles and boulders, and are dominant across the Proposed Development, occurring between approximately KP 490 to KP 570. These habitats consist of two Level 5 biotopes: '*Mediomastus fragilis, Lumbrineris spp.* and venerid bivalves in Atlantic circalittoral coarse sand or gravel' (MC3212); and '*Branchiostoma lanceolatum* in Atlantic circalittoral coarse sand with shell gravel' (MC3215), occurring at 21 and 11 sampling stations respectively. Both biotopes are classified as UKBF habitats. These biotopes are also categorised under the habitat 'subtidal sands and gravels'. Subtidal sands and gravels are PMFs, thus MC3212 and MC3215 are assessed in **Section 7.8.3.4.**

Venerid bivalves are suspension feeders, trapping food particles on their gill filaments; increased SSC can clog these gill filaments, negatively affecting feeding and respiration. For example, the oval venus occurs in areas of low SSC where organic particulate sorting is unnecessary. Thus, this species of bivalve has adapted to only have a small mid-gut with tiny palps. Therefore, the oval venus may struggle to sort organic materials during periods of increased SSC. As with venerid bivalves, the sand mason worm is a suspension feeder and is susceptible to clogged feeding apparatus from increased SSC.

However, the characteristic infaunal species of coarse sediment habitats can temporarily relocate during periods of increased turbidity and to avoid smothering from sediment deposition but can return once associated activities are complete on the Proposed Development. For example, venerid bivalves are burrowing infauna and are likely to be unaffected by light smothering and the sand mason worm is an infaunal species that has a demonstrated ability to migrate upwardly through deposited sediment. Additionally, sand mason worms use shell fragments to form tubes that are erect from the seabed surface. Thus, smothering is unlikely to affect this species. The **sensitivity** of Atlantic infralittoral and circalittoral coarse sediment habitats to temporary increase and deposition of suspended sediment has been appraised as **low**.

Project specific data presented in **Chapter 6: Marine Physical Processes** demonstrates that coarse sediment plumes in areas of coarse sediment habitats, created from seabed preparation and cable trenching activities, would settle from the water column within the RLB. This coarse sediment would cause temporary light surface smothering of <5 cm and whilst sediment disturbed by construction activities would result in very high sediment concentrations within 5-10 m of the activity, this would not persist past the duration of the activity. Coarse sediment habitats occur in areas of high wave action. Increased SSC and deposition of suspended sediments is a temporary effect of cable construction activities. However, this high-water movement would further decrease the exposure time of coarse sediment habitats to this effect. Any sedimentation on Atlantic coarse sediment habitats outside of the RLB would be <1 mm and indistinguishable from background levels. Therefore, the **magnitude** of effect has been assessed as **negligible**.

The overall significance of the effect of temporary increase and deposition of suspended sediments to coarse sediment habitats has been assessed as **Negligible** and **Not Significant**.

Atlantic circalittoral sand (MC52)

Atlantic circalittoral sand within the RLB is comprised of sand and consists of the Level 5 biotope '*Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand' (MC5211). This biotope is categorised under the habitat 'subtidal sands and gravels'. Subtidal sands and gravels are PMFs, thus MC5211 has been assessed in **Section 7.8.3.4**.

Atlantic offshore circalittoral sand (MD52)

Atlantic offshore circalittoral sand within the RLB is comprised of sand, gravel, cobbles and boulders and consists of the Level 5 biotope '*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand' (MD5212). This biotope is categorised under the habitat 'subtidal sands and gravels'. Subtidal sands and gravels are PMFs, thus MD5212 has been assessed in **Section 7.8.3.4**.

7.8.3.3. Subtidal Annex I Habitats

Annex I *Sabellaria spinulosa* reefs

The presence of individual or small aggregations of ross worm were commonly found in areas defined as Atlantic circalittoral rock. Benthic survey analysis demonstrated the presence of 30 patches of 'low reef' structures between KP 563 and KP 540, encompassing the area where ross worm 'bommie' habitat was observed (KP 548 to KP 561). No 'medium reef' or 'high reef' structures were identified.

Ross worms are tube building polychaetes that thrive in areas of increased SSC. Ross worm requires a supply of suspended sediment sufficient for feeding and tube formation activities. Additionally, this polychaete can tolerate 5 cm of smothering for several weeks, suggesting a high adaptability to light sediment deposition. For example, Last *et al.* (2011) demonstrated that ross worm can survive for up to 32 days buried in depths of 2 cm, 5 cm and 7 cm of sand. However, at KP 548 pre-sweeping of sandwaves is predicted to cause medium sand to settle in thicknesses of up to 9.5 cm. The benchmark for heavy smothering outlined by MarESA is 'deposition of up to 30 cm of fine material added to the seabed in a single discrete event' (Tillin *et al.,* 2024b). The heavy smothering caused by construction of the Proposed Development would be temporary, and in areas of high wave action. Additionally, sedimentation would be from coarse sediment which would settle in a nonhomogeneous mosaic, allowing for gaps between sand particles and reduced clogging of respiration apparatus. Therefore, the smothering that would occur on Annex I *S. spinulosa* reefs would be significantly less than the MarESA benchmark of heavy smothering. It is also important to note that there is no evidence available for duration of time that ross worm can survive 30 cm of sediment smothering. However, as a precautionary approach, the **sensitivity** of Annex I *S. spinulosa* reefs to temporary increase and deposition of suspended sediment has been appraised as **medium**.

Project specific data presented in **Chapter 6: Marine Physical Processes** demonstrates that coarse sediment plumes in areas of Annex I *S. spinulosa* reef, created from seabed preparation and cable trenching activities, would settle from the water column within the RLB. This coarse sediment would cause temporary light surface smothering of <5 cm (except at KP 548, where smothering can reach up to 9.5 cm in thickness) and whilst sediment disturbed by construction activities would result in very high sediment concentrations within 5-10 m of the activity, this would not persist past the duration of the activity. As previously mentioned, ross worm demonstrates no sensitivity to increased SSC and needs high levels of turbidity for tube formation and suspension feeding. Any sedimentation on Annex I *S. spinulosa* reefs outside of the RLB would be <1 mm and indistinguishable from background levels.

The ross worm 'bommie' habitat observed at KP 548 occurs in wave exposed areas (JNCC, 2022). Increased deposition of suspended sediments is a temporary effect of cable construction activities. However, this high-water movement would further decrease the exposure time of ross worm to heavy smothering. Additionally, evidence suggests that recovery of ross worm from burial events is high, as ross worm larval dispersal is not interrupted by smothering and new ross worm reefs can establish over old, buried reefs (Fariñas-Franco *et al.*, 2014). Furthermore, Pearce *et al.* (2007) and Pearce *et al.* (2011) suggest that ross worm reefs present adjacent to aggregate dredging sites are not impacted by smothering from dredging operations and Earll and Erwin (1983) reported that the congener *S. alveolata* survived sediment burial for several weeks following a storm that changed sand levels by 2 m. Therefore, the **magnitude** of effect has been assessed **low**.

The overall significance of the effect of temporary increase and deposition of suspended sediments to Annex I *S. spinulosa* reef has been assessed as **Minor** and **Not Significant**.

Annex I stony reefs

The benthic characterisation survey identified Annex I rocky reef with high biodiversity and Annex I stony medium reef structures at Peterhead nearshore. No 'high reef' patches of Annex I stony reef were observed.

Annex I stony reefs are associated with sessile assemblages, which are unable to relocate to avoid smothering or increased suspended sediments. Despite this, the height of characterising fauna results in a low sensitivity to increased sediment suspension and smothering. For example, dead man's finger, a characterising species of Annex I stony reefs that is present within the Proposed Development, can grow up to 20 cm in height and can extend its tentacles to greater heights for feeding (Budd, 2008). Adult dead man's finger can also dislodge settled particles with large amounts of mucous, demonstrating a high tolerance to increased suspended sediment (Hill *et al.,* 1997). Juvenile colonies, however, that initially form crusts of 5 – 10 mm, can experience decreased respiration ability in periods on increased turbidity or smothering (Budd, 2008). The kelp *L. hyperborea* has a dominant presence on the Annex I stony and rocky reefs present within the RLB. Although smothering of adult individuals can reduce photosynthetic activity and smothering of juveniles can inhibit growth, it is unlikely that smothering would cause damage or mortality to *L. hyperborea* (Tyler-Walters, 2007).

Project specific data presented in **Chapter 6: Marine Physical Processes** demonstrates that coarse sediment plumes, created from seabed preparation and cable trenching activities, would settle from the water column within the RLB. This coarse sediment would cause temporary light surface smothering of <5 cm and whilst sediment disturbed by construction activities would result in very high sediment concentrations within 5-10 m of the activity, this would not persist past the duration of the activity. Any sedimentation on Annex I stony reefs outside of the RLB would be <1 mm and indistinguishable from background levels. Therefore, the **magnitude** of effect has been assessed as **negligible**.

The overall significance of the effect of temporary increase and deposition of suspended sediments to Annex I stony reefs has been assessed as **Negligible** and **Not Significant**.

7.8.3.4. PMFs

Subtidal sands and gravels

Subtidal sands and gravel habitats are classified as UKBF habitats, PMFs and featured on the Scottish Biodiversity List under Section 2(4) of the Nature Conservation (Scotland) Act 2004. Within the RLB, there are six Level 5 biotopes that fall under the category of a subtidal sands and gravels habitat. These include:

- *Glycera lapidum* in impoverished Atlantic infralittoral mobile gravel and sand (MB3235) (present within Atlantic infralittoral coarse sediment)
- *Nephtys cirrosa* and *Bathyporeia spp.* in Atlantic infralittoral sand (MB5233) (present within Atlantic infralittoral coarse sediment)
- *Mediomastus fragilis, Lumbrineris spp.* and venerid bivalves in Atlantic circalittoral coarse sand or gravel (MC3212) (present with Atlantic circalittoral coarse sediment)
- *Branchiostoma lanceolatum* in Atlantic circalittoral coarse sand with shell gravel (MC3215) (present with Atlantic circalittoral coarse sediment)
- *Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (MC5211) (present within Atlantic circalittoral sand)
- *Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand (MD5212) (present within Atlantic offshore circalittoral sand)

Construction of the Proposed Development is predicted to cause heavy smothering of up to 9.5 cm by medium sand at KP 548 and heavy smothering of up to 17.9 cm by coarse sand at KP 575. Within the RLB, biotopes MC5211 and MC3212 are present at KP 548 and biotopes MB3235 and MC3215 are present at KP 575, thus would be subject to heavy smothering in these areas.

Characterising species of biotopes MB3235, MC3212 and MC5211 include the bloodworm and catworm; these species of Polychaeta are infaunal, thus increased turbidity would not directly affect these taxa. Tellinidae (species present within the Proposed Development include the bean-like tellin (*Fabulina fabula)* and the dwarf tellin (*Asbjornsenia pygmaea))*, a family of habitat characterising bivalves, can migrate up to 40 cm in mud and up to 50 cm in sand. Similarly, cat worms can migrate upwardly 60 cm through mud and 90 cm through sand; Powilleit *et al.* (2009) demonstrated that *Nephtys hombergii* can successfully migrate 40 cm through deposited sediment at velocities of up to 20 cm/day. *S. bombyx*, another characterising Polychaeta, demonstrates quick recovery following smothering and bloodworms *G. alba* and *G. lapidum* are tolerant of light smothering (Tillin and Watson, 2023 and Tillin and Watson, 2024 and Tillin and Watson, 2024).

Biotope MC3215 occurs in areas of periodic increases in SSC. The European lancelet and the dog cockle are suspension feeders and reliant on inhalant currents for respiration; increased SSC may cause clogging of apparatus and adversely affect respiration and feeding. However, the feeding apparatus of the European lancelet is more robust than that of filter feeding molluscs. Characterising fauna of this biotope includes the heart urchin (*Echinocardium spp*.) which has been recorded to migrate upwardly 30 cm in sand (Tillin and Watson, 2023). Biotopes MB3235, MC3212 and MC5211 demonstrate medium sensitivity to heavy smothering and biotope MC3215 demonstrates low sensitivity to heavy smothering.

Biotopes MB5233 and MD5212 only occur within the RLB in areas predicted to experience light smothering from construction of the Proposed Development. Sand digger shrimp are characterising species of MB5233. Sand digger shrimp feed on diatoms within the water column; increased SSC could reduce light penetration, subsequently reducing food (diatom) supply for the sand digger shrimp. Sand digger shrimp are also able to migrate upwardly 20 cm through mud and 40 cm through sand (Gerrard, Lloyd and Watson, 2023). The brittletsar *Ophiura ophiura,* a characterising species of the biotope MD5212, is tolerant of periodic, light smothering; Last *et al.* (2011) demonstrated a <10 % mortality rate of *O. ophiura* after burial at 2 cm, 5 cm and 7 cm for 32 days. Sand stars, another characterising species of this biotope, are known to bury deeper than 5 cm in winter to avoid storms (Freeman *et al*., 2001), suggesting a tolerance to light smothering. *O. fusiformis* is a tube-building worm, that uses sand and shingle for tube formation; heavy smothering of clay and silt would prevent tube construction, which could result in high levels of mortality (De-Bastos, 2023).

All six biotopes demonstrate either low sensitivity or no sensitivity to increased SSC and light smothering; characterising species of these six biotopes are infaunal, thus increased turbidity would not directly affect individuals. Therefore, an assessment of heavy smothering on subtidal sands and gravels has been carried out within this MEAp, as any adverse impacts that arise from light smothering would be less than that of heavy smothering. The benchmark for heavy smothering outlined by MarESA is 'deposition of up to 30 cm of fine material added to the seabed in a single discrete event'. The heavy smothering caused by construction of the Proposed Development would be less than 30 cm and be from coarse sediment which would settle in a nonhomogeneous mosaic, allowing for gaps between sand particles and reduced clogging of respiration and feeding apparatus. Therefore, the smothering that would occur on subtidal sands and gravels would be significantly less than the MarESA benchmark of heavy smothering. However, as a precautionary approach, the **sensitivity** of subtidal sands and gravels to temporary increase and deposition of suspended sediments has been appraised as **medium**.

Project specific data presented in **Chapter 6: Marine Physical Processes** demonstrates that coarse sediment plumes in areas of subtidal sands and gravels, created from seabed preparation and cable trenching activities, would settle from the water column within the RLB. This coarse sediment would cause temporary light surface smothering of <5 cm (except at KP 548, where smothering can reach up to 9.5 cm in thickness, and KP 575, where smothering can reach up to 17.9 cm) and whilst sediment disturbed by construction activities would result in very high sediment concentrations within 5-10 m of the activity, this would not persist past the duration of the activity. As previously mentioned, subtidal sands and gravels demonstrate low to no sensitivity to increased SSC. Any sedimentation on subtidal sands and gravels outside of the RLB would be <1 mm and indistinguishable from background levels.

Subtidal sands and gravels occur in wave exposed to moderately wave exposed areas (JNCC, 2022). Increased deposition of suspended sediments is a temporary effect of cable construction activities. However, this high-water movement would further decrease the exposure time of subtidal sands and gravels to heavy smothering. Therefore, the **magnitude** of effect has been assessed as **low**.

The overall significance of the effect of temporary increase and deposition of suspended sediments to subtidal sands and gravels has been assessed as **Minor** and **Not Significant**.

Ocean quahog

As per MarESA, ocean quahog is not sensitive to increased SSC or sediment smothering (Tyler-Walters and Sabatini, 2017). Ocean quahog is a deposit feeder with a large intestinal tract and palps. This species of bivalve lives beneath the sediment surface and extends its siphon to feed on the organic material deposited at the seabed surface and therefore is not adversely affected by increased turbidity. Powilleit, Kleine and Leuchs (2006) recorded no significant change to population or growth rates of ocean quahog when buried 1.5 m deep in sediment. Additionally, Powilliet *et al.* (2009) demonstrated that ocean quahog are able to migrate through between 32 – 41 cm of smothering by fine and coarse sediment at a rate of 0.37 – 3.89 cm/day to regain contact with the sediment surface. Thus, the **sensitivity** of ocean quahog to temporary increase and deposition of suspended sediment is **negligible**.

Ocean quahog is present with Atlantic offshore circalittoral sand within the RLB. Fine sediments plumes created by project activities would cause light smothering of <1 mm of the seabed, indistinguishable from that caused by natural seabed disturbance. Therefore, the **magnitude** of this effect on ocean quahog has been assessed as **negligible**.

The overall significance of the effect of temporary increase and deposition of suspended sediments to ocean quahog has been assessed as **Negligible** and **Not Significant**.

Kelp beds

The benthic characterisation survey identified that Peterhead nearshore (defined by transects EGL3_PT_02 and EGL3_PT_03 respectively) was characterised by the PMF *Laminaria hyperborea* on tide-swept Atlantic infralittoral rock (MB1218).

Increased SSC causes a decrease in light levels. Light penetration influences the maximum depth at which kelp can grow; in areas of high turbidity the depth at which *L. hyperborea* occurs may be reduced. Additionally, photosynthetic activity of *Laminaria spp.* decreases by 50 % when turbidity increases by 0.1 /m and *L. hyperborea* is often outcompeted by the sugar kelp (*Saccharina latissimi*) in areas exposed to high levels of suspended silts. This further demonstrates the potential in reduction of abundance and density of *L. hyperborea* during periods of increased SSC. Although smothering of adult individuals can reduce photosynthetic activity and smothering of juveniles can inhibit growth, it is unlikely that smothering would cause damage or mortality to *L. hyperborea. Laminaria hyperborea* on tide-swept Atlantic infralittoral rock demonstrates **medium sensitivity** to temporary increase and deposition of suspended sediment.

Project specific data presented in **Chapter 6: Marine Physical Processes** demonstrates that coarse sediment plumes, created from seabed preparation and cable trenching activities, would settle from the water column within the RLB. This coarse sediment would cause temporary light surface smothering of <5 cm and whilst sediment disturbed by construction activities would result in very high sediment concentrations within 5-10 m of the activity, this would not persist past the duration of the activity. Any sedimentation outside of the RLB would be <1 mm and indistinguishable from background levels. Therefore, the **magnitude** of effect has been assessed as **low**.

The overall significance of the effect of temporary increase and deposition of suspended sediments to kelp beds has been assessed as **Minor** and **Not Significant**.

7.8.4. Electromagnetic Changes/Barrier to Species Movement – Operation

During the operation of an HVDC cable electromagnetic fields are generated. To inform this assessment, a number of scenarios were modelled to calculate the EMF emissions. The calculations are presented in **Appendix 3.A: EMF Report.** They show that for bundled HVDC poles the magnetic field dissipates to below background geomagnetic levels within 20 m when cables are buried at 1 m below the seabed. The magnetic field directly above the cables at the seabed is 123.8µT (or 76.4 µT without the earth's magnetic field).

There is very little information about the sensitivity of benthic species to EMF. It is known that magnetic sensitivity occurs in species that undergo large scale migrations or movements. With respect to subtidal benthic species this includes decapod crustaceans (crabs, lobster, shrimp, prawns), and isopods and amphipod crustaceans. Marine invertebrate species (molluscs, polychaetes, crustaceans and echinoderms) have been poorly studied. A review of available literature by Albert *et al.* (2020) reported that 50 % of papers provided support for an attraction towards magnetic fields in three crustacean species; 30 % of papers found no effects of magnetic field while studying more taxonomic groups (crustaceans, echinoderms, molluscs and polychaetes); Ernst and Lohmann (2018, cited in Albert *et al.,* 2020) reported repulsive behaviour in spiny lobster (*Panulirus argus*); Bochert and Zettler (2006; cited in Albert *et al.*, 2020) reported no significant differences in the spatial distribution of ragworms or the common starfish following exposure to a magnetic field of 2.8 mT for 1.5 hours; and Tomanova and Vacha (2016, cited in Albert *et al.,* 2020) reported orientation disruption in amphipods. However, it was noted that 75 % of the papers reviewed by Albert *et al.* (2020) related to controlled experiments made on individuals, and effects at a population or community level could not necessarily be inferred from the results. Ocean quahog are not known to exhibit sensitivity to EMF, and given their lack of magneto receptive capabilities, any potential effects from EMF exposure are considered negligible. The **sensitivity** of subtidal species to electromagnetic changes is **negligible**.

Where possible, the marine cables used within the Proposed Development would be buried at depths of <2.25 m. Given the background geomagnetic field of around 49 µT, the background induced electric field could range between 5.0 and 65.0 µV/m in tidal velocities ranging between 0.1 m/s and 1.35 m/s (**Appendix 3.A: EMF Report**). Although effects from electromagnetic changes would be long-term and occurring continuously for the operational lifetime of the Proposed Development, the highest intensity emission strength for the Proposed Development is significantly lower than that used in the laboratory experiments reviewed by Albert et al. (2020). Thus, the **magnitude** of the effect has been assessed as **negligible**.

The overall significance of the effect of electromagnetic changes/barrier to species movement has been assessed as **Negligible** and **Not Significant**.

7.8.5. Temperature Increase – Operation

During the operation of an HVDC cable, heat losses occur because of the resistance in the cable/conductor. This can cause localised heating of the surrounding environment (i.e., sediment for buried cables, or water in the interstitial spaces of external cable protection). There are no specific regulatory limits applied to temperature changes in the seabed, although a 2 °C change between seabed surface and 0.2 m depth is used as a guideline in Germany (Federal Maritime and Hydrographic Agency, 2020). The benchmark for sensitivity used by MarESA is a 5 °C increase in temperature for one month, or 2 °C for one year.

A change in sediment temperature has the potential to cause sediment dwelling and demersal mobile organisms to move away from the affected area. Increased heat may also alter physio-chemical conditions for epifaunal species and bacterial activity (with shifts in bacterial community composition and changes in nitrogen cycling) in surrounding sediments, contributing to altered faunal composition and localised ecological shifts.

An increase in temperature may affect spawning and recruitment levels in ocean quahog. Distribution of the species appears to be restricted by water temperature, with 16 °C being the upper threshold, with larvae tending to grow optimally between 13 °C and 15 °C. MarESA suggested a sensitivity of medium to temperature increases for the species (Tyler-Walters and Sabatini, 2017). Review of the sensitivity of other infaunal species identified within the RLB (e.g.*,* the elongate furrow shell *(Abra prismatica),* the two-toothed Montagu shell (*Kurtiella bidentata),* the bivalve *Thyasira spp.,* and the brittlestar *Amphiura filiformis*) concluded that their resistance and resilience to temperature increases lead to an overall low or no sensitivity categorisation by MarESA. Therefore, the sensitivity of ocean quahog has been used in the overall preliminary assessment, and the **sensitivity** of subtidal species to temperature increase is appraised as **medium**.

The heat loss from the cable is related to the physical and thermal properties of the cables. To inform the assessment, a number of scenarios were modelled to evaluate the thermal performance of the cables, including directly buried in a bundle to differing depths and contained within a duct at the landfall at various depths. The calculations are presented in **Appendix 3C: Heat Calculations**. They show that for cables operating at full power, the temperature is raised in the immediate vicinity of the cable but reduces with distance. Assuming an ambient seabed temperature of 12 °C, seabed temperatures at 0.2 m immediately above the cables are estimated to be 13 - 14 °C, with the cables operating at maximum operating temperatures. The actual system is unlikely to reach these temperatures as the system would have to operate at full load continuously for an extended period of time (months/years) to meet these temperatures. In reality, the system would not be at full load for this long and therefore the temperature would fluctuate and it would be unlikely to reach these maximums. Although thermal effects would be long-term and occurring continuously for the operational lifetime of the Proposed Development, the temperature increase is low level and likely to be only a few degrees higher than ambient at the shallow sediment depths (<20 cm) at which infaunal species are typically found. Where the cables are buried at a shallower depth, or surface laid with external cable protection, there is the potential for fauna to be exposed to higher temperature gradients. However, there is negligible capacity to heat the overlying water, meaning there would be no effects on epibenthic communities.

Due to natural seasonal changes in water temperature, a sediment temperature change of a few degrees higher than ambient is regarded as an insignificant temperature increase. Coupled with the fact that temperature changes would be isolated to immediately above the cables, the **magnitude** of the impact on benthic ecology has been assessed as **low**.

The overall significance of the effect of temperature increase to subtidal habitats, subtidal species and ocean quahog has been assessed as **Minor** and **Not Significant**.

7.9. Project Specific Mitigation Measures

The assessment of the effects of the Proposed Development on intertidal and subtidal benthic ecology identified effects not exceeding Minor significance for the construction, operation and maintenance and decommissioning phases. No project specific mitigation measures have been proposed.

7.10. Residual Effects

The MEA has concluded that no significant effects on intertidal and subtidal ecology are expected from the Proposed Development alone during construction, operation and maintenance, and decommissioning, provided embedded measures are implemented. No residual effects are predicted.

7.11. Cumulative Effects

If the construction or decommissioning of other plans and projects have a temporal overlap with the construction of the Proposed Development, there is potential for cumulative adverse effects on intertidal and subtidal benthic ecology greater than that caused solely by the Proposed Development. As outlined by **Chapter 4: Marine Environmental Appraisal Scope and Methodology**, a four-stage approach has been undertaken to assess the cumulative adverse effects from other plans and projects in-combination with the construction of the Proposed Development.

7.11.1. Stage 1: Identification of ZoI

Chapter 8: Marine Physical Processes concluded that the furthest distance that suspended sediment would be deposited from the Proposed Development is 13.6 km, dependant on peak flow speed. All sedimentation outside the RLB would be from fine particulates that would settle in 1 mm (at 6.5 km from the plume source) or less thicknesses, which is indistinguishable from background levels. Additionally, Sinclair *et al*. (2023) reported that 90 % of sediments suspended during cable laying activities are predicted to resettle within 1 km of the RLB and Gooding *et al*. (2012) suggests that fine particles may travel 1-2 km from the source. Therefore, the ZoI for the cumulative effects assessment for intertidal and subtidal benthic ecology is 2 km. Any sedimentation outside of this 2 km ZoI as a result of the Proposed Development would not cause significant cumulative adverse effects on intertidal and subtidal benthic ecology receptors. All plans and projects within the ZoI are assessed in-combination with the Proposed Development to determine if there would be any significant cumulative adverse effects to intertidal and subtidal benthic ecology (**Section 7.11.4**).

7.11.2. Stage 2: Shortlist of Plans and Projects Relevant to Intertidal and Subtidal Benthic Ecology

Chapter 4: Marine Environmental Appraisal Scope and Methodology outlines a longlist of plans and projects within 30 km of the Proposed Development. From this longlist, six plans/projects within 2 km of the Proposed Development have been shortlisted to inform the cumulative effects assessment for intertidal and subtidal benthic ecology (**Table 7-16**). Infrastructure within this ZoI that is already operational has been scoped out, since the effects of the maintenance of operational projects has influenced the baseline assessment.

Table 7-16: Shortlist of projects

Application Reference	Plan or Project	Type of Project	Distance from RLB	Status
00010344	Morven Offshore Wind Farm (OWF)	OWF	1.98 km	Pre Application - Scoping Report
00009943	Eastern Green Link 2 (EGL 2)	Cable	0 km/crosses	Licence granted

Application Reference	Plan or Project	Type of Project	Distance from RLB	Status
06771 & 06870	NorthConnect	Cable	0 km/crosses	Licence expired
00011091	Cenos Floating OWF	Export cable	0 km/crosses	Application – EIA Submitted
SCOP-0066	Aspen Floating OWF	Export cable	0 km/crosses	Pre Application – Scoping Report
SCOP-0020	MarramWind OWF	OWF	0 km/crosses	Pre Application – Scoping Report

7.11.3. Stage 3: Information Gathering and Identification of Pressure-Receptor Pathways

Construction of the Proposed Development is scheduled to commence in 2028 with the latest possible completion by 2033. Within this window, construction (including pre-lay activity) is expected to take 55 months.

Morven OWF is situated approximately 1.98 km from the Proposed Development and is due to commence construction in 2027, with commercial operation scheduled to begin in 2030 (Power Technology, 2024). Thus, there would be a direct temporal overlap in construction between the two projects. As Morven OWF is situated outside of the RLB of the Proposed Development, simultaneous construction or sequential construction in quick succession of the two projects has the potential for cumulative adverse effects from temporary increase and deposition of suspended sediments from associated construction activities. Due to the application stage of Morven OWF, there is no EIA available for this project and its project-alone impact to benthic receptors is unknown. Therefore, Morven OWF cannot be assessed in-combination with the Proposed Development and will not be taken forward to stage 4 of the cumulative effects assessment. It is worth noting that smothering from suspended sediments outside of the RLB would settle in <1 mm in thicknesses, which is indistinguishable from background levels and is insufficient to change an insignificant impact into a significant adverse impact when in combination with potential smothering from Morven OWF construction activities.

The construction of EGL 2 is currently underway, with cable operation scheduled for 2029 (Eastern Green Link 2, 2025). Additionally, EGL 2 and the Proposed Development share the same landfall at Sandford Bay, Peterhead. Therefore, it is expected that there would be a temporal overlap in construction with the Proposed Development for one year. As EGL 2 overlaps the RLB of the Proposed Development at the proposed landfall and Peterhead nearshore, there is potential for cumulative adverse effects from: temporary habitat loss from cable construction activities in the nearshore; temporary increase and deposition of suspended sediments from HDD at the landfall and cable construction activities in the nearshore; EMF changes and temperature increases from adjacent HVDC cables within Peterhead nearshore.

NorthConnect is planned to cross the Proposed Development at approximately KP 576. However, construction of NorthConnect has been placed on hold by the Norwegian Government, and the current Marine Licence for this project has expired (expiration date 2024) (NorthConnect, 2025). As no new Marine Licence applications has been submitted or Marine Licence granted for the project, it is assumed that this project would not have a temporal overlap in construction with the Proposed Development. Therefore, NorthConnect will not be assessed in-combination with the Proposed Development and will not be taken forward to stage 4 of the cumulative effects assessment.

Cenos Floating OWF's export cable corridor crosses the Proposed Development at KP 576, utilising the HVDC routing of NorthConnect within 12 NM to reduce the need for additional infrastructure (Scottish Government, 2025a). Cenos Floating OWF is currently in its permitting phase, having submitted EIA in January 2025 (application reference number: 00011091) (Scottish Government, 2025a), and is scheduled to commence construction from 2030, with operation in 2031. As such, there may be a direct temporal overlap in construction between the two projects. As outlined in **Chapter 3: Project Description**, a worst-case scenario has been assumed that, where the projects cross, Cenos Floating OWF would be constructed prior to the Proposed Development and the area of external cable protection required by the Proposed Development for this cable crossing is included in the worst-case scenario for permanent habitat loss outlined in **Table 7-8**. As Cenos Floating OWF's export cable corridor overlaps the RLB of the Proposed Development, there is potential for cumulative adverse effects from: temporary habitat loss from cable construction activities; temporary increase and deposition of suspended sediments from cable construction activities; EMF changes and temperature increases from adjacent HVDC cables. As the Proposed Development is assumed to cross Cenos Floating OWF's export cable corridor, there is potential for cumulative adverse effects from permanent habit loss from external cable protection at the crossing.

Aspen Floating OWF is currently in pre-application, having submitted a Scoping Report in May 2025 (application reference number: SCOP-0066) (Scottish Government, 2025b), and is scheduled to begin construction in 2027 with operation commencing in 2030. As such, there may be a direct temporal overlap in construction between the two projects. The export cable corridor scoping boundary of Aspen Floating OWF overlaps with the Proposed Development and, due to the uncertainty of overlap in construction timelines, it is unclear as to which project would carry out cable installation first. However, as outlined in **Chapter 3: Project Description**, a worst-case scenario has been assumed that, where the developments cross, Aspen Floating OWF would be constructed prior to the Proposed Development and the area of external cable protection required by the Proposed Development for this cable crossing is included in the worst-case scenario for permanent habitat loss (outlined in **Table 7-8)**. Due to the application stage of Aspen Floating OWF, there is no EIA available for this project and its project-alone impact to benthic receptors is unknown. Therefore, Aspen Floating OWF cannot be assessed in-combination with the Proposed Development and will not be taken forward to stage 4 of the cumulative effects assessment

MarramWind OWF is currently in pre-application, having submitted a Scoping Report in January 2023 (application reference number: SCOP-0020) (Scottish Government, 2023). Construction is scheduled to begin in the late 2020s, following planning decisions in 2026, and MarramWind OWF is scheduled to be operational in the 2030s. Therefore, there may be a direct temporal overlap in construction between the two projects. The scoping boundary of MarramWind OWF overlaps with the RLB of the Proposed Development at Peterhead nearshore. However, as outlined in **Chapter 3: Project Description**, a worst-case scenario has been assumed that, where the developments cross, MarramWind OWF would be constructed prior to the Proposed Development and the area of external cable protection required by the Proposed Development for this cable crossing is included in the worst-case scenario for permanent habitat loss (outlined in **Table 7-8)**. Due to the application stage of MarramWind OWF, there is no EIA available for this project and its project-alone impact to benthic receptors is unknown. Therefore, MarramWind OWF cannot be assessed in-combination with the Proposed Development and will not be taken forward to stage 4 of the cumulative effects assessment.

7.11.4. Stage 4: Assessment

7.11.4.1. Temporary habit loss/seabed disturbance

If simultaneous construction of EGL 2, Cenos Floating OWF and the Proposed Development were to occur, potential adverse cumulative effects of temporary habitat loss/seabed disturbance could arise.

EGL 2 overlaps the RLB of the Proposed Development at the proposed landfall and Peterhead nearshore (KP 580 – KP 579 and KP 575), within broadscale habitats Atlantic infralittoral rock, Atlantic infralittoral coarse sediment and Atlantic circalittoral rock. Both projects are committed to using HDD at the landfall, thus cumulative effects of temporary habitat loss/seabed disturbance to Atlantic infralittoral rock habitats would not occur. Cenos Floating OWF export cable corridor overlaps the RLB of the Proposed Development at Peterhead nearshore (KP 576), also within broadscale habitat Atlantic infralittoral coarse sediment and within Atlantic circalittoral coarse sediment. All coarse sediments present within the RLB qualify as subtidal sands and gravels habitat and are assessed as such below. Subtidal sands and gravels are classified as UKBF habitats, PMFs and featured on the Scottish Biodiversity List under Section 2(4) of the Nature Conservation (Scotland) Act 2004.

The above-mentioned subtidal sands and gravels biotopes (MB5233, MB3235 and MC3215) demonstrate low sensitivity to temporary habit loss/seabed disturbance and Atlantic circalittoral rock demonstrates medium sensitivity to temporary habit loss/seabed disturbance.

Section 7.8.1.1 of this MEAp concludes that there are no significant adverse effects of temporary habitat loss/seabed disturbance to subtidal sands and gravels (Atlantic infralittoral coarse sediment and Atlantic circalittoral coarse sediment) and Atlantic circalittoral rock as a result of the Proposed Development. Chapter 8: Benthic Ecology of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022b) concludes any broadscale habitats interacted with by the project are 'relatively tolerant of disturbance' and 'recovery of habitats is expected to be relatively rapid' and Chapter 10: Benthic Ecology of the Cenos EIA report (Scottish Government, 2024a) concludes there are no significant effects of temporary habitat loss/seabed disturbance to subtidal sands and gravels as a result of the project.

Chapter 2: Project Description of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022a), states the maximum width of temporary seabed disturbance from cable trenching is approximately 25 m and Chapter 5: Project Description of the Cenos EIA report (Scottish Government, 2024b) states the maximum width of temporary seabed disturbance from cable trenching is approximately 20 m. Thus, it is assumed the worst-case cumulative effect of temporary seabed disturbance would be approximately triple that from the Proposed Development. While it is acknowledged that the broadscale habitats within the overall area could potentially take longer to recover due to increased disturbance in the area, the potential for additive effects to become significant is considered unlikely. Additionally, a review of cable installation activities in similar habitats (i.e. gravel, sand and shell sediment composition) found that these habitats typically recovered quickly after seabed disturbance, rapidly returning to baseline conditions and those of adjacent undisturbed areas (RPS, 2019). Subtidal sands and gravels are found extensively across the wider North Sea; thus temporary habitat loss/seabed disturbance is likely to have negligible effects on the wider distribution and extent of these coarse sediment habitats. The cumulative effect of temporary habitat loss/seabed disturbance has been assessed to be of low magnitude.

The cumulative effect of temporary habitat loss/seabed disturbance to subtidal habitats has been assessed as **Minor** and **Not Significant**.

7.11.4.2. Permanent habitat loss

The external cable protection planned along EGL 2 does not occur within the same area or habitat as that where external cable protection would be needed at the cable crossing between Cenos Floating OWF and the Proposed Development. Thus, there would not be an adverse cumulative effect from all three projects within the same habitat, and each habitat would be affected differently. The cumulative effect of permanent habitat loss is therefore assessed as follows: EGL 2 in combination with the Proposed Development and Cenos Floating OWF in combination with the Proposed Development. The two assessments are split via subheadings below.

EGL 2

EGL 2 requires external cable protection within Peterhead nearshore to cross Annex I stony reef. Whilst this does not occur within the RLB of the Proposed Development, it occurs within the same Annex I stony reef habitat that the Proposed Development would also need to cross and add external cable protection to.

Annex I stony reefs are highly sensitive to habitat loss as a result of change in seabed composition. Where possible, external cable protection materials used by the Proposed Development would be selected to match the receiving environment (e.g., rock of similar diameter and material as the receiving environment will be used) (see **Section 7.7**), thus, where possible, there would not be a change in substrate type within this habitat. However, due to its high ecological value and the acknowledgement that mortality of epifauna is likely to occur during construction activities, the **sensitivity** of Annex I stony reefs to permanent habitat loss has been assessed as **medium**.

Section 7.8.2.2 of this MEAp concludes that there are no significant adverse effects of permanent habitat loss to Annex I stony reefs as a result of the Proposed Development. Chapter 8: Benthic Ecology of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022b) also concludes the effect permanent habitat loss to Annex I stony reefs is not significant. External cable protection would be a permanent addition to the Annex I medium stony reef structures within the RLB, and it is assumed that it would not be removed following decommissioning of the Proposed Development. However, only a small area of 0.00375 km^2 of external cable protection would be required, thus alternative remaining habitat would be available for epifauna to colonise.

Whilst it is acknowledged that the construction of the Proposed Development would further increase the area of external rock protection within this Annex I habitat, the use of matching external cable protection material would encourage the colonisation of cable protection by sessile invertebrates within this habitats. This has been previously demonstrated in studies by Sheehan *et al.* (2018), Sherwood *et al.* (2016) and Taormina *et al.* (2018). Therefore, the **magnitude** of this effect has been assessed as **low** as there is demonstrated potential for habitat recovery.

The cumulative effect of permanent habitat loss to Annex I stony reefs has been assessed as **Minor** and **Not Significant**.

Cenos Floating OWF

The export cable corridor of Cenos Floating OWF overlaps the Proposed Development at KP 576, thus external cable protection is required. This cable crossing occurs within biotopes '*Glycera lapidum* in impoverished Atlantic infralittoral mobile gravel and sand' (MB3235) (present within Atlantic infralittoral coarse sediment) and '*Branchiostoma lanceolatum* in Atlantic circalittoral coarse sand with shell gravel' (MC3215) (present with Atlantic circalittoral coarse sediment). As outlined in **Section 7.4.4.1** these biotopes are classified as subtidal sands and gravels habitats, which are classified as UKBF habitats, PMFs and featured on the Scottish Biodiversity List under Section 2(4) of the Nature Conservation (Scotland) Act 2004.

Biotopes MB3235 and MC3215 demonstrate high sensitivity to permanent habitat loss as a result of change of substrate type; the placement of external cable protection in subtidal sands and gravels habitats would result in the irreversible conversion of sands and gravels to hard substrate, permanently altering the ecological composition and function of the affected area. Such changes can lead to shifts in benthic community structures, favouring sessile species adapted for hard substrates while displacing infaunal organisms, such as bivalves and polychaetes, who live within softer sediments.

Section 7.8.2.3 of this MEAp concludes that there are no significant adverse effects of permanent habitat loss to subtidal sands and gravels as a result of the Proposed Development. Chapter 10: Benthic Ecology of the Cenos EIA report (Scottish Government, 2024a) concludes there are no adverse effects on benthic receptors from the addition of project-related artificial hard structures on the seabed. External cable protection would be a permanent addition to subtidal sands and gravels habitats within the RLB, and it is assumed that it would not be removed following decommissioning of the Proposed Development. However, only a small area of 0.005 km^2 of external cable protection would be required. Although a PMF, subtidal sands and gravels habitats are common throughout the North Sea. Thus, permanent habitat loss within a discrete section of these biotopes within the RLB would have little effect on their wider distribution. Therefore, the cumulative effect of permanent habitat loss has been assessed to be of negligible magnitude.

The cumulative effect of permanent habitat loss to subtidal sands and gravels has been assessed as **Minor** and **Not Significant**.

7.11.4.3. Temporary increase and deposition of suspended sediment

The cumulative effect of temporary increase and deposition of suspended sediment has the potential to effect intertidal habitats and subtidal habitats. As the effect to these habitats would be different, they have been assessed separately; the two assessments are split via subheadings below.

<u>Intertidal habitats</u>

Both EGL 2 and the Proposed Development would use HDD at the proposed landfall, avoiding intrusive works in the intertidal area. Each project would have separate cable ducts, adjacent to one another. The exit point for the cable ducts would be entirely in the subtidal environment and there would be no direct impacts to intertidal benthic ecology receptors by either project, except in the event of drilling fluid breakout (frac-out), where clean-up activities may be required. A frac-out can occur if drilling occurs within unconsolidated sediment. In this situation a pathway can form between the drilling bore and the surface (e.g., the ground or seabed). The bentonite used within the bore can travel through this pathway to the surface, causing a temporary increase of suspended sediment.

If a frac-out were to occur for each project, either simultaneously or in rapid succession, this would cause a greater sediment plume within the intertidal area than that of the Proposed Development. However, bentonite is an inert, clay-like lubricant listed on the Cefas list of notified chemicals and has been proven to have no long-lasting effects on the marine environment. Due to its clay-like nature, bentonite consists of very fine particulates that would remain within the water column. Thus, no smothering would occur. Additionally, the sensitivity of the habitats present within the intertidal zone to increased suspended sediment from a bentonite plume is negligible. The environment management plan for the Proposed Development includes mitigation plans to ensure frac-outs are managed appropriately should a pollution event occur; this involves the use of an absorbent matt to remove the bentonite from the marine environment. The cumulative magnitude of increased suspended sediments on intertidal habitats is therefore assessed as negligible.

The cumulative effect of temporary increase and deposition of suspended sediment to intertidal habitats has been assessed as **Negligible** and **Not Significant**.

<u>Subtidal habitats</u>

EGL 2 and Cenos Floating OWF overlap with the Proposed Development at Peterhead nearshore. If sediment plumes from each project were to overlap, this would increase SSC and smothering within the RLB of the Proposed Development.

Chapter 6: Marine Physical Processes demonstrates that coarse sediment plumes, created from seabed preparation and cable trenching activities, would result in very high SSC within 5-10 m of the activity and settle from the water column within the RLB. In most cases this coarse sediment would cause light surface smothering of <5 cm, but at KP 575, where EGL 2 is situated within the RLB of the Proposed Development, coarse sand can cause smothering of up 17.9 cm. Fine sediment particulate plumes can travel up to 13.6 km from trenching activities and would cause light surface smothering of <1 mm. <1 mm of smothering is indistinguishable from background levels and is insufficient to cause a significant effect when in combination with another project. Thus, there are no adverse cumulative effects of temporary increase and deposition of suspended sediments outside of the RLB.

As outlined in Chapter 7: Physical Environment of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022c), coarse sediment plumes, created from seabed preparation and cable trenching activities, would settle within 247 m of the source. Thus, there is potential for a spatial overlap of sediment plumes if simultaneous construction of the projects occurs within Peterhead nearshore. Chapter 7: Physical Environment of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022c) does not provide sediment deposition thicknesses; thus, due to exposure to the same physical environment, it is assumed that sedimentation thickness would be the same as that calculated for the Proposed Development, thus cumulative smothering thicknesses could be double that of the Proposed Development. Chapter 10: Benthic Ecology of the Cenos EIA report (Scottish Government, 2024a) states sedimentation past 72 m from cable trenching activities would cause smothering of <5 cm, whilst heavy smothering of >30 cm can occur within 1 m of cable trenching. Thus heavy smothering of >35 cm could occur within 1 m of cable trenching activities if cumulative smothering were to occur.

Section 7.8.3.2 of this MEAp, Chapter 8: Benthic Ecology of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022b) and Chapter 10: Benthic Ecology of the Cenos EIA report (Scottish Government, 2024a) all conclude that there are no significant project-alone adverse effects of temporary increase and deposition of suspended sediments to subtidal habitats.

The benchmark for heavy smothering outlined by MarESA is 'deposition of up to 30 cm of fine material added to the seabed in a single discrete event'. Atlantic infralittoral coarse sediment, Atlantic circalittoral coarse sediment and Atlantic circalittoral rock demonstrate medium sensitivity to heavy smothering. Coarse sediment habitats and the Level 5 biotope '*Flustra foliacea* and colonial ascidians on tide-swept moderately wave-exposed circalittoral rock' (MC1216), known to occur in areas of Atlantic circalittoral rock at Peterhead nearshore, occur in areas of moderate to high wave energy. Additionally, **Chapter 6: Marine Physical Processes** demonstrates that the peak flow speed at KP 575 is 1.05 m/s. Increased SSC and deposition of suspended sediments is a temporary effect of cable construction activities. However, this high-water movement would further decrease the exposure time of subtidal habitats to this effect.

Additionally, sedimentation from all projects would be from coarse sediment which would settle in a nonhomogeneous mosaic, allowing for gaps between sand particles and reduced clogging of respiration and feeding apparatus.

As outlined above, construction of the Proposed Development is scheduled to commence in 2028, construction of EGL 2 is currently underway, with cable operation scheduled for 2029, and Cenos Floating OWF's export cable corridor is scheduled to commence construction in 2030. It is unlikely that simultaneous construction of all three projects would occur in Peterhead nearshore, and, due to engineering constraints, the projects would be cable trenching sequentially with sufficient time in between to allow for smothering to disperse and SSC to decrease to background levels. Furthermore, it is also assumed the Proposed Development would cross Cenos Floating OWF's export cable corridor, thus heavy smothering from the construction activities of Cenos Floating OWF would disperse by construction of the Proposed Development within the same area. Therefore, the cumulative magnitude of temporary increase and deposition of suspended sediments has been assessed as low.

The cumulative effect of temporary increase and deposition of suspended sediment to subtidal habitats has been assessed as **Minor** and **Not Significant**.

7.11.4.4. Electromagnetic changes/barrier to species movement

EMF calculations for the Proposed Development are presented in **Appendix 3A: Electric and Magnetic Field Assessment.** They show that for bundled HVDC poles the magnetic field dissipates to below background geomagnetic levels within 20 m when cables are buried at 1 m below the seabed. The magnetic field directly above the cables at the seabed is 123.8μT (or 76.4 μT without the earth's magnetic field).

As outlined in Chapter 2: Project Description of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022a), EMF modelling states that, for separated cables, the magnetic field resulted in a combined field strength of 404 μT at the seabed, reducing to marginally above the background level 20 m from the cables. The bundled cables had significantly lower magnetic fields due to cancellation of the magnetic fields between poles; EMF from bundled cables reduced to the background geomagnetic field strength up to 10 m from the cable, as such having only a very localised effect. Chapter 10: Benthic Ecology of the Cenos EIA report (Scottish Government, 2024a) reports EMF to be 73 μT at the seabed when the cable is buried at 1.5 m, and EMF reduced to the background geomagnetic field strength beyond 10 m from the cable.

The sensitivity of subtidal species present within the RLB to EMF changes in negligible. Thus, **Section 7.8.4** of this MEAp concludes that there are no significant adverse effects of electromagnetic changes on subtidal species as a result of the Proposed Development. Chapter 8: Benthic Ecology of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022b) and Chapter 10: Benthic Ecology of the Cenos EIA report (Scottish Government, 2024a) concludes there are no significant adverse effects of electromagnetic changes.

Whilst it is acknowledged that the Proposed Development would create an additional source of EMF at Peterhead nearshore, each project cable would be buried within its own trench and at a distance greater than 10 m apart. Where the Proposed Development crosses Cenos Floating OWF, the cables would be separated by external rock protection. Therefore, as EMF from all project cables would reduce to background levels within 10 m of the cables, there is no potential for spatial overlap in EMF. The cumulative magnitude of electromagnetic changes has been assessed as negligible.

The cumulative effect of electromagnetic changes/barrier to species movement has been assessed as **Negligible** and **Not Significant**.

7.11.4.5. Temperature increase

Heat calculations for the Proposed Development are presented in **Appendix 3C: Heat Calculations**. They show that for cables operating at full power, the temperature is raised in the immediate vicinity of the cable but reduces with distance. Assuming an ambient seabed temperature of 12 °C, seabed temperatures at 0.2 m immediately above the cables are estimated to be 13 - 14 °C, with the cables operating at maximum operating temperatures. As outlined in Chapter 2: Project Description of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022a), heat modelling states that for bundled cables buried at a depth of 1.5 m, the increase in sediment temperature is limited to approximately 3 °C within 50 cm of the seabed surface. This was calculated based upon a maximum seabed ambient surface sediment temperature of 15 °C. Chapter 10: Benthic Ecology of the Cenos EIA report (Scottish Government, 2024a) concludes 'thermal emissions are highly localised to the immediate surroundings of the cable'.

The sensitivity of the subtidal species present within the RLB to temperature increase is medium; **Section 7.8.5** of this MEAp concludes that there are no significant adverse effects of temperature increase on subtidal species as a result of the Proposed Development, as the actual cable system is unlikely to reach the modelled temperatures because, to reach those temperatures, the system would have to operate at full load continuously for an extended period of time (months/years). In reality, the system would not be at full load for this long and therefore the temperature would fluctuate and it would be unlikely to reach these maximums. Chapter 8: Benthic Ecology of the Eastern Green Link 2 – Marine Scheme Environmental Appraisal report (AECOM, 2022b) and Chapter 10: Benthic Ecology of the Cenos EIA report (Scottish Government, 2024a) also concluded there are no significant adverse effects of temperature increase on subtidal species.

It is acknowledged that thermal effects would be long-term and occurring continuously for the operational lifetime of the cables but the temperature increase from each cable is low level and likely to be only a few degrees higher than ambient at the shallow sediment depths (<20 cm) at which infaunal species are typically found. Whilst the Proposed Development would create an additional source of thermal emissions at Peterhead nearshore, each project cable would be buried within its own trench and at a distance greater than 10 m apart. Where the Proposed Development crosses Cenos Floating OWF, the cables would be separated by external rock protection. Due to the localised nature of the cable associated temperature increases, there is no potential for spatial overlap in temperature increase; thus, the cumulative magnitude of temperature increase has been assessed as low.

The cumulative effect of temperature increase has been assessed as **Minor** and **Not Significant**.

7.11.4.6. Stage 4: Assessment Conclusions

The cumulative effects of temporary habitat loss, permanent habitat loss, temporary increase and deposition of suspended sediments, EMF, and temperature increase have been assessed in-combination with EGL 2, Cenos Floating OWF and the Proposed Development. In all instances, the cumulative effects have been assessed as **Minor** and **Not Significant.**

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