Environmental Impact Assessment Report
Volume 1, Chapter 10: Benthic, Epibenthic and Intertidal Ecology

MarramWind Offshore Wind Farm

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MarramWind

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10. Benthic, Epibenthic and Intertidal Ecology

10.1 Introduction

10.1.1.1 This benthic, epibenthic and intertidal ecology Chapter of the Environmental Impact Assessment (EIA) Report presents the results of the assessment of the likely significant effects on benthic, epibenthic and intertidal ecology that may arise from the construction, operation and maintenance (O&M) and decommissioning of the offshore Project seaward of Mean High Water Springs (MHWS). It should be read in conjunction with the project description provided in **Chapter 4: Project Description** and the relevant parts of the following chapters and appendices:

- **Chapter 6: Marine Geology Oceanography and Physical Processes:** Changes to marine geology, oceanography and physical processes have the potential to affect sensitive benthic, epibenthic and intertidal ecology receptor features and habitats. The information from the marine geology, oceanography and physical processes chapter will be used to inform this Chapter.
- **Chapter 7: Marine Water and Sediment Quality**: Changes to marine water and sediment quality have the potential to affect sensitive benthic, epibenthic and intertidal ecology receptor features and habitats. The information from the marine water and sediment quality chapter will be used to inform this Chapter.
- **Chapter 8: Underwater Noise:** Changes to underwater noise have the potential to affect sensitive benthic, epibenthic and intertidal ecology receptors, features and habitats. The information from the underwater noise chapter will be used to inform this Chapter.
- **Chapter 9: Electromagnetic Fields (EMF)**: Changes to EMF have the potential to affect sensitive benthic, epibenthic and intertidal ecology receptor features and habitats. The information from the EMF chapter will be used to inform this Chapter.
- **Chapter 11: Marine Mammals:** Changes to benthic, epibenthic and intertidal ecology have the potential to affect marine mammal receptors by affecting their prey species and habitats. The information from the benthic, epibenthic and intertidal ecology chapter will be used to inform the Marine Mammals chapter.
- **Chapter 12: Offshore and Intertidal Ornithology**: The seabird receptor species are sensitive to possible changes on prey resource habitats. Therefore, the benthic, epibenthic and intertidal ecology chapter will inform the offshore and intertidal ornithology assessment.
- **Chapter 13: Fish Ecology**: The fish receptor species are sensitive to possible changes on prey resource habitats. Therefore, the benthic, epibenthic and intertidal ecology chapter will inform the fish ecology assessment.
- **Chapter 14: Commercial Fisheries**: Changes to commercial fisheries have the potential to affect benthic, epibenthic and intertidal ecology. Therefore, the commercial fisheries chapter will inform this Chapter.

10.1.1.2 The shellfish receptor group was originally included in the fish and shellfish section within the Scoping Report (MarramWind Limited, 2023). Shellfish is now incorporated within this Chapter as the pressures that shellfish experience, impacts they are susceptible to and responses they exhibit are comparable to other benthic invertebrates. As a result, the amendment to include shellfish within this Chapter is deemed suitable.

10.1.1.3 This Chapter describes:

- the legislation, planning policy, guidance and other documentation that has informed the assessment (**Section 10.2: Relevant legislative and policy context**);
- the outcome of consultation and engagement that has been undertaken to date, including how matters relating to benthic, epibenthic and intertidal ecology have been addressed (**Section 10.3: Consultation and engagement**);
- the scope of the assessment for benthic, epibenthic and intertidal ecology (**Section 10.4: Scope of the assessment**);
- the data sources and methods used for gathering baseline data including surveys where appropriate (**Section 10.5: Methodology for baseline data gathering**);
- the overall environmental baseline (**Section 10.6: Baseline conditions**);
- the basis for EIA Report (**Section 10.7: Basis for EIA Report**);
- methodology for EIA Report assessment (**Section 10.8: Methodology for EIA Report assessment);**
- the assessment of benthic, epibenthic and intertidal ecology effects (**Section 10.9 Assessment of effects: construction stage**; **Section 10.10: Assessment of effects: operation and maintenance**; **Section 10.11: Assessment of effects: decommissioning**);
- a summary of effects (**Section 10.12: Summary of effects**);
- consideration of transboundary effects (**Section 10.13: Transboundary effects**);
- consideration of inter-related effects and cumulative effects (**Section 10.14: Inter-related effects** and **Section 10.15: Assessment of cumulative effects**);
- a summary of residual effects for benthic, epibenthic and intertidal ecology (**Section 10.16: Summary of residual likely significant effects**);
- a reference list is provided (**Section 10.17: References**); and
- a glossary of terms and abbreviations is provided (**Section 10.18: Glossary of terms and abbreviations**).

10.1.1.4 This Chapter is also supported by the following appendices in **Volume 3**:

- **Appendix 10.1: Offshore Wind Farm Benthic Characterisation Report**;
- **Appendix 10.2: Environmental Intertidal Survey – Benthic Report 2023**;
- **Appendix 10.3: Confidential Geophysical and Environmental Export Cable Corridor Survey – Benthic Survey Interpretative Report 2024**;
- **Appendix 10.4: Geophysical and Environmental Offshore Windfarm Survey Volume 2 of 11: Benthic Survey Interpretative Report**; and
- **Appendix 10.5: MarESA / FeAST Sensitivity Scores**.

10.2 Relevant legislative and policy context and technical guidance

10.2.1 Legislative and policy context

10.2.1.1 This Section identifies the relevant legislation and policy context that has informed the scope of the benthic, epibenthic and intertidal ecology assessment. Further information on policies relevant to the EIA and their status is set out in **Chapter 2: Legislative and Policy Context**, which provides an overview of the relevant legislative and policy context for the Project. **Chapter 2: Legislative and Policy Context** is supported by **Volume 3, Appendix 2.1: Planning Policy Framework**, which provides a detailed summary of international, national, marine and local planning policies of relevance to the EIA. Individual policies of specific relevance to this assessment and associated appendices have been taken into account.

10.2.1.2 This summary provides a foundation for understanding the specific requirements that this Chapter must address in terms of assessing and mitigating impacts on receptors and relevant environmental issues.

10.2.1.3 The legislation and international agreements relevant to benthic, epibenthic and intertidal ecology include:

- Convention on Biological Diversity Post-2020 Global Biodiversity Framework, 2022;
- The European Biodiversity Strategy for 2030, 2020;
- The Aichi Biodiversity Targets 2020;
- The Environment (EU Exit) (Scotland) (Amendment etc.) Regulations 2019: Part 2 Amendments to legislation concerning the water environment (Water Environment and Water Services (Scotland) Act 2003);
- Wildlife and Natural Environment (Scotland) Act 2011;
- Water Environment (Controlled Activities) (Scotland) Regulations 2011;
- The Marine Strategy Regulations 2010;
- Marine (Scotland) Act 2010;
- Marine and Coastal Access Act 2009;
- EC Directive (2008/56/EC) establishing a framework for Community action in the field of marine environmental policy (MSFD) (Marine Strategy Regulations 2010, Marine Environment (Amendment (EU Exit) Regulations 2018);
- Directive 2008/56/EC (Marine Strategy Framework Directive (MSFD));
- Nature Conservation (Scotland) Act 2004;
- EC Directive (2000/60/EC) (Water Framework Directive) (WFD);
- European Commission (EC) Directive (92/43/EEC) on the conservation of natural habitats and of wild fauna and flora (The Conservation (Natural Habitats, and c.) Regulations 1994, Conservation of Offshore and Marine Habitats and Species Regulations 2017);
- Convention on Biological Diversity 1992;

- Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) 1992;
- Wildlife and Countryside Act 1981; and
- Convention on Wetland of International Importance especially as Waterfowl Habitat 1971 (the 'Ramsar Convention) (UNESCO, 1971).

10.2.1.4 The policies relevant to benthic, epibenthic and intertidal ecology includes:

- Draft Updated Sectoral Marine Plan (Scottish Government, 2025);
- The Environment Strategy for Scotland 2020 (Scottish Government, 2020a), and Progress Report 2024 (Scottish Government, 2024);
- National Planning Framework 4 (NPF4) 2023 (Scottish Government, 2023a);
- Biodiversity strategy to 2045: tackling the nature emergency (Scottish Government, 2022);
- Aberdeenshire Council Natural Heritage Strategy 2019-2022 (Aberdeenshire Council, 2020);
- Sectoral Marine Plan for Offshore Wind 2020 (Scottish Government, 2020b);
- Scottish National Marine Plan 2015 (Scottish Government, 2015); and
- UK Marine Policy Statement 2011 (HM Government, 2011).

10.2.2 Relevant technical guidance

10.2.2.1 Other information and technical guidance relevant to the assessment undertaken for benthic, epibenthic and intertidal ecology include:

- JNCC, Natural England and Cefas position on the use of quieter piling methods and noise abatement systems when installing offshore wind turbine foundations (JNCC *et al.,* 2025).
- NatureScot advice on marine non-native species (NatureScot, 2022a);
- Marine Scotland's Feature Activity Sensitivity Tool (FeAST) (Marine Scotland, 2022);
- Sectoral Marine Plan (SMP): Regional Local Guidance (Scottish Government, 2020c);
- Natural Resources Wales (NRW), Guidance for undertaking benthic marine habitat survey and monitoring (NRW, 2019);
- Marine Scotland, Consenting and Licensing Guidance: For Offshore Wind, Wave and Tidal Energy (Marine Scotland, 2018a);
- Marine Evidence based Sensitivity Assessment (MarESA) (Tyler-Walters *et al*., 2018);
- Joint Nature Conservation Committee (JNCC) Monitoring Guidance for Marine Benthic (Noble-James *et al*., 2018);
- Chartered Institute for Ecology and Environmental Management (CIEEM), Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018);
- RenewableUK and NERC guidelines on Cumulative Impact Assessment Guidelines – Guiding Principles for Cumulative Impact Assessment in Offshore Wind Farms (RenewableUK, 2013);

- Scottish Natural Heritage (SNH) Identification of Priority Marine Features (PMF) (Howson *et al*., 2012);
- Guidelines for data acquisition to support marine environmental assessments of offshore renewable energy project (Judd, 2012);
- SNH Guidance on Survey and Monitoring in Relation to Marine Renewables Deployments in Scotland (Saunders *et al*., 2011);
- A Review of Assessment Methodologies for Offshore Wind Farms (Collaborative Offshore Wind Research into the Environment (COWRIE)) METH-08-08 (Maclean *et al*, 2009); and
- OSPAR, Guidance on Environmental Considerations for Offshore Wind Farm Development (OSPAR, 2008a, OSPAR, 2008b).

10.3 Consultation and engagement

10.3.1 Overview

10.3.1.1 This Section describes the consultation and stakeholder engagement undertaken on the Project in relation to benthic, epibenthic and intertidal ecology. This includes early engagement, the outcome of and response to the Scoping Opinions (Scottish Government, 2023b; Aberdeenshire Council, 2023) in relation to the benthic, epibenthic and intertidal ecology assessment, non-statutory consultation, and the findings of the Project's Statutory Consultation. An overview of engagement undertaken for the Project as a whole can be found in Section 5.5 of **Chapter 5: Approach to the EIA**.

10.3.2 Key issues

10.3.2.1 A summary of the key issues raised during statutory and non-statutory consultation, specific to benthic, epibenthic and intertidal ecology, is outlined below in **Table 10.1**, together with how these issues have been considered in the production of this EIA Report. A summary of the key issues raised during statutory and non-statutory consultation, specific to benthic, epibenthic and intertidal ecology, is outlined below in **Table 10.1**, together with how these issues have been considered in the production of this EIA Report.

Table 10.1 Stakeholder issues responses – benthic, epibenthic and intertidal ecology

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
NatureScot	224	29 September 2022, Meeting.	*"NatureScot states scour assessment effects, might be useful to link in with benthic colleagues. What can we be doing to use materials that can be used for a positive impact of Biodiversity – nature inclusive design?"*	The Project has developed a Nature Positive Strategy that was shared with Aberdeenshire Council, Marine Directorate – Licensing Operations Team (MD-LOT) and NatureScot in July 2024 with positive feedback received. A **Nature Positive Plan** is submitted alongside the consent applications. This plan sets out how consideration has been given towards nature inclusive design and nature positive enhancements for scour protection. All available options and solutions for benthic species are being assessed within the project area and considered within the EIA design envelope.
MD-LOT	299	12 May 2023, MD-LOT Scoping Opinion (Scottish Government, 2023b).	*"5.3.1 The Scottish Ministers are content with the baseline data sources regarding marine water and sediment quality used by the Developer in Table 5.2.6 of the Scoping Report. The Scottish Ministers advise in line with the NatureScot representation that consideration is given to impacts on blue carbon assessment and an assessment conducted for benthic ecology to focus on the potential impacts of the Proposed Development on marine sediments."*	A blue carbon assessment has been carried out and is provided in **Section 10.9** to **Section 10.11**.
NatureScot	448	12 May 2023, MD-LOT Scoping Opinion	*"Blue carbon In addition to the climate change assessments mentioned in the scoping report, we recommend that consideration is given to*	

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
		Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*impacts on blue carbon and whether or not an assessment can be undertaken. This should expand on the information and assessment conducted for benthic ecology to focus on the potential impacts of the proposed development on marine sediments."*	
MD-LOT	344	12 May 2023, MD-LOT Scoping Opinion (Scottish Government, 2023b).	*"5.9.10* *The Scottish Ministers, in line with the NatureScot representation, advise that the assessment should quantify where possible the likely impacts on PMFs and consider whether this could lead to a significant impact on the national status of the PMFs being considered."*	The impacts upon PMF's located within the study area have been assessed within **Section 10.9** to **Section 10.11.**
MD-LOT	336	12 May 2023, MD-LOT Scoping Opinion (Scottish Government, 2023b).	*"5.9.2* *Regarding baseline characterisation, the Scottish Ministers advise that the additional technical guidance, baseline data sets and data sources identified by NatureScot must be used in the assessment in the EIA Report. The Scottish Ministers acknowledge that the Developer has noted the relevance of invasive non-native species (INNS) throughout the technical guidance and data sets but advise that the EIA Report must provide details on how INNS will be considered, monitored and recorded. Additionally, biosecurity plans for each phase of the development should be considered in full regarding INNS."*	The additional technical guidance, baseline data sets and data sources identified by NatureScot with relevance to shellfish have been used in the benthic, epibenthic and intertidal ecology assessment. The INNS Management Plan is detailed within **Volume 4: Outline Offshore Invasive Non-Native Species Management Plan**.
MD-LOT	337	12 May 2023, MD-LOT Scoping Opinion (Scottish Government, 2023b).	*"5.9.3* *Regarding the identification of key species, in line with the NatureScot representation, the Scottish Ministers advise that the Developer must fully implement in NatureScot advice regarding pelagic fish, elasmobranchs, migratory fish, diadromous fish and shellfish. Additionally, Table 5.8.14 of the Scoping Report should be updated to include the minke whale feature of the Southern*	The NatureScot advice in relation to shellfish has been utilised within the benthic, epibenthic and intertidal ecology assessment. Minke whales primarily feed on fish and therefore are not considered further in this Chapter.

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
			Trench Marine Protected Area (MPA) as there may be impacts to this protected feature via impacts on prey fish species."	
MD-LOT	339	12 May 2023, MD-LOT Scoping Opinion (Scottish Government, 2023b).	*"5.9.5* *Potential impacts proposed to be scoped into the EIA Report are outlined in Table 5.8.16 of the Scoping Report. The Scottish Ministers agree that habitat loss and disturbance is a key impact pathway for the construction, O&M and decommissioning stages of the Project. In addition to these phases, the Scottish Ministers advise in line with the NatureScot representation that relevant pre-construction seabed preparation works are also included in the EIA Report. Additionally, the advice provided in section 5.4 of the Scoping Opinion regarding impacts from underwater noise and vibration on fish and shellfish should be implemented in the EIA Report."*	The impacts have been assessed within **Section 10.9** to **Section 10.11**.
MD-LOT	342	12 May 2023, MD-LOT Scoping Opinion (Scottish Government, 2023b).	*"5.9.8* *The Scottish Ministers agree with the remaining impacts scoped into and out of the EIA Report. For the avoidance of doubt, The Developer must fully address the representation from NatureScot in the EIA Report."*	The impacts have been assessed within **Section 10.9** to **Section 10.11**.
MD-LOT	345	12 May 2023, MD-LOT Scoping Opinion (Scottish Government, 2023b).	*"5.9.11* *With regards to cumulative effects, the Scottish Ministers advise in line with the NatureScot representation that the Developer must consider the cumulative effects of key impacts such as habitat loss or change, especially concerning diadromous fish as well as key fish and shellfish species that contribute to ecological importance as a prey resource."*	The cumulative effects of key impacts upon shellfish have been assessed within **Section 10.15**.
NatureScot	500	12 May 2023, MD-LOT Scoping Opinion	*"Fish and shellfish interests are considered in Sections 5.3 (underwater noise), 5.4 (EMF) and 5.8 (fish and shellfish) of the Scoping Report. Our advice below focusses on:*	The impacts upon shellfish have been assessed within **Section 10.9** to **Section 10.11**.

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
		Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	• *fish and shellfish species, and their associated habitats where appropriate, that are protected features of National Site Network or Nature Conservation MPAs; and* • *species of conservation interest including PMFs and key prey species."*	
NatureScot	502	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*"We are broadly content with the fish and shellfish study area as defined in Section 5.8.6 and Figure 5.8.1, which comprises:* • *the offshore Scoping Boundary together with the Zone of Influence (ZOI) up to the MHWS mark;* • *the ZOI is based on the tidal excursion, coastal processes and potential spread of underwater noise;* • *the ZOI buffer encompasses the area over which suspended sediments may travel following disturbance as a result of the Project's activities, extending 15 kilometers (km) around the array Scoping Boundary and a distance of 15km surrounding the offshore cable corridor; and* • *noting that species which require a larger study area will be considered as appropriate.*	The study area has remained as 15km and is detailed within **Section 10.4**. It should be noted that the ZOI is based on the tidal ellipse and not the excursion.
NatureScot	508	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*"We are content that Table 5.8.8 captures most of the relevant baseline datasets, but recommend inclusion of "Essential Fish Habitat Maps for Fish and Shellfish Species in Scotland" developed by the Scottish Marine Energy Research (ScotMER) programme (Scottish Government, 2024), which is due for publication shortly.* *We also recommend inclusion of the Feature Activity Sensitivity Tool (FEAST) (Marine Scotland, 2022), which is due to be updated with fish and shellfish information by the end of March 2023."*	These recommended resources have been used within this Chapter where relevant.

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
NatureScot	509	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*"With regard to data sources relating to fish and EMF, we recommend that a recent MSc paper by Lucie Hervé "An evaluation of current practice and recommendations for environmental impact assessment of electromagnetic fields from offshore renewables on marine invertebrates and fish" is included as a data source in Table 5.4.4. We can supply a copy of this paper on request."*	The recommended paper has been used to inform the assessment of EMF on marine invertebrates in this Chapter.
NatureScot	518	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*"Shellfish* *Table 5.8.13 focuses mainly on commercial shellfish species, and should be updated to include other shellfish species that may be in the study area such as flame shell, horse mussel etc, E523 are PMFs and will require consideration."*	Both commercially exploited invertebrates (shellfish) and the general invertebrate community are considered as potential receptors. All PMFs will be noted and due consideration to their value given.
NatureScot	520	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*"Habitat loss and disturbance (temporary and long-term) is a key impact pathway identified for the construction, O&M and decommissioning stages. We recommend that any relevant pre-construction seabed preparation works are also included in assessment."*	Any relevant seabed preparation works will be included as part of the construction assessment within **Section 10.9**.
NatureScot	522	12 May 2023, MD-LOT Scoping Opinion Appendix 1:	*"Underwater noise and vibration* *We note that Section 5.3.12 (Underwater noise and vibration) states that impulsive underwater noise will be assessed for relevant fish (and marine mammal) species. We advise that this*	The impacts upon shellfish have been assessed within **Section 10.9** to **Section 10.11**.

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
		Consultation Responses and Advice (Scottish Government, 2023b).	*should also include vibration (particle motion) for fish and shellfish. Sensitive fish species have not been specified but we would expect to see sandeel, cod and herring eggs if appropriate to the study area."*	
NatureScot	524	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*"EMF* *We welcome the scoping in of EMF effects on fish and shellfish receptors as another impact pathway that is not well understood at present, to increase our understanding of the effects of dynamic cables, particularly as floating wind becomes an established technology."*	These impacts upon shellfish have been assessed within **Section 10.9** to **Section 10.11**.
NatureScot	525	12 May 2023	*"EMF* *We note that cable burial / Cable Burial Risk Assessment are listed as embedded environmental measures (Table 5.8.15). However, we highlight research by Hutchinson et al. (2020)* that establishes that cable burial may actually generate a response from sensitive species, as it reduces EMF levels to the 'normal' range that species use to hunt prey or navigate."*	The recommended paper has been used to inform the assessment of EMF on marine invertebrates.
NatureScot	528	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*"INNS* *We advise that the EIAR should provide details on how INNS will be considered, monitored and recorded as well as being taken into account of in biosecurity plans for each phase of the development."*	Please refer to **Volume 4: Outline Offshore Invasive Non-Native Species Management Plan**.

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
NatureScot	530	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*"We broadly support the approach to assessment set out in Sections 5.8.15-17.* *PMFs (Scottish Government, 2024)* *We recommend that the assessment should quantify, where possible, the likely impacts to key fish and shellfish PMFs. It should assess whether these could lead to a significant impact on the national status of the PMFs being considered (NatureScot, 2016)."*	The impacts to PMFs, including shellfish, in the study area have been assessed within **Section 10.9** to **Section 10.11**.
NatureScot	531	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*"We note the anticipated list of impacts likely to be scoped into cumulative assessment in Section 5.8.66. The cumulative assessment should consider the cumulative effect of key impacts such as habitat loss / change particularly in relation to diadromous fish, as well as key fish and shellfish species that contribute ecological importance as a prey resource. This may differ depending on the life stage being considered."*	The cumulative effects of key impacts upon shellfish have been assessed within **Chapter 33: Cumulative Effects Assessment10.15**.
NatureScot	532	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*"We welcome the embedded environmental measures described in Table 5.8.15. We advise that the full range of mitigation measures and published guidance is considered and discussed in the EIA Report."*	These recommendations have been implemented within **Section 10.9** to **Section 10.11**.
NatureScot	533	12 May 2023, MD-LOT Scoping Opinion	*"No specific monitoring for fish and shellfish is mentioned in the Scoping Report, although the list of embedded environmental measures includes a commitment to implement a Project*	Please refer to **Volume 4: Outline Project Environmental Monitoring Programme**.

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
		Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*Environmental Monitoring Plan which will set out commitments to environmental monitoring. Further information on proposed monitoring should be discussed in the EIA Report."*	
Scottish Fishermen's Federation	617	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*"P4.1.17, table 5.4.6 and P5.4.4 table 5.4.2 would be improved by noting that any item scoped out without good reason would be monitored during the development lifeline. This includes the claim that decommissioning is a lesser impact. The table needs to include Thrumming and wake effects.* *P5.4.6- 5.4.9 regardless of citing many reports there is insufficient evidence to describe EMF as positive or negative."*	Only items that MD-LOT and NatureScot have agreed with are scoped out and the Project will Develop an Outline Project Environmental Monitoring Plan (Outline PEMP) (issue 533). The impacts of decommissioning and EMF on benthos including shellfish have been assessed within **Section 10.9** to **Section 10.11**. Thrumming and wake effects are not considered relevant to benthic ecology.
MD-LOT	310	12 May 2023, MD-LOT Scoping Opinion (Scottish Government, 2023b).	*"5.6.1 The Scottish Ministers are content with the study area proposed in sections 5.5.6 to 5.5.8 and Figure 5.5.1 of the Scoping Report. The Scottish Ministers note that the study area comprises the Scoping Boundary plus and secondary impact ZOI extending, to a precautionary 15km around the array Scoping Boundary and 15km around the offshore export cable corridor."*	The study area has remained as 15km and is detailed within **Section 10.4**.
MD-LOT	311	12 May 2023, MD-LOT Scoping Opinion (Scottish Government, 2023b).	*"5.6.2 The Scottish Ministers are content with the baseline characterisation. In line with the NatureScot representation, the Scottish Ministers are content that the species and habitats of conservation importance have been identified between sections 5.5.39 to 5.5.45 of the Scoping Report, as well as the relevant designated sites identified in Table 5.5.10 of the Scoping Report."*	This information has been included within the EIA and is detailed within **Section 10.6**.

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
MD-LOT	312	12 May 2023, MD-LOT Scoping Opinion (Scottish Government, 2023b).	*"5.6.3 The Scottish Ministers understand that the Developer communicated with NatureScot directly regarding the use of eDNA as a sampling method for baseline characterisation and this will be carried out. In line with the NatureScot representation, the Scottish Ministers advise that the Developer should produce a technical report for this sampling method to be included as part of the EIA Report submission, including a clear explanation of the novel nature of this technique. "*	The benthic baseline relies on a combination of desk study and grab survey data to ensure robustness. eDNA data was collected during the marine environmental surveys but not for the purposes of EIA. This was communicated to NatureScot via a Technical Note in 2025 eDNA have not been used in the definition of the benthic baseline.
MD-LOT	313	12 May 2023, MD-LOT Scoping Opinion (Scottish Government, 2023b).	*"5.6.4 The Scottish Ministers, in line with the NatureScot Representation, are broadly content with the impacts scoped in and out of the EIA Report, as described in Table 5.5.12 of the Scoping Report. Additionally, whilst some potential impacts are scoped out, they may still contribute to cumulative impacts. In line with the NatureScot representation, the Scottish Ministers advise that there does not need to be a spatial or temporal overlap for there to be cumulative impacts."*	The cumulative effects of key impacts upon benthic and epibenthic and shellfish receptors have been assessed within **Chapter 33: Cumulative Effects Assessment**.
MD-LOT	314	12 May 2023, MD-LOT Scoping Opinion (Scottish Government, 2023b).	*"5.6.5 Regarding cumulative impacts, the Scottish Ministers are broadly content with the cumulative assessments described within the Scoping Report, however, highlight the concerns raised by NatureScot on the likelihood of multiple offshore export cables making landfall in the area around Peterhead. NatureScot notes the potential for cumulative impacts arising from construction and associated geophysical, geotechnical, and environmental survey programmes. The Scottish Ministers support NatureScot's recommendation that this is assessed in the EIA Report."*	The cumulative effects of key impacts upon benthic, epibenthic and shellfish receptors have been assessed within **Chapter 33: Cumulative Effects Assessment**.
NatureScot	495	12 May 2023, MD-LOT Scoping Opinion Appendix 1:	*"We are content with the overall study area as proposed in Section 5.5.6-8 and Figure 5.5.1, which is broadly comprised of the Scoping Boundary plus a secondary impact ZOI. This ZOI has been informed by tidal excursion extent and coastal processes*	The study area has remained as 15km and is detailed within **Section 10.4**.

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
		Consultation Responses and Advice (Scottish Government, 2023b).	*and extends to 15km around the array Scoping Boundary and 15km around the offshore export cable corridor. We note that this 15km distance is precautionary and expected impacts are within 7km.* *We are also content with the proposed intertidal ecology study area, which is defined as the intertidal zone up to MHWS within the offshore export cable corridor Scoping Boundary"*	
NatureScot	496	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*"We note that the Scoping Report does not address the use of eDNA as a sampling method for baseline characterisation. However, we understand from email communication with the applicant* [MarramWind Limited] *that eDNA sampling and analysis will be carried out, and a technical report will be prepared. We suggest this is included as part of the EIA Report with a caveat indicating the novel nature of this technique. "*	As noted against Stakeholder Issue ID 312 above, eDNA data have not been used in the definition of the benthic baseline. The benthic baseline relies on a combination of desk study and grab survey data to ensure robustness. A Technical Note was submitted to NatureScot in November 2025.
NatureScot	497	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*"We agree that the relevant legislation and policy (Table 5.5.1), technical guidance (Table 5.5.2) and data sources (Table 5.5.7) have been identified."*	This information has been included within the EIA within **Section 10.2** and **Section 10.5**.
NatureScot	498	12 May 2023, MD-LOT Scoping Opinion	*"We support the species and habitats of conservation importance that have been identified (Sections 5.5.39-5.5.45), as well as the relevant designated sites that have been identified (Table 5.5.10)."*	This information has been included within the EIA, within **Section 10.6**.

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
		Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).		
NatureScot	499	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*"We advise that there are unlikely to be any transboundary impacts."*	Transboundary effects have been scoped out of the assessment. The relevant justification is provided within **Section 10.13**.
NatureScot	500	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*""Fish and shellfish interests are considered in Sections 5.3 (underwater noise), 5.4 (EMF) and 5.8 (fish and shellfish) of the Scoping Report. Our advice below focusses on: fish and shellfish species, and their associated habitats where appropriate, that are protected features of European sites or Nature Conservation MPAs; and species of conservation interest including PMFs and key prey species."*	These impacts upon shellfish have been assessed within **Section 10.9** to **Section 10.11**.
NatureScot	501	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish	*"We are broadly content with the impacts that are to be scoped in / out of assessment, as described in Table 5.5.12, and Section 5.5.59-63, noting that whilst some potential impacts may be screened out, they may still contribute to cumulative impacts. There does not need to be a spatial or temporal overlap for there to be cumulative impacts"*	This has been addressed within the EIA within **Section 10.15**.

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
		Government, 2023b).		
NatureScot	503	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*"We are content with the proposed approach to assessment."*	This information has been included within the EIA with **Section 10.7**.
NatureScot	505	12 May 2023, MD-LOT Scoping Opinion Appendix 1: Consultation Responses and Advice (Scottish Government, 2023b).	*"We are broadly content with the proposed approach to cumulative assessment described in Sections 5.5.60-47. However we are concerned with the likelihood of multiple offshore export cables making landfall in the area around Peterhead, and the potential for cumulative impacts arising from construction and associated geophysical, geotechnical and environmental survey programmes. We recommend that this is assess in the EIA Report."*	This information has been included within the EIA within **Section 10.15**.
NatureScot	699	16 February 2023, Meeting.	*"The Project mentioned that the Benthic Sampling Strategy will be sent to MD-LOT for review w/c 20 February 2023. The export cable corridor Benthic sampling strategy will consist of 60 sample stations for benthic fauna and Particle Size Distribution; 25 stations for contaminants; 25 vibrocore stations; and 60 drop-down video stations. The survey is focused on the export cable corridor and not the whole study area described in the European Protected Species (EPS) licence application. Three potential landfall options are still being considered so proposing to survey all three landfall options currently. Once geophysical survey outputs are reviewed, sampling station locations will be micro-*	Benthic sampling strategy was sent to MD-LOT and NatureScot 2 March 2023. NatureScot responded to the Benthic Sampling Strategy on 21 March 2023 confirming acceptance of proposed approach.

Stakeholder	Stakeholder issue ID	Date, document, forum	Stakeholder comment	How is this addressed in the EIA Report
			sited to avoid sensitive areas. The intertidal data collection will use multiple vertical transects (1 every 500m horizontally along the beach). Minimum of 4 sampling stations along each vertical transect from Mean Low Water Springs (MLWS) to MHWS. Each quadrant will take sediment sample, stills photography, sediment classification and qualitative assessment of surface fauna and vegetation. *NatureScot asked if any eDNA sampling will be done. The Project confirms eDNA will be conducted (number of samples will be approximately the same as on the export cable corridor samples. NatureScot highlighted the lowest landfall is within an SPA and asked for information of how long the surveys / boats will be there."*	
NatureScot	675	21 March 2023, Email.	*"Following the receipt of the Inshore Licence (EPS-BS-00010197) and the acceptance of our Notice of Exempt Activity (received on 1 February 2023) for MarramWind's export cable corridor preliminary site investigation campaign, MarramWind would like to present its Benthic Sampling Strategy (Doc ID: MAR-GEN-ENV-STG-SCW-000001). We discussed the principles of this benthic sampling strategy during our discussion on 16 February 2023.* *NatureScot are content with the approach presented in the strategy. The approach is very similar to what we saw last year for the offshore array area, and we note that you taken on board some of the comments / suggestions we made then (such as archiving the data in a suitable data store)."*	Benthic sampling strategy was sent to MD-LOT and NatureScot 2 March 2023. NatureScot responded to the Benthic Sampling Strategy on 21 March 2023 confirming acceptance of proposed approach.

10.4 Scope of the assessment

10.4.1 Overview

10.4.1.1 This Section sets out the scope of the EIA for benthic, epibenthic and intertidal ecology. This scope has been developed as the Project's design has evolved and responds to stakeholder feedback received to-date, as set out in **Section 10.3**.

10.4.2 Spatial scope and study area

10.4.2.1 The spatial extent of the benthic, epibenthic and intertidal ecology assessment encompasses the Offshore Red Line Boundary (including the OAA and offshore export cable corridor) as well as a secondary ZOI. Together, these areas define the study area presented in this Section and illustrated in **Volume 2, Figure 10.1: Benthic, epibenthic and intertidal ecology study area**.

10.4.2.2 The ZOI has been established based on tidal ellipse and coastal process dynamics. It reflects the area within which suspended sediments may disperse following project-related seabed disturbance. To ensure a precautionary approach, a buffer zone extending 15km around the offshore export cable corridor and OAA has been applied.

10.4.2.3 The 15km tidal ellipse buffer exceeds the local mean value of approximately 7km, as identified by the Atlas of UK Marine Renewable Energy Resources, thereby accounting for potential variation and ensuring adequate spatial coverage of indirect ecological effects (ABPmer, 2008).

10.4.2.4 The intertidal ecology study area is defined by the intertidal zone extending up to MHWS mark within the offshore export cable corridor Red Line Boundary. All land above MHWS will comprise the onshore terrestrial ecology and ornithology study area as detailed in **Chapter 23: Terrestrial Ecology and Ornithology**.

10.4.3 Temporal scope

10.4.3.1 The temporal scope of the assessment of benthic, epibenthic and intertidal ecology is the entire lifetime of the Project, which therefore covers the construction, O&M, and decommissioning stages as set out in **Chapter 4: Project Description**.

10.4.3.2 It is anticipated that the construction of the Project will commence in 2030, with the first phase becoming fully operational by 2037. It is anticipated that the second phase of the Project would become fully operational by 2040 and the third phase by 2043. The operational lifetime of the Project for each phase is expected to be 35 years.

10.4.4 Identified receptors

10.4.4.1 The spatial and temporal scope of the assessment enables the identification of receptors that may experience a change as a result of the Project. The main receptor groups identified that may experience likely significant effects for benthic, epibenthic and intertidal ecology are outlined in **Table 10.2**. It should be noted that these groups are necessarily broad and include within them different habitats and species. Additional detail is provided **Section 10.9, Section 10.10** and **Section 10.11** where individual values and sensitivities are provided in the context of specific impacts.

10.4.4.2 Within the Environmental Impact Assessment (EIA) Scoping stage of the Project, fish and shellfish were assessed within one chapter. However, shellfish receptors are assessed within this chapter while fish now sit in **Chapter 13: Fish Ecology**. This is because shellfish species generally inhabit benthic habitats, so their description and assessment is more aligned with the content of this chapter than alongside the free-swimming fish species described and assessed in **Chapter 13: Fish Ecology**. This approach was agreed with MD-LOT during stakeholder engagement in 2025.

10.4.4.3 It should be noted that impacts to designated sites have been assessed within the **Report to Inform Appropriate Assessment (RIAA)** and the **Marine Protected Area Assessment (MPA Assessment)**. Details of the designated sites present within the study area are provided in **Section 10.6**.

Table 10.2 Identified receptor groups requiring assessment for benthic, epibenthic and intertidal ecology

Receptor group	Description
Intertidal habitats and species	Habitats and species identified between the MHWS and MLWS.
Subtidal habitats and species	Habitats and species identified seaward of MLWS.
Shellfish	Aquatic invertebrates typically possessing a hard shell or exoskeleton that are often of commercial importance.
Habitats of conservation importance	Habitats recognised under national or international frameworks for their ecological value, rarity or vulnerability to degradation. This is distinct from site designations that are assessed in separate **RIAA** and the **MPA Assessment**.
Species of conservation importance	Species recognised under national or international frameworks for their ecological value, rarity or vulnerability to degradation.
Blue carbon	Carbon stored in coastal ecosystems and habitats such as seagrass meadows, kelp beds and salt marshes. These ecosystems are important for climate change mitigation as they sequester carbon.

10.4.5 Potential effects

10.4.5.1 Potential effects on benthic, epibenthic and intertidal ecology receptors that have been scoped in for assessment are summarised in **Table 10.3**.

Table 10.3 Potential effects on benthic, epibenthic and intertidal ecology

Receptor	Activity or impact	Potential effect
Construction stage		
Subtidal habitats and species, shellfish, habitats of conservation importance and species of conservation importance	Temporary habitat disturbance of seabed habitat.	Potential physical disturbance / damage to benthic habitats and displacement or mortality of associated benthic species.
Intertidal habitats and species, subtidal habitats and species, shellfish, habitats of conservation importance and species of conservation importance, blue carbon	Temporary increase in suspended sediment deposition.	Increased turbidity and smothering by resettling sediments may interfere with breeding, feeding or gas exchange mechanisms of benthic invertebrates, or photosynthesis of phytobenthos.
Intertidal habitats and species, subtidal habitats and species, shellfish, habitats of conservation importance and species of conservation importance, blue carbon	Disturbance of the seabed resulting in the mobilisation of sediment associated contaminants (for example, heavy metals, hydrocarbons).	Potential toxicity to benthic species.
Intertidal habitats and species, subtidal habitats and species, shellfish, habitats of conservation importance and species of conservation importance	Increased risk of introduction or spread of marine INNS.	Increased competition with, or displacement of native species and alteration of habitat structure and ecosystem function.
Intertidal species, subtidal species, shellfish, species of conservation importance	Underwater noise, vibration and particle motion for example, unexploded ordnance (UXO) clearance.	Potential mortality, injury to and behavioural changes of benthic species and alterations to predator prey dynamics.
O&M stage		
Subtidal habitats and species, shellfish, habitats of conservation importance and species of conservation importance	Temporary disturbance of seabed habitat.	Potential degradation of benthic habitats and displacement or mortality of associated benthic species.
Intertidal habitats and species, subtidal habitats and species, shellfish, habitats of conservation importance and species of conservation importance, blue carbon	Temporary increase in suspended sediment and redeposition.	Increased turbidity and smothering by resettling sediments may interfere with breeding, feeding or gas exchange mechanisms of benthic invertebrates, or photosynthesis of phytobenthos.
Intertidal habitats and species, subtidal habitats	Disturbance of the seabed resulting in the	Potential toxicity to benthic species.

Receptor	Activity or impact	Potential effect
and species, shellfish, habitats of conservation importance and species of conservation importance, blue carbon	mobilisation of sediment associated contaminants (for example, heavy metals or hydrocarbons).	
Subtidal habitats and species, shellfish, habitats of conservation importance and species of conservation importance, blue carbon	Long-term habitat loss.	Reduction in habitat availability for benthic species, potential alteration of local species composition and potential barrier to recovery or original habitat type.
Subtidal habitats and species, shellfish, habitats of conservation importance and species of conservation importance	Creation of areas of hard substrate.	Colonisation of hard structures leading to potential attraction of opportunistic or non-native species, alteration of local species composition and potential increase in biodiversity or risk of ecosystem imbalance.
Intertidal species, subtidal species, shellfish, and species of conservation importance	EMF generated by array and export cables.	Potential behavioural changes in EMF-sensitive species and alteration of predator-prey dynamics.
Intertidal species, subtidal species, shellfish, species of conservation importance	Underwater noise and vibration.	Potential mortality, injury to and behavioural changes of benthic species and alterations to predator prey dynamics.
Decommissioning stage		
Subtidal habitats & species, shellfish, habitats of conservation importance and species of conservation importance, blue carbon.	Temporary disturbance of seabed habitat.	Potential damage / degradation of benthic habitats and displacement or mortality of associated benthic species.
Intertidal habitats and species, subtidal habitats and species, shellfish, habitats of conservation importance and species of conservation importance.	Temporary increase in suspended sediment and subsequent re-deposition.	Increased turbidity and smothering by resettling sediments may interfere with breeding, feeding or gas exchange mechanisms of benthic invertebrates, or photosynthesis of phytobenthos.
Intertidal habitats and species, subtidal habitats and species, shellfish, habitats of conservation importance and species of conservation importance.	Disturbance of the seabed resulting in the mobilisation of sediment associated contaminants (for example, heavy metals or hydrocarbons).	Potential toxicity to benthic species.
Intertidal species, subtidal species, shellfish, species of conservation importance	Underwater noise and vibration.	Potential mortality, injury and behavioural changes of benthic species and alterations to predator prey dynamics.

Receptor	Activity or impact	Potential effect
Intertidal habitats and species, subtidal habitats and species, shellfish, habitats of conservation importance and species of conservation importance	Increased risk of introduction or spread of marine INNS.	Increased competition with, or displacement of native species and alteration of habitat structure and ecosystem function.

10.4.6 Impacts scoped out of assessment

10.4.6.1 A couple of potential impacts have been scoped out from further assessment, resulting from a conclusion of no likely significant effect at the scoping stage. These conclusions have been made based on the knowledge of the baseline environment, the nature of planned works and the professional judgement on the potential for impact from such projects more widely. The conclusions follow (in a site-based context) existing best practice. Each scoped out activity or impact is considered in turn in **Table 10.4**.

Table 10.4 Activities or Impacts scoped out of assessment

Activity or impact	Rationale for scoping out
Accidental Pollution	Accidental releases of pollutants, such as chemicals or hydrocarbons, may occur during the construction, O&M or decommissioning stages of the Project, primarily from vessels and associated equipment. However, the potential for significant adverse effects on benthic, epibenthic and intertidal ecological receptors is considered low. This conclusion is based on several factors: the limited volumes of hazardous substances typically present on site, the rapid natural attenuation of marine fuels through evaporation, dispersion and biodegradation, and the implementation of comprehensive embedded environmental measures. All vessels engaged in the Project will be required to adhere to strict environmental controls, including with an Outline Project Environmental Programme (PEMP (M-049), a Marine Pollution Contingency Plan (M-033), and Environmental Management Plan (M-121). These plans, which are subject to approval by relevant authorities and secured through section 36 (s.36) and marine licence conditions, set out procedures for spill prevention, emergency response and reporting, and incorporate industry best practice as outlined in OSPAR and International Convention for the Prevention of Pollution from Ships (MARPOL) guidelines. Given the combination of limited pollutant volumes, rapid environmental dissipation and robust management controls, accidental pollution is not anticipated to result in significant effects on benthic, epibenthic or intertidal ecology. Accordingly, this potential impact has been scoped out of further detailed assessment within the EIA.

10.5 Methodology for baseline data gathering

10.5.1 Overview

10.5.1.1 Baseline data collection has been undertaken to obtain information over the study area described in **Section 10.4**. The current and future baseline conditions are presented in **Section 10.6.**

10.5.2 Desk study

10.5.2.1 The data sources that have been collected and used to inform this benthic, epibenthic and intertidal ecology assessment are summarised in **Table 10.5**.

Table 10.5 Data sources used to inform the benthic, epibenthic and intertidal ecology chapter

Source	Summary	Coverage of study area
North Sea Habitats, European Marine Observation and Data Network (EMODnet) 2019	EMODnet broad-scale seabed habitat map for Europe of physical habitats (EMODnet, 2019) is a predictive habitat map that covers the seabed of a large area of European waters including the North Sea. Habitats are described in the European Nature Information System (EUNIS) and MSFD predominant habitat classifications and predicted based on a number of physical parameters. Associated confidence maps are also available which give a break down confidence in predicted habitats into high, medium and low.	Full coverage of study area.
EUSeaMap, 2021	EUNIS level 4 model, detailing biological zone and substrate.	Full coverage of study area.
Biologically informed habitat map (Cooper *et al.*, 2019)	A biologically informed habitat map produced using all Regional Seabed Monitoring Plan (RSMP) data. Samples have been collected over a period of 48 years from 1969 to 2016, although the vast majority (96%) were acquired since 2000.	Full coverage of study area
Special area of conservation (SAC) designation documents by JNCC	SAC designation documents and site management plans (JNCC, 2025a).	Designated site-specific data
Natura 2000 standard data form by JNCC (JNCC, 2015)	Natura 2000 standard data forms published by the JNCC.	Designated site-specific data
Benthic ecology data maintained by Marine Data Exchange (2025)	Benthic ecology survey data (undertaken in 2013) and reports previously done (Marine Data Exchange, 2025).	Hywind Offshore Wind Farm Pre-Construction Geophysical survey Regional context.
North Sea benthic data held by MarLIN	North Sea benthic data (MarLIN, 2025).	Regional context of the North Sea.
Offshore Energies UK (OEUK)	OEUK databased of offshore environmental surveys for UK benthos (OEUK, 2025).	Partial coverage of the study area.

Source	Summary	Coverage of study area
North Sea benthic data by National Biodiversity Network (NBN) Gateway	The NBN Gateway is a database that holds species records (NBN Atlas, 2025).	Patial coverage of the study area.
North Sea benthic and intertidal habitats held by Multi-Agency Geographic Information for the Countryside (MAGIC)	Online geographical information system that provides data from the natural environment from across government (MAGIC, 2022)	Full coverage of the study area.
MPAs by NatureScot (NatureScot, 2024)	MPA Reports from NatureScot.	Designated site-specific data.
Priority Marine Habitats by NatureScot and JNCC (NatureScot and JNCC, 2025b)	Priority marine habitats information from NatureScot and JNCC.	Partial coverage of the study area.
North Sea habitats (Marine Scotland, 2025)	NatureScot Habitat Map of Scotland (HabMoS) will publish all available habitat data and manage a programme to survey those areas for new information.	Full coverage of the study area.
Kelp bed habitat information by Marine Scotland (Marine Scotland, 2018b)	Kelp bed information from Marine Scotland including five layers available to cover the subtidal rock habitat.	Full coverage of the study area.
Burrowed mud habitats information by Marine Scotland (Marine Scotland, 2018c)	Burrowed mud habitats information from Marine Scotland including six layers, representing a number of important burrowed mud communities and species.	Full coverage of study area.
Ocean quahog habitat information by Marine Scotland (Marine Scotland, 2018d)	Ocean quahog (*A.islandica*) habitat information.	Full coverage of the study area
NorthConnect (2018)	Grab sampling (biota, PSA and chemical analysis), seabed photography and video systems were used across the selected sample locations as part of the baseline characterisation.	NorthConnect consenting corridor. Partial coverage of the study area.

Source	Summary	Coverage of study area
Hywind (2015)	DDV and photography were used over the whole survey area to provide information about seabed type, features and epibenthic biotopes. Grab sampling gear were deployed to collect sediment for analysis of benthic invertebrates and particle size across the survey area and along the export cable corridor to determine levels of metals and hydrocarbons.	Hywind Offshore Wind Farm Pre-Construction Geophysical and environmental baseline survey. Partial coverage of the study area.
Green Volt (2025)	Grab sampling and video transect surveys and stations using a remotely operated vehicle (ROV) were deployed to collect sediment for physio-chemical substances analysis and macrofaunal identification. The survey covered Green Volt's wind farm area (which is east for the Project's offshore Red Line Boundary for the offshore export cable) and two export cable routes, one to Buzzard and the other to land towards Peterhead area (which overlaps the offshore Scoping Boundary for the offshore export cable from the east to the southwest).	Green Volt area and two export cable routes. Partial coverage of the study area.
Species distribution modelling for marine benthos: a North Sea case study (Reiss *et al.*, 2011)	Species distribution models applied to predict the distribution of 20 marine benthic species in the North Sea.	Partial coverage of the study area.
Status of *Sabellaria spinulosa* reef off the Moray Firth and Aberdeenshire Coasts and Guidance (Pearce and Kimber, 2018)	Video footage, still images and ROV clips collected from five sites were analysed to determine the status of *S.spinulosa* habitats by applying reefiness criteria in Moray Forth and Aberdeenshire Coasts. Guidance for the conservation of the species off the Scottish east coast.	Partial coverage of the study area.

10.5.3 Site surveys

10.5.3.1 Environmental sampling was undertaken to establish the presence of any sensitivity habitats or features. This comprised a benthic sapling programme to collect drop-down video (DDV) footage, grab samples for macrobenthic faunal analysis and particle size distribution (PSD). Environmental sampling stations were predetermined via a benthic sampling strategy developed for the Project, which was shared with MD-LOT and accepted as suitable for use.

10.5.3.2 The site surveys that have been conducted and used to inform this benthic, epibenthic and intertidal ecology assessment are summarised in **Table 10.6** and the sampling locations detailed within **Volume 2, Figure 10.2: Survey locations**. See **Volume 3, Appendix 10.1** for further detail regarding survey methods.

Table 10.6 Site surveys undertaken

Survey type	Scope of survey	Coverage of Study Area
Volume 3, Appendix 10.2	Findings from surveys of intertidal habitats and biological communities in the vicinity of the three landfall options: Landfall D (Scotstown Beach), Landfall E (Lunderton Beach) and Landfall F (Sandford Bay). The landfall at Sandford Bay has been subsequently discounted from the Project design envelope so is not discussed further. Intertidal biotopes were mapped and photographed. Upper, mid and lower shore 0.01m^2 sediment core samples (1 for biota, 1 for PSA) were collected along transects placed at 500m intervals along each area (4 transects at Landfall D and Landfall E; 3 at Landfall F).	Partial coverage of the study area.
Volume 3, Appendix 10.3	For the nearshore section of the survey area, three camera transects and two grab sampling stations were proposed. Photographic data was successfully acquired at all stations and transects. A full suite of grab samples was successfully acquired at two proposed stations. Nearshore samples were taken between 13m and 17m water depth. For the offshore section of the survey area, 80 stations were proposed with sediment grab samples and photographic data to be collected at each station. Samples were successfully acquired from 74 of the 79 remaining proposed stations. Offshore samples were taken between 23m and 116m water depth.	Partial coverage of the study area.
Volume 3, Appendix 10.4	Eighty grab sampling stations were proposed. A full suite of grab samples were successfully acquired from 79 stations. Video and stills photographs were successfully acquired along all eighty proposed camera stations and fifty-eight transects.	Partial coverage of the study area.

10.5.4 Data limitations

10.5.4.1 There is a possibility for the benthic communities to have developed and evolved in the intervening period since the site-specific surveys were carried out in 2022 and 2023. However, as the surveys were conducted less than five years prior to submission, the results are considered to be appropriate for use for EIA.

10.5.4.2 The precise boundaries of each habitat or biotope are difficult to define, even when using site-specific geophysical survey data, as transitions between habitats are typically gradual rather than distinct, making exact delineation challenging.

10.6 Baseline conditions

10.6.1 Current baseline

10.6.1.1 A summary of the findings from the environmental surveys is presented below. For more detail regarding the survey outputs, see **Volume 3, Appendix 10.1**.

Benthic habitats

OAA

10.6.1.2 Broadscale regional habitat mapping to EUNIS Level 4, detailing biological zone and substrate (EUSeaMap, 2021), indicates that the habitats across the OAA are predominantly characterised by A5.27 Deep circalittoral sand (SS.SSa.Osa) (see **Volume 2, Figure 10.3: EUSeaMap benthic biotopes**). These habitats are consistent with the subtidal sediments identified within the OAA during the 2024 benthic survey (see **Volume 2, Appendix 10.1**) with the addition of:

- A5.251 *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (MC5211);
- A5.361 Sea pens and burrowing megafauna in circalittoral fine mud (MC6216); and
- A5.376 *Paramphinome jeffreysii*, *Thyasira spp*. and *Amphiura filiformis* in Atlantic offshore circalittoral sandy mud (MD6218).

10.6.1.3 Sea pens and burrowing megafauna communities have been identified as the dominant feature in the OAA.

Offshore export cable corridor

10.6.1.4 EUSeaMap habitats within the offshore export cable corridor include the same habitats as the windfarm OAA with the addition of the following:

- A4.1 Atlantic and Mediterranean high energy circalittoral rock (MC12);
- A4.2 Atlantic and Mediterranean moderate energy circalittoral rock (MB12);
- A4.27 Faunal communities on deep moderate energy circalittoral rock (MD12);
- A5.15 Deep circalittoral coarse sediment (MD32);
- A5.25 Circalittoral sand (MC52);
- A5.26 Circalittoral muddy sand (MC52);
- A3.1 Atlantic and Mediterranean high energy infralittoral rock (IR.HIR); and

- A4.1 Atlantic and Mediterranean high energy circalittoral rock (CR.HCR).

10.6.1.5 These habitats have also been recorded by previous surveys for other offshore windfarms in the area, such as the Hywind project. The Hywind survey data indicates broad-scale distribution of these habitats in the region. Furthermore, these habitats are consistent with the subtidal habitats identified within the offshore export cable corridor during the 2024 benthic survey with the addition of:

- A4.13 Mixed faunal turf communities;
- A4.21 Echinoderms and crustose communities (MB123A3);
- A4.221 *Sabellaria spinulosa* encrusted circalittoral rock (MC1281);
- A5.14: Circalittoral coarse sediment (MC32);
- A5.142 *Mediomastus fragilis*, *Lumbrineris spp*. and venerid bivalves in circalittoral coarse sand or gravel (MC3212);
- A5.145: *Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel (MC3215);
- A5.2 Sublittoral sand and muddy sands
- A5.44 Offshore circalittoral mixed sediment (MD42); and
- A5.661 *Sabellaria spinulosa* on stable circalittoral mixed sediment (MC2211);

10.6.1.6 This is supported by results of surveys conducted for the NorthConnect cable detailing the presence of bedrock, sand, mud and mixed sediments (NorthConnect, 2018) and Hywind Offshore Windfarm recording sediments composed of medium to fine sand, with coarse sand and very fine pebbles which demonstrates the broad-scale and non-isolated distribution of these habitats.

Intertidal

10.6.1.7 The landfall options surveyed during the 2023 intertidal surveys were predominantly sandy beaches. All landfall(s) included stretches of intertidal sand extending from dunes, through a dry upper shore zone to mid and lower shore mobile sand. Hard substrata were present at both landfall options.

10.6.1.8 The biotopes recorded at Scotstown and Lunderton Beach were:

- A1.113 *Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock (MA1223);
- A1.313 *Fucus vesiculosus* on moderately exposed to sheltered mid eulittoral rock (MA123D);
- A1.452 *Porphyra purpurea* and *Ulva spp*. on sand-scoured mid or lower eulittoral rock (MA123H);
- A1.214 *Fucus serratus* on moderately exposed lower eulittoral rock (MA1244);
- A2.211 Talitrids on the upper shore and strandline (MA5211);
- A2.221 Barren Atlantic littoral coarse sand (MA5231); and
- A2.223 Amphipods and *Scolelepis spp*. in littoral medium-fine sand (MA5233).

10.6.1.9 Certain biotopes were only recorded at Scotstown and these included:

- A1.314 *Ascophyllum nodosum* on very sheltered mid eulittoral rock (MA123E); and

- A2.2221 Oligochaetes in full salinity Atlantic littoral mobile sand (MA52321).

Wider study area

10.6.1.10 Additional EUSeaMap habitats located outside of the offshore export cable corridor and OAA Red Line Boundary but within the study area include:

- A3.2 Atlantic and Mediterranean moderate energy infralittoral rock (MB12); and
- A5.13: Infralittoral coarse sediment (MB32).

10.6.1.11 During the 2023 surveys, Sandford Bay was surveyed[1] which is located outside of the offshore export cable corridor and OAA Red Line Boundary but within the intertidal region of the wider study area. The following additional habitats were identified: -

- B3.111 Yellow and grey lichens on supralittoral rock (MA121);
- B3.113 *Verrucaria maura* on littoral fringe rock (MA1213);
- A1.312 *Fucus spiralis* on moderately exposed to sheltered mid eulittoral rock (MA123C);
- A1.211 *Pelvetia canaliculata* and barnacles on moderately exposed littoral fringe rock (MA1241);
- A2.24 Polychaete / bivalve-dominated Atlantic littoral muddy sand (MA525); and
- A3.211 *Laminaria digitata* on moderately exposed Atlantic sublittoral fringe rock (MB1217).

10.6.1.12 A description of each biotope located within the study area is presented in **Table 10.7** and shown in **Volume 2, Figure 10.3**, **Volume 2, Figure 10.4: Offshore export cable corridor and OAA benthic characterisation map** and **Volume 2, Figure 10.6: Intertidal benthic characterisation map at Scotstown landfall**.

[1]It should be noted that Sandford Bay is no longer a landfall option. However, it has been included within this chapter as it remains within the Benthic, Epibenthic and Intertidal Ecology study area. It therefore provides information regarding intertidal habitats within the wider study area, outside of the offshore export cable corridor and OAA Red Line Boundary.

Table 10.7 EUNIS habitat types and description within the benthic, epibenthic and intertidal ecology study area

EUNIS habitat type	EUNIS code	Description	Location
Atlantic and Mediterranean high energy infralittoral rock	A3.1	This biotope is rocky habitats in the infralittoral zone subject to exposed to extremely exposed wave action or strong tidal streams. Typically, the rock supports a community of kelp (*L. hyperborea*) with foliose seaweeds and animals, the latter tending to become more prominent in areas of strongest water movement. The sublittoral fringe is characterised by dabberlocks (*Alaria esculenta)* (EEA, 2025).	Located within the ECC.
Atlantic and Mediterranean moderate energy infralittoral rock	A3.2	Predominantly moderately wave-exposed bedrock and boulders, subject to moderately strong to weak tidal streams. On the bedrock and stable boulders there is typically a narrow band of kelp *L. digitata* in the sublittoral fringe which lies above a *L. hyperborea* forest and park. Associated with the kelp are communities of seaweeds, predominantly reds and including a greater variety of more delicate filamentous types than found on more exposed coasts (EEA, 2025).	Outside of the offshore export cable corridor and OAA Red Line Boundary but within the study area.
Atlantic and Mediterranean low energy infralittoral rock	A3.3	Infralittoral rock in wave and tide-sheltered conditions, support silty communities with *L. hyperborea* and / or *L. saccharina* (A3.31). Associated seaweeds are typically silt-tolerant and include a high proportion of delicate filamentous types. In turbid-water estuarine areas, the kelp and seaweeds (A3.32) may be replaced by animal-dominated communities (A3.36) whilst stable hard substrata in lagoons support distinctive communities (A3.34) (EEA, 2025).	Possibly present in restricted areas <1km west of the offshore cable corridor search area.
Atlantic and Mediterranean high energy circalittoral rock	A4.1	This biotope occurs on extremely wave-exposed to exposed circalittoral bedrock and boulders subject to tidal streams ranging from strong to very strong. Typically found in tidal straits and narrows. The high energy levels found within this habitat complex are reflected in the fauna recorded. Sponges such as *Pachymatisma johnstonia*, *Halichondria panicea*, *Esperiopsis fucorum* and *Myxilla incrustans* may all be recorded. Characteristic of this habitat complex is the dense 'carpet' of the hydroid (*Tubularia indivisa*). The barnacle (*Balanus crenatus*) is recorded in high abundance on the rocky substrata. On rocky outcrops, *Alcyonium digitatum* is often present (EEA, 2025)	Offshore export cable corridor.

EUNIS habitat type	EUNIS code	Description	Location
Mixed faunal and turf communities on circalittoral rock	A4.13	This habitat type occurs on wave-exposed circalittoral bedrock and boulders, subject to tidal streams ranging from strong to moderately strong. Characterised by its diverse range of hydroids (*Halecium halecinum*, *Nemertesia antennina* and *Nemertesia ramosa*), bryozoans (*Alcyonidium diaphanum*, *Flustra foliacea*, *Bugula flabellata* and *Bugula plumosa*) and sponges (*Scypha ciliata*, *Pachymatisma johnstonia*, *Cliona celeta*, *Raspailia ramosa*, *Esperiopsis fucorum*, *Hemimycale columella* and *Dysidea fragilis*) forming an often dense, mixed faunal turf. Other species found within this complex are *Alcyonium digitatum*, *Urticina felina*, *Sagartia elegans*, *Actinothoe sphyrodeta*, *Caryophyllia smithii*, *Pomatoceros triqueter*, *Balanus crenatus*, *Cancer pagurus*, *Necora puber*, *Asterias rubens*, *Echinus esculentus* and *Clavelina lepadiformis*.	Offshore export cable corridor.
Atlantic and Mediterranean moderate energy circalittoral rock	A4.2	Mainly occurs on exposed to moderately wave-exposed circalittoral bedrock and boulders, subject to moderately strong and weak tidal streams. This habitat type contains a broad range of biological subtypes, from echinoderms and crustose communities (A4.21) to *Sabellaria* reefs (A4.22) and circalittoral mussel beds (A4.24) (EEA, 2025).	Offshore export cable corridor.
Echinoderms and crustose communities on circalittoral rock	A4.21	This habitat type occurs on wave-exposed, moderately strong to weakly tide-swept, circalittoral bedrock and boulders. Echinoderms, faunal (*Parasmittina trispinosa*) and algal crusts (red encrusting algae) dominate this biotope, giving a sparse appearance. Typical echinoderms present are the starfish (*Asterias rubens*), the brittlestar (*Ophiothrix fragilis*) and the sea urchin (*Echinus esculentus*). There may be isolated clumps of the hydroids (*Nemertesia antennina* and *Abietinaria abietina*), *Alcyonium digitatum*, the anemone *Urticina felina* and the cup coral (*Caryophyllia smithii*). Other species present may include the polychaete *Pomatoceros triqueter* and the top shell (*Calliostoma zizyphinum*).	Offshore export cable corridor.
***Sabellaria spinulosa* encrusted circalittoral rock**	A4.221	This biotope is typically found encrusting the upper faces of wave-exposed and moderately wave-exposed circalittoral bedrock, boulders and cobbles subject to strong / moderately strong tidal streams in areas with high turbidity. The crusts formed by the sandy tubes of the polychaete worm *Sabellaria spinulosa* may even completely cover the rock, binding the substratum together to form a crust. A diverse fauna may be found attached to, and sometimes obscuring the crust, often reflecting the character of surrounding biotopes. Bryozoans such as *Flustra foliacea*, *Pentapora foliacea* and *Alcyonidium diaphanum*, anemones such as	Offshore export cable corridor.

EUNIS habitat type	EUNIS code	Description	Location
		Urticina felina and *Sagartia elegans*, the polychaete *Pomatoceros triqueter*, *Alcyonium digitatum*, the hydroid *Nemertesia antennina* and echinoderms such as *Asterias rubens* and *Crossaster papposus* may all be recorded within this biotope. There are two variants. The first (unit MC2-2131) contains significant cover of barnacles (*Balanus crenatus*) and bryozoans. The second (unit MC1-2132) has a dense turf of didemnid ascidians as well as scour-tolerant bryozoans such as *F. foliacea*, sponges such as *Tethya aurantium* and *Phorbas fictitius*, colonies of the serpulid worm (*Salmacina dysteri*) and patchy occurrences of the ascidians *Distomus variolosus*, *Polycarpa pomaria* and *P. scuba*.	
Faunal communities on deep moderate energy circalittoral rock	A4.27	These communities populate hard substrata with low hydrodynamics and strong sedimentation (EEA, 2025). Specific species are not mentioned in the EUNIS habitat description	Offshore export cable corridor.
Sublittoral sediment	A5	Sediment habitats in the sublittoral near shore zone (for instance, covering the infralittoral and circalittoral zones), typically extending from the extreme lower shore down to the edge of the bathyal zone (200m). Sediment ranges from boulders and cobbles, through pebbles and shingle, coarse sands, sands, fine sands, muds and mixed sediments. Those communities found in or on sediment are described within this broad habitat type (EEA, 2025).	Offshore export cable corridor and OAA.
Infralittoral coarse sediment	A5.13	Moderately exposed habitats with coarse sand, gravelly sand, shingle and gravel in the infralittoral, are subject to disturbance by tidal steams and wave action. Such habitats found on the open coast or in tide-swept marine inlets are characterised by a robust fauna of infauna polychaetes such as *Chaetozone setosa* and *Lanice conchilega*, cumacean crustacea such as *Iphinoe trispinosa* and *Diastylis bradyi*, and venerid bivalves. Habitats with the lancelet (*Branchiostoma lanceolatum*) may also occur (EEA, 2025).	Outside of the offshore export cable corridor and OAA Red Line Boundary but within the study area.
Circalittoral coarse sediment	A5.14	Tide-swept circalittoral coarse sands, gravel and shingle generally in depths of over 15m to 20m. This habitat may be found in tidal channels of marine inlets, along exposed coasts and offshore. This habitat, as with shallower coarse sediments, may be characterised by robust infauna polychaetes, mobile crustacea and bivalves. Certain species of sea cucumber (for example, *Neopentadactyla*) may also be prevalent in these areas along with the lancelet *B.lanceolatum* (EEA, 2025).	Offshore export cable corridor.

EUNIS habitat type	EUNIS code	Description	Location
***Mediomastus fragilis*, *Lumbrineris spp*. and venerid bivalves in circalittoral coarse sand or gravel**	A5.142	Circalittoral gravels, coarse to medium sands, and shell gravels, sometimes with a small amount of silt and generally in relatively deep water (generally over 15m to 20m), may be characterised by polychaetes such as *Mediomastus fragilis*, *Lumbrineris spp*., *Glycera lapidum* with the pea urchin (*Echinocyamus pusillus*). Other taxa may include *Nemertea spp*., *Protodorvillea kefersteini*, *Owenia fusiformis*, *Spiophanes bombyx* and *Amphipholis squamata* along with amphipods such as *Ampelisca spinipes*. This biotope may also be characterised by the presence of conspicuous venerid bivalves, particularly *Timoclea ovata*. Other robust bivalve species such as *Moerella spp*., *Glycymeris glycymeris* and *Astarte sulcata* may also be found in this biotope. *Spatangus purpureus* may be present especially where the interstices of the gravel are filled by finer particles, in which case, *Gari tellinella* may also be prevalent (EEA, 2025)	Offshore export cable corridor.
***Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel**	A5.145	Gravel and coarse sand with shell gravel often contains communities of robust venerid bivalves (A5.142). Shallower examples, such as the biotope presented here, may support a significant population of *Branchiostoma lanceolatum*. Sessile epifauna are typically a minor component of this community.	Offshore export cable corridor.
Deep circalittoral coarse sediment	A5.15	Offshore (deep) circalittoral habitats with coarse sands and gravel or shell. This habitat may cover large areas of the offshore continental shelf. Such habitats are quite diverse compared to shallower versions of this habitat and generally characterised by robust infauna polychaete and bivalve species. Animal communities in this habitat are closely related to offshore mixed sediments and in some areas, the settlement of Modiolus larvae may occur and consequently these habitats may occasionally have large numbers of juvenile M. modiolus (EEA, 2025).	Offshore export cable corridor.
Sublittoral sand and muddy sands	A5.2	Clean medium to fine sands or non-cohesive slightly muddy sands on open coasts, offshore or in estuaries and marine inlets. Such habitats are often subject to a degree of wave action or tidal currents which restrict the silt and clay content to less than 15%. This habitat is characterised by a range of taxa including polychaetes, bivalve molluscs and amphipod crustacea.	Offshore export cable corridor.
Circalittoral fine sand	A5.25	Clean fine sands with less than 5% silt / clay in deeper water, either on the open coast or in tide-swept channels of marine inlets in depths of over 15m to 20m. The habitat may also extend offshore and is characterised by a wide range of	Offshore export cable corridor.

EUNIS habitat type	EUNIS code	Description	Location
		echinoderms (in some areas including the sea urchin (*Echinocyamus pusillus*), polychaetes and bivalves (EEA, 2025).	
***Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand**	A5.251	Circalittoral and offshore medium to fine sand (from 40m to 140m) characterised by the pea urchin (*Echinocyamus pusillus*), the polychaete *Ophelia borealis* and the bivalve *Abra prismatica*. Other species may include the polychaetes *Spiophanes bombyx*, *Pholoe sp*., *Exogone spp*., *Sphaerosyllis bulbosa*, *Goniada maculata*, *Chaetozone setosa*, *Owenia fusiformis*, *Glycera lapidum*, *Lumbrineris latreilli* and *Aricidea cerrutii* and the bivalves *Thracia phaseolina* and *Moerella pygmaea* and to a lesser extent *Spisula elliptica* and *Timoclea ovata*.	OAA
Circalittoral muddy sand	A5.26	Circalittoral non-cohesive muddy sands with the silt content of the substratum typically ranging from 5% to 20%. This habitat is generally found in water depths of over 15m to 20m and supports animal-dominated communities characterised by a wide variety of polychaetes, bivalves such as *Abra alba* and *Nucula nitidosa*, and echinoderms such as *Amphiura spp*. and *Ophiura spp*., and *Astropecten irregularis* (EEA, 2025).	Offshore export cable corridor.
Deep circalittoral sand	A5.27	Offshore (deep) circalittoral habitats with fine sands or non-cohesive muddy sands. Very little data are available on these habitats. However, they are likely to be more stable than their shallower counterparts and characterised by a diverse range of polychaetes, amphipods, bivalves and echinoderms (EEA, 2025).	OAA
Sea pens and burrowing megafauna in circalittoral fine mud	A5.361	Plains of fine mud at depths greater than about 15m may be heavily bioturbated by burrowing megafauna; burrows and mounds may form a prominent feature of the sediment surface with conspicuous populations of seapens, typically *Virgularia mirabilis* and *Pennatula phosphorea*. The burrowing crustacea present typically include *Nephrops norvegicus*, which is frequently recorded from surface observations. The burrowing anemone (*Cerianthus lloydii*) and the ubiquitous epibenthic scavengers *Asterias rubens*, *Pagurus bernhardus* and *Liocarcinus depurator* are present in low numbers in this biotope whilst the brittlestars *Ophiura albida* and *Ophiura ophiura* are sometimes present but are much more common in slightly coarser sediments. Low numbers of the anemone *Pachycerianthus multiplicatus* may also be found, and this species, which is scarce in the UK, appears to be restricted to this habitat. The infauna may contain significant populations of the polychaetes *Pholoe spp*., *Glycera spp*., *Nephtys spp*., spionids,	OAA

EUNIS habitat type	EUNIS code	Description	Location
		Pectinaria belgica and *Terebellides stroemi*, the bivalves *Nucula sulcata*, *Corbula gibba* and *Thyasira flexuosa*, and the echinoderm *Brissopsis lyrifera*.	
***Paramphinome jeffreysii*, *Thyasira spp*. and *Amphiura filiformis* in Atlantic offshore circalittoral sandy mud**	A5.376	Deep, offshore cohesive sandy mud communities characterised by the polychaete *Paramphinome jeffreysii*, bivalves such as *Thyasira equalis* and *Thyasira gouldi* and the brittlestar *Amphiura filiformis*. Other taxa may include *Laonice cirrata*, the sea cucumber *Labidoplax buski* and the polychaetes *Goniada maculata*, *Spiophanes kroyeri* and *Aricidea catherinae*. *Amphiura chiajei* may be occasional in this biotope as may *Philine scabra*, *Levinsenia gracilis* and *Pholoe inornata*.	OAA
Offshore circalittoral mixed sediment	A5.44	Mixed (heterogeneous) sediment habitats in the circalittoral zone (generally below 15m to 20m) including well mixed muddy gravelly sands or very poorly sorted mosaics of shell, cobbles and pebbles embedded in or lying upon mud, sand or gravel. Due to the variable nature of the seabed a variety of communities can develop which are often very diverse. A wide range of infaunal polychaetes, bivalves, echinoderms and burrowing anemones such as *Cerianthus lloydii* are often present in such habitat and the presence of hard substrata (shells and stones) on the surface enables epifaunal species to become established, particularly hydroids such as *Nemertesia spp* and *Hydrallmania falcata*. The combination of epifauna and infauna can lead to species rich communities.	Offshore export cable corridor.
***Sabellaria spinulosa* on stable circalittoral mixed sediment**	A5.661	The tube-building polychaete *Sabellaria spinulosa* at high abundances on mixed sediment. These species typically form loose agglomerations of tubes forming a low-lying matrix of sand, gravel, mud and tubes on the seabed. The reefs formed by *Sabellaria spp*. consolidate the sediment and allow the settlement of other species not found in adjacent habitats leading to a diverse community of epifaunal and infauna species. The development of such reefs is assisted by the settlement behaviour of larval *Sabellaria spp.,* which are known to selectively settle in areas of suitable sediment and particularly on existing *Sabellaria* tubes. The infauna comprises typical sublittoral polychaete species such as *Protodorvillea kefersteini*, *Pholoe synophthalmica*, *Harmothoe spp*, *Scoloplos armiger*, *Mediomastus fragilis*, *Lanice conchilega* and cirratulids, together with the bivalve *Abra alba*, and tube building amphipods such as *Ampelisca spp*. The epifauna comprise a variety of bryozoans including *Flustra foliacea*, *Alcyonidium diaphanum* and *Cellepora pumicosa*, in addition to calcareous tubeworms, pycnogonids, hermit crabs and amphipods.	Offshore export cable corridor.

EUNIS habitat type	EUNIS code	Description	Location
***Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock (MA1223);**	A1.113	Exposed to moderately exposed mid to upper eulittoral bedrock and large boulders characterised by dense barnacles *Semibalanus balanoides* and the limpet *Patella vulgata*. The community has a relatively low diversity of species though occasional cracks and crevices in the rock can provide a refuge for small individuals of the mussel *Mytilus edulis*, the winkle *Littorina saxatilis* and the whelk *Nucella lapillus*. Seaweeds are usually not found in high numbers through fissures and crevices in the bedrock can hold a sparse algal community including the green seaweed *Enteromorpha intestinalis*. On some shores, the olive green lichen *Verrucaria mucosa* can be present in some abundance.	Intertidal area within the Offshore Red Line Boundary
Fucus vesiculosis on moderately exposed to sheltered mid eulittoral rock	A1.313	Moderately exposed to very sheltered mid eulittoral bedrock and large boulders characterised by a dense canopy of the wrack *Fucus vesiculosis*. Beneath the seaweed canopy the rock surface has a sparse covering of the barnacle *Semibalanus balanoides* and the limpet *Patella vulgata*. The mussel *Mytilus edulis* is confined to pits and crevices. A variety of winkles including *Littorina littorea* and *Littorina saxatilis* can be found grazing on the fucoid fronds. The whelk *Nucella lapillus* is found beneath the seaweed canopy. In areas of localised shelter the wrack *Ascophyllum nodosum* may occur, though never at high abundance. The crab *Carcinus maenus* may be present in pools or among the boulders.	Intertidal area within the Offshore Red Line Boundary
Porphyra purpurea and Ulva spp. on sand-scoured mid or lower eulittoral rock	A1.452	Exposed and moderately exposed mid-shore bedrock and boulders occurring adjacent to areas of sand which significantly affects the rock. As a consequence of sand-abrasion, wracks such as *Fucus vesiculosus* or *Fucus spiralis* are scarce and the community is typically dominated by ephemeral red or green seaweeds, particularly the foliose red seaweed *Porphyra purpurea* and green seaweeds such as *Ulva spp*. Under the blanket of ephemeral seaweeds, the barnacles *Semibalanus balanoides* or *Austrominius modestus* and the limpet *Patella vulgata* may occur in the less scoured areas, along with the occasional winkles *Littorina littorea* and *Littorina saxatilis*. Few other species are present.	Intertidal area within the Offshore Red Line Boundary
Fucus serratus on moderately exposed lower eulittoral rock	A1.214	Lower eulittoral bedrock and stable boulders on moderately exposed to sheltered shores with a canopy of the wrack *Fucus serratus* and an associated fauna consisting of the limpet *Patella vulgata*, the barnacle *Semibalanus balanoides*, the whelk *Nucella lapillus*, the anemone *Actinia equina* and the sponge *Halichondria panicea*. Green seaweeds such as *Enteromorpha intestinalis* and *Ulva lactuca* are usually present among/beneath the *F.serratus* canopy.	Intertidal area within the Offshore Red Line Boundary

EUNIS habitat type	EUNIS code	Description	Location
Talitrids on the upper shore and strandline	A2.	A community of sandhoppers (talitrid amphipods) may occur on any shore where drift lines of decomposing seaweed and other debris accumulate on the strandline. The biotope occurs most frequently on medium and fine sandy shores but may also occur on a wide variety of sediment shores composed of muddy sediment, shingle and mixed substrata, or on rocky shores. The decaying seaweed provides cover and humidity for the sandhopper *Talitrus saltator*. In places on sand that regularly accumulate larger amounts of weed*, Talorchestia deshayesi*i is often present. Oligocahetes, mainly enchytaeids, can occur where the stranded debris remains damp as a result of freshwater seepage across the shore or mass accumulation of weed in shaded situations.	Intertidal area within the Offshore Red Line Boundary
Barren Atlantic littoral coarse sand	A2.221	Freely-draining sandy beaches, particularly on the upper and mid shore, which lack a macrofaunal community due to their continual mobility. Trial excavations are unlikely to reveal any macrofauna in these typically steep beaches on exposed coasts. Oligocahetes, probably mainly enchytraeids, and the isopod *Eurydice pulchra* may be found in extremely low abundances. Burrowing amphipods may be present on very rare occasions. Occasionally, other species may be left behind in low abundance by the ebbing tide.	Intertidal area within the Offshore Red Line Boundary
Amphipods and Scolelepis spp. in littoral medium-fine sand	A2.223	Mobile clean sandy beaches on exposed and moderately exposed shores, with sediment grain sizes ranging from medium to fine, often with a fraction of coarser sediment. The sediment contains little or no organic matter, and usually no anoxic layer is present at all. The mobility of the sediment leads to a species-poor community, dominated by polychaetes, isopods and burrowing amphipods.	Intertidal area within the Offshore Red Line Boundary
Ascophyllum nodosum on very sheltered mid eulittoral rock	A1.314	Sheltered to extremely sheltered mid eulittoral rock with the wrack *Ascophyllum nodosum*. The red seaweed Vertebrata lanosa is often found growing as an epiphyte on the *A.nodosum* fronds while disturbed areas among the *A.nodosum* is colonised by the wrack *Fucus vesiculosus* and the green seaweed *Ulva intestinalis*, the barnacle *Semibalanus balanoides*, the limpet *Patella vulgata* and *Littorina littorea* can all be found on the bedrock underneath the *A.nodosum* canopy along with corraline crusts.	Intertidal area within the Offshore Red Line Boundary
Oligochaetes in full salinity Atlantic littoral mobile sand	A2.2221	A species-poor community of oligochaetes occurring in fully marine conditions on open shores with mobile, medium to fine, usually clean, sand. Oligochaetes, including enchytraeid oligochaetes, constitute the infaunal assemblage.	Intertidal area within the Offshore Red Line Boundary

EUNIS habitat type	EUNIS code	Description	Location
Yellow and grey lichens on supralittoral rock	B3.111	Vertical to gently sloping bedrock and stable boulders in the supralittoral of the majority of rocky shores are typically characterised by a diverse maritime community of yellow and grey lichens. Pools, damp pits and crevices in the rock are occasionally occupied by winkles such as *Littorina saxatilis* and halacarid mites may also be present.	Outside of the offshore export cable corridor and OAA Red Line Boundary but within the study area.
Verrucaria maura on littoral fringe rock	B3.113	Bedrock or stable boulders and cobbles in the littoral fringe which is covered by the black lichen Verrucaria maura. This lichen typically covers the entire rock surface giving a distinct black band in the upper littoral fringe. The winkle *Littorina saxatilis* is usually present.	Outside of the offshore export cable corridor and OAA Red Line Boundary but within the study area.
Fucus spiralis on moderately exposed to sheltered mid eulittoral rock	A1.312	Sheltered upper eulittoral bedrock is typically characterised by a band of the spiral wrack *Fucus spiralis* overlying the black lichen *Littorina saxatilis* and *Littorina littorea* and the barnacle *Semibalanus balanoides*. The rock surface can often be covered by the red crust *Hildenbrandia rubra*. During the summer months, the ephemeral green seaweed *Enteromorpha intestinalis* can be common.	Outside of the offshore export cable corridor and OAA Red Line Boundary but within the study area.
***Pelvetia canaliculata* and barnacles on moderately exposed littoral fringe rock**	A1.211	Exposed to moderately exposed steep, lower littoral fringe rock and mixed substrata characterised by the wrack Pelvetia canaliculata and sparse barnacles Chthamalus montagui and Semibalanus balanoides. On sheltered shores, the biotope is restricted to vertical faces. The limpet Patella vulgata and the wrack Fucus spiralis are usually present as well.	Outside of the offshore export cable corridor and OAA Red Line Boundary but within the study area.
Polychaete/bivalve-dominated Atlantic littoral muddy sand	A4.24	Muddy sand or fine sand, often occurring as extensive intertidal flats on open coasts and in marine inlets. The sediment generally remains water-saturated during low water. The infauna consists of a diverse range of amphipods, polychaetes, bivalves and gastropods.	Outside of the offshore export cable corridor and OAA Red Line Boundary but within the study area.
Laminaria digitata on moderately exposed Atlantic sublittoral fringe rock	A3.211	Exposed to moderately exposed sublittoral fringe rock characterised by the kelp *Laminaria digitata* with corraline crusts covering the rock beneath the kelp canopy. Foliose red seaweeds such as *Palmaria palmata*, *Membranoptera alata*, *Chondrus crispus* and *Mastocarpus stellatus* are often present along with the calcareous *Corallina officinalis*.	Outside of the offshore export cable corridor and OAA Red Line Boundary but within the study area.

Benthic communities and species

10.6.1.13 **Volume 2, Figure 10.5: CEFAS biological based habitat classification map** shows the biologically informed habitat map from Cooper *et al*., 2019. This biological-based seabed map uses a comprehensive dataset of macrofaunal data to produce a baseline assessment for UK shelf waters. This large dataset was created by integrating empirical data acquired from both government and non-governmental sector (for example, marine aggregates, offshore wind, oil and gas) monitoring efforts and is a useful resource. This demonstrates that the macrofaunal assemblages across the Project's benthic, epibenthic and intertidal study area were characterised by four groups, as detailed in **Table 10.8**.

Table 10.8 Biological characteristics of the macrofaunal assemblages relevant to the Project (Cooper *et al*., 2019)

Group	Characteristic taxa
C1a	Characterised by the polychaete families Spionidae, Terebellidae, Serpulidar, Syllidae, Capitelliae, Cirratulidae, Lumbrineridae, Sablleriidae, Glyceridae and the phylum Nemertea. This group is likely to be located on a variety of sandy substrates.
D2a	Represented by a faunal assemblage that was characterised by the polychaete families Spionidae, Glyceridae, Terebellidae, Capitellidae, Phyllodocidae and the phylum Nemertea. This group is likely to be located on a variety of sandy substrates.
D2b	Represented by a faunal assemblage that was characterised by the polychaete families Spionidae, Glyceridae, Terebellidae, Capitellidae, Phyllodocidae and the phylum Nemertea. This group is likely to be located within deep water, muddy sands.
D2c	Represented by a faunal assemblage that was characterised by several polychaete families including Nephtyidae, Spionidae and Opheliidae, all of which are typically found in sand and muddy sands.
D2d	Represented by a faunal assemblage that was characterised by the polychaete and amphipod families Spionidae, Bathyporeiidae, Nephtyidae, Magelonidae and Tellinidae.

OAA

10.6.1.14 Surveys carried out in 2024 identified that the macrofaunal community within the OAA was dominated by the polychaetes *Paramphinome jeffreysii*, *Lanice conchilega* and *Ampharete falcata* and the molluscs *Adontorhina similis* and *Retusa umbilicata* (**Volume 3, Appendix 10.4**).

10.6.1.15 Overall, the macrofaunal community structure and composition recorded during the surveys are in line with those reported to be typical of this region of the North Sea (**Volume 3, Appendix 10.4**).

Offshore export cable corridor

10.6.1.16 Surveys carried out in 2024 identified that the macrofaunal community along the offshore export cable corridor was dominated by annelids, which were the most abundant phylum at the majority of stations. Of the Annelida, the polychaete *Sabellaria spinulosa* was the most abundant across the survey area and particularly found in the sections of the offshore export cable corridor approaching the shore and *Lanice conchilega* was the second most abundant taxon at most stations (**Volume 3, Appendix 10.3**). At certain stations along the offshore export cable corridor, the most abundant group was echinoderms, particularly the urchin *Echinocyamus pusillus* (**Volume 3, Appendix 10.3**). Six epifaunal taxa were also recorded from surveys along the offshore export cable corridor route with cnidarians (Hydrozoa and *Alcyonium digitatum*) and barnacles (Sessilia and *Verruca stroemia*), comprising most of the epifauna observed.

10.6.1.17 Overall, the macrofaunal community structure and composition recorded during the surveys are in line with those reported to be typical of this region of the North Sea (**Volume 3, Appendix 10.3**).

Intertidal

10.6.1.18 Thirty-three taxa were recorded from the 2023 sediment core samples across the landfall options (**Volume 3, Appendix 10.2**). In upper shore samples, the most widespread taxa were enchytraeid oligochaete worms, fly larvae (Limoniidae) and sandhoppers (*Talitrus salator*). In the mid and lower shore samples, there were nemertean and nematode worms, the polychaete worms *Scolelepis squamata*, *Protodriloides chaetifer* and *Arenicola marina*, the amphipod crustacea *Pontocrates arenarius*, *Bathyporeia pelagica*, *B.sarsi* and *Haustorius arenarius* (**Volume 3, Appendix 10.2**).

Species and habitats of conservation importance

OAA

10.6.1.19 The following habitats and species of conservation importance are present within the OAA Red Line Boundary (**Volume 3, Appendix 10.4**) (see **Volume 2, Figure 10.7: Habitats and species of conservation importance**):

- OSPAR habitat 'Sea-pen and burrowing megafauna communities';
- OSPAR species Ocean quahog *Arctica islandica*;
- PMF habitat 'potential' burrowed mud;
- PMF habitat 'offshore subtidal sands and gravels;
- Annex I habitat *Caryophyllia smithii*, sponges and crustose communities on wave-exposed circalittoral rock; and
- PMF Northern Sea fan and sponge communities.

10.6.1.20 The following descriptions provide context for the protected habitats and species identified within the OAA Red Line and further information is provided in **Volume 3, Appendix 10.1**.

10.6.1.21 The presence of the OSPAR listed threatened and / or declining habitat 'Sea pens and burrowing megafauna communities' is almost ubiquitous across the OAA. Faunal burrows were present along the majority of video transects and stations. Where present, burrows were largely assessed as being 'frequent' to 'common'. The abundance of sea pens (*P.phosphorea*) across the OAA was 'occasional' to 'common' along all transects and stations and *Virgularia sp*. in abundances ranging from 'rare' to 'frequent'.

10.6.1.22 As with the offshore export cable corridor, the 'Sea pens and burrowing megafauna in circalittoral fine mud' biotope was observed within sandy and muddy sand sediments. Therefore, the PMF broad habitat 'Burrowed mud' and the UK BAP habitat 'Mud Habitats in Deep Water' are considered unlikely but have the potential to occur within the OAA.

10.6.1.23 An area towards the centre of the OAA was classified as 'Offshore circalittoral sand' which falls within the broad PMF habitat 'Offshore subtidal sands and gravels', a common habitat in the UK offshore marine environment.

10.6.1.24 Ocean quahog (*Arctica islandica*), an OSPAR threatened species was observed at numerous stations across the OAA. Edwardsiidae, indicating the possible presence of the timid burrowing anemone (*E.timida*) were recorded within the surveyed area. *E. timida* is listed by both the UK BAP as priority species and is also included on the SBL. The presence of the common cup coral (*C.smithii*) may indicate the presence of the Annex I habitat '*Caryophyllia smithii*, sponges and crustose communities on wave-exposed circalittoral rock' and the PMF 'Northern Sea fan and sponge communities'. However, given the offshore location, the presence is unlikely.

Offshore export cable corridor

10.6.1.25 The following habitats and species of conservation importance are present within the offshore export cable corridor Red Line Boundary (**Volume 3, Appendix 10.3**) (see **Volume 2, Figure 10.7a**):

- Annex I (geogenic reef);
- Annex I habitat 'Reef' (biogenic);
- OSPAR habitat and PMF 'Sea pens and burrowing megafauna communities';
- OSPAR and SBL species Ocean quahog (*Arctica islandica);*
- Edible sea urchin *Echinus esculentus* ('near threatened' on the International Union for Conservation of Nature (IUCN) Red List;
- PMF Northern Sea fan and sponge communities;
- Annex I habitat *Caryophyllia smithii*, sponges and crustose communities on wave-exposed circalittoral rock;
- UK BAP and SBL Timid burrowing anemone (*Edwardsia timida)*;
- PMF Potential Burrowed Mud;
- PMF habitat 'Subtidal sands and gravels; and
- PMF habitat 'Offshore subtidal sands and gravels'

10.6.1.26 The following descriptions provide context for the protected habitats and species identified within the offshore export cable corridor Red Line Boundary and further information is provided in **Volume 3, Appendix 10.1**.

10.6.1.27 The presence of areas of pebbles, cobbles and boulders guided the selection for assessing the presence of the Annex I habitat 'Reef' (geogenic). Most categories of 'Stony Reef' were recorded, including 'no reef', 'not a reef', 'low reef' and 'medium reef'. No areas with 'high reef' potential were identified across the assessed areas. All areas of stony reef were located towards the shoreward extreme of the offshore export cable corridor. Possible areas of stony reef were also identified; these areas were within the same vicinity and same habitat classifications as the identified stony reef. However, survey data were not available to confirm presence / absence.

10.6.1.28 The allocation of the biotopes '*Sabellaria spinulosa* on stable circalittoral mixed sediment' and '*Sabellaria spinulosa* encrusted circalittoral rock', at ten locations resulted in the assessment for the presence of the Annex I habitat 'Reef' (biogenic). The category 'low reef' was allocated to nine locations located approximately in the middle of the offshore export cable corridor. A single isolated patch of potential biogenic was identified towards the shoreward extreme. No areas of 'high reef' were identified. One area of possible biogenic reef was also identified within the nearshore area of the offshore export cable corridor. However, survey data were not available to confirm presence / absence.

10.6.1.29 The biotope 'Sea pens and burrowing megafauna in circalittoral fine mud' was observed throughout the offshore section of the offshore export cable corridor. This results in the presence of the OSPAR-listed threatened and / or declining habitat 'Sea pens and burrowing megafauna communities' being identified throughout the offshore section of the offshore export cable corridor. This was assigned due to observations of the sea pens *P. phosphorea* and occasional *Virgularia sp*., along with faunal burrows, including the characteristic burrows of the Norway lobster (*N. norvegicus*). Abundances of each species met the minimum criteria for the assignment of the potential sensitive habitat throughout the offshore section of the cable corridor.

10.6.1.30 41 individuals of the Ocean quahog (*Arctica islandica*), an OSPAR threatened species were recorded from 20 stations along the offshore export cable corridor.

10.6.1.31 The family Caryophyllidae comprising various stony corals, were observed at four of the video stations. They are not specifically listed as a protected group under international or national regulations, but specific species or habitats where they occur can be protected. For example, cup-coral fields, where Caryophyllidae are representative, are considered a vulnerable marine ecosystem (VME) under the 2016 EU Regulation. In addition, the presence of the common cup coral (*Caryophyllia smithii*) at 14 video stations may indicate the presence of the PMF 'Northern Sea fan and sponge communities' and Annex I habitat '*Caryophyllia smithii*, sponges and crustose communities on wave-exposed circalittoral rock'.

10.6.1.32 The presence of the habitat types 'Sublittoral sands and muddy sands', 'Circalittoral coarse sediment', 'Offshore circalittoral coarse sediment' and 'Offshore circalittoral sand' indicates the occurrence of the PMF broad habitats 'Subtidal sands and gravels' and 'Offshore subtidal sands and gravels'. These broad PMF habitats are present across much of the offshore export cable corridor. These habitats are amongst the most common habitats in the UK offshore marine environment.

10.6.1.33 Although present, the biotope 'Sea pens and burrowing megafauna in circalittoral fine mud' was largely recorded within sandy / muddy sand sediments. Therefore, PMF broad habitat 'Burrowed mud' and the BAP habitat 'Mud Habitats in Deep Water' are less likely to occur within the survey area. However, using the precautionary principle 'Potential Burrowed Mud' has been mapped and assessed.

Intertidal

10.6.1.34 No species of conservation importance were recorded during the 2023 intertidal survey (**Volume 3, Appendix 10.2**).

Wider study area

10.6.1.35 Although not recorded within the 2023 survey (**Volume 3, Appendix 10.2**), previous records indicate that kelp beds may be present within the wider study area. **Volume 2, Figure 10.7b** shows that kelp beds have previously been recorded along the coastline, south of Peterhead.

10.6.1.36 The following habitats were recorded by the NorthConnect (2018) surveys within its proposed offshore export cable corridor Scoping Boundary:

- *S.spinulosa* with a bryozoan turf and barnacles on silty turbid circalittoral rock PMF; and

- A5.251 – *E.pusilus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand PMF.

10.6.1.37 The benthic survey results for the Green Volt offshore windfarm observed 'sea pen and burrowing megafauna communities' habitats in a number of locations within the Blackbird area of the wind farm site (UKCS Block 20/02) (Green Volt, 2022). NorthConnect surveys also recorded 'sea pen and burrowing megafauna communities' habitats along the last 95km of the survey corridor up to the edge of the UK EEZ (NorthConnect, 2018) which overlaps the Project's study area.

Invasive non-native species (INNS)

10.6.1.38 No INNS were detected in the intertidal surveys, though two INNS were found in the offshore surveys of the offshore export cable corridor:

- *Goniadella gracilis* (which was detected at 19 locations along the offshore export cable corridor) is a small (approximately 3cm) polychaete worm that was first described from the northeastern United States and has since been found in European waters including the North Sea.
- *Monocorophium sextonae* (which was detected at one location along the offshore export cable corridor) is a small burrowing amphipod crustacean, native to New Zealand. It was introduced near Plymouth in the 1930s and had spread to Ireland by the late 1970s. It can now be found along the European coast from southern Norway to the Mediterranean and is considered naturalised.

Designated sites

10.6.1.39 A desk-based review has been undertaken to identify designated sites with relevance to benthic, epibenthic and intertidal ecology located within the study area.

10.6.1.40 The nature conservation designations that have been screened in for consideration in the benthic, epibenthic and intertidal ecology assessment comprise the national site network (for instance, SACs, Special Protection Areas, Site of Community Importance and Ramsar sites) and national designations (for instance, Marine Protected Areas (MPAs), Site of Special Scientific Interest and National Nature Reserves), which are listed in **Table 10.9** and presented in **Volume 2, Figure 10.8: Designated sites** surrounding the Project, with relevance to benthic, epibenthic and intertidal ecology. It should be noted that only sites with benthic qualifying features are detailed.

Table 10.9 Marine nature conservation designations with relevance to benthic, epibenthic and intertidal ecology

Site	Location relative to study area	Features or description
Southern Trench MPA	Within the study area and crossing the western reach of the offshore export cable corridor.	The Southern Trench MPA is located off the coast of the Aberdeenshire coast and is designated to protect marine mammals (minke whales), burrowed mud, fronts and shelf deeps. The offshore export cable corridor intersects the MPA (see **Volume 2, Figure 10.8** surrounding the Project, with relevance to benthic, epibenthic and intertidal ecology). The burrowed mud habitat (EUNIS code: A5.361) PMF present in the Southern Trench MPA is characterised by the presence of Norway lobster, crabs, seapens and

Site	Location relative to study area	Features or description
		anemones. The burrowed mud habitat is in favourable condition but is listed by OSPAR as a threatened and declining habitat. Burrowed mud habitats are highly sensitive to physical disturbance; disturbances to water flow, wave, exposure; and siltation. The conservation objectives of the site for burrowed mud include: "*Conserve the diversity, abundance and distribution of typical species associated within the burrowed mud (including Nephrops norvegicus, Pennatula phosphorea, Virgularia mirabilis, Goneplax rhomboides, Munida spp., Calacaris macandreae, and Callianassa subterranean)"* (NatureScot, 2020b).

Shellfish

10.6.1.41 The Project OAA is located within ICES rectangle 45E9, and the offshore export cable corridor is located across six ICES rectangles: 45E8, 45E9, 44E7, 44E8, 44E9 and 43E8. Further information is provided in **Chapter 14: Commercial Fisheries**.

10.6.1.42 The study area is not located within any Classified Shellfish Harvesting Areas (NMPi, 2024).

10.6.1.43 *Nephrops* spawning and nursery grounds are located within the study area (Coull *et al.*, 1998). The spawning period for *Nephrops* is January to December with peak spawning taking place from April to June (Coull *et al.*, 1998).

10.6.1.44 The top fifteen species landed from the study area include *Nephrops spp*, scallop, *Cancer pagurus* brown crab, lobster, squid, octopi and velvet crab *(Necora puber*). Other species potentially present within the area include the king scallop (*Pecten maximus*).

Blue carbon

10.6.1.45 Blue carbon refers to coastal and marine ecosystem's ability to absorb and store carbon dioxide from the atmosphere. Plants, calcifying organisms and sediments all play a role in capturing and storing carbon, both in the short-term (for example, plants) and long-term (for example, reefs and deep-sea sediments). A major threat to long-term carbon storage is any activity that disrupts the surface layers of sediment such as the installation of subsea cables and infrastructure.

10.6.1.46 There are various blue carbon habitats and these fall into two categories; seabed sediments and coastal vegetated habitats.

10.6.1.47 This Section provides a qualitative overview of the blue carbon potentially stored within coastal vegetated habitats located within the study area (Burrows *et al.*, 2014). Estimates regarding the amount of blue carbon stored within sediments is detailed within **Chapter 7: Marine Water and Sediment Quality**. Coastal vegetated habitats include:

- saltmarsh;
- kelp forests;
- intertidal seaweeds;
- seagrass; and
- maerl.

10.6.1.48 Of these habitats, intertidal seaweeds are located within the offshore export cable corridor Red Line Boundary where horizontal directional drilling (HDD) (or similar trenchless technique) will be utilised. In relation to trenchless cable burial techniques, HDD has been assessed in the EIA. Whilst other trenchless methods are available, HDD is presented herein as it is likely to have the largest construction footprint. Kelp beds have not been identified within the offshore export cable corridor and OAA Red Line Boundary but may be present within the wider study area. These have been identified within the wider study area under the biotope 'A3.211 *Laminaria digitata* on moderately exposed Atlantic sublittoral fringe rock (MB1217)' (See **Volume 2, Figure 10.3**).

10.6.2 Future baseline

10.6.2.1 Determining the future baseline draws upon information about the likely future use and management of the Project sites in the absence of development. Key considerations include:

- existing species population trends;
- effects of climate change on distribution and ecological interactions;
- management of marine habitats and protected areas; and
- any other proposed developments (consented or otherwise) that may act cumulatively with the Project to affect benthic, epibenthic and intertidal ecology features.

10.6.2.2 Climate change is affecting both the abundance and distribution of marine organisms (Couce *et al*., 2025) and can impact the suitable hydrographic conditions for both mobile and sedentary species, the timing or location of spawning events and hence migration patterns. Climate change can also have indirect consequences through changes in food webs for example, prey availability for birds and mammals, or through competition and disease and can affect the future resilience of an ecosystem or population.

10.6.2.3 Distributions of benthic species in the North Sea have changed, with many showing a north-westerly shift on average between 1986 and 2000. Most studies show that overall, in the northern hemisphere, warming tends to be associated with a distributional shift northward. However, these changes are modulated at the local scale by the biological requirements of each species, such as substrate or sediment needs, depth preferences, food availability or human pressures such as fishing and dredging. (Couce *et al*., 2025).

10.7 Basis for EIA Report

10.7.1 Maximum design scenario

10.7.1.1 The process of assessing using a parameter-based design envelope approach means that the assessment considers a maximum design scenario whilst allowing the flexibility to make improvements in the future in ways that cannot be predicted at the time of submission of the planning application, marine licences applications and s.36 consent.

10.7.1.2 The assessment of the maximum adverse scenario for each receptor establishes the maximum potential adverse effect and as a result effects of greater adverse significance would not arise should any other scenario (as described in **Chapter 4: Project Description**) to that assessed within this Chapter be taken forward in the final scheme design.

10.7.1.3 The maximum design scenario parameters that have been identified to be relevant to infrastructure and other marine users are outlined in **Table 10.10** and are in line with the project design envelope (**Chapter 4: Project Description**).

Table 10.10 Maximum design scenario for impacts on benthic, epibenthic and intertidal ecology

Impact / activity	Maximum design scenario parameter	Justification
Construction		
Impact C1: Temporary habitat disturbance of seabed habitat	**Wind turbine generators (WTGs): 6.75km^2** • up to 225 WTGs; • mooring concepts: catenary; • maximum seabed displacement: Anchor type: drag embedment[2] fully buried (breadth 12.5m). 300m drag length. Seabed impact of 3,750m^2 per anchor; and • total anchor disturbance (assuming 225 WTGs, each with 8 anchors) is 6.75km^2. **Array cables: 20.4km^2** • 225 array cables; • 680km total array cable length; • assumed jet trenching installation method as worst-case for sediment mobilisation with 30m disturbance width; • temporary construction disturbance assumed 100% of total array cable length is buried by jet trenching; 680km x 0.03km = 20.4km^2 **Subsea distribution centres (SDC): 125,280m^2** • up to 45 SDCs; • assumed worst-case is gravity base foundations; • SDC construction footprint: 58m x 48m, footprint is 2,784m^2 per SDC; and • total disturbance is 125,280m^2 for 45 SDCs. **Offshore substations: 57,200m^2** • 4 offshore substations with jacket foundations secured with suction caisson; • offshore substation construction footprint: 130m x 110m = 14,300m^2 per offshore substations; and • total disturbance is 57,200m^2 for four offshore substations;	This is the maximum area of temporary disturbance required for the installation of WTG anchors; offshore substations and RCPs jacket foundations; SDCs; and offshore cables (array and export). Catenary mooring and drag-embedment anchors are considered the worst-case design options in terms of habitat disturbance, due to maximising the area of seabed swept by chains / cables, in addition to the direct footprint of the anchor. Offshore substations are considered the worst-case design scenario over subsea substations due to having the largest construction footprint. For offshore substation and RCP, jacket foundations secured by suction caissons have been considered as the worst-case design scenario due to having the largest footprint of all the foundation types. Jet trenching is considered the worst-case cable installation method as it has to penetrate to achieve the same burial depth

[2] Should the drag embedment end point be out of tolerance then it would be required to lift the anchor and re-lay increasing the seabed displacement by the same amount. At the design stage, it is not possible to accurately determine the level of installation failure or damage when laying the anchors. There will remain a residual risk that some anchors may need to be re-laid as they are out of tolerance or moved during service. This will depend on seabed conditions and other factors associated with offshore operations of the install vessels.

Impact / activity	Maximum design scenario parameter	Justification
	Offshore export cables: 21km² • 5 offshore export cable trenches; • 140km offshore grid transmission route length per trench; • assumed jet trenching installation method as worst-case for sediment mobilisation with 30m disturbance width, • temporary construction disturbance assumed 100% of total export cable length is buried by jet trenching of 140km x 0.03km = 4.2km² per cable; and • total disturbance is 21km² for five cables. **Cable crossings: 714,000m²** • 6 cable crossings per trench within the OAA with construction footprint of 170m x 30m = 5,100m², total of 153,000m² for 6 cable crossings for 5 cable trenches; and • 22 cable crossings along the offshore export cable corridor with construction footprint of 170m x 30m =5,100m², total of 561,000m² for 22 cable crossings for 5 cable trenches. **Reactive compensation platforms (RCPs): 14,450m²** • 2 RCPs with jacket foundations secured with suction caisson; construction footprint: 85m x 85m = 7,225m² (per RCP); and • total disturbance is 14,450m² for 2 RCP's. **Landfall(s): 80m²** • Scotstown, Lunderton North and Lunderton South; • 8 HDD ducts; HDD exit pit dimensions: assumed 5m x 2m as worst-case, 10m² per exit pit; and • total disturbance is 80m² for 8 exit pits. **Total temporary habitat disturbance = 49,110,010m² (49.11km²).**	and disturbs a greater amount of sediment, therefore affecting a greater area of habitat. It also tends to resuspend a greater portion of sediment, increasing total suspended sediment and the area prone to redeposition.
Impact C2: Temporary increase in suspended	**Seabed preparation for wind turbine anchors** • 225 WTGs each with 8 anchors, total of 1,800 anchors; • Anchor type: driven pile anchor; and	The maximum design scenario corresponds to (a combination of) the greatest amount of material disturbed and

Impact / activity	Maximum design scenario parameter	Justification
sediment and deposition	• bedform clearance (for example sandwaves). **Seabed preparation for array cables** • Bedform clearance (or example sandwaves). **Installation activities for array cables** • Jet trenching up to 530km of array cables with trench dimensions of 30m wide, 2m deep. **SDCs** • 45 SDCs; and • bedform clearance (or example sandwaves). **Seabed preparation for subsea substation** • 4 subsea substations; and • bedform clearance (or example sandwaves). **Seabed preparation for offshore substations** • 4 offshore substations; and • bedform clearance (or example sandwaves). **Piling for substation foundation installation** • 56 drilled piles (12 driven piles per offshore substation and 4 driven piles per reactive compensation platform (RCP)) with 94.5m drill penetration depth and 3m drill diameter, creating 667.7m^3 of drill arisings per pile. **Seabed preparation for offshore export cables** • bedform clearance (or example sandwaves); and • 35,000m^3 of sandwave clearance from the offshore export cable. **Installation activities for export cables** • Jet trenching up to 5 offshore export cable trenches, with trench dimensions of 30m wide, 2m deep, along 140km offshore export cable corridor length.	the greatest geographical extent of the impact. **Seabed preparation** Seabed preparation, specifically sandwave clearance / levelling, may be undertaken using a range of techniques – mass flow excavator and suction hopper dredging are considered the worst case. Dredge spoil release is assumed to be an instantaneous release at the water surface, with 10% of the hopper volume (typically 11,000m^3) assumed to form the passive phase of the sediment plume. Other seabed preparation such as boulder clearance does not represent the maximum design scenario in terms of potential increases in SSC and associated changes to seabed substrate. **Installation activities for cables** Pre-lay trenching may be undertaken using a range of techniques – jetting, ploughing and trenching. Jetting will give maximum design scenario for sediment disturbance. 100% fluidisation of material expelled from trench is conservatively assumed. In reality, pre-lay jetting will move a proportion of material rather than bringing it fully into suspension. **Piling** Based on the greatest amount of material disturbed in a drilling event, considering the largest driven pile dimension and largest driven pile penetration depth.

Impact / activity	Maximum design scenario parameter	Justification
	Landfall installation activities • 8 horizontal directional drill (HDD) cable bore exit pits and ducts with sub-tidal location for punch-out; and • 1,000 HDD duct length.	**Landfall installation activities** Other stages of drilling (pilot hole drilling and stages of reaming) may result in smaller release events separated in time. But the maximum design scenario is considered as a release of drilling mud (Bentonite) from a single conduit. The parameters are supported by modelling within **Volume 3, Appendix 6.1: Physical Processes Modelling**, which simulates sediment dispersion, deposition and SSC levels. Figure 3 within **Volume 3, Appendix 6.1** further illustrates the spatial footprint of the construction activities.
Impact C3: Direct and indirect seabed disturbances leading to the release of sediment contaminants	Refer to Impact C2.	This scenario has the largest spatial extent of seabed interaction. It represents the maximum total seabed disturbance and therefore the maximum amount of contaminated sediment that may be released into the water column during construction activities.
Impact C4: Increased risk of introduction or spread of marine INNS	Construction window of up to 12 years. It is anticipated that approximately 10 vessels would be on site at any one time during the construction of the Project. It is estimated that approximately 3,838 individual vessel transits would be required during the construction of the Project. **Total volume of introduced hard substrates: 2,399,000m^3** • 225 WTGs; • 1,122,000m^3 of rock for array cable protection;	Vessel movements associated with the construction of the Project can lead to an increased risk of introduction or spread of marine INNS. These parameters are considered the worst-case in terms of vessel movements. This scenario represents the maximum area of hard substrate that could be introduced on the seabed. Hard substrates

Impact / activity	Maximum design scenario parameter	Justification
	• 500m^3 scour protection per offshore substation platform, total 2,000m^3 for four offshore substations; • 500m^3 scour protection per RCP, total 1,000m^3 for two RCPs; • 140km offshore export cable with 1,155,000m^3 of cable protection; and • 28 cable crossings per cable trench (140 cable crossings total) total 850m^3 x 140 = 119,000m^3 of cable protection. • Total introduced hard substrate = 2,399,000m^3.	offer ideal settlement surfaces for species that are typically absent from soft sediment environment. The introduction of hard substrate can act as a stepping stone for the spread of INNS, particularly those that are opportunistic and thrive on artificial substrate. The maximum design scenario is used to ensure a precautionary approach in assessing risk of introduction or spread of INNS, capturing the worst-case extent of habitat alteration and associated biosecurity concerns.
Impact C5: Mortality, injury and behavioural changes, resulting from underwater noise, vibration and particle motion	Construction window of up to 12 years. **WTG anchor installation with driven piles:** • 8 driven pile anchors per floating unit, total 1,800 driven piles; • maximum pile length: 30m; • maximum pile diameter: 3m; • maximum hammer energy: 3,500kJ; • maximum number of driven piles per day per location is 2; • maximum number of concurrent piling locations is 2; • maximum hours of piling per driven pile is 2.35; and • maximum number of piling days is 1,800 (assuming one driven pile installed per day). **Offshore substation foundation installation with driven piles:** • 4 offshore substations with jacket foundations secured by driven piles; • 48 driven piles (12 per offshore substation); • maximum pile diameter: 3m; • maximum pile length: 95m; • maximum hammer energy: 3,500kJ; • maximum number of driven piles per day per location is 2; • maximum number of concurrent piling locations is 2; • maximum hours of piling per driven pile is 2.35; and	Impulsive noise created during piling for the installation of the WTG anchors; offshore substation and RCP jacket foundations; and UXO clearance have the potential to result in mortality, injury and behavioural changes to shellfish and invertebrate species. These two construction activities are considered the worst-case for potential underwater noise effects. The scenario with the maximum number of piling days represents the temporal worst-case. Other seabed clearance and installation activities such as cable laying, dredging and vessel movements may create pathways for underwater noise to effect sensitive receptors. However, these activities are established as producing low levels of noise, in the case of vessel movement no greater than the existing baseline of regional vessel noise, affecting

Impact / activity	Maximum design scenario parameter	Justification
	• maximum number of piling days is 48 (assuming one pile installed per day. **RCP foundation installation with driven piles:** • 2 RCPs with jacket foundation secured by driven piles; • 8 driven piles (4 per RCP); • maximum pile diameter: 3m; • maximum pile length: 95m; • maximum hammer energy: 3,500kJ; • maximum number of driven piles per day per location is 2; • maximum number of concurrent piling locations is 2; • maximum hours pilling per driven pile is 2.35; and • maximum number of piling days is 8 (assuming one pile installed per day). Maximum number of piling days: 1,800 (WTG anchors) + 48 (offshore substations) + 8 (RCPs) = 1,856 days. The type, size and number of possible UXO that might require clearance is currently unknown. The primary method of clearance will be low-order, with high-order being assessed as the worst-case scenario.	a relatively small area in the immediate vicinity of activities. These general activities are therefore considered to not fall within the worst-case scenario. UXO clearance will be licensed under a separate marine licence but is included in the EIA Report for illustrative purposes
O&M		
Impact O1: Temporary habitat disturbance of seabed habitat	Each phase will be operational for 35 years. **Maintenance of:** • replacement of mooring line components; • replacement of mooring or anchors using the same process as construction; • replacement or repair of array cables including routine inspection and cable repair (recovery and reburial); • SDC and subsea substations includes routine inspections, and scour protection repair / replacement; • offshore substations and RCPs including routine inspections, removal of marine growth and replacement of scour protection; and	These are the activities likely to result in temporary disturbance of seabed habitats during O&M. The frequency of these activities is currently unknown. Therefore, the temporary disturbance of seabed habitat cannot be quantified in relation to each of the maintenance activities stated. Any temporary habitat disturbance during O&M is expected to be of the same or lower

Impact / activity	Maximum design scenario parameter	Justification
	• offshore export cables including routine inspection and cable repair (recovery and reburial).	magnitude than that assessed for the construction stage.
Impact O2: Temporary increase in suspended sediment and deposition.	Refer to Impact O1.	Refer to Impact O1.
Impact O3: Direct and indirect seabed disturbance leading to the release of sediment contaminants	Refer to Impact O1.	Refer to Impact O1.
Impact O4: Long-term habitat loss	Each phase will be operational for 35 years. **WTGs: 270,000m^2** • 8 anchors per floating unit, total number of anchors 8 x 225 =1,800; • worst-case assumed: drag embedment anchor; and • maximum total area of seabed covered by 1 anchor: 12m x 12.5m = 150m^2, total 270,000m^2 for 1,800 anchors. **Array cables: 2.04km^2** • 225 array cables; • secondary protection rock placement, localised: concrete mattresses and bags; • 680km total array cable length; • 136km length of unburied cable; • conservative cable corridor swathe width of 15m assumed for areas of cable protection, and; • maximum total area of seabed covered by cable protection based on conservative 136km x 0.015km = 2.04km^2. **SDCs: 47,880m^2** • 45 SDCs;	The maximum design scenario is defined by the maximum area of seabed lost by the footprint of the anchors on the seabed, offshore substation and RCP jacket foundations, SDCs, scour and cable protection for offshore cables (array and export), and cable crossings. Offshore substations are considered the worst-case design scenario over subsea substations due to having the largest seabed footprint. Worst-case design scenario footprints for cable protection have been determined based on: • 20% of total cable length requiring cable protection for the array cables; and

Impact / activity	Maximum design scenario parameter	Justification
	• assumed worst-case is gravity base foundations; and • dimensions of SDC including cable protection: 38m x 28m, footprint is 1,064m^2 and total 47,880m^2 for 45 SDCs. **Offshore substations: 39,600m^2** • 4 offshore substations with jacket foundations secured by suction caisson; • maximum seabed footprint (including scour protection): 110m x 90m, footprint is 9,900m^2 and total 39,600m^2 for 4 offshore substations. **Offshore export cables: 10.5km^2** • 5 offshore export cable trenches; • 140km offshore grid transmission rout length per trench; • conservative cable corridor swathe width of 15m assumed for areas of cable protection, and; • maximum seabed footprint (including cable protection): 140km x 0.015km = 2.1km^2 per cable trench and total 10.5km^2 for 5 cable trenches; **Cable crossings: 231,000m^2** • 6 cable crossings per trench within the OAA with construction footprint of 150m x 11m = 1,650m^2, total of 49,500m^2 for 6 cable crossings for 5 cable trenches; and • 22 cable crossings along the offshore export cable corridor with construction footprint of 150m x 11m = 1,650m^2, total of 181,500m^2 for 22 cable crossings for 5 cable trenches. **RCPs: 8,450m^2** • 2 RCPs with jacket foundations secured by suction caisson; • maximum seabed footprint (including scour protection): 65m x 65m = 4,225m^2 and total 8,450m^2. **Maximum long-term habitat loss = 13,136,930m^2 (13.137km^2).**	• 20% of total cable trench length requiring cable protection for the offshore export cables.
Impact O5: Colonisation of hard substrates	**Total volume of introduced hard substrates:** • 225 WTGs; • 1,122,000m^3 of rock for array cable protection;	This scenario would result in the largest amount of permanent hard structure and associated scour protection, which would

Impact / activity	Maximum design scenario parameter	Justification
	• 500m^3 scour protection per offshore substation platform, total 2,000m^3 volume for four offshore substations; • 500m^3 scour protection per RCP, total 1,000m^3 for 2 RCPs; • 140km offshore export cable with 1,155,000m^3 of rock for cable protection; and • cable crossings with 850m^3 x 140 = 119,000m^3 of cable protection. **Total introduced hard substrate = 2,399,000m^3.**	provide the largest potential area for colonisation.
Impact O6: EMF generated by array and export cables	See Table 9.5 of **Chapter 9: Electromagnetic Fields** for the detailed design parameters for the maximum design scenarios for the array and offshore export cables. EMF analysis has determined that these parameters will generate the worst EMF emissions: • 66kV AC array cables will generate an EMF of 50 micro tesla (μT) to approximately 0.8m from each array cable. • HVDC offshore export cables will generate an EMF of 50μT to approximately 1.1m around a 320kV cable, and approximately 11m around 525kV cable; and • 275 kV HVAC offshore export cables will generate an EMF of 50μT to approximately 1.15m around the cable. The operational lifetime of the Project is 35 year per phase.	The scenario generates the maximum electromagnetic field that might affect marine biota. The design, number and maximum spatial extent of the array and export cables represent the worst-case scenario for EMF impacts on benthic and epibenthic receptors. The maximum operating current of the array and offshore export cables will result in the greatest potential for EMF effects. The minimum target cable burial depth of 1 m represents the worst-case scenario. EMF will be reduced with greater burial depth as the field attenuates as distance increases.
Impact O7: Noise and vibration on shellfish	Peak of up to 7 O&M vessels offshore with up to 364 round trips to port per year. The operational lifetime of the Project is 35 year per phase.	The maximum design scenario is defined by the maximum number of vessel movements. The design, number and power capacity of the WTGs, and the design, dimension and maximum spatial extend of keeping systems will lead to the worst-case for noise-related impacts.

Impact / activity	Maximum design scenario parameter	Justification
Decommissioning		
Impact D1: Temporary habitat disturbance of seabed habitat	The worst-case design scenario will be equal to (or less than) that of the construction stage. Refer to Impact C1.	The maximum design scenario assumes full removal of all offshore infrastructure during decommissioning, including cables and associated protection where technically feasible and environmentally appropriate. This approach reflects a precautionary assessment of potential impacts. In cases where infrastructure is left *in situ*, the extent of temporary habitat disturbance would be correspondingly reduced from the construction stage, as fewer seabed intervention would be required.
Impact D2: Temporary increase in suspended sediment deposition	The worst-case design scenario will be equal to (or less than) that of the construction stage. Refer to Impact C2.	The maximum design scenario assumes complete removal of all offshore infrastructure, including cables and cable protection, where it is possible and appropriate to do so. If any infrastructure is left *in situ*, this will result in reduced levels of suspended sediment and associated deposition during decommissioning.
Impact D3: Direct and indirect seabed disturbances leading to the release of	The worst-case design scenario will equal to (or less than) that of the construction stage. Refer to Impact C3.	The maximum design scenario assumes complete removal of all offshore infrastructure, including cables and cable protection, where it is possible and appropriate to do so.

Impact / activity	Maximum design scenario parameter	Justification
sediment contaminants		If any infrastructure is left *in situ*, this will result in reduced levels of sediment disturbance during decommissioning.
Impact D4: Underwater noise and vibration on shellfish	The worst-case design scenario will equal to (or less than) that of the construction stage. Refer to Impact C5.	The maximum design scenario assumes complete removal of all offshore infrastructure, including cables and cable protection, where it is possible and appropriate to do.
Impact D5: Increase risk of introduction or spread of marine INNS	The worst-case design scenario will equal to (or less than) that of the construction stage. Refer to Impact C4.	The maximum design scenario assumes complete removal of all offshore infrastructure, including cables and cable protection, where it is possible and appropriate to do. If any offshore infrastructure has become colonised by marine INNS over time, their removal can dislodge and disperse these species into surrounding waters.

10.7.2 Embedded environmental measures

10.7.2.1 As part of the Project design process, a number of embedded environmental measures have been adopted to reduce the potential for adverse impacts on benthic, epibenthic and intertidal ecology. These embedded environmental measures have evolved over the development process as the EIA has progressed and in response to consultation.

10.7.2.2 These measures also include those that have been identified as good or standard practice and include actions that would be undertaken to meet existing legislation requirements. As there is a commitment to implementing these embedded environmental measures, and also to various standard sectoral practices and procedures, they are considered inherently part of the design of the Project and are set out in this EIA Report.

10.7.2.3 **Table 10.11** sets out the relevant embedded environmental measures within the design and how these affect the benthic, epibenthic and intertidal ecology assessment.

10.7.2.4 Further detail on the embedded environmental measures in **Table 10.11** is provided in the **Volume 3, Appendix 5.2: Commitments Register**, which sets out how and where particular embedded environmental measures will be implemented and secured.

Table 10.11 Relevant benthic, epibenthic and intertidal ecology embedded environmental measures

ID	Environmental measure proposed	Project stage measure introduced	How the environmental measures will be secured	Relevance to benthic, epibenthic and intertidal ecology assessment
M-028	An **Outline Scour Protection Plan** has been submitted with this Application (**Volume 4**), and includes details of the need, type, quantity and installation methods for scour protection. A Final Scour Protection Plan will be completed prior to construction commencing and will include measures during the O&M stage such as periodic inspection and maintenance requirements and will be submitted to MD-LOT for approval.	Scoping Amended at EIA Report.	s.36 conditions and marine licences conditions.	This measure will reduce the risk of habitat disturbance, sediment resuspension and smothering of sensitive communities.
M-033	An **Outline Marine Pollution Contingency Plan** (MPCP) (Appendix to the **Environmental Management Plan** (EMP)) has been submitted with this Application (**Volume 4**). This Outline MPCP outlines details of procedures to protect personnel working and to safeguard the marine environment and mitigation measures in the event of an accidental pollution event arising from offshore operations relating to the Project. The Final MPCP will be completed prior to construction commencing and submitted to MD-LOT for approval and will include relevant key emergency contact details.	Scoping Amended at EIA Report.	s.36 conditions and marine licences conditions	This measure will reduce the risk and duration of exposure to pollutants, thereby minimising ecological harm.
M-049	An **Outline Project Environmental Monitoring Plan (PEMP)** has been submitted with **Volume 4**. The Final PEMP will be completed prior to construction commencing and submitted to MD-LOT for approval. The Final PEMP will set out commitments to environmental monitoring in pre-, during and post-construction stages of the Project.	Scoping Amended at EIA Report.	s.36 conditions and marine licences conditions.	This measure will enable habitat recovery to be tracked and detect any unforeseen effects and inform adaptive management if required.

ID	Environmental measure proposed	Project stage measure introduced	How the environmental measures will be secured	Relevance to benthic, epibenthic and intertidal ecology assessment
M-054	A detailed Cable Burial Risk Assessment (CBRA) will be undertaken to enable informed judgements about burial depth. This should reduce the risk of buried cables reemerging whilst also limiting the amount of sediment disturbance to that which is necessary. The array and export cables will typically be buried at a target burial depth between 1m to 2m below the seabed surface. The final depth of the cable will be dependent on the seabed mobility and CBRA. The CBRA will manage and mitigate risks from loading and sediment transport across the seabed. The CBRA will be included within the Final Cable Plan.	Scoping Amended at EIA Report.	s.36 conditions and marine licences conditions.	This measure will reduce the risk of disturbance to benthic species.
M-055	Avoidance of key sensitive habitats, where known, through pre-construction surveys and micro-siting of proposed offshore Project Infrastructure	Scoping	s.36 conditions and marine licences conditions	This measure will reduce the risk of temporary and permanent habitat loss.
M-056	To reduce environmental impact of the landfall, a trenchless solution (e.g. HDD) is to be implemented to install ducts at landfall. Determination of the most suitable trenchless landfall crossing method will be undertaken during the detailed design stage of the Project, following geotechnical investigations of the onshore and nearshore areas.	Scoping Amended at EIA Report.	Project design; s.36 conditions and marine licences conditions	This measure will reduce the risk of habitat loss, reduce sedimentation and prevent disruption to species and communities present.
M-102	An **Outline Offshore Invasive Non-Native Species (INNS) Management Plan** has been submitted with this Application (**Volume 4**). The Final INNS Management Plan will be completed prior to construction commencing and submitted to MD-LOT for approval. The Final INNS Management Plan will include management measures to limit the risk of INNS being introduced to the marine environment.	Scoping Amended at EIA Report.	s.36 conditions and marine licences conditions	This measure will reduce the risk of introduction and spread of INNS and will reduce the impact of any potential introductions.

ID	Environmental measure proposed	Project stage measure introduced	How the environmental measures will be secured	Relevance to benthic, epibenthic and intertidal ecology assessment
M-105	An **Outline Piling Strategy** has been submitted with this Application (**Volume 4**). The Final Piling Plan will be completed prior to construction commencing and submitted to MD-LOT for approval. It will detail the method of pile installation and associated underwater noise levels. It will describe any mitigation measures to be implemented (e.g. soft start and ramp up measures, or the use of acoustic deterrent devices) prior to and during pile installation to manage the effects of underwater noise.	Scoping Amended at EIA Report	Required under Sections 105 (Energy Act 2004) and marine licences conditions.	This measure will set out procedures for piling and outline mitigation for piling noise, therefore reducing the noise exposure to benthic receptors.
M-106	The development of and adherence to a Decommissioning Programme. The Decommissioning Programme will outline measures for the decommissioning of the Project. The Decommissioning Programme would be submitted prior to construction commencing to MD-LOT and approved by Scottish Ministers prior to construction.	Scoping Amended at EIA Report.	Required under Sections 105 (Energy Act 2004) and marine licences consent conditions.	This measure will reduce the risk to benthic, epibenthic and intertidal ecology receptors during the decommissioning stage.
M-114	The Project will use 'low order' techniques such as deflagration for UXO disposal, where possible and required.	Scoping	HRA and marine licences conditions.	This measure will reduce the risk of impacts for underwater noise to benthic receptors.
M-120	An **Outline Construction Method Statement** (CMS) has been submitted with this Application (**Volume 4**). The Final CMS will be completed prior to construction commencing and submitted to MD-LOT for approval. The Final CMS will include: a) details of the commence dates, duration and phasing of key elements of construction, working areas, the construction procedures and good working practices; b) details of the roles and responsibilities; and c) details of how the construction related mitigation step proposed are to be delivered.	EIA Report	s.36 conditions and marine licences conditions.	This measure will reduce the risk of disturbance to benthic receptors during the construction stage.

ID	Environmental measure proposed	Project stage measure introduced	How the environmental measures will be secured	Relevance to benthic, epibenthic and intertidal ecology assessment
M-121	An **Outline Environmental Management Plan** (EMP) has been submitted with this Application (**Volume 4**) and includes the following Appendix: - Outline Marine Pollution Contingency Plan. The Final EMP will be completed prior to construction commencing and submitted to MD-LOT for approval. The Final EMP will be implemented by the contractor(s). The contractor(s) will ensure that the relevant environmental measures within the EMP and health and safety procedures are implemented. The Final EMP will identify the project management structure roles and responsibilities with regard to managing and reporting on the environmental impact of the construction and O&M stages. Other measures that feed into the EMP include: - A Waste Management Plan (WMP) will be developed as an Appendix of the EMP post-submission to manage all waste generated during the construction and operation stages of the Project. The WMP will be appended to the Environmental Management Plan. The WMP will follow the principles of the waste hierarchy (Department for Environment, Food & Rural Affairs, 2001) which consists of: prevention, re-use, recycle, other recovery and disposal. - The Final EMP will include a Chemical Risk Assessment to identify, evaluate and mitigate potential environmental and health risks associated with the use, storage and disposal of hazardous substances during O&M and decommissioning stages of the Project. The EMP will be the securing mechanism for many measures.	EIA Report	s.36 conditions and marine licences conditions.	This measure will reduce the risk of disturbance to benthic receptors.

ID	Environmental measure proposed	Project stage measure introduced	How the environmental measures will be secured	Relevance to benthic, epibenthic and intertidal ecology assessment
M-122	Development of and adherence to a Offshore Operations and Maintenance Plan, which will confirm the Project's operations and maintenance activities. This will be submitted to MD-LOT for approval post-consent.	EIA Report	s.36 conditions and marine licences conditions.	This measure will reduce the risk of disturbance to benthic receptors during the O&M stage.

10.8 Methodology for EIA Report assessment

10.8.1 Introduction

10.8.1.1 The project-wide approach to assessment is set out in **Chapter 5: Approach to EIA**. Whilst this has informed the approach that has been used in this benthic, epibenthic and intertidal ecology assessment, it is necessary to set out how this methodology has been applied, and adapted as appropriate, to address the specific needs of the benthic, epibenthic and intertidal ecology assessment.

10.8.2 Significance evaluation methodology

Overview

10.8.2.1 The significance level attributed to each effect has been assessed based on the sensitivity of the affected receptor and the magnitude of change resulting from the Project. Sensitivity of a receptor is derived from several factors including resistance, resilience and value.

10.8.2.2 The sensitivity and value of the features and the magnitude of impact specific to benthic, epibenthic and intertidal ecology are provided in the following sections. This assessment is also conducted with reference to Guidelines for Ecological Impact Assessment in the UK and Ireland – Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018).

Sensitivity

10.8.2.3 Four-point scales (high, medium, low or negligible) for the sensitivities of benthic, epibenthic and intertidal species and habitats have been developed. These scales have been developed with reference to the Marine Life Information Network (MarLIN) MarESA (Tyler-Walters, 2018). The scales for resistance and resilience are provided in **Table 10.12** and **Table 10.13** Marine Scotland's FeAST has also been used in assessment of sensitivity of MPA protected features (Marine Scotland, 2022). FeAST has developed a sensitivity matrix of marine habitats and species to pressures taking place in the marine environment[3].

10.8.2.4 The sensitivity of a feature is dependent upon its adaptability (the degree to which a feature can avoid or adapt to an effect), tolerance (the ability of a feature to absorb stress or disturbance without changing character) and recoverability (the temporal scale and extent to which a feature will recover following an effect). In locations where several sensitivity levels are given for features against a potential impact, professional judgement has been used and justified for the assessment.

[3] It is noted that the tool has recently been revised and is currently in Beta mode whilst the final stages of user testing / bug-fixing are carried out. Consequently, much of the information is not accessible at the time of writing. In such cases, results from earlier interrogations (prior to the revision) have been used where available.

Table 10.12 Assessment scale for resistance (tolerance) to a defined intensity of pressure.

Resistance	Definition
High	No significant effects on the physiochemical character of habitat and no effect on population viability of key / characterising species but may affect feeding, respiration and reproduction rates.
Medium	Some mortality of species (can be significant where these are not keystone structural / functional and characterising species) without change to habitats relates to loss <25% of the species or habitat component.
Low	Significant mortality of key and characterising species with some effects on the physiochemical character of habitat. A significant decline / reduction relates to the loss of 25% to 75% of the extent, density or abundance of the selected species or habitat component, for example, loss of 25% to 75% of the substratum.
None	Key functional, structural, characterising species severely decline and / or physiochemical parameters are also affected for example, removal of habitats, causing a change in habitat types. A severe decline / reduction relates to the loss of 75% of the extent, density or abundance of the selected species or habitat component for example, loss of 75% substratum (where this can be sensibly applied).

Table 10.13 Assessment scale for resilience (recovery)

Resilience	Definition
High	Full recovery within two years.
Medium	Full recovery within 2 to 10 years.
Low	Full recovery within 10 to 25 years.
None	Negligible or prolonged recovery possible, at least 25 years to recover structure and function.

Value of receptor

10.8.2.5 In addition, for some assessments the ‘value’ of a feature may also require consideration in the assessment where relevant – for instance if a feature is designated or has an economic value or provides key ecological functions or services. The definitions of value levels have been developed using a four-point scale and example definitions of the value levels are provided in **Table 10.14**.

Table 10.14 Definitions of value levels for benthic, epibenthic and intertidal ecology

Value	Definition
High	Internationally / nationally important / rare with limited potential for offsetting / compensation. Habitats and species protected under international law (for example, qualifying features of a Ramsar listed site) and habitats and species that are qualifying features of sites comprising the national sites network sites located within the study area. Keystone species or habitats that provide critical ecological functions / services such as key nursery or spawning area. Species and / or habitats within the study area support substantial commercial activities or community (for example, key shellfish harvesting area).
Medium	Regionally important / rare with limited potential for offsetting / compensation. Habitats of species protected under national law but not within a national site network site. UK Biodiversity Action Plan (BAP) priority habitats and species. Species / habitats that may be rare or threatened in the UK. Some local economic use of species and / or habitats within the study area but not central to the community or regional economy. Performs a moderate ecological function including providing shelter, feeding grounds or transitional habitat, supporting species of ecological or commercial importance and contributing to habitat diversity or local food web interactions.
Low	Locally important / rare; regional UK BAP priority habitats. Habitats or species that provide prey items for other species of conservation value. Limited or no current economic or social use of species and / or habitats within the study area. Performs a limited ecological function typically offering minimal trophic support or ecosystem services.
Very low	Habitats and species that are not protected under conservation legislation and are not considered to be particularly important (in terms of ecological function / services) or rare. No identifiable socio-economic benefit or interaction from species / habitats within the study area. Performs no discernible ecological function due to absence of benthic or epibenthic communities, substrate unsuitable for colonisation or biological productivity.

Magnitude of changes

10.8.2.6 The magnitude of impact relates to the level of change compared to the baseline conditions, using the duration, timing, scale, size and frequency to determine the magnitude of the impacts to each receptor. Magnitude is evaluated in accordance with the definitions set out in CIEEM's Guidelines for Ecological Impact Assessment, summarised in **Table 10.15**.

10.8.2.7 The following characteristics inform the definition of the magnitude of potential impacts on benthic, epibenthic and intertidal ecology:

- Extent or spatial scope of the impact.
- Reversibility of impact – whether the impact is naturally reversible or reversible through mitigation measures.
- Timing and frequency of the impact, in relation to ecological changes.
- Likely duration of the impact – short term (< 5 year), medium term (5 to 10 years) or long term (10 or more years).

Table 10.15 Benthic, epibenthic and intertidal ecology definitions of impact magnitude

Magnitude of Impact	Definition
Negligible	Changes to baseline conditions within the range of natural variability.
Low	Partial loss and / or recoverable alteration to the extent, composition or character of a habitat / community, or population of a species, with recovery expected within less than 5 years. Recovery largely through natural processes.
Medium	Partial loss and / or recoverable alteration in extent, composition or character of a habitat / community, or population of a species, with recovery expected within 5 to 10 years. Recovery typically through natural processes.
High	Changes to natural conditions that, either singly or through recurrence, alter the extent, composition or character of a habitat / community, or population of a species beyond the ability of the receptor to recover within a period of 10 years. Recovery likely requires some targeted mitigation.

Evaluation of significance

10.8.2.8 Following the identification of receptor overall sensitivity, and the magnitude of the impact, it is possible to determine the significance of the effect. The matrix provided in **Table 10.16** and the definitions of sensitivity and value described above in are used as a framework to aid in determination of the impact assessment.

10.8.2.9 Where possible, assessment of the magnitude of the impact on benthic, epibenthic and intertidal ecology is based upon quantitative criteria, together with the use of value judgement and expert interpretation to establish the extent to which an impact is significant. Further information is provided in **Chapter 5: Approach to the EIA**.

10.8.2.10 During the assessment of effects for each identified receptor, the value will be combined with the magnitude of change from **Table 10.15** to produce an overall significance rating based on the evaluation matrix shown in **Table 10.16**. As a general rule, **Major** and **Moderate** effects are considered to be **Significant** and **Minor** and **Negligible** effects are considered to be **Not Significant**. However, professional judgement is applied, where appropriate, to determine significance of effect. Where effects are assessed, according to the matrix in **Table 10.16** to be **Potentially Significant** in EIA terms, professional judgement is applied to determine whether they are **Significant** or **Not Significant**.

Table 10.16 Significant of effect matrix

		Magnitude of change			
		High	**Medium**	**Low**	**Negligible**
Value / Sensitivity	**High**	**Major (Significant).**	**Major (Significant).**	**Moderate (Potentially Significant).**	**Minor (Not Significant).**
	Medium	**Major (Significant).**	**Moderate (Potentially Significant).**	**Minor (Not Significant).**	**Minor (Not Significant).**
	Low	**Moderate (Potentially Significant).**	**Minor (Not Significant).**	**Minor (Not Significant).**	**Negligible (Not Significant).**
	Very low	**Minor (Not Significant).**	**Minor (Not Significant).**	**Negligible (Not Significant).**	**Negligible (Not Significant).**

10.9 Assessment of effects: construction stage

10.9.1 Introduction

10.9.1.1 This Section provides an assessment of the effects for benthic, epibenthic and intertidal ecology from the construction of the offshore elements of the Project.

10.9.1.2 The assessment methodology set out in **Section 10.8** has been applied to assess effects to benthic, epibenthic and intertidal ecology from the Project.

10.9.2 Impact C1: temporary disturbance of seabed habitat

Overview

10.9.2.1 Habitat disturbance will include structural changes to habitats due to the following activities:

- seabed preparation and ground clearance activities;
- installation of drag embedment anchors;
- installation of the array cables;
- installation of the export cable corridor;
- deployment of stabilising legs of jack up barges;
- installation of jacket foundations secured with suction caisson for offshore substations and RCPs; and
- installation of gravity-based foundations for subsea distribution centres.

10.9.2.2 The area of disturbance is likely to be larger during construction activities as opposed to operation due to the nature of the installation methods. Temporary habitat disturbance is more likely to affect sessile species and habitats that have limited mobility as opposed to more mobile species that are able to avoid potentially impacted areas. The maximum design scenario parameters relating to temporary habitat disturbance during the construction stage is presented in **Table 10.10**. Where residual effects are predicted, an assessment of the magnitude of change (impact) resulting in each effect has been completed based on the methodology provided in **Section 10.8.** The magnitude of impact and hence the significance of the potential effects has been assessed on the assumption that the embedded environmental measures outlined in **Table 10.11** have been implemented as part of the Project. The relevant MarESA pressures and their benchmarks that have been used to inform this impact assessment are:

- habitat structure changes – removal of substratum (extraction);
- abrasion / disturbance at the surface of the substratum or seabed: the benchmark for which is damage to surface features (for example, species and physical structures within the habitat); and
- penetration and / or disturbance of the substratum subsurface: the benchmark for which is damage to sub-surface features (for example, species and physical structures within the habitat).

10.9.2.3 The relevant FeAST pressures that have been used to inform this assessment are:

- sub-surface abrasion / penetration.

10.9.2.4 The value, resistance, resilience and sensitivities for each receptor in relation to the above pressures are detailed within Table 1.1 of **Volume 3, Appendix 10.5**. It should be noted that construction activities will not lead to disturbance of seabed habitat located outside of the offshore Red Line Boundary and therefore only habitats and species located within the OAA and offshore export cable corridor have been considered for this impact. Intertidal habitats are not considered to be at risk of this impact due to the use of HDD for construction at the landfall(s). Blue carbon receptors present within the wider study area and outside of the offshore Red Line Boundary are therefore not affected by this impact. As a result, these receptor groups have not been considered within this Section.

Subtidal habitats and species

10.9.2.5 The value of subtidal habitats and species is considered to be **medium**.. The MarESA and FeAST sensitivity scores of subtidal habitats and species range from low to medium sensitivity. The overall sensitivity for subtidal habitats and species is therefore considered to be **medium**.

Shellfish

10.9.2.6 The value of shellfish species is considered to range from medium to high. The MarESA sensitivity scores for shellfish range from low to medium sensitivity[4]. The overall sensitivity for shellfish is therefore considered to be **medium**.

Habitats of conservation importance

10.9.2.7 Offshore subtidal sands and gravels are considered by the Scottish Government FeAST tool under the illustrative biotopes: A5.14 Circalittoral coarse sediment; A5.25 Circalittoral fine sand; and A5.26 Circalittoral muddy sand (continental shelf sands and continental shelf coarse sediments) to have a sensitivity ranging from negligible to high to disturbance in the form of seabed abrasion (cable laying, site clearance), which is dependent upon the species present (FeAST, 2023). The higher sensitivities are based upon the presence of more fragile sessile species that are not able to tolerate abrasion damage and have a low recoverability, whereas the lower sensitivity is based upon tolerant species with a quick

[4] A precautionary approach has been applied in determining overall sensitivity. While MarESA scores indicate low or no sensitivity, the high ecological and commercial value of shellfish concludes their overall sensitivity to medium. This reflects the principle that overall sensitivity accounts not only for biological response but also for receptor value and other relevant factors.

recovery time. Based upon the species present within the Offshore Red Line Boundary, the sensitivity to this impact is considered to be **medium** for Offshore subtidal sands and gravels.

10.9.2.8 The value of habitats of conservation importance is high. The MarESA and FeAST sensitivity scores for habitats of conservation importance range from low to high. The overall sensitivity for habitats of conservation importance is therefore considered to be **high**.

Species of conservation importance

10.9.2.9 The value of species of conservation importance is considered to be high. The MarESA and FeAST sensitivity scores for species of conservation importance range from low to high. The overall sensitivity for species of conservation importance is therefore considered to be **high**.

Magnitude of impact

10.9.2.10 The total maximum area of temporary habitat disturbance due to construction activities is approximately 49.11km^2 and 3.9% of substrate present within the Offshore Red Line Boundary, as described in **Table 10.10**. This is based on the maximum areas of disturbance detailed within **Table 10.17**.

Table 10.17 The area of subtidal habitat likely to be disturbed as a result of each construction activity

Activity	Subtidal area disturbed
Installation of drag embedment anchors	6.75km^2
Installation of array cables	20.4km^2
Installation of SDCs	0.12528km^2
Installation of offshore substations	0.0572km^2
Installation of offshore export cable corridor	21km^2
Installation of cable crossings	0.714km^2
Installation of RCPs	0.01445km^2
HDD exit pits	0.00008km^2

10.9.2.11 Overall, the disturbance of the seabed will be temporary and reversible in nature as construction activities will take place over a period of 12 years and will be carried out in three phases. Due to the phased approach, there is the potential for recovery of habitats and species between the phases. Furthermore, embedded environmental measures are detailed within **Table 10.11** and include the commitment to undertake pre-installation surveys and micro-siting of infrastructure and therefore avoidance of sensitive receptors, where possible. Therefore, the magnitude of this impact is considered to be **negligible** to **low**.

Significance of residual effect

10.9.2.12 The Project's embedded environmental measures (as shown in **Table 10.11**) include the use of micro siting (M-055) to avoid direct impacts to key sensitive receptors. As a result, the following effects are predicted for the relevant receptors:

- overall, it is predicted that the effect upon subtidal habitats and species is **Minor Adverse** (**Not Significant**);
- overall, it is predicted that the effect upon shellfish is **Minor Adverse** (**Not Significant**).

10.9.2.13 Although M-055 will not directly lead to the avoidance of disturbance to burrowing species such as ocean quahog, the Project will minimise the seabed footprint as far as is practicable and consequently minimise disturbance to all benthos, including ocean quahog. As a result, it is predicted that the effect on both Habitats and species of conservation importance is **Minor Adverse** (**Not Significant**) to **Moderate Adverse** (**Potentially Significant**).

10.9.3 Impact C2: temporary increase in suspended sediment and deposition

Overview

10.9.3.1 During the construction stage, a number of activities have the potential to result in elevated levels of suspended solids and subsequent deposition within the study area including:

- drilling for offshore foundation installation;
- seabed preparation for WTG anchors, SDCs, subsea substations and offshore substation foundations;
- cable burial; and
- drilling fluid release during HDD at the landfall(s).

10.9.3.2 An assessment of the physical characteristics of the above, including the methodological approach used to assess the characteristics of sediment plumes and associated changes in bed level arising from settling of material is set out in **Volume 3, Appendix 6.1**.

10.9.3.3 From an ecological perspective, there are several potential implications relating to the mobilisation and resettlement of sediments.

10.9.3.4 Changes in suspended solids and remobilisation may impact photosynthesis and therefore inhibit growth and density of canopy forming seaweeds when turbidity increases by 0.1/m (light attenuation coefficient). However, kelp are relatively resilient to such changes. Further studies showed that smothering by 5cm to 30cm sediment during discrete events is unlikely to damage *Saccharina latissima* and *Chorda filum* but may provide a physical barrier to light penetration, essential to kelps and adversely impact recruitment processes. However, studies showed that the species can survive in darkness for between 6 to 16 months at a temperature of 8°C, indicating kelp is highly resilient (Stamp *et al*., 2022).

10.9.3.5 Increased turbidity may reduce the feeding efficiency of filter and deposit feeders by reducing the nutritional value of the suspended matter. However, they are not solely reliant on organic particles and also incorporate free-floating micro-organisms into their diet. While it has been observed that increased turbidity may reduce growth and increase mortality of some deposit feeders, this is for high concentrations over protracted periods (Nicholls *et al*., 2003).

10.9.3.6 Suspension feeders such as mussels (*Mytilus spp.*) are relatively resilient to siltation and turbidity and have been shown to tolerate up to 100 mg/l suspended sediment for one month. Mussels can discharge sand from the mantle cavity and recoverability has been reported as immediate. Mussels are generally sedentary; however, studies have shown they re-position on the shore or within the seabed when buried by sand, but burial by large-scale sand depositions may lead to mortalities. They may be able to move upwards through the sediment, though some younger individuals may succumb (Widdows *et al*., 1989).

10.9.3.7 The ability of benthos to recover is based on a combination of the environmental conditions of the site, the frequency (repeated disturbances versus a one-off event) and the intensity of the disturbance, as well as the resilience of the species in question. The re-colonisation potential differs between those species that recruit from dispersed larvae (such as for the *Polydora ciliata* and *Pygospio elegans* species) and those dependent on local populations (such for the infaunal deposit feeders *Scoloplos armiger* and *Arenicola marina*, and amphipods *Corophium* sp.). In high energy environments full recoverability can be <2 years and in lower energy environments this can take between 2 to 10 years (DeBastos and Raymont, 2022).

10.9.3.8 The maximum design scenario relating to temporary increase in suspended sediment and deposition during the construction stage is presented in **Table 10.10**. Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 10.8**. The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 10.11** will be implemented as part of the Project.

Sensitivity or value of receptor

10.9.3.9 The benchmarks for the relevant MarESA pressures that have been used to inform this impact assessment are:

- Changes in suspended solids (water clarity): the benchmark is a change in one rank on the WFD scale (for example, from clear to intermediate for one year, caused by activities disturbing sediment or organic particulate material and mobilising it into the water column).
- Smothering and siltation rate changes (light): the benchmark for light sediment deposition is up to 5cm of fine material added to the habitat in a single discrete event.
- Smothering and siltation rate changes (heavy): the benchmark for heavy deposition is up to 30cm of fine material added to the seabed in a single discrete event.

10.9.3.10 The value, resistance, resilience and sensitivities for each receptor in relation to the above pressures are detailed within Table 1.2 of **Volume 3, Appendix 10.5**.

Intertidal habitats and species

10.9.3.11 The value of intertidal habitats and species is considered to range from low to very low. The MarESA sensitivity scores of intertidal habitats and species to sediment mobilisation and resettlement range from no sensitivity to high sensitivity. As a precautionary approach, due to some low value habitats having a high sensitivity to the impact, the overall sensitivity for intertidal habitats and species is considered to be **medium**.

Subtidal habitats and species

10.9.3.12 The value of subtidal habitats and species is considered to be medium. The MarESA sensitivity scores of subtidal habitats and species to sediment mobilisation and resettlement range from low to medium sensitivity. The overall sensitivity for subtidal habitats and species is therefore considered to be **medium**.

Shellfish

10.9.3.13 The value of shellfish is considered to range from medium to high. The MarESA sensitivity scores for shellfish range from no sensitivity to low sensitivity[4]. As a result, the overall sensitivity for shellfish to sediment mobilisation and resettlement is considered to be **medium**.

Habitats of conservation importance

10.9.3.14 Offshore subtidal sands and gravels under the illustrative biotopes: A5.14 Circalittoral coarse sediment; A5.25 Circalittoral fine sand; A5.26 Circalittoral muddy sand (continental shelf sands and continental shelf coarse sediments) are considered by the Scottish Government FeAST tool to have a negligible sensitivity to increases in suspended sediment (changes to water clarity) (FeAST, 2023). This is due to the hydrological conditions these habitats are located within influences the scale and duration of increases of suspended sediments. Therefore, the sensitivity to the impact is considered to be **negligible**.

10.9.3.15 Offshore subtidal sands and gravels are considered by the Scottish Government FeAST tool to have a medium sensitivity to light sedimentation up to 5cm). The FeAST tool considers continental coarse sediment to have a medium sensitivity to heavy sedimentation (between 5cm to 30 cm) and continental shelf sand to have a high sensitivity to heavy sedimentation. Therefore, the sensitivity to this impact is considered to be **medium**.

10.9.3.16 The value of habitats of conservation importance is high. However, the MarESA and FeAST sensitivity scores to sediment mobilisation and resettlement for habitats of conservation importance ranges from negligible to medium. The overall sensitivity for habitats of conservation importance is therefore considered to be **medium**.

Species of conservation importance

10.9.3.17 The value of species of conservation importance is considered to be high. The MarESA sensitivity scores for these species are range from Very low to medium, thus the overall sensitivity for species of conservation importance to sediment mobilisation and resettlement is considered to be **low**.

Blue carbon

10.9.3.18 The value of blue carbon receptors is considered to be high. The MarESA sensitivity scores of blue carbon is considered to range from not sensitive to low sensitivity. Furthermore, blue carbon habitats are located outside of the offshore export cable corridor and OAA Red Line Boundary (although within the wider study area) and subsequently any suspended sediment is likely to be limited within the area where the blue carbon habitats are located. As a result, the overall sensitivity for blue carbon receptors to sediment mobilisation and resettlement is therefore considered to be **low**.

Magnitude of impact

10.9.3.19 Details of the modelling undertaken to inform this assessment is presented in **Volume 3, Appendix 6.1**.

10.9.3.20 The actual magnitude and extent of the impact will depend in practice on a range of factors such as the actual total volumes and rates of sediment disturbance, the local water depth and current speed at the time of the activity, the local sediment type and grain size distribution, and the local seabed topography and slopes. There will be a wide range of possible combinations of these factors and so it is not possible to predict specific dimensions with complete certainty. To provide a robust assessment, a range of realistic combinations have been considered, based on environmental and project specific information, including a range of water depths, heights of sediment ejection / initial resuspension and sediment types.

10.9.3.21 The laying of cables has the potential to result in mobilisation of sediment, with jet trenching assumed to produce the highest levels of mobilised sediments. However, this method is only practical on softer sediments.

10.9.3.22 Sediment deposition associated with the Project is predicted to fall within four main zones of effect, based on the distance from the activity causing sediment disturbance. A summary of these findings is presented within **paragraph 10.9.3.23** to **paragraph 10.9.3.26**.

10.9.3.23 The zone of highest suspended sediment concentration (SSC) increases and greatest likely thickness of deposition is within 25 m of the activity. All gravel sized sediment likely deposited in this zone, also a large proportion of sands that are not resuspended high into the water column, and also most or all dredge spoil in the active phase. Plume dimensions and SSC, and deposit extent and thickness, are primarily controlled by the volume of sediment released and the manner in which the deposit settles.

- During the activity that generates the disturbance, SSC may increase by several orders of magnitude, resulting in SSC of tens to hundreds of thousands of mg/l for the duration of active disturbance.
- This will persist for approximately 30 minutes following the end of disturbance before redeposition. Sands and gravels may deposit in local thicknesses of tens of centimetres to metres depending on the degree of seabed intervention. Fine sediment is unlikely to deposit in measurable thickness.
- More than one hour after the end of active disturbance, SSC will no longer be elevated and with no measurable ongoing deposition.

10.9.3.24 The wider zone of 25m to 250m will show measurable SSC increases and measurable but lesser thickness of deposition, mainly sands that are released or resuspended higher in the water column and resettling to the seabed whilst being advected by ambient tidal currents. Plume dimensions and SSC, and deposit extent and thickness, are primarily controlled by the volume of sediment released, the height of resuspension or release above the seabed, and the ambient current speed and direction at the time.

- At the time of active disturbance SSC may increase (hundreds to low thousands of mg/l) lasting for the duration of active disturbance plus up to 30 minutes following the end of the activity. Sands and gravels may deposit in local thicknesses of up to tens of centimetres; fine sediment is unlikely to deposit in measurable thickness.
- More than one hour after the end of active disturbance no change to SSC will be evident, with no measurable ongoing deposition.

10.9.3.25 Beyond 250m to the tidal excursion buffer distance is a zone of lesser but measurable SSC increase and no measurable deposition. Suspended material comprises mainly fines that are maintained in suspension for more than one tidal cycle and are advected by ambient tidal currents. Plume dimensions and SSC are primarily controlled by the volume of sediment released, the patterns of current speed and direction at the place and time of release and where the plume moves to over the following 24 hours.

- At the time of active disturbance, low to intermediate SSC increase occurs within a narrow plume (tens to a few hundreds of metres wide). SSC may be elevated to tens to low hundreds of mg/l solely as a result of any remaining fines in suspension. SSC decreases rapidly by dispersion to ambient values within one day after the end of active disturbance and fine sediment is unlikely to deposit in measurable thickness.
- One to six hours after end of active disturbance – decreasing to low SSC increase (tens of mg/l); fine sediment is unlikely to deposit in measurable thickness.
- Six to 24 hours after the end of active disturbance – decreasing gradually through dispersion to background SSC (no measurable local increase); fine sediment is unlikely to deposit in measurable thickness. No measurable change from baseline SSC after 24 hours to 48 hours following cessation of activities.

10.9.3.26 Beyond the tidal excursion buffer distance, or anywhere not tidally aligned to the active sediment disturbance activity there is no expected change to SSC nor a measurable sediment deposition.

10.9.3.27 The generation of elevated suspended solids concentrations will be temporary. Following cessation of activities, suspended sediments will return to normal levels due to resettlement and redistribution by prevailing currents and wave action. Therefore, the magnitude of change from baseline levels caused due to construction activities is likely to be **low**.

Significance of residual effect

10.9.3.28 For all benthic receptors, it is predicted that the effect of increases in SSC and subsequent re-deposition is **Minor Adverse** (**Not Significant**).

10.9.4 Impact C3: mobilisation of sediment associated contaminants (for example, heavy metals, hydrocarbons)

Overview

10.9.4.1 The direct and indirect disturbances associated with the construction stage of the Project may lead to the release of sediment contaminants into the water column. Where these become bioavailable in sufficient concentrations, they may cause a range of lethal and sublethal toxic effects on benthic organisms.

10.9.4.2 The maximum design scenario relating to direct and indirect seabed disturbances leading to the release of sediment contaminants during the construction stage is presented in **Table 10.10**. Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 10.8.** The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 10.11** have been implemented as part of the Project. The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 10.11** have been implemented as part of the Project.

Sensitivity or value of receptor

10.9.4.3 The benchmarks for the relevant MarESA pressures that have been used to inform this impact assessment are:

- Transition elements and organo-metal contamination: the benchmark for which is exposure of marine species or habitat to one or more relevant contaminants via uncontrolled releases of incidental spills.

- Hydrocarbon and Polycyclic Aromatic Hydrocarbons (PAH) contamination: the benchmark for which is exposure of marine species or habitat to one or more relevant contaminants via uncontrolled releases or incidental spills.

10.9.4.4 The value, resistance, resilience and sensitivities for each receptor in relation to the above pressures are detailed within Table 1.3 of **Volume 3, Appendix 10.5**.

Intertidal habitats and species

10.9.4.5 The value of intertidal habitats and species is considered to range from low to very low. No MarESA sensitivity scores were available for intertidal habitats and species. As a precautionary approach, the overall sensitivity for intertidal habitats and species is therefore considered to be **medium**.

Subtidal habitats and species

10.9.4.6 The value of subtidal habitats and species is considered to be medium due to the greater extent to which subtidal habitats support species of ecological and commercial importance (compared to intertidal habitats). No MarESA sensitivity scores were available for subtidal habitats and species. The overall sensitivity for subtidal habitats and species is therefore considered to be **medium**.

Shellfish

10.9.4.7 The value of shellfish is considered to range from medium to high. The MarESA sensitivity scores for shellfish are low[4]. The overall sensitivity for shellfish is therefore considered to be **low**.

Habitats of conservation importance

10.9.4.8 The value of habitats of conservation importance is high. The MarESA sensitivity scores for habitats of conservation importance are high. The overall sensitivity for habitats of conservation importance is therefore considered to be **high**.

Species of conservation importance

10.9.4.9 The value of species of conservation importance is high. MarESA sensitivity scores were available for the edible sea urchin which was determined to be **low**. FeAST scores were available for the Northern sea fan which determined the species to be sensitive.. The overall sensitivity for species of conservation importance considering their value and their sensitivity scores is therefore considered to be **high**.

Blue carbon

10.9.4.10 The value of blue carbon habitats is high. No MarESA sensitivity scores were available for blue carbon habitats. The overall sensitivity for blue carbon habitats is therefore considered to be **high**.

Magnitude of impact

10.9.4.11 Construction activity will inevitably lead to some disturbance of the seabed settlements. Suspended sediments will be briefly mobilised to the water column and where they contain contaminants, these may potentially be mobilised under certain conditions. However, metals tend to enter solution only under anoxic conditions and hydrocarbons are generally tightly bound to fine fractions of the settlement. Therefore, the risk of any contaminants, if present, being bioavailable is low.

10.9.4.12 As described in **Chapter 6: Marine Geology, Oceanography and Physical Processes**, elevated suspended sediment concentration resulting from the Project will be temporary and short-lived. Annual Average (AA) EQS values are unlikely to be affected by short-term changes in sediment mobilisation. It was determined within **Chapter 7: Marine Water and Sediment Quality** that overall, there was no exceedance of water column MAC EQS in the OAA, offshore export cable corridor and landfall(s) area. PAH, PCB and TBT concentrations in sediments were also predominantly within Marine Scotland AL1 thresholds. In addition, the location of the Project has no history of heavy industry, with the sediment comprising of mainly of sand and gravel and is therefore unlikely to contain appreciable concentrations of with heavy metals or hydrocarbons. Consequently, the magnitude of this impact is considered **negligible**.

Significance of residual effect

10.9.4.13 The following effects are predicted for the relevant receptors:

- overall, it is predicted the effect on intertidal habitats and species is **Minor Adverse** (**Not Significant**);
- overall, it is predicted that the effect on subtidal habitats and species is **Minor Adverse** (**Not Significant**);
- overall, it is predicted that the effect on shellfish is **Negligible** (**Not Significant**);
- overall, it is predicted that the effect on habitats of conservation importance is **Minor Adverse** (**Not Significant**);
- overall, it is predicted that the effect on species of conservation importance is **Minor Adverse** (**Not Significant**); and
- overall, it is predicted that the effect on blue carbon is **Minor Adverse** (**Not Significant**).

10.9.5 Impact C4: increased risk of introduction or spread of marine INNS

Overview

10.9.5.1 During construction and pre-construction, the following activities may pose a risk of introducing or facilitating the spread of INNS:

- presence of new structures in the water column;
- installation of WTGs, including floating units, and mooring and anchoring systems;
- installation of offshore substations / RCP / SDC platforms, including foundations;
- installation of array and offshore export cables; and
- vessel movements for the construction stage.

10.9.5.2 The introduction of INNS through changes to habitat type and construction of infrastructure as well as increased vessel traffic has the potential to impact benthic, epibenthic and intertidal ecology receptors. The introduction of INNS has the potential to result in changes to species composition, increased competition for resources (including space and food sources) and potential increased predation on native species (Wilhelmson *et al*., 2010). However, no specific information is available to suggest that artificial habitat introduction associated with offshore wind farms will provide uniquely beneficial opportunities not currently available to alien species to assist their invasion in UK waters (Linley et al., 2007).

10.9.5.3 INNS establishment depends on multiple factors, including salinity, depth, current strength, and the presence of suitable substrates. Fully marine salinities can support a wider range of INNS (Evans, 1980), while strong currents may reduce larval settlement but aid dispersal. Sites with stable, submerged surfaces (natural or artificial) are more susceptible to colonisation, especially if structures remain undisturbed for extended periods.

10.9.5.4 The risk of INNS establishment is further elevated by the existence of artificial structures, even if the structure has only been present for just a few weeks as INNS are capable of rapidly forming populations (Bax *et al*., 2003). Periods of low vessel activity or seasonal temperature changes can increase biosecurity risk by creating favourable conditions for settlement and reproduction. The introduction of non-native species may impair the ecosystem equilibrium as artificial structures are reported to be more suitable for non-native species than natural reefs by changing competitive interactions.

10.9.5.5 The maximum design scenario relating to increased risk of introduction or spread of marine INNS during the construction stage is presented in **Table 10.10** Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 10.8**. The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 10.11** have been implemented as part of the Project. It should further be noted that a framework for managing the risk of INNS is included in **Volume 4: Outline Offshore Invasive Non-Native Species Management Plan**.

Sensitivity or value of receptor

10.9.5.6 The value, resistance, resilience and sensitivities for each receptor in relation to the above pressures are detailed within Table 1.4 of **Volume 3, Appendix 10.5**.

10.9.5.7 The benchmark for the relevant MarESA pressures that have been used to inform this impact assessment are:

- introduction or spread of INNS pressures; the benchmark for which is the introduction of one or more INNS.

10.9.5.8 The benchmark for the relevant FeAST pressure that has been used to inform this assessment of effect is:

10.9.5.9 Introduction or spread of non-native species and translocations (competition): the benchmark for which is a significant pathway exists for introduction of one or more INNS.

Intertidal habitats and species

10.9.5.10 The value of intertidal habitats and species is considered to range from very low to low. However, the MarESA sensitivity scores ranged from No sensitivity to high sensitivity. As a result, the overall sensitivity for intertidal habitats and species is considered to be **medium**.

Subtidal habitats and species

10.9.5.11 The value of subtidal habitats and species is considered to be medium. MarESA sensitivity scores for subtidal habitats and species are high. The overall sensitivity for subtidal habitats and species is therefore considered to be **medium** to **high**.

Shellfish

10.9.5.12 The value of shellfish is considered to range from medium to high. No MarESA or FeAST sensitivity scores were available for shellfish but based on the characteristics of other mobile benthos, and with a degree of precaution, the overall sensitivity for shellfish is considered to be **medium**.

Habitats of conservation importance

10.9.5.13 Offshore subtidal sands and gravels are considered by the Scottish Government FeAST tool to have a medium sensitivity to the introduction of INNS (FeAST, 2023). This sensitivity is based upon the evidence that some INNS species such as slipper limpets *Crepidula fornicata*, pacific oyster and others are able to outcompete native species and proliferate. Therefore, the sensitivity to this impact is considered to be **medium** for offshore subtidal sands and gravels.

10.9.5.14 The value of habitats of conservation importance is high. MarESA / FeAST indicate medium resistance and sensitivity to the introduction or spread of INNS, with very low resistance. The overall sensitivity for habitats of conservation importance is therefore considered to be **high**.

Species of conservation importance

10.9.5.15 The value of species of conservation importance is considered to be high. No MarESA sensitivity scores were available for species of conservation importance. The overall sensitivity for species of conservation importance is therefore considered to be **high**.

Blue carbon

10.9.5.16 The value of blue carbon is high. The MarESA sensitivity scores for blue carbon habitats are also high, thus the overall sensitivity is considered to be **high**.

Magnitude of impact

10.9.5.17 The benchmark for the relevant MarESA pressures that have been used to inform this impact assessment are:

- introduction or spread of INNS pressures; the benchmark for which is the introduction of one or more INNS.

10.9.5.18 The benchmark for the relevant FeAST pressure that has been used to inform this assessment of effect is:

- introduction or spread of non-native species and translocations (competition): the benchmark for which is a significant pathway exists for introduction of one or more INNS.

10.9.5.19 The increased risk of introduction of INNS begins in the construction stage and continues with the O&M stage. This impact is deemed to be long-term.

10.9.5.20 Once established, eradication of INNS is difficult to achieve. Therefore, the introduction of INNS is likely to result in an irreversible impact and prevention is a critical component of controlling INNS. The Applicant is committed to producing and adhering to an Outline Offshore INNS Management Plan (see **Volume 4: Outline Offshore Invasive Non-Native Species Management Plan** and M-102 detailed within **Section 10.7.2**) to prevent and reduce impacts from the introduction of INNS.

10.9.5.21 The **Outline Offshore Invasive Non-Native Species Management Plan** identifies all Project activities as presenting a low risk of INNS introduction. This, combined with the mitigation measures set out in the Outline Offshore INNS Management Plan (M-102), are expected not to result in any increase in the rate of introduction of INNS into Scottish waters, or to their spread within the project area. The magnitude of impact to benthic ecology receptors is thus classed as **negligible** (comparable to natural variation).

Significance of residual effect

10.9.5.22 The Project's embedded environmental measures (as show in **Table 10.11** include the adherence to an Outline Offshore INNS Management Plan (M-102) to prevent and reduce impacts to receptors from the introduction of INNS. As a result, it is predicted that the potential introduction and spread of INNS is **Minor Adverse** (**Not Significant**) for all benthic ecology receptors.

10.9.6 Impact C5: underwater noise and vibration

Overview

10.9.6.1 During the construction stage of the Project, several activities have the potential to generate underwater noise, most notably during the installation of offshore infrastructure. These include:

- installation of driven pile anchors;
- installation of the offshore substation foundations; and
- installation of the RCP foundations.

10.9.6.2 Additional, lower-level continuous noise sources include vessel operations, trenching for cable installation, cable laying, dredging, drilling, rock placement, UXO clearance and other general construction activities.

10.9.6.3 The effects of underwater noise on marine mammals and fish have been extensively studied over the last few decades. However, impacts to invertebrate species (including shellfish) are not as well understood. It is also recognised that shellfish species have a lower sensitivity to underwater noise than marine mammals and fish due to difference in their physiology, including the lack of gas filled spaces within their bodies (Popper *et al*., 2001). Research has shown that invertebrates are able to sense sound / particle waves through organs that evolved to allow them to maintain their equilibrium in the water and sense gravity (Sole *et al*., 2023). However, how underwater noise impacts these species is not as well recorded.

10.9.6.4 The production of underwater noise through construction activities has the potential to impact shellfish species through changes to behaviour and in some cases the cessation of burrowing, closing of valves or avoidance of areas where noise is present (Solan *et al*., 2016), and may result in injury or mortality if in close proximity to piling activities.

10.9.6.5 The maximum design scenario relating to underwater noise and vibration during the construction stage is presented in **Table 10.10.** Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 10.8**. The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 10.11** have been implemented as part of the Project.

Sensitivity or value of receptor

10.9.6.6 There were no relevant MarESA or FeAST pressures and benchmarks available to inform the assessment on any of the receptors, due to the limited available information on the impacts of underwater noise, vibration and particle motion on benthic invertebrates and shellfish.

10.9.6.7 Studies undertaken by Solan investigating the impacts of underwater noise on Norway lobster, reported that exposure to underwater noise resulted in reduced activity (movement and burrowing) and clearing of burrows compared to control experiments, indicating a behavioural response, however there were no records of mortality (Solan *et al*. 2016).

10.9.6.8 Cuttlefish has been assessed by MarLIN as having a medium sensitivity to underwater noise (Gibson-Hall and Wilson, 2018). The sensitivity is derived from a medium tolerance and medium ability to recover following exposure to underwater noise. Cuttlefish are thought to be able to habituate to some levels of noise exposure. Noise can cause changes to behaviour (including avoidance of areas) above thresholds of 139dB to 142dB, and damage to statocysts (i.e. organs regulating balance and orientation) may occur.

10.9.6.9 On the basis of available evidence, with some suggestion of possible behavioural changes but no direct mortality, the sensitivity of the shellfish receptor group is considered to be **low**.

Magnitude of impact

10.9.6.10 The greatest level of noise generated will be 3,500 kJ over a period of 12 years for 56 piles in relation to 2 RCPs and 4 offshore substations and driven pile WTG anchors.

10.9.6.11 Details of the modelling approach and outputs of the potential noise levels generated because of construction activities have been reported in **Chapter 8: Underwater Noise** and **Volume 3, Appendix 8.1: Underwater Noise and Vibration Modelling Assessment**. However, it should be noted that criteria for thresholds in sound pressure at which effects (for example, mortality, auditory injury, recoverable injury, disturbance and / or behavioural effects) may occur, have been produced for marine mammals (Southall *et al*., 2019) and fish (Popper *et al*., 2014). These are not applicable to invertebrates that generally rely on the detection of particle motion. Given the paucity of particle motion data and difficulties calculating it from pressure (Nedelec *et al*., 2018), as well as the small number of studies of noise impacts for such a diverse group, no accepted thresholds for noise effects on aquatic invertebrates exist. Therefore, this Chapter has taken a qualitative approach to assessing the impacts of underwater noise on shellfish receptors.

10.9.6.12 Based on the results from **Volume 3, Appendix 8.1** it is concluded that noise from construction activities, considering all embedded environmental measures, is likely to be relatively localised, reversible and of limited duration. The overall magnitude is therefore assessed as **medium**.

Significance of residual effect

10.9.6.13 Overall, it is predicted that the effect of underwater construction noise on shellfish is **Minor Adverse** (**Not Significant**).

10.10 Assessment of effects: operation and maintenance stage

10.10.1 Introduction

10.10.1.1 This Section provides an assessment of the effects for benthic, epibenthic and intertidal ecology from the O&M of the offshore elements of the Project.

10.10.1.2 The assessment methodology set out in **Section 10.8** has been applied to assess effects to benthic, epibenthic and intertidal ecology from the Project.

10.10.2 Impact O1: temporary disturbance of seabed habitat

Overview

10.10.2.1 Maintenance activities such as repair or replacement of sections of cable and major component replacement of WTGs requiring a jack-up vessel have the potential to result in long-term habitat disturbance across the lifetime of the Project. This could take the form of seabed abrasion from moving and relaying cable and the replacement of armour following repairs, as well as scour around structures on the seabed. The ecological implications of this are potential degradation of benthic habitats and displacement or mortality of associated benthic species, albeit on a very limited scale.

10.10.2.2 The maximum design scenario relating to the temporary habitat disturbance of seabed habitat is presented in **Table 10.10**. Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 10.8**. The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 10.11** have been implemented as part of the Project.

10.10.2.3 Temporary seabed disturbance will occur during the O&M stage. This may result from episodic activities such as the following activities:

- replacement of repair mooring line components;
- replacement of repair of array cables;
- replacement of mooring or anchors using same process as construction;
- SDCs and subsea includes routine inspections, cable and scour protection repair / replacement;
- offshore substation and RCPs: routine inspections; removal of marine growth, replacement of scour protection; and
- offshore export cables: routine inspection, cable repair (recovery and reburial).

Sensitivity or value of receptor

10.10.2.4 The sensitivity of each receptor to temporary habitat disturbance is detailed within **paragraph 10.9.2.4** to **paragraph 10.9.2.10** It should be noted that O&M activities will not lead to temporary disturbance of seabed habitat located outside of the OAA and offshore export cable corridor Red Line Boundary and therefore only habitats and species located within the OAA and offshore export cable corridor have been considered for this impact. Intertidal habitats are not considered to be at risk of this impact due to the use of HDD. Likewise, blue carbon receptors are present within the wider study area and outside of the

OAA and offshore export cable corridor and therefore unlikely to be affected by this impact. As a result, these receptor groups have not been considered within this Section.

Subtidal habitats and species

10.10.2.5 The value of subtidal habitats and species is considered to range from medium to high. The MarESA and FeAST sensitivity scores of subtidal habitats and species is considered to range from low to medium sensitivity. The overall sensitivity for subtidal habitats and species is therefore considered to be **medium**.

Shellfish

10.10.2.6 The value of shellfish species is considered to range from medium to high. The MarESA sensitivity scores for shellfish is considered to range from low to medium sensitivity. The overall sensitivity for shellfish is therefore considered to be **medium**.

Habitats of conservation importance

10.10.2.7 The value of habitats of conservation importance is high. The MarESA and FeAST sensitivity scores for habitats of conservation importance range from medium to high. The overall sensitivity for habitats of conservation importance is therefore considered to be **high**.

Species of conservation importance

10.10.2.8 The value of species of conservation importance is considered to be high. The MarESA and FeAST sensitivity scores for species of conservation importance are high. The overall sensitivity for species of conservation importance is therefore considered to be **high**.

Magnitude of impact

10.10.2.9 While these activities are short in duration and reversible, they represent repeated disturbance events across the 35-year operational lifespan for each Project phase. Associated maintenance is expected to be undertaken using the same methods as those used during installation.

10.10.2.10 Any temporary habitat disturbance during O&M is expected to be of the same or lower magnitude than that assessed for the construction stage. It is acknowledged that cable maintenance, reburial and repair works could occur on multiple occasions over the Project's operational life, which may result in a greater frequency of localised habitat disturbance events compared to the construction stage. Thus, although maintenance activities generating temporary habitat disturbance will be for short durations for each event, they will occur over the duration of the Project lifecycle, therefore will result in a longer-term impact to benthic, epibenthic and intertidal ecology receptors. However, it should be noted that the scale of works will be reduced as each event will occur over a smaller spatial and temporal scale than the initial construction stage.

10.10.2.11 Similarly to construction related disturbance, the magnitude of seabed disturbance during O&M is assessed as being **negligible** to **low**.

Significance of residual effect

10.10.2.12 The Project's embedded environmental measures commitments (as shown in **Table 10.11**) include the use of micro siting (M-055) to avoid direct impacts to key sensitive receptors. As a result, the following effects are predicted for the relevant receptors:

- overall, it is predicted that the effect upon subtidal habitats and species is **Minor Adverse** (**Not Significant**);
- overall, it is predicted that the effect upon shellfish is **Minor Adverse** (**Not Significant**); and
- overall, it is predicted that the effect on both Habitats and species of conservation importance is **Minor Adverse** (**Not Significant**) to **Moderate Adverse** (**Potentially Significant**).

10.10.3 Impact O2: temporary increase in suspended sediment and redeposition

Overview

10.10.3.1 Increases in suspended sediment have the potential to impact benthic ecology receptors through a variety of pathways as discussed in **Section 10.9.3**.

10.10.3.2 The maximum design scenario relating to the temporary increase in suspended sediment deposition during the O&M stage is presented in **Table 10.10**. Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 10.8**. The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 10.11** have been implemented as part of the Project.

Sensitivity or value of receptor

10.10.3.3 The sensitivity of each receptor to sediment mobilisation and resettlement is detailed within **paragraph 10.9.3.9** to **paragraph 10.9.3.18**. In summary:

- the overall sensitivity for intertidal and subtidal habitats and species, including shellfish, is considered to be **medium**;
- the overall sensitivity for habitats of conservation importance is considered to be **medium**;
- the overall sensitivity for species of conservation importance is considered to be **low**; and
- the overall sensitivity for blue carbon receptors is considered to be **low**.

Magnitude of impact

10.10.3.4 O&M activities within the offshore export cable corridor and OAA Red Line Boundary are expected to result in increases in SSCs and localised sediment deposition during cable repair, replacement and reburial operations. Under the maximum design scenario, repairs of damaged sections of the export cable corridor and cable protection areas and reburial of sections of cable that become exposed may occur over the 35-year Project lifetime.

10.10.3.5 Associated cable reburial is expected to be undertaken using the same methods as those used during installation, with jet trenching representing the worst-case scenario in terms of sediment disturbance and resulting increases in SSCs and associated deposition.

10.10.3.6 Any increases in SSCs and associated deposition during O&M are expected to be of the same or lower magnitude than those assessed for the construction stage. This reflects that, under the maximum design scenario (and associated modelling of sediment dispersion, SSC, and deposition), construction allowed for more intensive and concurrent activities, such combined, large-scale works will not occur during the O&M stage, and therefore, sediment disturbance will be comparatively lower. Depending on the frequency of reburial and repair works, these operational activities could result in a greater frequency of localised sediment disturbance events over the Project's operational life, compared to the construction stage.

10.10.3.7 Elevated SSCs during the O&M stage are expected to be short-term, intermittent, and spatially limited. Deposition is predicted to be highly localised and naturally reversible through tidal processes. Although reburial works may occur more frequently than during construction, each is expected to be of short duration. The impact is adverse but temporary, localised and reversible. As such, the magnitude of impact is assessed as **low**.

Significance of residual effect

10.10.3.8 Overall, it is predicted that the effect on all benthic receptors is **Minor** (**Not Significant**).

10.10.4 Impact O3: mobilisation of sediment associated contaminants

Overview

10.10.4.1 The maximum design scenario relating to the direct and indirect seabed disturbances leading to the release of sediment contaminants is presented in **Table 10.10**. Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 10.8**. The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 10.11** have been implemented as part of the Project.

Sensitivity or value of receptor

10.10.4.2 The sensitivity of each receptor is detailed within **paragraph 10.9.4.3** to **paragraph 10.9.4.10.**

10.10.4.3 In summary:

- sensitivity of intertidal habitats and species is considered to be **low;**
- sensitivity of subtidal habitats and species is considered to be **medium;**
- sensitivity of shellfish is therefore considered to be **low;**
- sensitivity for both habitats and species of conservation importance is considered to be **high**; and
- sensitivity of blue carbon habitats is considered to be **high.**

Magnitude of impact

10.10.4.4 As with the construction stage (See **Section 10.9.4**), the magnitude of this impact is considered **negligible**.

Significance of residual effect

10.10.4.5 The following effects are predicted for the relevant receptors:

- the effect on intertidal habitats and species is **Negligible** (**Not Significant**);
- the effect on subtidal habitats and species is **Minor Adverse** (**Not Significant**);
- the effect on shellfish is **Negligible** (**Not Significant**);
- the effect on both habitats and species of conservation importance is **Minor Adverse** (**Not Significant**); and
- the effect on blue carbon is **Minor Adverse** (**Not Significant**).

10.10.5 Impact O4: long-term habitat loss

Overview

10.10.5.1 Subtidal habitat loss will occur because of the placement of infrastructure. Long-term habitat loss will result from the installation of WTG and offshore substation platform foundations (where required), along with associated scour protection and cable protection where necessary.

10.10.5.2 The maximum design scenario relating to long-term habitat loss is presented in **Table 10.10**. Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 10.8.**The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 10.11** have been implemented as part of the Project.

Sensitivity or value of receptor

10.10.5.3 The relevant MarESA pressure and its benchmark that has used to inform this impact assessment is:

- Physical change (to another seabed type): the benchmark for which is change in sediment type from sedimentary or soft rock substrata to hard rock or artificial substrate or vice-versa.

10.10.5.4 The relevant FeAST pressure that have been used to inform this assessment is:

- Physical change (to another seabed type).

10.10.5.5 The value, resistance, resilience and sensitivities for each receptor in relation to the above pressures are detailed within Table 1.5 of **Volume 3, Appendix 10.5**. It should be noted that the operation of the Project will not lead to long-term habitat loss outside of the OAA and offshore export cable corridor Red Line Boundary and therefore only habitats and species located within the OAA and offshore export cable corridor have been considered for this impact. Intertidal habitats are not considered to be at risk of this impact due to the use of HDD. Likewise, blue carbon receptors are present within the wider study area and outside of the OAA and offshore export cable corridor and therefore unlikely to be affected by this impact. As a result, these receptor groups have not been considered within this Section.

Subtidal habitats and species

10.10.5.6 The value of subtidal habitats and species is considered to be medium. The MarESA sensitivity scores for subtidal habitats is high. The overall sensitivity for subtidal habitats and species is therefore considered to be **high**.

Shellfish

10.10.5.7 The value of shellfish species is considered to range from medium to high. The MarESA sensitivity scores for shellfish are medium. The overall sensitivity for shellfish is therefore considered to be **medium**.

Habitats of conservation importance

10.10.5.8 Offshore subtidal sands and gravels are considered by the Scottish Government FeAST tool to have a medium sensitivity to slight changes in habitat type, but a high sensitivity in large changes to habitat type (from sand / gravel to rock armour) (FeAST, 2023). Therefore, the sensitivity to this impact is considered to be high for offshore subtidal sands and gravels.

10.10.5.9 The value of habitats of conservation importance is high. The MarESA and FeAST sensitivity scores for habitats of conservation importance are high. The overall sensitivity for habitats of conservation importance is therefore considered to be **high**.

Species of conservation importance

10.10.5.10 The value of species of conservation importance is considered to be high. The MarESA and FeAST sensitivity scores for species of conservation importance are high. The overall sensitivity for species of conservation importance is therefore considered to be **high**.

Magnitude of impact

10.10.5.11 Long-term seabed habitat loss will occur as a result of the operational presence of the Project infrastructure. The maximum seabed footprint for each element of the Project is detailed within **Table 10.18**. Based upon the maximum design scenario, it is anticipated that there will be up to 13.137km^2 of long-term habitat loss from the Project infrastructure including associated scour protection, which accounts for approximately 1.04**%** of the substrate present within the OAA and offshore export cable corridor Red Line Boundary.

10.10.5.12 In these areas, the change would represent a substantial shift from natural sedimentary substrate to hard substrate (for example, concrete structures or rock armour). A proportion of this within the direct footprint of structures will be lost as habitat entirely.

Table 10.18 Area of subtidal habitat likely to be lost as a result of the Project

Project component	Subtidal area disturbed
Anchors	0.27km^2
Array cables	2.04km^2
SDCs	0.0478km^2
Offshore substations	0.0396km^2
Offshore export cables	10.5km^2
Cable crossings	0.231km^2

Project component	Subtidal area disturbed
RCPs	0.00845

10.10.5.13 The areas subject to change will occur over a wide spatial extent. However, the changes will be discrete and localised, either in the immediate vicinity of the infrastructure foundations (including scour protection) or along narrow, linear stretches of the cable route. As such, the footprint of habitat loss or conversion is small in proportion to the extent of similar habitats in the wider region.

10.10.5.14 While the change from natural to artificial substrate does not constitute complete functional loss, it alters the physical structure and ecological character, which may affect associated benthic communities. It should be noted that there is some potential for recolonisation of artificial hard structures by epifaunal species. While these changes will persist for the lifetime of the Project, considering the very limited spatial extent and ultimate reversibility, the overall magnitude of this impact is assessed as **low**.

Significance of residual effect

10.10.5.15 The Project's embedded environmental measures (as show in **Table 10.11**) include the use of micro siting (M-055) to avoid direct impacts to key sensitive receptors. As a result, the following effects are predicted for the relevant receptors:

- overall, it is predicted that the effect upon subtidal habitats and species is **Moderate Adverse** (**Potentially Significant**);
- overall, it is predicted that the effect upon shellfish is **Minor Adverse** (**Not Significant**);
- overall, it is predicted that the effect upon habitats of conservation importance is **Moderate Adverse** (**Potentially Significant**); and
- overall, it is predicted that the effect upon species of conservation importance is **Moderate Adverse** (**Potentially Significant**).

10.10.6 Impact O5: colonisation of hard substrates

Overview

10.10.6.1 The introduction of the hard substrates on the seabed and the WTG floating units, mooring lines and dynamic cables of WTGs within the water column may potentially affect the established benthic community by providing new habitat and ecosystem function. These hard substrates include:

- mooring lines and anchors on the seabed;
- array and export cable protection and cable crossing protection; and
- WTG floating units in the water column.

10.10.6.2 Colonisation of artificial hard substrates can lead to the establishment of communities that are not characteristic of the pre-development baseline environment. This may include an increase in sessile epibionts, including reef-associated organisms, or even non-native species (see **Section 10.9.5**), which could alter trophic interactions and local biodiversity. In shallow water where light allows, seaweeds and their associated fauna may also establish.

10.10.6.3 The maximum design scenario relating to colonisation of hard substrates is presented in **Table 10.10** Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 10.8**. The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 10.11** have been implemented as part of the Project.

Sensitivity or value of receptor

Subtidal habitats and species

10.10.6.4 The value of subtidal habitats and species is considered to be medium. MarESA and FeAST sensitivity scores are only available for a limited range of gravel substrates that have low resistance and resilience to this impact. Habitats on more mobile substrates are likely to have a greater resilience due to their inherent ability to recover from disturbance. Where natural hard substrates exist, the introduction of additional hard materials does not represent a substantial qualitative change. The overall sensitivity of subtidal habitats and species to this impact is therefore considered to be **medium**.

Shellfish

10.10.6.5 The value of shellfish is considered to range from medium to high. No MarESA sensitivity scores are available for velvet crab. Other species have a high to moderate tolerance to substratum loss, and a medium resistance to physical change. As a result, the overall sensitivity for shellfish is therefore considered to be **medium.**

Habitats of conservation importance

10.10.6.6 The value of habitats of conservation importance is high. No MarESA sensitivity scores are available for some habitats of conservation importance, however generally other habitats of conservation importance have no resistance and low resilience. Their sensitivity according to MarESA is high. The overall sensitivity for habitats of conservation importance is therefore considered to be **high**.

Species of conservation importance

10.10.6.7 The value of species of conservation importance is considered to be high. They have no resistance and low resilience to physical change and are of a high sensitivity according to MarESA. The overall sensitivity for species of conservation importance is therefore considered to be **high**.

Magnitude of impact

10.10.6.8 The introduction of artificial hard substrates (such as scour and cable protection) may lead to increased habitat heterogeneity and subsequently to new biological communities, specifically within soft sediment environments. These structures provide novel surfaces for colonisation by hard substrate-associated species. Post-construction studies of offshore wind farms show that turbine foundations support dense populations of filter feeders, typically blue mussels (*Mytilus edulis*), which has also been recorded on other structures projecting from the sea floor, such as oil platforms and pier pilings (Lindeboom *et al.* 2011). Such artificial substrates are reported to support faunal assemblages that differ significantly not only from those typical of soft sediment seabed, but also from those occurring on natural hard substrate (Wilhelmsson and Malm, 2008). The colonisation of the subsea structures is influenced by physical and biological factors, as well as by the position and orientation of the new substrate within the water column. Therefore, the assemblages on these structures may differ from those on the scour protection around them.

10.10.6.9 Monitoring studies of offshore windfarms to date indicate that the addition of artificial infrastructure in areas of soft sediment is not likely to have a significant effect on the native communities, at least in the short term (Lindeboom *et al.* 2011). These studies indicate that the benthic communities of the soft sediment areas occurring within turbine arrays were not considerably different from those occurring within reference areas.

10.10.6.10 In line with impacts relating to habitat loss, the overall magnitude of this change is considered **low.**

10.10.6.11 The addition of artificial substrates may act as a pathway for the spread of INNS by providing colonisation opportunities in habits previously unsuitable for them. This impact is assessed separately **Section 10.9.5** for construction impacts, and the same conclusions apply to O&M activities.

Significance of residual effect

10.10.6.12 The following effects are predicted for the relevant receptors:

- overall, it is predicted that the effect upon subtidal habitats and species is **Minor Adverse** (**Not Significant**);
- overall, it is predicted that the effect upon shellfish is **Minor Adverse** (**Not Significant**);
- overall, it is predicted that the effect upon habitats of conservation importance is **Moderate Adverse** (**Potentially Significant**); and
- overall, it is predicted that the effect upon species of conservation importance is **Moderate Adverse** (**Potentially Significant**).

10.10.7 Impact O6: EMF generated by array and export cables

Overview

10.10.7.1 The production of EMF during the operational stage of the Project has the potential to impact benthic species, notably decapod crustaceans through changes to behaviour, notably reduced mobility, production of a stress response and attraction to EMF (Hervé, 2021). This may in turn alter predator / prey dynamics and other trophic relationships, albeit on a very localised scale.

10.10.7.2 The maximum design scenario relating to EMF generated by array and export cables is presented in **Table 10.10** . Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 10.8.** The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 10.11** have been implemented as part of the Project.

Sensitivity or value of receptor

10.10.7.3 There were no relevant MarESA pressures and benchmarks available to inform the assessment on any of the receptors, due to the limited available information on the impacts of EMF on benthic species (Tillin and Tyler-Walters, 2014a, Tillin and Tyler-Walters, 2014b).

Shellfish

10.10.7.4 The studies available regarding effects of EMF on shellfish are generally species-specific, life-stage specific and there are certain groups that are poorly evidenced in the literature (e.g. molluscs) (Hervé, 2021). As a result, there continues to be a paucity of data regarding species sensitivity to EMF and the effects upon marine invertebrates, specifically regarding effect thresholds.

10.10.7.5 A review of the sensitivities of a range of benthic invertebrates to EMF undertaken by Normandeau (2011) concluded that there was no direct evidence to support impacts from subsea cables on invertebrate species. This was based upon the fact that although a range of invertebrate species are sensitive to EMF during laboratory experiments, the levels at which responses / impacts are observed are orders of magnitude higher than those generated in the field.

10.10.7.6 For decapod crustaceans, the sensitivity of brown crab has been used as a proxy for sensitivity to EMF. Laboratory studies undertaken by Scott *et al*. (2021) reported that a field strength of less than 250μT, no changes to behaviour or stress response was observed in brown crab. Scott *et al*. reported that behavioural responses such as attraction and production of a stress response occurred at field strengths above 500μT.

10.10.7.7 Limited information is available on the effects of EMF on cuttlefish. Therefore, a precautionary approach has been taken and the sensitivity of cuttlefish to the impact is considered to be **low**.

10.10.7.8 Overall, the sensitivity of the shellfish receptor group to EMF generated by array and export cables is considered to range from **very low** to **low**.

Magnitude of impact

10.10.7.9 The installation of array cables and array cable to landfall(s) / export cables to landfall(s) will include High Voltage Alternating Current cables under the maximum design scenario. EMFs are generated by 2 main components: electric fields (E-fields) and magnetic fields (B-fields). The strength of these fields depends on the amount of current flowing through the cable and the potential difference (voltage) across it.

10.10.7.10 Magnetic fields are not shielded by cable insulation and can extend into the surrounding water. The strength of these fields varies depending on the amount of current flowing through the cable and can be detected by species sensitive to magnetic fields (magneto-sensitive species).

10.10.7.11 Unlike magnetic fields, electric fields generated by subsea cables are usually contained within the cable's insulation, so under normal conditions, marine species are not directly exposed to the electric field itself. However, when a conductor (like a fish, or seawater from tidal movement) moves through the produced magnetic field, it can induce a secondary electric field, called an induced electric field (iE-fields). Induced electric fields can be detectable by electrosensitive species. Alternating current (AC) cables have the potential to produce weak induced electric fields in the range of microvolts per metre (μV/m). Background measurements of the magnetic field are approximately 50μT across the North Sea (similar to the global average), and the naturally occurring electric field in the North Sea is approximately 25μV/m. The calculated background magnetic field in the OAA is approximately 50μT (National Oceanic Atmospheric Administration, 2025).

10.10.7.12 FeAST gives a benchmark of elevated local electric field of 1V/m above ambient, or local magnetic field of 10μT due to anthropogenic means. The potential EMF produced by the Project has been modelled and is reported in **Chapter 9: Electromagnetic Fields**. The modelling results are detailed within Table 9.7 of **Chapter 9: Electromagnetic Fields** and indicate that the 525kV voltage scenario would be the worst-case as the field extends horizontally for 11m before being attenuated to the 50μT background level, and the vertical field extends 7m around any single pole of the 525kV bipole cables. It should be stressed that this is the extent of the detectable field above background levels, and not the area wherein organisms might be adversely affected, which is much smaller. No adverse effects on benthic communities or shellfish have been observed historically from operational cables, as previously discussed and laboratory studies suggest responses occur at filed strengths an order of magnitude higher. The duration of impact will be long-term during the operational stage (35 years per Project phase), but reversible upon decommissioning with recovery expected to be rapid through natural recruitment. Considering the limited spatial extent and strength of the field around each cable, affecting an extremely small proportion of the available habitat, and that the cable will be buried, the magnitude of impact is considered to be **low**.

Significance of residual effect

10.10.7.13 The Project's embedded environmental measures (as shown in **Table 10.11**) include cable burial depth typically of up 2m (M-054), which is greater than the vertical extent of most fields with the exception of the 525 kV bipole cable where the field extends a vertical distance of 7m and therefore intersects the seabed surface.

10.10.7.14 As a result, the majority of the cable fields will not interact with shellfish near the seabed surface apart from the 525 kV bipole cable which will affect an area of approximately 4.48km^2. In the context of the area of similar habitats located within the wider region, this is not an appreciable proportion. In view of the small geographical range of effect and the relative insensitivity of shellfish to this impact, it is predicted that the effect on shellfish is **Negligible** to **Minor Adverse** (**Not Significant**).

10.10.8 Impact O7: operational noise on shellfish

Overview

10.10.8.1 During the O&M stage of the Project, maintenance activities have the potential to generate underwater noise during cable burial replacement and maintenance.

10.10.8.2 The effects of underwater noise on invertebrates are detailed in **paragraph 10.9.6.1** to **paragraph 10.9.6.4**.

10.10.8.3 The maximum design scenario relating to noise and vibration during the O&M stage is presented in **Table 10.10**. Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 10.8**. The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 10.11** have been implemented as part of the Project.

Sensitivity or value of receptor

10.10.8.4 The explanation of values and sensitivity of receptors to noise and vibration is provided in **paragraph 10.9.6.6** to **paragraph 10.9.6.9**. The overall sensitivity of the shellfish receptor group to underwater noise is considered to be **low**.

Magnitude of impact

10.10.8.5 The impact is expected to be equal to or lower magnitude that that generated during the construction stage of the Project (see **Section 10.9.6**).

10.10.8.6 **Chapter 13: Fish Ecology** has assumed that a magnitude of medium for disturbance from underwater noise will be produced based upon the results from **Volume 3, Appendix 8.1**. However, it should be noted that fish species are more sensitive to noise than shellfish due to differences in physiology. Therefore, the overall magnitude of impact from all O&M activities that could generate underwater noise relating to the Project, considering all embedded environmental measures, is localised, reversible and medium-term in nature with an overall magnitude of **medium** (**Volume 3, Appendix 8.1**).

Significance of residual effect

10.10.8.7 The significance of the effects of underwater noise on shellfish during O&M is assessed as **Minor Adverse** (**Not Significant**).

10.11 Assessment of effects: decommissioning stage

10.11.1 Introduction

10.11.1.1 This Section provides an assessment of the effects for benthic, epibenthic and intertidal ecology from the decommissioning of the offshore elements of the Project.

10.11.1.2 The assessment methodology set out in **Section 10.8** has been applied to assess effects to benthic, epibenthic and intertidal ecology from the Project.

10.11.2 Impact D1: temporary disturbance of seabed habitat

Overview

10.11.2.1 Temporary habitat disturbance of seabed habitat will occur as a result of the removal of hard substrates during decommissioning. This has the potential to result in both adverse and beneficial impacts for subtidal and intertidal benthos.

10.11.2.2 The removal of scour protection and rock armour from areas with underlying soft sediment has the potential to increase areas of available habitat for re-colonisation by infaunal species that burrow as part of their life history strategy (including a wide variety of bivalves, polychaetes and *Nephrops)* thus resulting in a beneficial impact. However, for species that are adapted to living on hard substrates and have colonised the submerges structures, such as marine algae, encrusting sponges and some bivalves, this will result in habitat loss.

10.11.2.3 The maximum design scenario relating to the temporary habitat disturbance of seabed habitat is presented in **Table 10.10**.. Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 10.8**. The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 10.11** have been implemented as part of the Project.

Sensitivity or value of receptor

10.11.2.4 It should be noted that decommissioning activities will not lead to temporary disturbance of seabed habitat located outside of the OAA and offshore export cable corridor Red Line Boundary and therefore only habitats and species located within the OAA and offshore export cable corridor have been considered for this impact.

10.11.2.5 Intertidal habitats are not considered to be at risk of this impact due to the use of HDD. Likewise, blue carbon receptors are present within the wider study area and outside of the

OAA and offshore export cable corridor and therefore unlikely to be affected by this impact. As a result, these receptor groups have not been considered within this Section.

10.11.2.6 The explanation of values and sensitivity of receptors to temporary habitat disturbance of seabed habitat is provided in **Section 10.9.2**. In summary:

- the overall sensitivity of subtidal habitats and species, including shellfish, is considered to be **medium**; and
- the overall sensitivity for both habitats and species of conservation importance is considered to be **high**.

Magnitude of impact

10.11.2.7 Decommissioning activities within the Red Line Boundary are expected to follow the reverse of the construction stage of the Project. As a precautionary approach, this assessment will assume that the removal of all hard substrate installed as part of the Project will be removed.

10.11.2.8 It is understood that all infrastructure above the seabed will be removed. Any infrastructure below the seabed will be assessed to determine if it is less impactful (from an environmental perspective) to remove the infrastructure or leave it in position. For example, leaving the cable protection in situ may be beneficial to preserve the marine habitat that has developed during the Project's lifespan. Engagement with relevant stakeholders and regulatory bodies will help determine the most suitable approach. If artificial hard substrate is removed, this will result in areas of substrates being returned closer to their natural state and could result in areas of hard substrate such as bedrock, cobbles and boulders being exposed. In addition, the removal of hard structures will also expose some areas of softer sediments such as offshore sands and gravels and mixed sediments.

10.11.2.9 Regardless of the qualitative changes, the extent of habitat alteration if all hard structures are removed during decommissioning will be comparable to the magnitude of alterations experienced during the construction stage. In reality, it is expected that not all structures will be removed, and buried cables may be left in situ.

10.11.2.10 As such, considering the adverse nature of the impact, its limited spatial extent, partial reversibility and long-term duration, the overall magnitude of impact is assessed as **low**.

Significance of residual effect

10.11.2.11 The Project's embedded environmental measures (as shown in **Table 10.11**) include the adherence to a decommissioning programme (M-106) to reduce the risk of disturbance to key sensitive receptors. As a result, the following effects are predicted for the relevant receptors:

- the effect on subtidal habitats and species, including Shellfish, is **Minor Adverse** (**Not Significant**); and
- the effect on both habitats and species of conservation importance is **Moderate Adverse** (**Potentially Significant**).

10.11.3 Impact D2: temporary increase in suspended sediment and subsequent redeposition

Overview

10.11.3.1 Increases in suspended sediment have the potential to impact benthic ecology receptors through a variety of pathways as discussed in **Section 10.9.3**.

10.11.3.2 The following decommissioning activities could potentially give rise to increases in SSC and associated deposition of material within the OAA and the offshore export cable corridor:

- removal of foundation structures;
- cutting off of piles at foundation legs / anchors; and
- removal of buried cables, protection, and anchors.

10.11.3.3 The maximum design scenario relating to the temporary increase in suspended sediment deposition is presented in **Table 10.10**. Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 10.8**. The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 10.11** have been implemented as part of the Project.

Sensitivity or value of receptor

10.11.3.4 The explanation of values and sensitivity of receptors to temporary increases in suspended sediment and deposition is provided in **Section 10.9.3**. In summary:

- the overall sensitivity for intertidal and subtidal habitats and species, including shellfish, is considered to be **medium**;
- the overall sensitivity for habitats of conservation importance is considered to be **medium**;
- the overall sensitivity for species of conservation importance is considered to be **low**; and
- the overall sensitivity for blue carbon receptors is considered to be **low**.

Magnitude of impact

10.11.3.5 The removal of structures is expected to result in some localised seabed disturbance accompanied by temporary increases in SSC and deposition. Foundations involving piled solutions would be cut off at or just below, potentially causing a localised disturbance of the bed and a temporary increase in SSC.

10.11.3.6 It is understood that all infrastructure above the seabed will be removed. Any infrastructure below the seabed will be assessed to determine if it is less impactful (from an environmental perspective) to remove the infrastructure or leave it in position. For example, leaving the cable protection in situ may be beneficial to preserve the marine habitat that has developed during the Project's lifespan. Engagement with relevant stakeholders and regulatory bodies will help determine the most suitable approach. If the cables are removed from the seabed during decommissioning, it is probable that equipment similar to that used to install the cables could be used to reverse the burial process and expose the cables. Accordingly, the area of seabed impacted during the removal of the cables would be similar as the area impacted during the installation of the cables. It is assumed there will be no decommissioning works required in the intertidal zone; thus intertidal receptors are excluded.

10.11.3.7 For all of the above, the changes in SSC and the accompanying changes to bed levels than those associated with decommissioning activities are expected to be lesser than that associated with construction.

10.11.3.8 It is expected that suspended sediments will take the same amount of time to fall out of suspension as during construction activities. This will likely result in a temporary, localised, adverse and reversible impact. As such, the magnitude of this impact is assessed as **low**.

Significance of residual effect

10.11.3.9 The predicted effect for all benthic receptors is **Minor Adverse** (**Not Significant**).

10.11.4 Impact D3: mobilisation of sediment associated contaminants

Overview

10.11.4.1 The maximum design scenario relating to the direct and indirect seabed disturbances leading to the release of sediment contaminants is presented in **Table 10.10**. Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 10.8**. The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 10.11** have been implemented as part of the Project.

Sensitivity or value of receptor

10.11.4.2 The sensitivity of each receptor is detailed within **paragraph 10.9.4.3** to **paragraph 10.9.4.10**.

10.11.4.3 In summary:

- sensitivity of intertidal habitats and species is considered to be **low**;
- sensitivity of subtidal habitats and species is considered to be **medium**;
- sensitivity of shellfish is considered to be **low**;
- sensitivity for both habitats and species of conservation importance is considered to be **high**; and
- sensitivity of blue carbon habitats is considered to be **high.**

Magnitude of impact

10.11.4.4 The impact is expected to be equal to or lower magnitude than that generated during the construction stage of the Project (see **Section 10.9.4**) and therefore **negligible.**

Significance of residual effect

10.11.4.5 The following effects are predicted for the relevant receptors:

- overall, it is predicted that the effect on intertidal habitats and species is **Negligible** (**Not Significant**);

- overall, it is predicted that the effect on subtidal habitats and species is **Minor Adverse** (**Not Significant**);
- overall, it is predicted that the effect on shellfish is **Negligible** (**Not Significant**);
- overall, it is predicted that the effect on habitats of conservation importance is **Minor Adverse** (**Not Significant**);
- overall, it is predicted that the effect on species of conservation importance is **Minor Adverse** (**Not Significant**); and
- overall, it is predicted that the effect on blue carbon is **Minor Adverse** (**Not Significant**).

10.11.5 Impact D4: underwater noise and vibration on shellfish

Overview

10.11.5.1 During the decommissioning stage of the Project, the removal of structures and cables will generate underwater noise and vibration.

10.11.5.2 The effects of underwater noise on invertebrate species are detailed within **paragraph 10.9.6.1** to **paragraph 10.9.6.4**.

10.11.5.3 The maximum design scenario relating to noise and vibration during the decommissioning stage is presented in **Table 10.10**. Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 10.8**. The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 10.11** have been implemented as part of the Project.

Sensitivity or value of receptor

10.11.5.4 The explanation of the sensitivity of shellfish receptors to underwater noise and vibration is provided in **Section 10.9.6**, which concluded that the overall sensitivity of the shellfish receptor group to noise is **low**.

Magnitude of impact

10.11.5.5 The impact is expected to be equal to or lower magnitude that that generated during the construction stage of the Project (see **Section 10.9.6**).

10.11.5.6 Based on the results from **Volume 3, Appendix 8.1** it is concluded that noise from decommissioning activities, considering all embedded environmental measures, is likely to be relatively localised, reversible and of limited duration. The overall magnitude is therefore assessed as **medium**.

Significance of residual effect

10.11.5.7 Overall, it is predicted that the effect of underwater decommissioning noise on Shellfish is **Minor Adverse** (**Not Significant**).

10.11.6 Impact D5: increased risk of introduction or spread of marine INNS

Overview

10.11.6.1 The removal of infrastructure will lead to increased vessel traffic, which has the potential to lead to the introduction of INNS and subsequently has the potential to impact benthic, epibenthic and intertidal ecology receptors. The introduction of INNS has the potential to result in changes to species composition, increased competition for resources (including space and food sources) and potential increased predation on native species.

10.11.6.2 The maximum design scenario relating to the increased risk or introduction of spread to marine INNS is presented in **Table 10.10**. Where predicted effects are identified, an assessment of the magnitude of change for each effect has been completed based on the methodology provided in **Section 10.8.** The magnitude of change, and hence the significance of potential effects has been assessed on the assumption that the embedded environmental measures from **Table 10.11** have been implemented as part of the Project.

10.11.6.3 The Outline Offshore INNS Management Plan identifies all Project activities as presenting a low risk of INNS introduction. This, combined with the mitigation measures set out in the INNS plan and M-102, are expected not to result in any increase in the rate of introduction of INNS into Scottish waters, or to their spread within the Project's Red Line Boundary or beyond. The magnitude of impact to benthic ecology receptors is thus classed as **negligible** (comparable to natural variation).

Sensitivity or value of receptor

10.11.6.4 The explanation of values and sensitivity of receptors to increased risk of introduction or spread of marine INNS is provided in **Section 10.11.6.** In summary:

- the overall sensitivity for intertidal habitats and species is considered to be **medium**;
- the overall sensitivity for subtidal habitats and species is considered to be **medium** to **high**;
- the overall sensitivity for shellfish is considered to be **medium**;
- the overall sensitivity for habitats and species of conservation importance is considered to be **high**; and
- the overall sensitivity for blue carbon receptors is considered to be **high**.

Magnitude of impact

10.11.6.5 Considerations regarding the potential magnitude of impacts associated with INNS and their mitigation are described in **Section 10.9.5.** The impact is expected to be equal to or lower magnitude that that generated during the construction stage of the Project thus it is anticipated that the magnitude of impact to benthic, epibenthic and intertidal ecology receptors will be **negligible**.

Significance of residual effect

10.11.6.6 The potential introduction and spread of INNS during decommissioning is assessed as **Minor Adverse** (**Not Significant**) for all benthic ecology receptors.

10.12 Summary of effects

10.12.1.1 A summary of the effects arising from the construction, O&M and decommissioning stages of the Project in relation to benthic, epibenthic and intertidal ecology are summarised in **Table 10.19**.

Table 10.19 Summary of effects on benthic, epibenthic and intertidal ecology

Receptor	Sensitivity / value	Activity and potential effect	Embedded environmental measures	Magnitude of impact	Significance of effects
Construction					
Subtidal habitats and species	**Medium**	C1: temporary disturbance of seabed habitat.	M-028 M-054 M-055 M-056	**Low**	**Minor Adverse** (**Not Significant**).
Shellfish	**Medium**				**Minor Adverse** (**Not Significant**).
Habitats of conservation importance	**High**				**Minor Adverse** (**Not Significant**) to **Moderate Adverse** (**Potentially Significant**).
Species of conservation importance	**High**				**Minor Adverse** (**Not Significant**) to **Moderate Adverse** (**Potentially Significant**).
Intertidal habitats and species	**Medium**	C2: Temporary increase in suspended sediment and deposition.	M-028 M-054 M-056	**Low**	**Minor Adverse** (**Not Significant**).
Subtidal habitats and species	**Medium**				
Shellfish	**Low**				
Habitats of conservation importance	**Medium**				

Receptor	Sensitivity / value	Activity and potential effect	Embedded environmental measures	Magnitude of impact	Significance of effects
Species of conservation importance	**Low**				
Blue carbon	**Low**				
Intertidal habitats and species	**Low**	C3: Mobilisation of sediment associated contaminants.	M-028 M-054 M-056	**Negligible**	**Negligible** (**Not Significant**).
Subtidal habitats and species	**Medium**				**Minor Adverse** (**Not Significant**).
Shellfish	**Low**				**Negligible** (**Not Significant**).
Habitats of conservation importance	**High**				**Minor Adverse** (**Not Significant**).
Species of conservation importance	**High**				**Minor Adverse** (**Not Significant**).
Blue carbon	**High**				**Minor Adverse** (**Not Significant**).
Intertidal habitats and species	**Medium**	C4: Increased risk of introduction and spread of INNS.	M-102	**Negligible**	**Minor Adverse** (**Not Significant**).
Subtidal habitats and species	**Medium to high**				
Shellfish	**Medium**				
Habitats of conservation importance	**High**				

Receptor	Sensitivity / value	Activity and potential effect	Embedded environmental measures	Magnitude of impact	Significance of effects
Species of conservation importance	**High**				
Blue carbon	**High**				
Shellfish	**Low**	C7: Underwater noise and vibration.	M-105 M-114	**Medium**	**Minor Adverse** (**Not Significant**).
O&M					
Subtidal habitats and species	**Medium**	O1: Disturbance of seabed habitat.	M-121	**Negligible to low**	**Minor Adverse** (**Not Significant**).
Shellfish	**Medium**				**Minor Adverse** (**Not Significant**).
Habitats of conservation importance	**High**				**Minor Adverse** (**Not Significant**) to **Moderate Adverse** (**Potentially Significant**).
Species of conservation importance	**High**				**Minor Adverse** (**Not Significant**) to **Moderate Adverse** (**Potentially Significant**).
Intertidal habitats and species	**Medium**	O2: Temporary increase in suspended sediment and redeposition.	M-121	**Low**	**Minor Adverse** (**Not Significant**).
Subtidal habitats and species	**Medium**				
Shellfish	**Medium**				

Receptor	Sensitivity / value	Activity and potential effect	Embedded environmental measures	Magnitude of impact	Significance of effects
Habitats of conservation importance	**Medium**				
Species of conservation importance	**Low**				
Blue carbon	**Low**				
Intertidal habitats and species	**Low**	O3: Mobilisation of sediment associated contaminants.	M-121	**Negligible**	**Negligible** (**Not Significant**).
Subtidal habitats and species	**Medium**				**Minor Adverse** (**Not Significant**).
Shellfish	**Low**				**Negligible** (**Not Significant**)
Habitats of conservation importance	**High**				**Minor Adverse** (**Not Significant**).
Species of conservation importance	**High**				**Minor Adverse** (**Not Significant**).
Blue Carbon	**High**				**Minor Adverse** (**Not Significant**).
Subtidal habitats and species	**High**	O4: Long-term habitat loss.	M-121	**Low**	**Moderate Adverse** (**Potentially Significant**).
Shellfish	**Medium**				**Minor Adverse** (**Not Significant**).
Habitats of conservation importance	**High**				**Moderate Adverse** (**Potentially Significant**).

Receptor	Sensitivity / value	Activity and potential effect	Embedded environmental measures	Magnitude of impact	Significance of effects
Species of conservation importance	**High**				**Moderate Adverse** (**Potentially Significant**).
Subtidal habitats and species	**Medium**	O5: Creation of areas of hard substrate.	-	**Low**	**Minor Adverse** (**Not Significant**).
Shellfish	**Medium**				**Minor Adverse** (**Not Significant**).
Habitats of conservation importance	**High**				**Moderate Adverse** (**Potentially Significant**).
Species of conservation importance	**High**				**Moderate Adverse** (**Potentially Significant**).
Shellfish	**Very low to low**	O6: EMF generated by array and export cables.	-	**Low**	**Negligible** to **Minor Adverse** (**Not Significant**).
Shellfish	**Low**	O7: Operational Noise.	M-105 M-114	**Medium**	**Minor Adverse** (**Not Significant**).
Decommissioning					
Subtidal habitats and species	**Medium**	D1: Temporary disturbance of seabed habitat.	M-106	**Low**	**Minor Adverse** (**Not Significant**).
Shellfish	**Medium**				**Minor Adverse** (**Not Significant**).
Habitats of conservation importance	**High**				**Moderate Adverse** (**Potentially Significant**).
Species of conservation importance	**High**				**Moderate Adverse** (**Potentially Significant**).

Receptor	Sensitivity / value	Activity and potential effect	Embedded environmental measures	Magnitude of impact	Significance of effects
Intertidal habitats and species	**Medium**	D2: Temporary increase in suspended sediment and subsequent redeposition.	M-106	**Low**	**Minor Adverse** (**Not Significant**).
Subtidal habitats and species	**Medium**				
Shellfish	**Medium**				
Habitats of conservation importance	**Medium**				
Species of conservation importance	**Low**				
Blue carbon	**Low**				
Intertidal habitats and species	**Low**	D3: Mobilisation of sediment associated contaminants.	M-106	**Negligible**	**Negligible** (**Not Significant**).
Subtidal habitats and species	**Medium**				**Minor Adverse** (**Not Significant**).
Shellfish	**Low**				**Negligible Adverse** (**Not Significant**).
Habitats of conservation importance	**High**				**Minor Adverse** (**Not Significant**).
Species of conservation importance	**High**				**Minor Adverse** (**Not Significant**).
Blue carbon	**High**				**Minor Adverse** (**Not Significant**).

Receptor	Sensitivity / value	Activity and potential effect	Embedded environmental measures	Magnitude of impact	Significance of effects
Shellfish	**Low**	D4: Underwater noise and vibration.	M-106	**Medium**	**Minor Adverse** (**Not Significant**).
Intertidal habitats and species	**Medium**	D5: Increased risk of introduction or spread of marine INNS.	M-102 M-106	**Negligible**	**Minor Adverse** (**Not Significant**)
Subtidal habitats and species	**Medium to high**				
Shellfish	**Medium**				
Habitats of conservation importance	**High**				
Species of conservation importance	**High**				
Blue carbon	**High**				

10.13 Transboundary effects

10.13.1.1 Transboundary effects arise when impacts from a development with one European Economic Area State affects the environment of another European Economic Area State(s). A screening of transboundary effects has been carried out and is presented in Appendix 4B of the Scoping Report (MarramWind Ltd., 2023).

10.13.1.2 Based on the knowledge of the baseline environment, the nature of planned works and the wealth of evidence on the potential for impact from such projects more widely, there are not considered to be any transboundary effects on benthic, epibenthic and intertidal ecology receptors from the Project.

10.14 Inter-related effects

10.14.1.1 A description and assessment of the likely inter-related effects arising from the Project on benthic, epibenthic and intertidal ecology is provided in **Chapter 32: Inter-Related Effects**.

10.15 Assessment of cumulative effects

10.15.1.1 A description and assessment of the cumulative effects arising from the Project on benthic, epibenthic and intertidal ecology is provided in **Chapter 33: Cumulative Effects Assessment**.

10.16 Summary of residual likely significant effects

10.16.1.1 **Table 10.20** presents a summary of the residual likely significant effects on benthic, epibenthic and intertidal ecology receptors assessed in the Chapter.

Table 10.20 Summary of assessment of residual likely significant effects for benthic, epibenthic and intertidal ecology

Activity and potential effect	Receptor	Embedded environmental measures	Sensitivity	Magnitude	Significance	Additional mitigation measures	Assessment of residual likely significant effects
Construction							
Impact C1: Disturbance of seabed	Habitats of conservation importance. Species of conservation importance.	M-028 M-054 M-055 M-056	**High**	**Low**	**Minor Adverse** (**Not Significant**) to **Moderate Adverse** (**Potentially Significant**).	It is considered that these impacts are highly unlikely to prove significant effects.	**Minor Adverse** (**Not Significant**).
O&M							
Impact O1: Disturbance of seabed habitat	Habitats of conservation importance. Species of conservation importance.	M-121	**High**	**Negligible** to **low**	**Minor Adverse** (**Not Significant**) to **Moderate Adverse** (**Potentially Significant**).	It is considered that these impacts are highly unlikely to prove significant effects.	**Minor Adverse** (**Not Significant**).
Impact O4: Long-term habitat loss	Subtidal habitats. Habitats of conservation importance.	M-121	**High**	**Low**	**Moderate Adverse** (**Potentially Significant**).	It is considered that these impacts are highly unlikely to prove	**Moderate Adverse** (**Not Significant**).

Activity and potential effect	Receptor	Embedded environmental measures	Sensitivity	Magnitude	Significance	Additional mitigation measures	Assessment of residual likely significant effects
	Species of conservation importance.					significant effects.	
Impact O5: Colonisation of hard substrates	Habitats of conservation importance.	-	**High**	**Low**	**Moderate Adverse** (**Potentially Significant**).	It is considered that these impacts are highly unlikely to prove	**Moderate Adverse** (**Not Significant**).
	Species of conservation importance.	-	**High**	**Low**	**Moderate Adverse** (**Potentially Significant**).	It is considered that these impacts are highly unlikely to prove	**Moderate Adverse** (**Not Significant**).

10.17 References

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10.18 Glossary of terms and abbreviations

10.18.1 Abbreviations

Acronym	Definition
blows/minute	blows per minute
CBRA	Cable Burial Risk Assessment
EEA	European Environment Agency
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EMODnet	European Marine Observation and Data Network
EPS	European Protected Species
EUNIS	European Nature Information System
FeAST	Feature Activity Sensitivity Tool
INNS	Invasive Non-Native Species
JNCC	Joint Nature Conservation Committee
kilometres	km
MarESA	Marine Evidence-bases Sensitivity Assessment
MarLIN	Marine Life Information Network
MD-LOT	Marine Directorate – Licensing Operations Team
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MPA	Marine Protected Area
MPCP	Marine Pollution Contingency Plan
MSFD	Marine Strategy Framework Directive
O&M	Operation and Maintenance
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
PAH	Polycyclic Aromatic Hydrocarbon
PEMP	Project Environmental Monitoring Plan
PMF	Priority Marine Features

Acronym	Definition
RCP	Reactive Compensation Platform
RIAA	Report to Inform Appropriate Assessment
SAC	Special Area of Conservation
SDC	Subsea Distribution Centre
SSC	Suspended Sediment Concentration
UXO	Unexploded Ordnance
ZOI	Zone of Influence

10.18.2 Glossary of terms

Term	Definition
Annex I reef	Refers to a marine habitat listed under Habitat 1170 of the EU Habitats Directive (92/43/EEC). Hard compact substrata on solid and soft bottoms, which arise from the sea floor in sublittoral and littoral zones.
Biogenic reef	Created by living organisms.
Epifauna	Benthic organisms that live on the surface of the seabed or on submerged structures such as rocks, shells or marine vegetation.
Geogenic reef	Refers to a reef that has developed naturally over time through geological processes, without significant biological contribution.
ICES rectangles	ICES statistical rectangles provide a grid covering the area between 360N and 85030’N and 440W and 68030’E. Fisheries data collected by the ICES is recorded and collated according to these statistical rectangles.
Infauna	Benthic organisms that inhabit the sediments of the seafloor, living within or partially within the substrate.
Shellfish	Aquatic invertebrates characterised by an external shell or shell-like exoskeleton. They are commonly divided into 2 primary groups: molluscs and crustaceans.
Tidal excursion	The net horizontal distance that a water particle travels due to tidal currents between low-water slack tide and high-water slack tide.
Resilience	Refers to the ability of a receptor to recover from disturbance or stress.
Resistance	Indicates whether a receptor can absorb disturbance or stress without changing character.
Zone of Influence	Refers to the area surrounding the Offshore Project that may experience direct or indirect ecological effects due to changes in environmental conditions.

MarramWind