Bowdun Offshore Wind Farm, Offshore EIA Report

Volume 2, Chapter 8: Benthic Ecology

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Glossary

Defined Term	Definition
Additional Mitigation	Also referred to as secondary mitigation which is defined by The Institute of Sustainability and Environmental Professionals (ISEP) (formerly Institute of Environmental Management and Assessment (IEMA)) as: actions that will require further activity in order to achieve the anticipated outcome. These may be imposed as part of the planning consent, or through inclusion in the EIA Report (sic).
Annex I	Habitats of community interest whose conservation requires the designation of Special Areas of Conservation (SACs), as identified in Annex I1 of the Habitats Directive (Council Directive 92/43/EEC).
Applicant (the)	Bowdun Offshore Wind Farm Limited (BOWFL).
Appropriate Assessment (AA)	An assessment to determine the implications of a plan or project for a European site in view of that site's conservation objectives. An Appropriate Assessment forms part of the Habitats Regulations Appraisal (HRA) and is required when a plan or project (either alone or in combination with other plans or projects) is likely to have a significant adverse effect on a European site.
Array Area	The Array Area is the area in which the Offshore Generation Assets will be located.
Benthic	Living on or in the seabed.
Biotope	A term which refers to the combination of physical environment (habitat) and its distinctive assemblage of conspicuous species. The biotope concept is used to enable description and comparison. Within biotope names, Latin names of species are used in full on every mention (e.g. Genus species) and never abbreviated or referred to using a common name,
Blue Carbon	Carbon captured by the world's ocean and coastal ecosystems. Typically includes carbon stored within ocean sediments and ocean vegetation such as seagrasses or kelp.
Bowdun Offshore Wind Farm Limited (BOWFL)	A Special-Purpose Vehicle (SPV) (legal entity) for the purpose of developing the Project. BOWFL are the Applicant for the Offshore Application.
Circalittoral	The subzone of the rocky sublittoral below that dominated by algae (the infralittoral) and dominated by animals.
Crown Estate Scotland (CES)	Public corporation accountable to Scottish Government, responsible for the management of land and property, including marine assets in Scotland owned by the monarch.
Cumulative Effects	The effects of the Proposed Development assessed together with effects from the Onshore Infrastructure forming the Project as well as one or more different projects on the same receptor/resource.
Effect	Term used to express the consequence of an impact (i.e. the result of change or changes) on specific environmental resources or receptors. The significance of an effect is determined by correlating the magnitude of the impact with the importance, or sensitivity of the receptor or resource in accordance with defined significance criteria.

Defined Term	Definition
Embedded Mitigation	Measures that are adopted as part of the Proposed Development and therefore assessed within the EIA. The proposed approach for the EIA for the Proposed Development is that Embedded Mitigation includes both primary mitigation and tertiary mitigation. These are defined by the ISEP as follows: Primary: Modifications to the location or design of the development made during the pre-application phase that are an inherent part of the project, and do not require additional action to be taken. Tertiary: Actions that would occur with or without input from the EIA feeding into the design process. These include actions that will be undertaken to meet other existing legislative requirements, or actions that are considered to be standard practices used to manage commonly occurring environmental effects.
Environmental Impact Assessment (EIA)	Process for the assessment of likely significant environmental effects of a project on the physical, biological and human environment during construction, Operation and Maintenance (O&M) and decommissioning.
Environmental Impact Assessment Regulations (EIA Regulations)	Terminology used in this Offshore EIA Report to refer to three sets of regulations: • The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; • The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017; and • The Marine Works (Environmental Impact Assessment) Regulations 2007.
European Sites	This term recognises SACs, candidate SACs (cSACs), Sites of Community Importance (SCIs), Special Protection Areas (SPAs), possible SACs (pSACs), potential SPAs (pSPAs) and Ramsar sites (where also designated as another European Site), which protect species and habitats shared across Europe and were originally designated under European legislation.
Export Cable Corridor	The area seaward of Mean High Water Springs (MHWS) which connects the Array Area with the Landfall within which the Offshore Export Cables will be installed.
Habitats Regulations	A term that refers to the collective legislation that translates the Habitats Directive into specific legal obligations in Scotland, namely: The Conservation (Natural Habitats, &c.) Regulations 1994; The Conservation of Habitats and Species Regulations 2017; and The Conservation of Offshore Marine Habitats and Species Regulations 2017 (in each case as amended).
Habitats Regulations Appraisal (HRA)	An assessment carried out under the Habitats Regulations to determine if a plan or project could adversely affect the integrity of a European Site.
High Voltage Alternating Current (HVAC)	A system of power transmission and distribution that utilises alternating current at voltages typically exceeding 1000 volts, as defined by the International Electrotechnical Commission (2015). HVAC systems are designed to efficiently deliver electricity over long distances with minimal losses, leveraging transformers to modify voltage levels.
Impact	A change caused by an action that occurs during a project’s lifetime.
Infauna	Organisms living within the seabed sediment.

Defined Term	Definition
Infralittoral	A subzone of the sublittoral in which upward-facing rocks are dominated by erect algae, typically kelps; it can be further subdivided into the upper and lower infralittoral.
Inter-Array Cables (IAC)	Cables which link the Wind Turbines to each other and with the Offshore Substation Platforms (OSPs).
Inter-Related Effects	The potential effects of multiple impacts from the construction, O&M and decommissioning of the Project, affecting one receptor.
Interconnector Cables	Cables which will connect individual OSPs to each other to provide redundancy against cable failure elsewhere.
Intertidal Area	The area between MHWS and Mean Low Water Springs (MLWS).
Landfall	The area in which the Offshore Export Cables make landfall and is also the transitional area between the Offshore Transmission Assets and the Onshore Transmission Assets. Located in the Intertidal Area at Benholm.
Likely Significant Effect (LSE)	A significant effect on a designated site that has the potential to occur as a result of the Proposed Development (as determined by the LSE Screening Report). Where a LSE cannot be ruled out, further assessment is needed as part of the AA.
Marine Directorate (MD)	The Marine Directorate of the Scottish Government, formerly known as Marine Scotland. The planning and licensing authority for Scotland's seas and custodian of Scotland's National Marine Plan (NMP). The Marine Directorate - Licensing Operations Team (MD-LOT) are specifically responsible for managing Section 36 Consent and Marine Licence Applications seaward of MHWS.
Marine Protected Areas (MPAs)	MPAs are designated under the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act (MCAA) 2009. The MPA network protects nationally and internationally important marine wildlife, habitats, geology, and underwater landforms. Scotland's MPAs are significantly important for European, North-East Atlantic, and global MPA networks.
Maximum Design Scenario (MDS)	The scenario within the design envelope likely to result in the greatest impact on a particular topic receptor, and therefore the one that should be assessed for that topic receptor.
Mean High Water Springs (MHWS)	The average tidal height throughout the year of two successive high waters during those periods of 24 hours when the range of the tide is at its greatest.
Mean Low Water Springs (MLWS)	The average tidal height throughout the year of two successive low waters during those periods of 24 hours when the range of the tide is at its greatest.
Mitigation	Measures to avoid, prevent, reduce or control effects on the environment. See also definitions for Embedded Mitigation and Additional Mitigation.
Offshore Environmental Impact Assessment (EIA) Report (hereafter, 'Offshore EIA Report')	Document prepared to report the findings of the EIA for the Proposed Development and produced in accordance with the EIA Regulations. The Offshore EIA Report is submitted to support the Offshore Application for the Proposed Development, and to comply with EIA Regulations.
Offshore Export Cables	Subsea cables used to transmit electricity generated offshore by the Wind Turbines from the OSPs to shore. The Transition Joint Bay is the location where the Offshore Export Cables terminate, and the onshore cabling begins.

Defined Term	Definition
Offshore Generation Assets	The infrastructure of the Proposed Development required to generate electricity comprising of the Wind Turbines, Wind Turbine foundations and associated infrastructure (e.g. IACs).
Offshore Infrastructure	All of the Offshore Infrastructure associated with the Proposed Development that is located seaward of MHWS, comprising the Offshore Generation Assets and the Offshore Transmission Assets.
Offshore Scoping Report	The report that presents the findings of the EIA scoping process undertaken for the Proposed Development with the purpose of obtaining a Scoping Opinion. The Offshore Scoping Report defines what is intended to be assessed and reported as part of the EIA.
Offshore Substation Platform(s) (OSPs)	OSPs comprise the support structure, topside and electrical components used for collecting and/or converting electricity generated by the Wind Turbines for transmission by the Offshore Export Cables.
Offshore Transmission Assets	The infrastructure of the Proposed Development required to transmit the generated electricity comprising of the OSPs, Offshore Export Cables and associated infrastructure up to MHWS.
Operation and Maintenance (O&M)	The phase of the Proposed Development following completion of construction. This phase of development includes routine inspections, repairs and replacement of infrastructure and equipment (including Interconnector Cables and IACs), Scour Protection replenishment or replacement, major component replacement, painting and/or other coating works, removal of marine growth, and replacement of access ladders.
Oslo Paris [Convention] (OSPAR)	OSPAR Convention (Convention for the Protection of the Marine Environment of the North-East Atlantic).
Pathway	Describes the means or route by which a receptor (such as the coast) can be affected by an identified impact source (such as Wind Turbine foundations).
Piling	The action of installing piles: installation can use various methodologies, the most common of which are impact piling (in which the piles are struck by a 'hammer') and drilling (during which a hole is drilled into the seafloor, the drilling tool is removed, and the pile is slotted into that hole).
Project (the)	An overarching term for the Bowdun Offshore Wind Farm (Bowdun OWF) comprising the offshore and onshore infrastructure required to generate and transmit electricity from the Array Area to the onshore GCP. The Project includes the Offshore Generation Assets, the Offshore Transmission Assets and the Onshore Transmission Assets.
Project Design Envelope (PDE)	A description of the range of possible elements that make up the design options for the Proposed Development under consideration when the exact engineering parameters are not yet known.
Proposed Development	Term used to define the Offshore Infrastructure associated with the Project seaward of MHWS for which consent is being sought. Further details of the parameters are included in Volume 1, Chapter 3: Project Description.
Qualifying Features	The features for which a European site has been officially designated to protect.

Defined Term	Definition
Report to Inform Appropriate Assessment (RIAA)	The RIAA provides detailed information to support the process of AA (undertaken by the competent authority) as part of the HRA, which evaluates the potential impacts of a project or plan on European Sites.
Scoping Opinion	A document produced by MD-LOT which is issued in response to submission and review of the Offshore Scoping Report. The Scoping Opinion is supported with feedback and advice from consultees, which details what is expected to be included in the Offshore EIA Report and what can be scoped out of the EIA process.
Scoping Workshop	A series of sessions preceding the finalisation of the Offshore Scoping Report to provide an opportunity for the Applicant to consult on the draft scope and for stakeholders to request additional information on key issues.
Scour Protection	Protective materials installed to avoid sediment being eroded away from the base of the foundations and/or buried subsea cable due to the flow of water.
Sectoral Marine Plan (SMP)	A plan developed by the Scottish Government which provide the strategically planned spatial footprint for offshore wind development in Scotland.
Significance	Effect factor that is determined by the magnitude of impact along with the sensitivity of the receptor.
Site Boundary	The boundary within which all elements of the Proposed Development will be located. The Site Boundary comprises the Array Area and Export Cable Corridor which ends at MHWS.
Special Areas of Conservation (SACs)	SACs are areas designated for the conservation of certain plant and animal species listed in the Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.
Special Protection Areas (SPAs)	SPAs are sites that are designated to protect rare or vulnerable birds (as listed on Annex I of the Directive 2009/147/EC on the conservation of wild birds), as well as regularly occurring migratory species.
Spring Tidal Excursion	The distance suspended sediment is transported prior to being carried back on the returning tide.
Statutory Nature Conservation Body (SNCB)	A statutory adviser to the UK and Scottish Governments on Scottish, UK and international nature conservation.
Study Area	For each environmental topic, the baseline environment will be characterised, and the potential environmental impacts will be described within a topic-specific study area. Specific study areas are defined for each topic and are based on the maximum spatial extent across which potential impacts of the Project may be experienced by the relevant receptors (i.e. Zone of Influence).
Subtidal	Areas of the coastal marine environment that lie below the level of MLWS and are continuously submerged by seawater.
Thistle Wind Partners (TWP)	Company established for the development of the Project.
Wind Turbines	Structures comprising of a tubular tower, rotor blades, and a nacelle which houses the Wind Turbine generator.
Zone of Influence	The geographical area within which the Proposed Development may have environmental effects.

Acronyms

Acronym	Definition
AC	Alternating Current
AL1	Action level 1
AL2	Action Level 2
BAP	Biodiversity Action Plan
BOEM	Bureau of Ocean Energy Management
CaP	Cable Plan
CBA	Cable Burial Assessment
CBRA	Cable Burial Risk Assessment
CCME	Canadian Council of Ministers of the Environment
CEA	Cumulative Effects Assessment
CEFAS	Centre for Environment, Fisheries, and Aquaculture Science
CIEEM	Chartered Institute for Ecology and Environmental Management
CMS	Construction Method Statement
CoCP	Code of Construction Practice
CSIP	Cable Specification and Installation Plan
CSQG	Canadian Sediment Quality Guidelines
DDV	Drop Down Video
DECC	Department of Energy and Climate Change
Defra	Department for Environment Food and Rural Affairs
EEA	European Economic Area
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EMODnet	European Marine Observation and Data Network
EMP	Environmental Management Plan
ES	Environmental Statement
EUNIS	European Nature Information System
FeAST	Feature Activity Sensitivity Tool
HDD	Horizontal Directional Drilling
HM	His Majesty's
HRA	Habitats Regulation Appraisal
HSE	Health and Safety Executive
IAC	Inter Array Cable
IEF	Important Ecological Feature
IMO	International Maritime Organization
INNS	Invasive Non-Native Species
JNCC	Joint Nature Conservation Committee
MarESA	Marine Evidence based Sensitivity Assessment

Acronym	Definition
MCCIP	Marine Climate Change Impacts Partnership
MDS	Maximum Design Scenario
MD-LOT	Marine Directorate – Licensing Operations Team
MFE	Mass Flow Extractor
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MPA	Marine Protected Area
MPCP	Marine Pollution Contingency Plan
MPS	Marine Policy Statement
NMP	National Marine Plan
NMPi	National Marine Plan interactive
OFTO	Offshore Transmission Owner
OSP	Offshore Substation Platform
OSPAR	Oslo Paris [Convention]
OWF	Offshore Wind Farm
O&M	Operation and Maintenance
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls
PDE	Project Design Envelope
PEL	Probable Effect Level
PMF	Priority Marine Feature
PSA	Particle Size Analysis
RIAA	Report to Inform Appropriate Assessment
SAC	Special Area of Conservation
SD	Standard Deviation
SMP	Sectoral Marine Plan
SNCBs	Statutory Nature Conservation Bodies
SPA	Special Protection Area
SSC	Suspended Sediment Concentration
SSEN	Scottish and Southern Electricity Networks
SSER	Scottish and Southern Energy Renewables
SSSI	Sites of Special Scientific Interest
TEL	Threshold Effect Level
UK	United Kingdom
UXO	Unexploded Ordnance
WMP	Waste Management Plan
ZoI	Zone of Influence

Table of Units

Units	Definition
%	Percent
°C	Degrees Celsius
mm	Millimetres
cm	Centimetre
m	Metres
km	Kilometre
m^2	Squared Metres
km^2	Squared Kilometres
m^3	Cubed Metres
m/s	Metre per second
mg/kg	Milligrams per kilogram
mg/l	Milligrams per litre
kg/s	Kilograms per second
MW	MegaWatt
GW	GigaWatt
Hz	Hertz
kV	Kilovolt
μV/m	Microvolts per metre
mV/m	Millivolts per metre
mT	Millitesla
μT	Microtesla
mG	Milligauss

8 Benthic Ecology

8.1 Introduction

8.1.1 This chapter of the Offshore Environmental Impact Assessment (EIA) Report presents the assessment of the likely significant environmental effects on benthic ecology, that may potentially occur as a result of the Proposed Development during the construction, Operation and Maintenance (O&M) and decommissioning phases.

8.1.2 The assessment presented is informed by the following technical chapters:

- Volume 2, Chapter 7: Physical Processes; and
- Volume 3, Technical Appendix 8.1: Benthic Ecology Technical Report.

8.2 Benthic Ecology Study Area

8.2.1 The study area(s) for benthic ecology are shown in Figure 8.1 and are defined as follows:

- The Local Benthic Ecology Study Area is defined as the area encompassed by the Site Boundary and a buffer of one Spring Tidal Ellipse (modelled as ranging from 6.22 km to 9.42 km around the Site Boundary). The buffer of one Spring Tidal Ellipse ensures the Local Benthic Ecology Study Area is large enough to account for the Zone of Influence (ZoI) of impacts to benthic ecology, which may extend beyond the Site Boundary, such as through increased Suspended Sediment Concentrations (SSC) and changes in physical processes.
- The Regional Benthic Ecology Study Area is defined as the area encompassing the Site Boundary and extends further into the North Sea. The Regional Benthic Ecology Study Area has been informed by the Scottish Offshore Wind Energy Plan North-East Region (Scottish Government, 2020a). This guidance outlines the offshore wind plan option areas, as well as the spread of other key industries in this region which has been used to ensure the Regional Benthic Ecology Study Area encompasses all the relevant projects and regional datasets which can help characterise the baseline. The Regional Benthic Ecology Study Area has been defined to ensure a comprehensive baseline is provided, and to provide wider context to the Local Benthic Ecology Study Area.

8.2.2 The Regional and Local Benthic Ecology Study Areas were presented during the Scoping Workshop, and it was agreed that the study areas were sufficient for the ZoI of impacts and appropriate for characterising benthic ecology. This was confirmed in the Scoping Opinion (Marine Directorate – Licensing Operations Team (MD-LOT), 2024) (see all relevant consultation in Section 8.4).

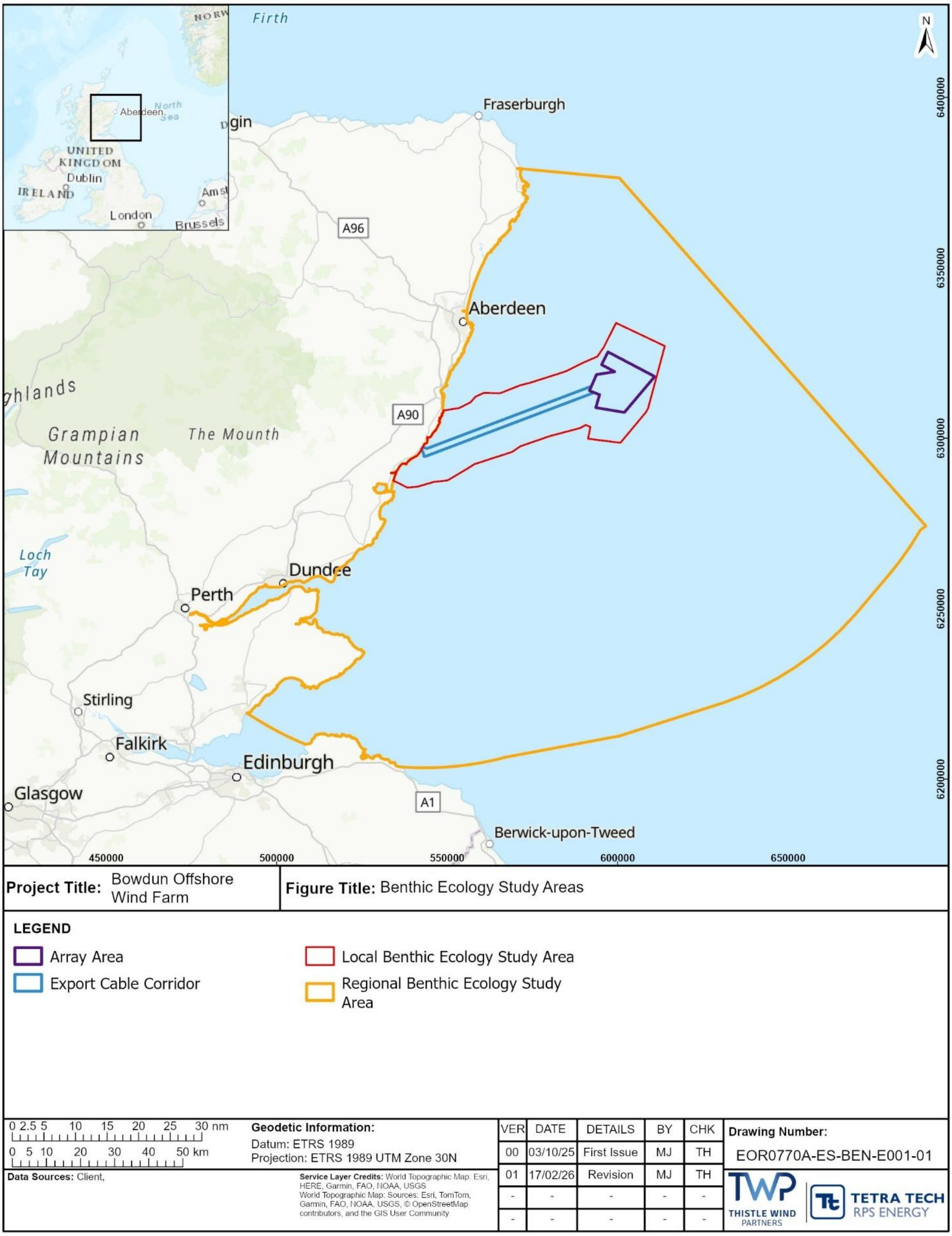


Figure 8.1: Benthic Ecology Study Areas

8.3 Legislative and Policy Context

8.3.1 A summary of the legislative provisions relevant to benthic ecology are provided in Table 8.1 below, with other relevant policy provisions set out in Table 8.2 to Table 8.4.

8.3.2 The overarching policy and legislation applicable to the Proposed Development is presented in Volume 1, Chapter 2: Policy and Legislation. Policy and legislation specific to benthic ecology, is contained in the Habitats Regulations, Sectoral Marine Plan (SMP) for Offshore Wind Energy (Scottish Government, 2020b) and the draft updated SMP for Offshore Wind Energy (Scottish Government, 2025), Scotland's National Marine Plan (NMP) (Scottish Government, 2015), and the United Kingdom (UK) Marine Policy Statement (MPS) (UK Government, 2011).

8.3.3 The Habitats Regulation Appraisal (HRA) has been prepared and presented separately in the Report to Inform Appropriate Assessment (RIAA) and provides an assessment of potential impacts on designated European sites, including Special Areas of Conservation (SACs) (RIAA, Part 2: Special Areas of Conservation (TWP-BOW-RPS-ENV-RPT-00014)) and Special Protection Areas (SPAs) (RIAA, Part 3: Special Protection Areas and Ramsar Sites (TWP-BOW-RPS-ENV-RPT-00015)).

Table 8.1: Summary of Habitats Regulations (Conservation of Offshore Marine Habitats and Species Regulations 2017 and Conservation of Habitats and Species Regulations 2017) Relevant to Benthic Ecology

Summary of Relevant Legislation	How and Where Considered in the Offshore EIA Report
Designated sites	
Before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which is to be carried out on or in any part of the waters, or on, or in any part of the seabed or subsoil comprising the offshore marine area, or on or in relation to an offshore marine installation, is likely to have a significant effect on a European offshore marine site or a European site (either alone or in combination with other plans or projects), and is not directly connected with or necessary to the management of the site, a competent authority must make an Appropriate Assessment of the implications for the site in view of that site's conservation objectives.	All relevant European and designated sites have been identified in Section 8.6, with their distances to the Proposed Development presented in Table 8.8. Relevant protected features of these designated sites have been defined as Important Ecological Features (IEFs) and assessed in relation to the potential impacts from the Proposed Development on benthic ecology features in Section 8.10.

Table 8.2: Summary of the SMP for Offshore Wind Energy (Scottish Government, 2020b) Relevant to Benthic Ecology

Summary of Relevant Policy	How and Where Considered in the Offshore EIA Report
Offshore Wind and Marine Renewable Energy Policy	
Regional cumulative effects include the potential for adverse effects on benthic habitats, bird populations, cetaceans, navigational safety, seascape, landscape, and commercial fisheries. The SMP for Offshore Wind Energy includes measures to mitigate likely significant effects at various scales. **(Plan Options - National Perspective, Section 4.1)**	The potential cumulative impacts of the Proposed Development alongside other plans, projects, and activities have been assessed within the Cumulative Effects Assessment (CEA) (Section 8.12).

Table 8.3: Summary of Scottish NMP (Scottish Government, 2015) Relevant to Benthic Ecology

Summary of Relevant Policy	How and Where Considered in the Offshore EIA Report
General Policies	
Development and use of the marine environment must: • **Comply with legal requirements for protected areas and protected species (including designated sites);** • **Not result in significant impact on the national status of Scottish Priority Marine Features (PMFs); and** • **Protect and enhance (where appropriate) the health of the marine area.** **(GEN 9 Natural Heritage)**	Protected areas, and associated relevant benthic designated species, have been identified in Table 8.8. These and other protected habitats and species, including PMFs, have been carried forward as IEFs in Table 8.9. These IEFs have been considered in the assessment of significance for benthic ecology impacts from the Proposed Development alone (Section 8.10) and cumulatively with nearby plans, projects, and activities (Section 8.12).
The management requirement of protected sites must be met. These include Marine Protected Areas (MPAs) and SACs, as well as former Natura 2000 sites and the marine components of Sites of Special Scientific Interest (SSSIs) and Ramsar sites. **(Site Protection, paragraphs 4.41 to 4.50)**	Protected sites with relevant benthic ecology features have been identified in Section 8.6, with distances to the Proposed Development presented in Table 8.8. The relevant benthic ecology features were identified as IEFs, which have been assessed in relation to the impact of the Proposed Development alone in Section 8.10 and cumulatively with other projects in Section 8.12.
The Marine Acts requires all regulators to ensure that there is no significant risk of hindering the achievement of the conservation objectives of an MPA before giving consent to an activity, plan, or project. A management intervention will be required if an ongoing activity presents a significant risk of hindering the achievement of an MPA's conservation objectives. This intervention will be practical and proportionate, utilising the most appropriate statutory mechanism to reduce the risk.	As stated above, designated sites, including MPAs, with relevant benthic ecology features have been identified in Section 8.6. These relevant benthic ecology features were identified as IEFs, which have been assessed in relation to the impact of the Proposed Development alone in Section 8.10 and cumulatively with other projects in Section 8.12.

Summary of Relevant Policy	How and Where Considered in the Offshore EIA Report
(Site Protection, paragraph 4.47)	
Opportunities to reduce the introduction of Invasive Non-Native Species (INNS) to a minimum or proactively improve the practice of existing activity should be taken when decisions are being made. **(GEN 10 Invasive non-native species)**	The potential impacts associated with INNS on relevant benthic ecology IEFs have been assessed within Section 8.10 for the Proposed Development alone. Additionally, an INNS Biosecurity Plan (Volume 4, Appendix 26: Marine Invasive and Non Native Species Biosecurity Plan)) has been included as an Embedded Mitigation (outlined in Section 8.9). This provides details on methods to reduce the risk of introduction or spread of INNS during all phases of the Proposed Development.
Cumulative impacts affecting the ecosystem of the marine plan area should be addressed in decision-making and plan implementation process. **(GEN 21 Cumulative Impacts)**	The potential cumulative impacts of the Proposed Development alongside other plans, projects, and activities have been assessed within the CEA (Section 8.12).
Offshore Wind and Marine Renewable Energy Policy	
Marine planners and decision makers should support the development of joint research and monitoring programmes for offshore wind and marine renewables energy developments. **(RENEWABLES 9)**	The potential need for monitoring is outlined in Section 8.13.

Table 8.4: Summary of UK MPS (UK Government, 2011) Relevant to Benthic Ecology

Summary of Relevant Policy	How and Where Considered in the EIA Report
General Policies	
Ensure a sustainable marine environment which promotes healthy, functioning marine ecosystems and protects marine habitats, species and our heritage assets. **(Introduction)**	The magnitude of potential benthic impacts and the sensitivity of IEFs are assessed to determine if any significant change from baseline conditions for each IEF is likely to occur in Section 8.10. The potential effects of a shifting future baseline due to climate change if the Proposed Development is not carried forward is discussed in Section 8.6. Embedded Mitigation measures adopted for the Proposed Development are listed in Section 8.9, with these used to reduce the potential impacts to benthic ecology IEFs as far as reasonably practicable.
Biodiversity is protected, conserved and recovered (where appropriate) and biodiversity loss has been halted. **(Box 1, Section 2.2, The high level marine objectives)**	

8.4 Consultation

8.4.1 The approach to consultation for the Proposed Development is set out in Volume 1, Chapter 5: Consultation and Engagement. A summary of the issues raised during consultation activities undertaken to date specific to benthic ecology is presented in Table 8.5, together with how these issues have been considered in the production of this assessment. Further detail is presented within Volume 1, Chapter 5: Consultation and Engagement, Volume 3, Technical Appendix 5.1: Consultation Log and Volume 3, Technical Appendix 5.2: Pre-Application Consultation Report.

Table 8.5: Summary of Key Consultation Issues Raised During Consultation Activities Undertaken for the Proposed Development Relevant to Benthic Ecology

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Offshore EIA Report
25/04/2024	NatureScot and MD-LOT Scoping Workshop	NatureScot agreed with the impacts proposed to be scoped in and out of the assessment, however they raised that some impacts will need to be assessed in the CEA despite being negligible in the project alone assessment (e.g. Electromagnetic Fields (EMF)).	The impacts scoped in to the assessment are listed in Table 8.10 as part of the Maximum Design Scenario (MDS) and those scoped out are listed and justified in Table 8.11. The impact of EMF has also been considered in Section 8.10 of the CEA.
18/10/2024	NatureScot (2024 Bowdun Offshore Wind Farm (OWF) Scoping Opinion – Scoping Response)	NatureScot were content with the Local Benthic Ecology Study Area and Regional Benthic Ecology Study Area proposed.	The agreed study areas have been outlined in Section 8.2.
		NatureScot were also content with the proposed data sources and guidance documents.	The full list of desktop data sources used to define the Local Benthic Ecology Study Area and Regional Benthic Ecology Study Area are provided in Table 8.6. Relevant guidance documents used to inform this chapter are provided in Section 8.8.
		NatureScot noted that whilst no sites overlap with the Array Area or Export Cable Corridor, various sites are within the Local Benthic Ecology Study Area.	Relevant designated sites have been identified in Section 8.6 and any MPAs with benthic features will be considered in Volume 3, Technical Appendix 8.3: Marine Protected Area Assessment and any SACs with benthic features will be considered in RIAA, Part 2: Special Areas of Conservation (TWP-BOW-RPS-ENV-RPT-00014).
		NatureScot was broadly content with the impacts proposed to be scoped in and out of the assessment.	The impacts scoped in to the assessment are listed in Table 8.10 as part of the MDS and those scoped out are listed and justified in Table 8.11.
		NatureScot advised that EMF should be scoped in for all cabling (buried and unburied) as burial will not completely remove the possibility of EMF effects on infaunal and epifaunal species. NatureScot also proposed that the spatial and temporal scale of the EMF impact be considered in the CEA.	The MDS for EMF is presented in Table 8.10 and includes consideration for the full lengths of Export Cables, IACs and Interconnector Cables regardless of if they are buried or not. The spatial and temporary impact of EMF has also been considered in Section 8.12.

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Offshore EIA Report
		NatureScot welcome the identification of Embedded Mitigation but further advised that the Offshore EIA Report must clearly articulate the measures within the relevant plans/programmes that will be adhered to in order to avoid or reduce the predicted significant adverse effect on the Proposed Development.	The relevant Embedded Mitigation measures are listed in Section 8.9, including the specific measures within the plans which reduce and avoid predicted significant adverse effects of the Proposed Development.
24/10/2024	Scottish Fisherman Federation (2024 Bowdun OWF Scoping Opinion – Scoping Response)	The Scottish Fisherman's Federation, recommended that the potential impact of thermal emissions from subsea electrical cables be scoped in for the construction phase of the Proposed Development.	The impact of thermal emissions from subsea electrical cables has been assessed in Section 8.10.
		The Scottish Fisherman's Federation, recommended that the potential impact of hard substrate removal also be scoped in for the construction phase of the Proposed Development.	The Proposed Development is not anticipating the removal of hard substrates in the construction phase and therefore this impact has not been included in the assessment of this phase. The temporary disturbance of boulders through boulder clearance has been included in regard to the temporary habitat loss and disturbance (Section 8.10). These boulders may be moved out of the path of the cable laying machinery however they will be moved to an area just beyond the cable corridor and they will not be removed from the environment, therefore this activity has not been considered as removal of hard substrate and not assessed as part of the construction phase.
25/11/2024	MD-LOT (2024 Bowdun OWF Scoping Opinion)	MD-LOT, in line with the NatureScot representation, were broadly content with the Local Benthic Ecology Study Area and Regional Benthic Ecology Study Area proposed.	The agreed study areas have been outlined in Section 8.2.
		MD-LOT requests that any unexpected survey results, such as previously unidentified benthic PMFs, are flagged to all relevant stakeholders prior to application submission, as supported by NatureScot.	The benthic ecology survey results are presented in Section 8.6, with no unexpected results or previously unidentified PMFs noted.
		MD-LOT advises consideration should be given to impacts on Blue Carbon as a result of the Proposed	The impacts on benthic marine sediments have been given consideration for the Proposed Development

Date	Consultee and Type of Consultation	Summary of Issue(s) Raised	Response to Issue Raised and/or Where Considered in this Offshore EIA Report
		Development, as well as an expanded assessment for benthic ecology to focus on potential impacts on marine sediments and coastal habitats.	alone in Section 8.12 and cumulatively with other projects in Section 8.12. Blue Carbon is given specific consideration in Volume 2, Chapter 22: Climatic Change.
		MD-LOT advises that the impact of EMFs should be scoped in for both the Proposed Development assessment alone and cumulatively with other projects. This is supported by NatureScot and the Scottish Fishermen Federation.	Potential impacts to IEFs have been identified in Table 8.10 as part of the MDS, with these assessed for the Proposed Development alone in Section 8.12 and cumulatively with other projects in Section 8.12.
		MD-LOT are content with the proposed mitigation but further advised that the EIA Report must clearly articulate the measures within the relevant plans/programmes that will be adhered to in order to avoid or reduce the predicted significant adverse effects of the Proposed Development.	The relevant Embedded Mitigation measures are listed in Section 8.9, including the specific measures within the plans which reduce and avoid predicted significant adverse effects of the Proposed Development.
		MD-LOT, in line with the NatureScot representation, agree that transboundary impacts can be scoped out from further consideration within the Offshore EIA Report.	This has been confirmed in the consideration of transboundary effects in Section 8.14.
		MD-LOT, in line with the Scottish Fisherman's Federation, recommended that the potential impact of hard substrate removal also be scoped in for the construction phase of the Proposed Development.	The Proposed Development is not anticipating the removal of hard substrates in the construction phase and therefore this impact has not been included in the assessment of this phase. The temporary disturbance of boulders through boulder clearance has been included in regard to the temporary habitat loss and disturbance (Section 8.10). These boulders may be moved out of the path of the cable laying machinery however they will be moved to an area just beyond the cable corridor and they will not be removed from the environment, therefore this activity has not been considered as removal of hard substrate and not assessed as part of the construction phase.

8.5 Data Sources

8.5.1 A range of published survey reports and datasets have been reviewed and analysed to inform this benthic ecology baseline.

Desktop Study

8.5.2 Information on benthic ecology within the Regional Benthic Ecology Study Area was collected through a detailed desktop review of existing studies and datasets which are summarised in Table 8.6.

8.5.3 A literature review of the reports was used to characterise the baseline. Volume 3, Technical Appendix 8.1: Benthic Ecology Technical Report includes full details of the analysis undertaken to develop the benthic ecology baseline.

Table 8.6: Summary of Key Data Sources

Title	Source	Extent	Year	Author
Marine Scotland National Marine Plan Interactive (NMPi) Maps	Marine Scotland	Regional Benthic Ecology Study Area	2025	NMPi (
European Marine Observation and Data Network (EMODnet) biogenic substrate in European waters dataset	EMODnet – Seabed Habitats	Regional Benthic Ecology Study Area	2025	EMODnet
One Benthic platform	Centre for Environment, Fisheries, and Aquaculture Science (Cefas)	Regional Benthic Ecology Study Area	2024	Cefas
Ossian Array EIA Report, Chapter 8: Benthic Subtidal Ecology	Ossian Offshore Wind Farm (OWF) Limited	Ossian OWF Array Area	2024a	Ossian OWFL,
Morven Offshore Wind Array Project EIA Scoping Report	Morven Offshore Wind Limited	Morven OWF Array Area	2023	MvOWL
MPA Mapper	Joint Nature Conservation Committee (JNCC)	Regional Benthic Ecology Study Area	2025	JNCC
EMODnet broadscale seabed habitat map for Europe (EUSeaMap)	EMODnet – Seabed Habitats	Regional Benthic Ecology Study Area	2023	EMODnet
Berwick Bank Wind Farm Offshore EIA Report, Chapter 8 Benthic Subtidal and Intertidal Ecology	Scottish and Southern Electricity Renewables (SSER)	Berwick Bank OWF	2022	SSE Renewables
Annex I Reefs in UK Waters (Open Data)	JNCC	Regional Benthic Ecology Study Area	2021	JNCC
The Status of *Sabellaria spinulosa* Reef off the Moray Firth and Aberdeenshire Coasts	Marine Scotland Science (now Marine Directorate –	Regional Benthic Ecology Study Area	2020	Pearce and Kimber

Title	Source	Extent	Year	Author
and Guidance for Conservation of the Species off the Scottish East Coast	Science, Evidence, Data and Digital)			
Annex I Sandbanks in the UK – Public Polygons	JNCC	Regional Benthic Ecology Study Area	2019	JNCC
Neart Na Gaoithe Offshore Wind Farm Environmental Statement (ES), Chapter 14 – Benthic Ecology	Mainstream Renewable Power	Neart na Gaoithe OWF	2019	Mainstream Renewable Power
A big data approach to macrofaunal baseline assessment, monitoring and sustainable exploration of the seabed	Cefas	Regional Benthic Ecology Study Area	2017	Cooper and Barry
Descriptions of Scottish PMFs	Scottish Natural Heritage (now NatureScot)	Regional Benthic Ecology Study Area	2016	Tyler-Walters *et al.*
Kincardine OWF ES	Kincardine Offshore Windfarm Limited	Kincardine OWF	2016	Kincardine OWF Limited
Hywind Scotland Pilot Park: ES Hywind Scotland	Hywind Scotland Pilot Park: ES Hywind Scotland	Hywind OWF	2015	Statoil
Mapping habitats and biotopes from acoustic datasets to strengthen the information base of MPAs in Scottish Waters – Phase 2	JNCC	Regional Benthic Ecology Study Area	2014	Sotheran and Crawford-Avis
Analysis of seabed imagery from the 2011 survey of the Firth of Forth Banks Complex, the 2011 International Bottom Trawl Survey and additional deep-water sites from Marine Scotland Science surveys (2012)	JNCC	Regional Benthic Ecology Study Area	2014	Axelsson *et al.*
Biotope assignment of grab samples from four surveys undertaken in 2011 across Scotland's seas (2012)	JNCC	Regional Benthic Ecology Study Area	2014	Pearce *et al.*
Mapping habitats and biotopes from acoustic datasets to strengthen	JNCC	Regional Benthic Ecology Study Area	2013	Sotheran and Crawford-Avis

Title	Source	Extent	Year	Author
the information base of MPAs in Scottish Waters				
Seagreen Environmental Impact Statement, Volume 1, Chapter 11 Benthic Ecology and intertidal Ecology	Seagreen Alpha and Bravo OWFs (have since been renamed to Seagreen 1 and Seagreen 1A)	Seagreen OWF	2012	Seagreen Wind Energy Limited
European Offshore Wind Deployment Centre: Request for an EIA Scoping Opinion	Aberdeen OWF Limited (also referred to as the European Offshore Wind Deployment Centre)	Aberdeen OWF	2011a	European Offshore Wind Deployment Centre

Identification of Designated Sites

8.5.4 A three-step process was used to identify all designated sites within the Regional Benthic Ecology Study Area and qualifying interest features that could be affected by the construction, O&M, and decommissioning phases of the Proposed Development. This process is described below:

- Step 1: All designated sites of international, national, and local importance within the Regional Benthic Ecology Study Area were identified using a number of sources. These sources included NMPi (2025) and JNCC (2025).
- Step 2: Information was compiled on the relevant benthic ecology features for each of these sites as follows:
  - Firth of Forth Banks Complex MPA;
  - Montrose Basin Ramsar site;
  - Southern Trench MPA;
  - Firth of Tay and Eden Estuary SAC; and
  - Isle of May SAC.
- Step 3: Using the above information and professional judgement, sites were included for further consideration if:
  - a designated site directly overlaps with the Proposed Development and therefore has the potential to be directly affected by the Proposed Development; or
  - sites and associated features were located within the Local Benthic Ecology Study Area ZoI (Figure 8.1) for impacts associated with the Proposed Development; this area is defined as the area encompassed by the Site Boundary and a buffer of one Spring Tidal Ellipse (Section 8.2).

Site-Specific Surveys

8.5.5 Site-specific surveys were undertaken, as agreed with MD-LOT and NatureScot, to inform this assessment (see Table 8.5 for further details). A summary of the surveys is outlined in Table 8.7.

Table 8.7: Summary of Site-Specific Survey Data

Title	Extent of Survey	Overview of Survey	Survey Contractor	Date	Reference
Geophysical survey campaign	Across the Array Area and 1 km wide corridor within Export Cable Corridor	High resolution Side Scan Sonar, Sub-Bottom Profiler, 2D Ultra High Resolution Seismic and Multibeam Echosounder	G-tec	2024	G-Tec (2024a) G-Tec (2024b)
Benthic subtidal survey	Across the Array Area and Export Cable Corridor	Drop Down Video (DDV) and grab samples, to determine biotopes and sediment contamination	Ocean Ecology Limited	2024	Volume 3, Technical Appendix 8.2: Bowdun OWF Benthic Characterisation Survey 2024: Survey Report
Phase I intertidal walkover survey	Intertidal (from Mean High Water Springs (MHWS) to approximately Mean Low Water Springs (MLWS) at the Landfall)	Phase I intertidal walkover survey for biotope classification	RPS	2023	Volume 3, Technical Appendix 4.1: Scoping Report, Appendix E Benthic Phase 1 Intertidal Walkover Survey Report

8.6 Baseline Environment

Overview of Baseline Environment

8.6.1 The following sections provide a summary of the benthic ecology baseline environment. Volume 3, Technical Appendix 8.1: Benthic Ecology Technical Report includes full details of the analysis undertaken to develop the benthic ecology baseline and information on benthic subtidal and intertidal ecology.

Site-Specific Surveys – Subtidal Ecology

8.6.2 The achieved grab sample and DDV sampling stations for the benthic subtidal survey are presented in Figure 8.2.

Seabed Sediments

8.6.3 The results of the Particle Size Analysis (PSA) from the benthic subtidal survey found the sediments within the Site Boundary (within the Local Benthic Ecology Study Area) range from muddy sand to sandy gravel, with the majority of stations classified as sand according to the Folk Classification (Folk, 1954; Long, 2006) (Figure 8.3). The geophysical site-specific survey interpreted the seabed sediments to be characterised by bedrock outcrops close to shore and megaripples, smaller ripples, and scattered boulders throughout the rest of the Local Benthic Ecology Study Area.

8.6.4 The sediment composition (i.e. proportion of mud ≤0.63 mm; sand <2 mm; gravel ≥2 mm) across stations was composed on average of 6.43% gravel (Standard Deviation (SD) 0.09), 86.66% sand (SD 0.13), and 6.91% mud (SD 0.10). The majority of stations were classified as sand, with a small proportion of mud, and a single station, located in the centre of the Array Area, was composed of sandy gravel, with a Folk classification of very fine gravel (ENV059).

8.6.5 In general, the coarser sediments with the greatest percentages of gravel were found in the west of the Local Benthic Ecology Study Area, along the Export Cable Corridor (Figure 8.3). The station with the finest sediment classifications (muddy sand at ENV002) was located in the nearshore section of the Export Cable Corridor.

8.6.6 These results broadly aligned with the desktop data, which indicated the seabed sediments within the Array Area are predominately comprised of European Nature Information System (EUNIS) classified deep circalittoral sand (A5.27) and with an area of deep circalittoral coarse sediment (A5.15) along the northern edge. The Export Cable Corridor passes through both these habitats, before it intersects with circalittoral fine sand or circalittoral muddy sand (A5.25 or A5.26), circalittoral sandy mud (A5.35), and another area of deep circalittoral coarse sediment (A5.15) at the Landfall (EMODnet, 2023).

Sediment Contamination

8.6.7 Forty-six sediment samples across the subtidal Site Boundary (within the Local Benthic Ecology Study Area) were analysed for sediment chemistry. This analysis measured levels of heavy metals, organotins (dibutyltin and tributyltin), Polychlorinated Biphenyls (PCBs), and Polycyclic Aromatic Hydrocarbons (PAHs), which were subsequently compared to the Marine Scotland Action Level 1 (AL1)/Action Level 2 (AL2) and the Canadian Sediment Quality Guidelines (CSQG) thresholds (Canadian Council of Ministers of the Environment (CCME), 2017)). The Marine Scotland AL1 threshold for chromium (50 mg/kg) was exceeded at ENV005, and this station also exceeded the CSQG Threshold Effect Level (TEL) thresholds for chromium and lead. The Marine Scotland AL1 threshold for arsenic was exceeded at three stations (ENV033 and ENV039 in the north of the Array Area, and ENV025 in the offshore area of the Export Cable Corridor close to the Array Area (Figure 8.2)). The CSQG TEL threshold for arsenic was exceeded at 41 stations. All stations were below the relevant Marine Scotland AL1 and CSQG TEL and Probable Effect Level (PEL) for PCBs. Regarding PAHs, two stations exceeded the CSQG TEL thresholds, with both ENV003 and ENV005 (both located nearshore in the Export Cable Corridor (Figure 8.2)) exceeding for dibenzo[a,h]anthracene, and ENV005 also exceeding for acenaphthylene and benzo[a]pyrene. All other stations were below the relevant PAH thresholds.

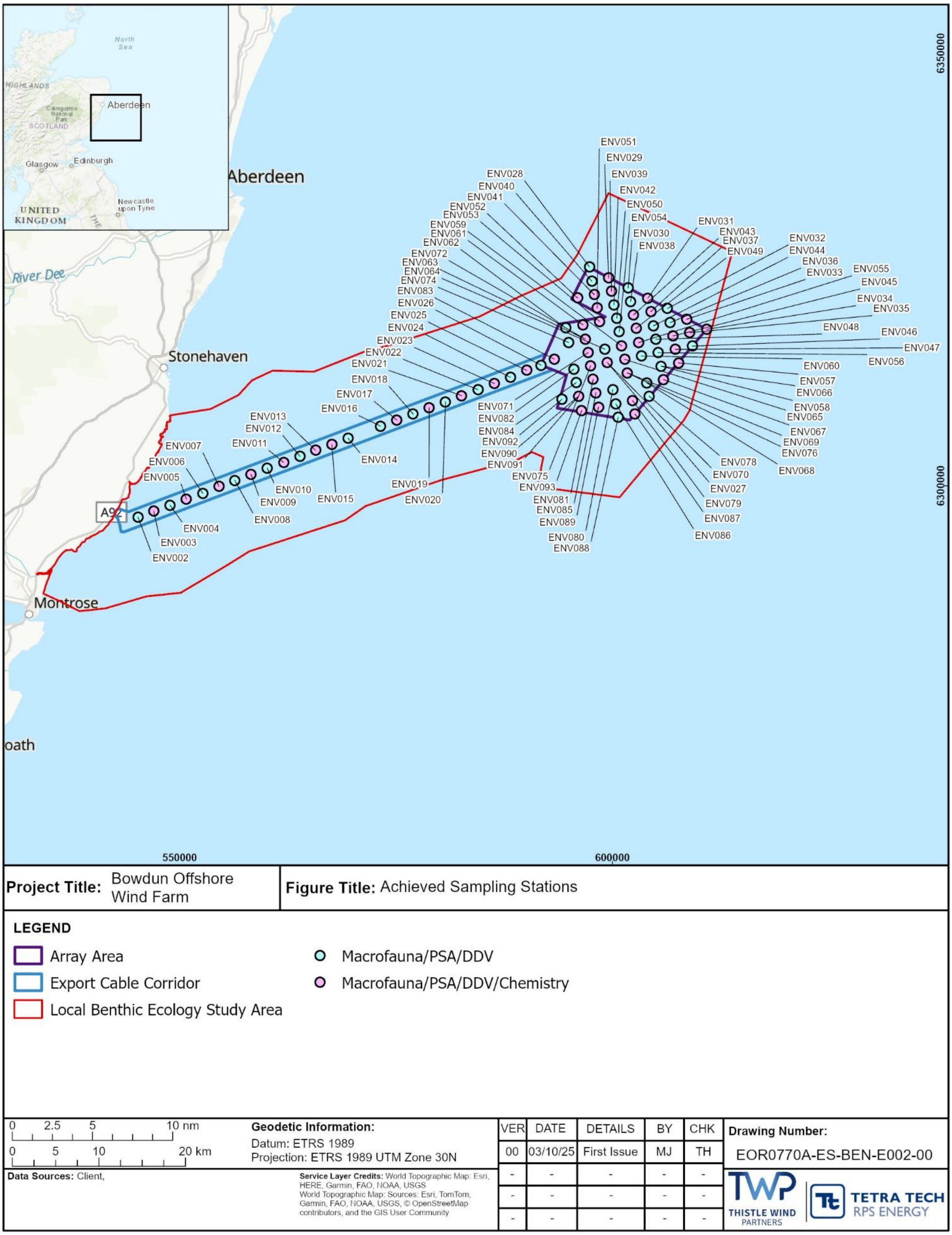


Figure 8.2: Achieved Sampling Stations

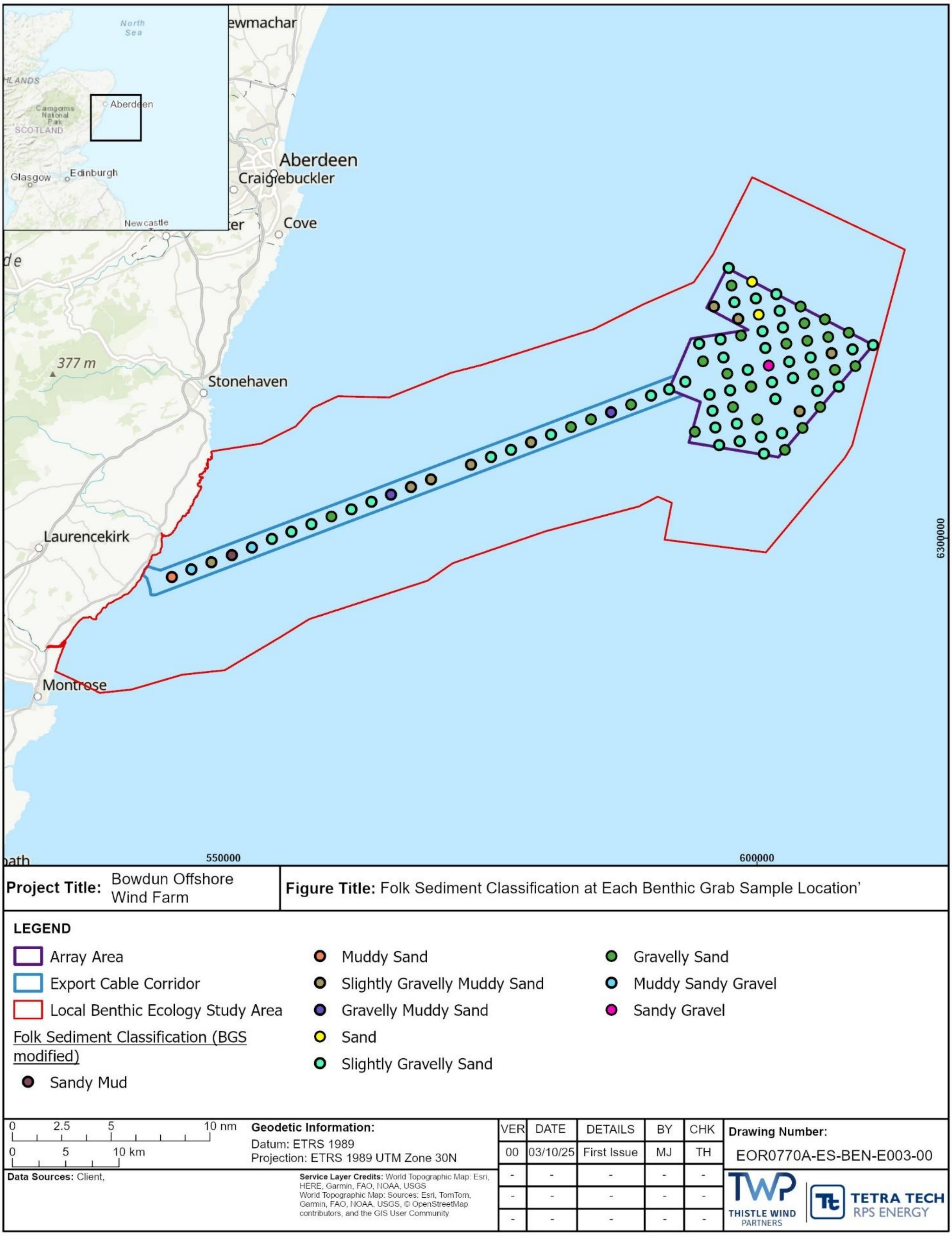


Figure 8.3: Folk Sediment Classification at Each Benthic Grab Sample Location

Subtidal Species and Biotopes

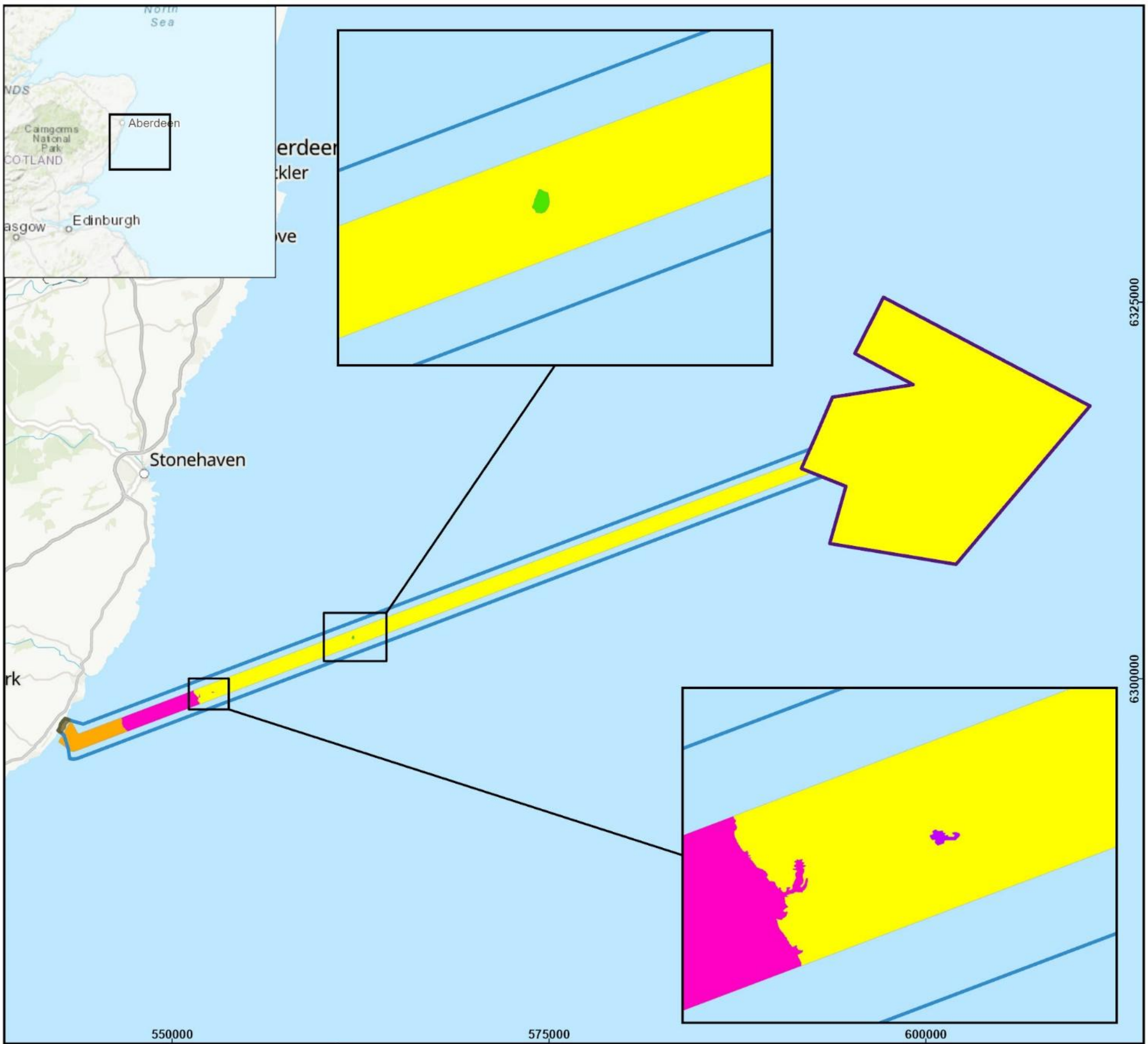
8.6.8 Across the Site Boundary (within the Local Benthic Ecology Study Area), the infaunal communities were generally dominated by Annelida (49.25% of all individuals), followed by Echinodermata (22.55% of all individuals). Juveniles of the echinoderm *Echinocyamus pusillus* were the most abundant individual taxon, with a total of 1,925 individuals recorded. In terms of biomass, the data did not reflect the dominance of Annelida with respect to the number of individuals and number of taxa. Mollusca accounted for most of the mass recorded (92.56%) across all stations, with Echinodermata accounting for the second highest biomass (24.08%) across all stations.

8.6.9 Relatively few epifaunal species were recorded, with visible species typically dominated by hydrozoans, bryozoans, and cnidarians. The most abundant taxon present was the hydroid *Merona cornucopiae*, followed *Flustra foliacea*, *Folliculinidae* sp., and hermit crabs *Paguridae* sp.

8.6.10 Due to the limited number of epifaunal species the two faunal groups identified by the multivariate analysis did not directly match the descriptions of any specific biotopes. Therefore, two biotopes were classified based on the sediment type of the majority of stations in the faunal group. The infaunal data provided the most comprehensive overview of the communities present. The infaunal biotopes have therefore been accepted as being representative of habitats across the Site Boundary (within the Local Benthic Ecology Study Area), with the epifaunal biotopes accepted for those areas with DDV only. Combined infaunal and epifaunal biotopes are presented in Figure 8.4.

8.6.11 The benthic communities within the Array Area were classified as the *Echinocyamus pusillus, Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (SS.SSa.CFiSa.EpusOborApri) biotope (Figure 8.4).

8.6.12 The west of the Export Cable Corridor was dominated by *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment (SS.SSa.CMuSa.AalbNuc) close to the nearshore, and circalittoral muddy sand (SS.SSa.CMuSa) immediately to the east. Single stations of *Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel (SS.SCS.CCS.MedLumVen) and offshore circalittoral sand (SS.SSa.Osa) were recorded in the west of the Export Cable Corridor (Figure 8.4).



Project Title: Bowdun Offshore Wind Farm

Figure Title: Combined Infaunal and Epifaunal Biotopes

LEGEND

- Array Area
- Export Cable Corridor
- Intertidal Area

Biotope within Geophysical Data Coverage Area

- SS.SCS.CCS.MedLumVen
- SS.SSa.CFiSa.EpusOborApri
- SS.SSa.CMuSa
- SS.SSa.CMuSa.AalbNuc
- SS.SSa.OSa

0 2.5 5 nm
0 5 10 km

Geodetic Information:
Datum: ETRS 1989
Projection: ETRS 1989 UTM Zone 30N

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Drawing Number: EOR0770A-ES-BEN-E004-00

Data Sources: Client,

Service Layer Credits: World Topographic Map: Esri, HERE, Garmin, FAO, NOAA, USGS
World Topographic Map: Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community

Figure 8.4: Combined Infaunal and Epifaunal Biotopes

Habitat Assessments

8.6.13 Several seabed habitats were taken forward for further assessment to determine their potential to align with features of conservation habitats.

8.6.14 An Annex I cobble/stony reef assessment was performed at 14 stations (ENV058, ENV064, ENV069, ENV072, ENV073, ENV077, ENV088, ENV090, ENV007, ENV008, ENV009, ENV011, ENV017, and ENV022) across the Proposed Development. All sampling stations were classified as 'not a reef' or 'low resemblance' reef as they all scored a 'low' in at least one of the four defining characteristics (composition, elevation, extent or biota) as per Irving (2009). Therefore, these areas were not considered to be Annex I cobble/stony reef habitat.

8.6.15 The 'seapen and burrowing megafauna communities' assessment identified three sampling stations (ENV005, ENV008 and ENV018) within the Export Cable Corridor with burrows and one station where the seapen *Virgularia mirabilis* was present (ENV020) (however, this species are not necessarily required to classify this habitat (Robson, 2014)). However, due to the sparsity of faunal burrows over the surveyed transects, none of these stations met the criteria to be classified as 'seapen and burrowing megafauna communities' Oslo Paris Convention (OSPAR) habitat.

8.6.16 Potential small aggregations of *Sabellaria spinulosa* were observed in drop down camera imagery at two stations (ENV067 and ENV088). Due to the low area covered by *Sabellaria* tubes and aggregations, the features do not meet the required characteristics to be considered a reef based on the criteria adopted by (Gubbay, 2007).

8.6.17 No *Modiolus modiolus* individuals were recorded at any stations, and therefore no assessment of elevation or biodiversity was required, and this Annex I habitat was not present.

8.6.18 Some evidence of hard and soft Porifera was observed throughout the Local Benthic Ecology Study Area, with two stations showing evidence of Porifera. Percentage coverage of sponges in single images ranged from 1% at ENV067 to approximately 5% at ENV090. Other species listed within the fragile sponge and anthozoan communities on rocky habitats (Henry and Roberts, 2014) such as *Alcyonidium diaphanum* were present, but they were present at low abundances and so were not considered representative of this habitat.

Species of Conservation Importance

8.6.19 No species of conservation importance were identified as part of the subtidal site-specific surveys.

Site-Specific Surveys – Intertidal Ecology

Seabed Sediments

8.6.20 The Intertidal Survey Area at Benholm Beach was largely composed of rocky shore (Figure 8.5). The substrate composition reflected bedrock pavements with a conglomerate matrix (Figure 8.5, Image C) with areas of loose boulders and cobbles representing erosional deposits, typically in tidal drainage channels (Figure 8.5, Image D).

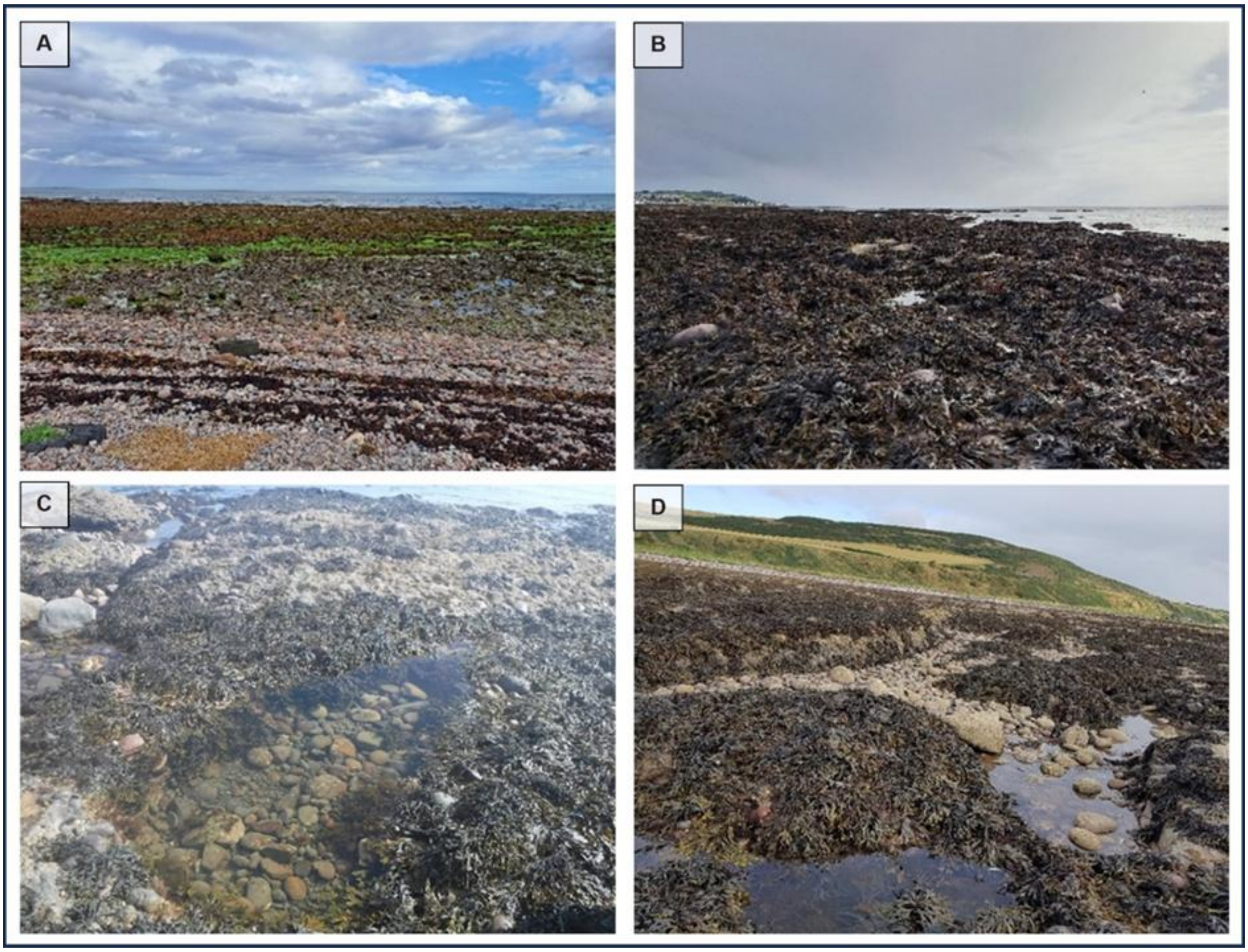


Figure 8.5: Representative Photographs of Benholm Beach

Intertidal Species and Biotopes

8.6.21 The rocky shore environment was highly heterogenous, with 17 biotopes identified overall, forming mosaics of two to three biotopes per shore area. The biotopes present within the Intertidal Survey Area are mapped in Figure 8.6.

<u>Strandline and Upper Shore</u>

8.6.22 The strandline on the upper shore was comprised of the biotopes Talitrids on the upper shore and strandline (LS.LSa.St.Tal) and Littoral coarse sediment (LS.LCS), and epibiota were scarce except for talitrid amphipods and unidentified white polychaetes. The upper shore was composed of the biotope *Fucus spiralis* on sheltered upper eulittoral rock (LR.LLR.F.Fspi), and *Ulva* spp. on freshwater-influenced and/or unstable upper eulittoral rock (LR.FLR.Eph.Ulv). Tidal or rock pools in the upper shore were sparse and generally shallow and characterised by the presence of dense coverage of spiral wrack and gutweed.

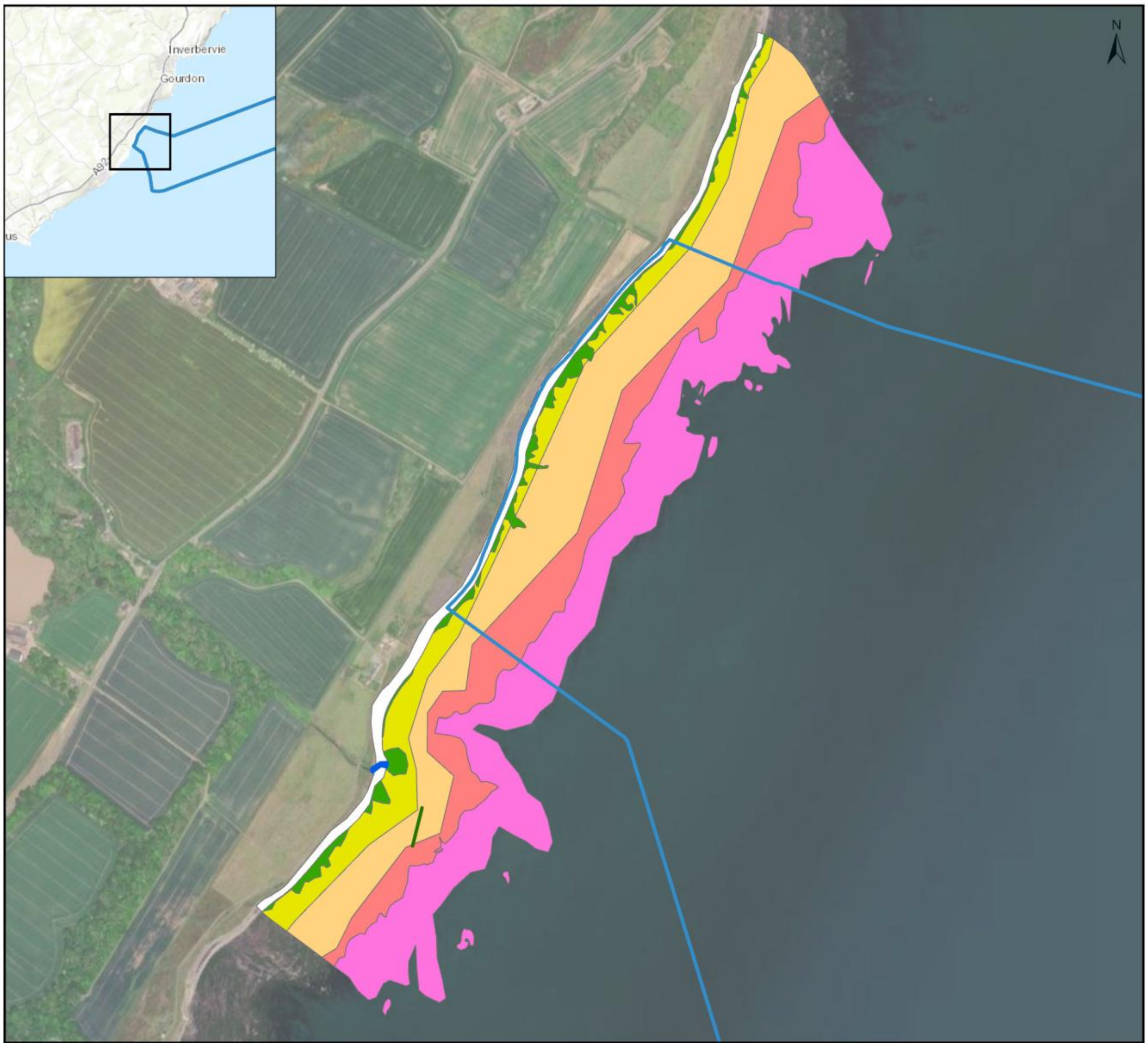
<u>Mid Shore</u>

8.6.23 A total of eight biotopes were identified in the mid shore zone, with the two dominant biotopes being *Fucus vesiculosus* on moderately exposed to sheltered mid eulittoral rock (LR.LLR.F.Fves) and LR.LLR.F.Fspi, representing 60% and 18%

respectively of the biotopes identified in this zone. The remaining six biotopes were *Ascophyllum nodosum* on full salinity mid eulittoral rock (LR.LLR.F.Asc.FS), *Fucus serratus* on sheltered lower eulittoral rock (LR.LLR.F.Fserr), *Semibalanus balanoides*, *Fucus vesiculosus*, and red seaweeds on exposed to moderately exposed eulittoral rock (LR.HLR.MusB.Sem.FvesR), *Semibalanus balanoides* and *Littorina* spp. on exposed to moderately exposed eulittoral boulders and cobbles (LR.HLR.MusB.Sem.LitX), Littoral mixed sediment (LS.LMx), and *Fucus serratus* on moderately exposed lower eulittoral rock (LR.MLR.BF.Fser). Tidal pools with a range of algae including *Corallina officinalis*, *Lithophyllaceae* sp., and *Scytosiphon lomentaria* were also present.

Lower Shore

8.6.24 A total of seven biotopes were identified in the lower shore; the three dominant biotopes were LR.LLR.F.Fserr, *Laminaria hyperborea* forest and foliose red seaweeds on moderately exposed lower infralittoral rock (IR.MIR.KR.Lhyp.Ft), and LR.MLR.BF.Fser. The four other biotopes present in the lower shore were *Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock (LR.MLR.BF.Fser.R), LR.LLR.F.Fves, LR.HLR.MusB.Sem.LitX, and *Osmundea pinnatifida* on moderately exposed mid eulittoral rock (LR.HLR.FR.Osm). Tidal or rock pools in the lower shore were generally shallow and characterised by the presence of dense coverage of serrated wrack and/or kelp.



Project Title: Bowdun Offshore Wind Farm

Figure Title: Intertidal Dominant Biotopes and Notable Features Identified

LEGEND

Export Cable Corridor

Biotopes

Talitrids on the upper shore and strandline (LS.LSa.St.Tal)

Ulva spp. on freshwater-influenced and/or stable upper eulittoral rock (LR.FLR.Eph.Ulv)

Semibalanus balanoides, Fucus vesiculosus, and red seaweeds on exposed to moderately exposed eulittoral rock (LR.HLR.MusB.Sem.FvesR) and Littoral mixed sediment (LS.LMx)

Fucus spiralis on sheltered upper eulittoral rock (LR.LLR.F.Fspi) and *Ulva spp.* on freshwater-influenced and/or stable upper eulittoral rock (LR.FLR.Eph.Ulv)

Fucus serratus on sheltered lower eulittoral rock (LR.LLR.F.Fserr) and Semibalanus balanoides and *Littorina spp.* on exposed to moderately exposed eulittoral boulders and cobbles (LR.HLR.MusB.Sem.LitX)

Laminaria hyperborea forest and foliose red seaweeds on moderately exposed upper infralittoral rock (IR.MIR.KR.Lhyp.Ft)

Area of freshwater input

Dense band of *A. nodosum*

0 0.05 0.1 0.2 nm
0 0.25 0.5 km

Geodetic Information:
Datum: ETRS 1989
Projection: ETRS 1989 UTM Zone 30N

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-	-	-	-	-

Drawing Number:
EOR0770A-ES-BEN-E005-00

Data Sources: Client, Intertidal Survey Results

Service Layer Credits: World Imagery: Maxar, Microsoft
World Topographic Map: Esri UK, Esri, HERE, Garmin, USGS, NGA

Figure 8.6: Intertidal Dominant Biotopes and Notable Features Identified

Habitat Assessments

8.6.25 No species or features were identified as part of the intertidal site-specific survey which required further assessment.

Species of Conservation Importance

8.6.26 No species of conservation importance were identified as part of the intertidal site-specific survey.

Designated Sites

8.6.27 Designated sites and relevant qualifying features identified for the benthic ecology are summarised in Table 8.8 and presented in Figure 8.7.

Table 8.8: Designated Sites and Relevant Qualifying Features for the Benthic Ecology

Designated Site	Closest Distance to Proposed Development (km)	Relevant Qualifying Interest Feature(s)
Firth of Forth Banks Complex MPA	7.5	• Ocean quahog *Arctica islandica* (listed as a Scottish PMF and on the OSPAR List of Threatened and Declining Habitats and Species; • Offshore subtidal sands and gravels (Scottish PMF); and • Shelf banks and mounds (large scale feature).
Montrose Basin Ramsar	12.9	• Estuary; and • Mudflats.
Southern Trench MPA	35.9	• Burrowed mud habitat (Scottish PMF and on the OSPAR List of Threatened and Declining Habitats and Species).
Firth of Tay and Eden Estuary SAC	40.4	• Annex I Estuaries; • Annex I Mudflats and sandflats not covered by seawater at low tide; and • Annex I Sandbanks which are covered by sea water at all times.
Isle of May SAC	67.1	• Annex I Reefs

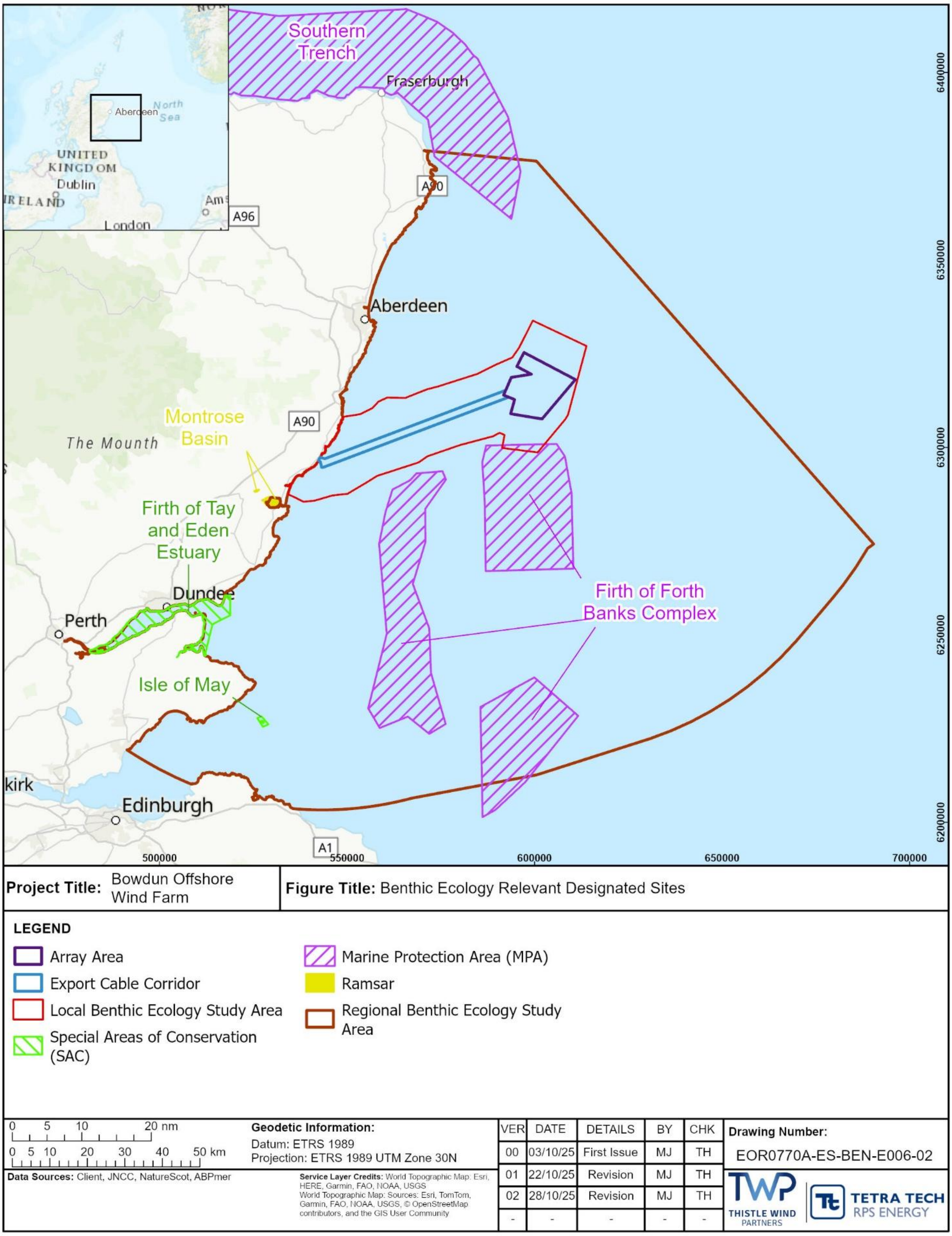

Figure 8.7: Benthic Ecology Relevant Designated Sites

Important Ecological Features

8.6.28 IEFs have been identified using best practice guidelines (Chartered Institute of Ecology and Environmental Management (CIEEM), 2024). See Section 8.8 for methodology including the impacts of the Proposed Development which have been scoped into the assessment. The impacts have all been assessed against the IEFs to determine whether or not they are significant, therefore, the IEFs assessed are those that are considered to be important and potentially impacted by the Proposed Development. Importance may be assigned due to quality or extent of habitats, habitat or species rarity or the extent to which they are threatened (CIEEM, 2024). For a species or habitat to be considered IEFs, they must have a specific biodiversity importance recognised through international or national legislation or through local, regional, or national conservation plans (e.g. Annex I habitats under the Habitats Directive, OSPAR, National Biodiversity Plan or the Marine Strategy Framework Directive, Scottish PMFs and the Scottish Biodiversity List).

8.6.29 Table 8.9 lists all of the confirmed IEFs within the Local Benthic Ecology Study Area. These comprise two subtidal IEFs and three intertidal IEFs identified during the site-specific surveys.

Table 8.9: IEFs Within the Proposed Development Local Benthic Ecology Study Area

IEF	Description and Representative Biotopes	Protection Status	Conservation Interest	Importance
Subtidal Habitats and Species				
Offshore subtidal sands and gravels	SS.SSa.CFiSa.EpusOborApri SS.SSa.OSa SS.SCS.CCS.MedLumVen	None	PMF (Scotland), Nature Conservation (Scotland) Act 2004	Regional
Offshore muddy and mixed sediments	SS.SSa.CMuSa.AalbNuc SS.SSa.CMuSa	None	UK Biodiversity Action Plan (BAP) priority habitat	Regional
Qualifying Features of an MPA				
Ocean quahog	*Arctica islandica*	OSPAR protected species	PMF (Scotland)	Regional
Intertidal Habitats and Species				
Tide-swept algal communities	LR.LLR.F.Fves LR.LLR.F.Fspi LR.LLR.F.Fserr LR.MLR.BF.Fser LR.LLR.F.Asc.FS LR.FLR.Eph.Ulv LR.MLR.BF.Fser.R	None	PMF (Scotland)	Regional
Kelp beds	IR.MIR.KR.Lhyp.Ft	None	PMF (Scotland) OSPAR habitat	Regional

IEF	Description and Representative Biotopes	Protection Status	Conservation Interest	Importance
Intertidal rocky and mixed sediment communities	LR.HLR.MusB.Sem.FvesR LR.HLR.MusB.Sem.LitX LR.HLR.FR.Osm LS.LMx[1]	None	UK BAP priority habitat	Regional

[1] This biotope was not present in the Marine Evidence based Sensitivity Assessment (MarESA) therefore LS.LMx.GvMu.HedMx biotope has been used as a proxy for sensitivity as it occurs at the same shore height and has the same mixed sediment.

Future Baseline Scenario

8.6.30 The EIA Regulations require that "*a description of the relevant aspects of the current state of the environment (baseline scenario) and an outline of the likely evolution thereof without implementation of the project as far as natural changes from the baseline scenario can be assessed with reasonable effort, on the basis of the availability of environmental information and scientific knowledge*" is included within the Offshore EIA Report.

8.6.31 If the Proposed Development does not come forward, an assessment of the 'without development' future baseline conditions has also been carried out and is described within this section.

8.6.32 Along with the potential effects of climate change on the marine environment, variability and long term changes in physical processes may bring direct and indirect changes to benthic habitats and communities in the mid to long term (Department of Energy and Climate Change (DECC), 2016). Much evidence suggests that long term changes to benthic ecology (abundances and species distribution) may be related to changes in the climate and/or nutrient availability (DECC, 2016; Marine Climate Change Impacts Partnership (MCCIP), 2020). Anthropogenic influences such as pollution, contamination, and seabed disturbance due to activities such as trawling, dredging and Offshore Infrastructure development are also known to influence benthic communities, and this trend can be expected to continue in the future. The MCCIP (2020) scientific review concluded that climatic processes both directly (e.g. winter mortality) and indirectly (e.g. via hydrographic conditions), influence the abundance and species composition of benthic communities. In turn, alteration to benthic communities could alter the rates and timing of processes such as nutrient cycling, planktonic larval supply, and organic waste assimilation (MCCIP, 2020).

8.6.33 Recently, the Department for Environment, Food, and Rural Affairs (Defra) have centred their focus on the risk of climate change to ecosystem services on INNS and their likely adverse influence on native communities and ecosystems, the increased risk of disease via new pathogens due to shifting distributions, and the impacts on coastal zone high biodiversity value areas due to increased storms and erosion (His Majesty's (HM) Government, 2022). The risks associated with ocean acidification and increased water temperatures due to climatic changes have also been highlighted by Defra (HM Government, 2022). Specifically, ocean water around Scotland has increased in temperature by an average rate of 0.22°C to 0.40°C per decade, with a longer term trend of 0.04°C between 1990 and 2006 (Hughes *et al.*, 2018). Increases in temperature are expected to have differing effects on aspects of benthic habitats and species, including distribution and reproduction times (Hiscock *et al.*, 2001). It is therefore difficult to define, for certain, how the benthic ecology baseline may evolve in the future, but it is unlikely that any potential pressures described will result in any significant changes to substrate type. As substrate type is a key driver of species assemblages and biotope classification, it is unlikely that significant changes will occur. The Proposed Development benthic ecology baseline constitutes a current snapshot of the existing and gradually changing benthic ecosystem. Any changes within the up to 30 year O&M phase of the Proposed Development have to be considered in the context of increased variability and changing trends in the national and international marine environment.

8.6.34 The effects of climate change on this assessment have not been considered through the use of an up to date baseline for the Proposed Development which allows for the consideration of the ecological communities as they currently are, capturing any community shift associated with climate change (Section 8.6). It is, however, not possible to consider any future changes in community due to the variety of scenarios which could be possible. Nonetheless, as mentioned above, changes are unlikely to be significant (Paragraph 8.6.33).

8.6.35 Other considerations include the assessment of impacts such as increased risk of introduction and spread of INNS which is likely to increase as a result of climate change, as noted above in Paragraph 8.6.33. The Proposed Development has therefore included Embedded Mitigation to ensure the potential for this impact is minimised in line with international standards (Table 8.16).

Data Limitations and Assumptions

8.6.36 The data sources used in this chapter are detailed in Table 8.6 and Volume 3, Technical Appendix 8.1: Benthic Ecology Technical Report. The desktop data used are the most up to date, publicly available information.

8.6.37 Site-specific surveys were undertaken to characterise the benthic ecology baseline (Table 8.7). There are specific limitations associated with the acquired data, see Volume 3, Technical Appendix 8.1: Benthic Ecology Technical Report. Full geophysical coverage of the Export Cable Corridor was not obtained during the site-specific surveys (the coverage extent is shown in Figure 3.1 within Volume 3, Technical Appendix 7.1: Physical Processes Baseline Environment). However, this limitation has been overcome through the use of existing UK Hydrographic Office bathymetry data, which is available for the area not covered by the Proposed Development specific survey. The acquired environmental data were therefore used to extrapolate the biotope map to cover the whole of the Export Cable Corridor.

8.6.38 The sampling design and data collection have provided robust data on the benthic communities, however interpreting these data has limitations. It can be difficult to interpolate data collected from discrete sample locations to cover a wider area and define the precise extents of each biotope. Benthic communities generally show a transition between biotopes, and therefore the boundaries of where one biotope ends, and another begins is an approximation; these boundaries indicate where communities grade into one another. Classification of the community data into biotopes is based on a best fit approach, as some communities do not readily fit the available descriptions in the biotope classification system. However, this site-specific study does provide a suitable baseline characterisation which describes the main habitats and communities within the Local Benthic Ecology Study Area for the purposes of the assessment.

8.6.39 Overall, these limitations are not considered to materially affect the conclusions of the assessment.

8.7 Key Parameters for Assessment

Maximum Design Scenario

8.7.1 Table 8.10 presents those parameters expected to have the potential to result in the greatest effect on an identified receptor or receptor group. Any other development scenario within the Project Design Envelope (PDE), will result in the same, or less, level of environmental effect. The scenario has been selected from the details provided in Volume 1, Chapter 3: Project Description.

8.7.2 The assessment of the impacts associated with the Proposed Development for benthic ecology has been informed by and will inform other chapters within the Offshore EIA Report. For example, the assessment on the impact of ‘increased SSCs and associated deposition’ and ‘changes to physical processes’ has been informed by Volume 2, Chapter 7: Physical Processes, and Volume 3, Technical Appendix 7.1: Physical Processes Baseline Environment.

Table 8.10: MDS Considered for Each Potential Impact as Part of the Assessment of Likely Significant Environmental Effects on Benthic Ecology

<table>
<tr><th rowspan="2">Potential Impact</th><th colspan="3">Phase*</th><th rowspan="2">Maximum Design Scenario</th><th rowspan="2">Justification</th></tr>
<tr><th>C</th><th>O</th><th>D</th></tr>
<tr><td>Temporary habitat loss and/or disturbance</td><td>✓</td><td>✓</td><td>✓</td><td>Construction phase - Subtidal
Up to 19,414,805 m² of subtidal temporary habitat loss and/or disturbance, this represents up to 6.66% of the total area of the Site Boundary, due to:

<u>Trenchless Technique Exit Pit Excavation (e.g. Horizontal Directional Drilling (HDD)</u>
Up to 17,130 m² of habitat disturbance associated with excavation of exit pits comprising:
• up to 16,800 m² from deposition of 8,400 m³ of trenchless techniques excavation material; and
• up to 330 m² of habitat disturbance from the installation of up to 3 trenchless techniques exit pits.
<u>Sandwave clearance</u>
Up to 835,872 m² of habitat disturbance associated with sandwave clearance comprising:
• Wind Turbine foundations: 141,000 m² for the installation of up to 50 Wind Turbine foundations (this may also include boulder clearance but sandwave clearance is the greater impact of the 2).
• Offshore Substation Platform (OSP) foundations: 24,359 m² for the installation of up to 3 OSP foundations.
• Inter-Array Cables (IACs): up to 49,552 m² (assumes 0.56% requires clearance with a 58.6 m width of disturbance).
• Interconnector Cables: up to 11,814 m² (assumes 0.56% requires clearance with a 58.6 m width of disturbance).
• Offshore Export Cables: up to 609,147 m² (assumes 4.95% requires clearance with a 58.6 m width of disturbance).

<u>Sandwave clearance material deposition</u></td><td>The MDS for this impact considers the maximum seabed footprint of temporary habitat loss and/or disturbance during the construction, O&M, and decommissioning phases of the Proposed Development. The MDS for this impact is represented by the 50 x 20 MW Wind Turbine layout scenario.

Construction phase – Subtidal
<u>Trenchless techniques Exit Pit Excavation</u>
Based on up to:
• assuming a mound of uniform thickness of 0.5 m height; and
• 110 m² per exit pit.
<u>Sandwave clearance</u>
Based on up to:
• 151 km total length of IACs on the seabed;
• 36 km total length Interconnector Cables; and
• 210 km total length of Offshore Export Cables.
<u>Sandwave Clearance material deposition</u>
The area of seabed affected by the placement of sandwave clearance material has been calculated based on the maximum volume of sediment to be placed on the seabed, assuming all this sediment is coarse</td></tr>
</table>

<table>
<tr><th rowspan="2">Potential Impact</th><th colspan="3">Phase*</th><th rowspan="2">Maximum Design Scenario</th><th rowspan="2">Justification</th></tr>
<tr><th>C</th><th>O</th><th>D</th></tr>
<tr><td></td><td></td><td></td><td></td><td>Up to 8,774,332 m^2 of habitat disturbance associated with the deposition of sandwave clearance material comprising:
• Wind Turbines foundations: up to 1,188,770 m^2 from deposition of 594,385 m^3 of sandwave clearance material;
• OSP foundations: up to 272,824 m^2 from deposition of 136,412 m^3 of sandwave clearance material;
• IACs: up to 395,910 m^2 from deposition of 197,955 m^3 of sandwave clearance material;
• Interconnector Cable: up to 94,382 m^2 from deposition of 47,191 m^3 of sandwave clearance material; and
• Offshore Export Cables: up to 6,822,446 m^2 from deposition of 3,411,223 m^3 of sandwave clearance material.
<u>Cable installation (including boulder clearance)</u>
Up to 9,638,945 m^2 of habitat disturbance associated with cable installation comprising:
• IACs: up to 3,753,860 m^2 disturbance from installation of up to 151 km of IACs (99.44% of the total length, including the length which requires boulder clearance, with a 25 m width of disturbance, separate to sandwave clearance);
• Interconnector Cable: up to 894,960 m^2 from installation of up to 36 km of Interconnector Cable (99.44% of the total length, including the length which requires boulder clearance, with a 25 m width of disturbance, separate to sandwave clearance); and
• Offshore Export Cables: up to 4,990,125 m^2 of disturbance from installation of up to 200 km of Offshore Export Cables (95.05% of the total length, including the length which requires boulder clearance, with a 25 m width of disturbance, separate to sandwave clearance).
<u>Jack-up events</u>
Up to 148,400 m^2 of disturbance due to jack-up vessel use for the installation of up to three OSPs and up to 50 Wind Turbine foundations.</td><td>material (i.e. is not dispersed through tidal currents; see "Potential changes to SSCs" impact below). The total footprint of seabed affected has been calculated, for the purposes of the MDS, assuming a mound of uniform thickness of 0.5 m height. Temporary loss of benthic habitat is assumed beneath this.

<u>Cable installation (including boulder clearance)</u>
The MDS assumes that up to 151 km of the IACs will be on the seabed, with up to 16 km within the Wind Turbine foundation.

Based on the assumption that the width of disturbance for sandwave clearance also includes subsequent cable installation as repeat disturbance. As such, up to 95.05% of the length of Offshore Export Cables, and up to 99.44% of the length of IACs and Interconnector Cables has been assumed for cable installation. Boulder clearance is captured within the disturbance corridor for cable installation.

<u>Jack-up events</u>
Based on the assumption that there will be up to a maximum of up to 2 jack-up positions per OSP and Wind Turbine foundation.</td></tr>
</table>

Potential Impact	Phase*			Maximum Design Scenario	Justification
	C	O	D		
				Up to 126 m^2 of disturbance due to jack-up vessel use for the installation of up to three trenchless techniques exit pits. Additional Subtidal Information In addition, up to 13,987 m^2 of temporary habitat loss and/or disturbance could occur due to crater formation from the clearance of Unexploded Ordnance (UXO). This value has not been included in the total disturbance presented above, as the footprint from UXO clearance will likely overlap with area subject to temporary habitat disturbance from other site preparation activities. Additionally, the footprint associated with the UXO clearance has not been derived from Volume 1, Chapter 3: Project Description. Instead, it has been calculated based on appropriate crater sizes estimated in Ordtek (2018) and applied to the 40 UXOs that may require clearance during the construction phase of the Proposed Development (30 in the Array Area and 10 along the Export Cable Corridor). **Construction phase – Intertidal** There is no impact in the intertidal zone as cables will be installed via trenchless techniques with exit pits located below MLWS and above MHWS. **O&M phase** A total of **11,688,813 m^2** of temporary subtidal habitat loss and/or disturbance, this represents up to **4.01%** of the total area of the Site Boundary, over the 30 year life cycle of the Proposed Development due to: Disturbance caused by reburial of IACs, Interconnector Cables, and Offshore Export Cables Up to 4,915 m of cable reburial may be required per year for repair of IACs. The width of the minimum installation corridor is up to 25 m.	Additional Subtidal Information UXO clearance MDS calculated from the maximum estimated crater diameter of 21.10 m in Ordtek, 2018. **O&M phase** Disturbance caused by reburial of IACs, Interconnector Cables, and Offshore Export Cables. **Decommissioning phase** In the decommissioning phase, the MDS accounts for the maximum amount of infrastructure which could be removed from the seabed. This approach varies from other impacts as it represents the MDS for temporary habitat loss and/or disturbance specifically. The MDS approach to decommissioning will vary between impacts.

Potential Impact	Phase*			Maximum Design Scenario	Justification
	C	O	D		
				Up to 2,040 m of cable reburial may be required per year for repair of Interconnector Cables. The width of the minimum installation corridor is up to 25 m. Up to 6,390 m of cable reburial may be required per year for repair of Offshore Export Cables. The width of the minimum installation corridor is up to 25 m. <u>Jack-up events</u> Up to 1,680,000 m² of disturbance due to jack-up vessel use for the repair of Wind Turbines. Up to 63 m² of disturbance due to jack-up vessel use for repair and reburial event at the 3 trenchless techniques exit pits. **Decommissioning phase** A Decommissioning Programme will be submitted to MD-LOT for consultation and approval. The Decommissioning Programme will be updated during the Proposed Development's lifespan to take account of changing best practice and new technologies. The approach for decommissioning is yet to be determined, however, for the purposes of this MDS, total removal of all infrastructure including buried cables and cable protection has been assumed, and as such the environmental impact of decommissioning will be the same if not lower than construction.	
Long term habitat loss and/or disturbance	✓	✓	✓	**Construction and O&M phases** Up to **2,251,000 m²** of subtidal long term habitat loss and/or disturbance due to infrastructure installed in the construction phase, which will persist into the O&M phase. This represents up to **0.77%** of the total area of the Site Boundary and comprises: • footprint area of 170,000 m² due to fixed 3-legged suction bucket jacket Wind Turbine foundations (up to 50	**Construction and O&M phases** The MDS for this impact considers the maximum seabed footprint of infrastructure installed during the construction phase. This will persist through the up to 30 year O&M phase. This impact considers the design parameters that will result in

Potential Impact	Phase*			Maximum Design Scenario	Justification
	C	O	D		
				foundations with a seabed footprint of 3,400 m^2 each per foundation for Scour Protection); • footprint area of 15,000 m^2 due to OSP foundations (up to 3 OSPs) and their Scour Protection; • footprint area of 755,000 m^2 due to cable protection for IACs (up to 75.5 km of cable requiring protection, with a cable protection width up to 10 m); • footprint area of 40,500 m^2 due to cable crossing protection for IACs (up to nine crossings, with a length of 500 m and width up to 9 m each); • footprint area of 180,000 m^2 due to cable protection for Interconnector Cables (up to 18,000 m of cable requiring protection, with a cable protection width up to 10 m); • footprint area of 13,500 m^2 due to cable crossing protection for Interconnector Cables (up to three crossings, with a length of 500 m and width up to 9 m each); • footprint area of 1,050,000 m^2 due to cable protection for Offshore Export Cables (up to 105 km of cable requiring protection, with a cable protection width of 10 m); and • footprint area of 27,000 m^2 due to cable crossing protection for Offshore Export Cables (up to six crossings, with a length of 500 m and width up to 9 m each). The O&M phase will last up to 30 years. **Decommissioning phase** A Decommissioning Programme will be submitted to MD-LOT for consultation and approval. The Decommissioning Programme will be updated during the Project's lifespan to take account of changing best practice and new technologies. The approach for decommissioning is yet to be determined, however, for the purposes of this MDS it has been assumed that all Scour Protection, cable protection, and cable crossing	the greatest footprint of habitat loss and disturbance. The MDS for this impact is represented by the 50 x 20 MW Wind Turbine layout scenario. **Decommissioning phase** In the decommissioning phase, the MDS accounts for the maximum seabed footprint of infrastructure that could remain *in situ*. It should be noted that after an up to 30 year O&M phase, these hard structures left *in situ* on the seabed would represent established habitats within the Site Boundary. The MDS assumes that the Scour Protection is pre-installed, with the pile then installed through the Scour Protection. The total footprint therefore remains the same as with Scour Protection only. This approach varies from other impacts as it represents the MDS for long term habitat loss specifically. The MDS approach to decommissioning will vary between impacts.

Potential Impact	Phase*			Maximum Design Scenario	Justification
	C	O	D		
				protection will be left *in situ*. Therefore, up to **2,251,000 m²** of long term habitat loss will persist past the decommissioning phase. This value is the total footprint area for all Scour Protection, cable protection, and cable crossing protection. This represents up to **0.77%** of the total area of the Site Boundary.	
Changes to SSC, bed levels and sediment type	✓	✓	✓	**Construction phase** Drilling for pile installation Up to 318,086 m³ of drill arising for all piles in the Array Area for the 40 x 25 MW fixed monopile Wind Turbine Layout, comprising: • maximum number of drilled piles: 40 (max foundations = 40; max piles per foundation = 1); • maximum dimensions of drilled pile section: 15 m diameter, 45 m maximum penetration depth; • maximum volume of drill arisings per pile: 7,952.12 m³; and • maximum concurrent drilling events: two. IAC installation • maximum total length of IAC on the seabed for the whole Array Area: 151 km for the 40 x 25 MW and 50 x 20 MW Wind Turbine Layouts; • trench dimensions: up to 6 m wide; 1.5 m deep (average); ‘V’ shape profile; • Trench excavation method: Jetting, Mass Flow Excavation (MFE), Ploughing/Pre-Ploughing, Trenching/Pre-Trenching (incl. dredging, cutting); and • MFE pre-lay trenching rate: 400 m/hour. Offshore Export Cables installation • maximum number of Offshore Export Cables: three; • maximum total length of each Offshore Export Cable: 70 km;	The MDS corresponds to (a combination of) the greatest amount of material disturbed and the greatest geographical extent of the impact. **Construction phase** Drilling for pile installation Based on the greatest amount of material disturbed in a drilling event, considering the largest pile dimension, largest pile penetration depth and number of concurrent drilling events. Assumes two concurrent drilling events can occur for neighbouring foundations, resulting in the MDS for instantaneous SSC. Piles relating to OSPs are smaller in diameter and require less drilling depth than Wind Turbine foundations therefore do not represent the MDS. IAC installation Pre-lay trenching by MFE will give MDS for sediment disturbance. Conservatively assumes 100% fluidisation of material expelled from trench. In reality, pre-lay jetting will move a proportion of material rather

Potential Impact	Phase*			Maximum Design Scenario	Justification
	C	O	D		
				• trench dimensions: up to 6 m wide; 1.5 m deep (average); 'V' shape profile; • excavation method: Jetting, MFE, Ploughing/Pre-Ploughing, Trenching/Pre-Trenching (incl. dredging, cutting); and • MFE pre-lay trenching rate: 400 m/hour. <u>Interconnector Cable installation</u> • Maximum number of Interconnector Cables: three; • Maximum total length of each Export Cable: 12 km; • Trench dimensions: up to 6 m wide; 1.5 m deep (average); 'V' shape profile; • Excavation method: Jetting, MFE, Ploughing/Pre-Ploughing, Trenching/Pre-Trenching (incl. dredging, cutting); and • MFE Pre-lay trenching rate: 400 m/hour. <u>Sandwave clearance</u> • sandwave clearance width along IAC: 58.6 m; • area of IAC sandwave clearance: 49,552 m^2 for the 40 x 25 MW and 50 x 20 MW Wind Turbine Layouts; • area of Interconnector Cable sandwave clearance: 11,814 m^2; • area of OSP Scour Protection sandwave clearance: 24,359 m^2 for three OSPs; • area of fixed foundation sandwave clearance: 172,220 m^2 for the 67 x 15 MW Wind Turbine Layouts; • sandwave clearance width along Offshore Export Cables: 58.6 m; • area of Offshore Export Cables sandwave clearance: 609,147 m^2; and • clearance method: MFE and/or Dredger.	than bringing it fully into suspension. Modelling was carried out for sediment release along a section of an indicative cable route which runs parallel and then perpendicular to the tidal axis for two full tidal cycles. <u>Offshore Export Cables installation</u> Pre-lay trenching by MFE will give MDS for sediment disturbance. Conservatively assumes 100% fluidisation of material expelled from trench. In reality pre-lay jetting will move a proportion of material rather than bringing it fully into suspension. Offshore Export Cables Corridor pre-lay trenching modelling assumes sediment release along the whole Export Cable Corridor. <u>Interconnector Cable installation</u> Pre-lay trenching by MFE will give MDS for sediment disturbance. Conservatively assumes 100% fluidisation of material expelled from trench. In reality, pre-lay jetting will move a proportion of material rather than bringing it fully into suspension. Covered by Offshore Export Cable and IAC installation model scenarios. <u>Sandwave clearance</u> Sandwave clearance/levelling activities may be undertaken using a

<table>
<tr><th rowspan="2">Potential Impact</th><th colspan="3">Phase*</th><th rowspan="2">Maximum Design Scenario</th><th rowspan="2">Justification</th></tr>
<tr><th>C</th><th>O</th><th>D</th></tr>
<tr><td></td><td></td><td></td><td></td><td><u>Trenchless techniques exit pit excavation</u>
• number of exit pits: up to three;
• 2,800 m^3 excavated material for each pit for the 220 kV scenario (8,400 m^3 for all pits); and
• exit pit dimensions: 2.2 m x 50 m.

<u>Trenchless techniques drilling fluid release (at Landfall)</u>
• number of exit/release events: up to three;
• up to 2,870 m^3 drilling mud generated per trenchless techniques duct, based on bore diameter of 2.2 m and duct length of 755 m (8,610 m^3 total for all 3 ducts);
• 100,000 mg/l (100 kg/m^3) assumed conservative maximum concentration of bentonite in drilling mud; and
• wet punch-out.

O&M phase
<u>Cable repairs</u>
• number of annual IAC repairs: one;
• maximum annual length of IAC reburial: 4,915 m;
• number of annual Interconnector Cable repairs: 0.18;
• maximum annual length of Interconnector Cable reburial: 2,040 m;
• number of annual static Offshore Export Cables repairs: 1; and
• maximum annual length of Offshore Export Cables reburial: 6,390 m.

Decommissioning phase
A Decommissioning Programme will be submitted to MD-LOT for consultation and approval. The Decommissioning Programme will be updated during the Proposed</td><td>range of techniques – MFE and suction hopper dredging. Releases via both are modelled. A MFE near-bed sediment release rate of 1,000 kg/s is conservatively estimated based on the MDS trench cross section dimensions, the speed of progress of the tool, and the bulk density of the local sediment type. Dredge spoil release is simulated as an instantaneous release at the water surface. 10% of an 11,000 m^3 hopper is assumed to form the passive phase of the plume. Other seabed preparation such as boulder clearance is not considered here as the activity does not represent the MDS in terms of potential increases in SSC and associated changes to seabed substrate.

<u>Trenchless techniques exit pit excavation</u>

Based on maximum exit pit dimensions.

<u>Trenchless techniques drilling fluid release (at Landfall)</u>
Based on maximum trenchless techniques duct dimensions. Assumes a conservative bentonite concentration of 100 kg/m^3 in drilling mud. Other stages of drilling (pilot hole drilling and stages of reaming) may result in smaller release events separated in time. But the MDS is</td></tr>
</table>

Potential Impact	Phase*			Maximum Design Scenario	Justification
	C	O	D		
				Development's lifespan to take account of changing best practice and new technologies. The approach for decommissioning is yet to be determined, however, for the purposes of this MDS total removal of all infrastructure including buried cables and cable protection has been assumed, and as such the environmental impact of decommissioning will be the same if not lower than construction.	considered as a release of drilling mud from a single conduit. **O&M phase** The MDS for sediment disturbance during operation will be no greater than that set out for the construction phase of the Proposed Development. Cable repairs These limited activities would disturb a much smaller volume of material for each repair/reburial event than simulated for the construction phase. **Decommissioning phase** The MDS for sediment disturbance during decommissioning will be no greater than that set out for the construction phase of the Proposed Development.
Changes in physical processes	×	✓	✓	The MDS for this impact has been informed by the conclusions of the assessment of significance for the Physical Processes assessment (Volume 2, Chapter 7: Physical Processes), and considers a range of potential impacts, such as changes to seabed morphology, the tidal regime, wave regime, sediment transport regime, stratification and frontal systems, and scour.	The MDS for this impact considers all activities which have the potential to create changes in physical processes.
Colonisation of hard structures	✓	✓	✓	**Construction and O&M phases** Introduction of up to **2,705,020 m^2** of hard structure surface area installed throughout the construction phase and persisting into the up to 30 year O&M phase. The MDS is for 3-legged suction bucket jacket Wind Turbine foundations (up to 67 foundations) and is due to:	**Construction and O&M phases** The MDS for this impact considers the maximum surface area of hard structures installed on the seabed during the construction phase and persisting into the O&M phase. This

Potential Impact	Phase*			Maximum Design Scenario	Justification
	C	O	D		
				• surface area of 448,350 m² from up to 67 Wind Turbine foundations; • surface area of 24,570 m² from up to three OSP foundations; • footprint area of 236,100 m² from Scour Protection for Wind Turbines and OSPs; • footprint area of 1,915,000 m² from cable protection; and • footprint area of 81,000 m² from cable crossings. **Decommissioning phase** A Decommissioning Programme will be submitted to MD-LOT for consultation and approval. The Decommissioning Programme will be updated during the Project's lifespan to take account of changing best practice and new technologies. The approach for decommissioning is yet to be determined, however, for the purposes of this MDS it has been assumed that all Scour Protection, cable protection, and cable crossing protection will be left *in situ*. Wind Turbine and OSP foundations will however be removed. Therefore, up to **2,232,100 m²** of hard structures will be left *in situ* on the seabed, allowing this impact to persist past the decommissioning phase.	represents artificial habitat which may be colonised by benthic species. Surface area has been calculated for Wind Turbines and OSPs based on the dimensions given within the PDE. The MDS for this impact is represented by the 67 x 15 MW Wind Turbine layout scenario. Footprint areas for Scour Protection, cable crossings and cable protection have been calculated as per the long term habitat loss and/or disturbance impact.
Increased risk of introduction and spread of INNS	✓	✓	✓	**Construction phase** Increased risk of introduction or spread of INNS due to: • introduction of hard substrate: up to **2,750,020 m²** as set out in the colonisation of hard substrate impact above; and • vessel movement: vessels associated with Wind Turbine installation, OSP installation, IACs and Interconnector Cables installation, with up to 2,120 vessel return trips in total over the construction phase.	**Construction and O&M phases** The MDS for this impact is represented by the 67 x 15 MW Wind Turbine layout scenario. **Decommissioning phase** In the decommissioning phase, the MDS accounts for the maximum seabed footprint of infrastructure that could remain *in situ*.

Potential Impact	Phase*			Maximum Design Scenario	Justification
	C	O	D		
				Maximum duration of the construction phase is up to five years. **O&M phase** Increased risk of introduction or spread of INNS due to: • colonisation of hard substrate: up to **2,750,020 m²** as set out in the colonisation of hard substrate impact above; • vessel movement: up to 713 vessel return trips per year during the O&M phase. In addition to this, a further number of vessels will undertake another 260 return trips spread over the 30 year O&M phase; and • removal of marine growth from foundations or access ladders. The O&M phase will last up to 30 years. **Decommissioning phase** Increased risk of introduction or spread of INNS due to: • hard substrate: The approach for decommissioning is yet to be determined, however, for the purposes of this MDS it has been assumed that all Scour Protection, cable protection, and cable crossing protection will be left *in situ*. Wind Turbine and OSP foundations will however be removed. Therefore, up to **2,232,100 m²** of hard structures will be left *in situ* on the seabed, allowing this impact to persist past the decommissioning phase; and • vessel movement: the approach for decommissioning is yet to be determined, however, for the purposes of this MDS it has been assumed that the number of vessel return trips will be equal to or lesser than the construction phase. A Decommissioning Programme will be submitted to MD-LOT for consultation and approval. The Decommissioning Programme will be updated during the Project's lifespan to take account of changing best practice and new technologies.	This approach varies from other impacts as it represents the MDS for increased risk of introduction and spread of INNS specifically. The MDS approach to decommissioning will vary between impacts.

Potential Impact	Phase*			Maximum Design Scenario	Justification
	C	O	D		
Removal of hard substrates	×	×	✓	**Decommissioning phase** A Decommissioning Programme will be submitted to MD-LOT for consultation and approval. The Decommissioning Programme will be updated during the Project's lifespan to take account of changing best practice and new technologies. The approach for decommissioning is yet to be determined, however, for the purposes of this MDS, total removal of all infrastructure including buried cables and cable protection has been assumed and, as such, the environmental impact of decommissioning will be the same if not lower than construction. The MDS for this impact is therefore removal of up to **2,705,020 m^2** of hard substrates in total from the removal of all introduced hard surfaces.	The MDS for benthic receptors is that all hard substrate could be removed. The MDS for this impact is represented by the 67 x 15 MW Wind Turbine layout scenario.
Impacts to benthic ecology due to EMF	×	✓	×	**O&M phase** EMFs may be emitted to the marine environment from IAC, Interconnector Cables, and Offshore Export Cables. Where feasible, a minimum burial depth of 0.5 m applies to all cables, however, there will be a target burial depth of 1.5 m. Where burial is not possible, cable protection will be used. There will be a total of **397 km** of High Voltage Alternating Current cables, comprised of: • up to 151 km (on seabed) of 132 kV IAC; • up to 36 km of 275 kV ICs; and • up to 210 km of 275 kV Offshore Export Cables (up to 3 Offshore Export Cables, with a maximum length of 70 km each). The O&M phase will last up to 30 years.	The MDS for this impact is based on the greatest cable lengths proposed, in the water column, buried in the seabed, and protected where burial is not possible.

Potential Impact	Phase*			Maximum Design Scenario	Justification
	C	O	D		
Impacts to benthic ecology due to heat from subsea electrical cables	×	✓	×	**O&M phase** Heat may be emitted to the marine environment from IAC, Interconnector Cables, and Offshore Export Cables. Where feasible, a minimum burial depth of 0.5 m applies to all cables, however, there will be a target burial depth of 1.5 m. Where burial is not possible, cable protection will be used. There will be a total of **397 km** of High Voltage Alternating Current cables, comprised of: • up to 151 km (on seabed) of 132 kV IAC; • up to 36 km of 275 kV Interconnector Cables; and • up to 210 km of 275 kV Offshore Export Cables (up to 3 Offshore Export Cables, with a maximum length of 70 km each). The O&M phase will last up to 30 years.	The MDS for this impact is based on the greatest cable lengths proposed, in the water column, buried in the seabed, and protected where burial is not possible.

* Proposed Development Phase refers to construction (C), O&M (O) and decommissioning (D).

Impacts Scoped Out of the Assessment

8.7.3 The Scoping Workshop (see Table 8.5) was used to facilitate stakeholder engagement on topics to be scoped out of the assessment.

8.7.4 On the basis of the baseline environment and the Project Description outlined in Volume 1, Chapter 3: Project Description, a number of impacts are scoped out of the assessment for benthic ecology. These impacts were proposed to be scoped out in the Bowdun Offshore Scoping Report (Thistle Wind Partners, 2024) and this was confirmed in the Scoping Opinion (MD-LOT, 2024).

8.7.5 These impacts are outlined, together with a justification for scoping them out, in Table 8.11.

Table 8.11: Impacts Scoped Out of the Assessment for Benthic Ecology

Potential Impact	Phase*			Justification
	C	O	D	
Accidental pollution to the surrounding environment	✓	✓	✓	There is a risk of accidental pollution from vessels and equipment during all three phases. However, this risk is mitigated by the implementation of measures set out in Section 8.9. These include the Environmental Management Plan (EMP), which contains a Marine Pollution Contingency Plan (MPCP). These measures will include planning for accidental spills, address the sources of all potential contaminants which could be released, and include key emergency contact details. They will also set out good industry practice and relevant guidelines for preventing pollution at sea (such as those from OSPAR, International Maritime Organization (IMO), and the International Convention for the Prevention of Pollution from Ships. Thus, it is unlikely that accidental pollution will occur. In the unlikely event that it did, the magnitude will be minimised through measures such as the MPCP. Therefore, this impact has been scoped out of further consideration, as agreed by MD-LOT in the Scoping Opinion (MD-LOT, 2024).
Release of sediment-bound contaminants	✓	✓	✓	Activities in all three phases could result in seabed disturbance and the remobilisation of sediment-bound contaminants. These contaminants could have adverse effects on benthic communities. However, sediment chemistry analyses from recent site-specific surveys of other OWFs in the Regional Benthic Ecology Study Area have recorded very low levels of contamination (MvOWL, 2023; Ossian OWFL, 2023). The site-specific sampling within the Local Benthic Ecology Study Area showed that levels of sediment contaminants were low to very low (see Volume 3, Technical Appendix 8.1: Benthic Ecology Technical Report). Specifically, sediment contamination analysis identified that most stations were below marine Scotland AL1 and AL2 and CSQG TEL and PEL for PAHs, organotins, and PCBs. Metal contamination was mostly below these thresholds, except for chromium and arsenic, with one and three stations respectively exceeding the AL1, but below the AL2. As the contamination across the stations was low, this impact is scoped out of further consideration, as agreed by MD-LOT in the Scoping Opinion (MD-LOT, 2024).

* Proposed Development Phase refers to construction (C), O&M (O) and decommissioning (D).

8.8 Methodology for Assessment of Effects

Overview

8.8.1 The benthic ecology assessment of effects has followed the methodology set out in Volume 1, Chapter 4: Environmental Impact Assessment Methodology. Specific to the benthic ecology assessment, the following guidance documents have also been considered:

- Guidelines for Ecological Impact Assessment in the UK and Ireland (CIEEM, 2022);
- The Status of *Sabellaria spinulosa* Reef off the Moray Firth and Aberdeenshire Coasts and Guidance for Conservation of the Species off the Scottish East Coast (Pearce and Kimber, 2020);
- Advances in Assessing *Sabellaria spinulosa* Reefs for Ongoing Monitoring (Jenkins *et al.*, 2018);
- Marine Evidence Based Sensitivity Assessment – A Guide (Tyler-Walters *et al.*, 2018; Tyler-Walters *et al.*, 2023);
- Guidelines for Data Acquisition to Support Marine Environmental Assessments of Offshore Renewable Energy Projects (Judd, 2012);
- Guidance on Survey and Monitoring in Relation to Marine Renewables Deployments in Scotland – Volume 5: Benthic Habitats (Saunders *et al.*, 2011);
- Best Methods for Identifying and Evaluating *Sabellaria spinulosa* and Cobble Reef (Limpenny *et al.*, 2010);
- Identification of the Main Characteristics of Stony Reef Habitats under the Habitats Directive (Irving, 2009);
- Guidance on Environmental Considerations for Offshore Windfarm Development (OSPAR Commission, 2008); and
- Defining and Managing *Sabellaria spinulosa* Reefs (Gubbay, 2007).

Criteria for Assessment

8.8.2 When determining the significance of effects, a process is used which involves defining the magnitude of the potential impacts and the sensitivity of the receptors. This section describes the criteria applied in this chapter to assign values to the magnitude of potential impacts and the sensitivity of the receptors. The terms used to define magnitude and sensitivity are based on those which are described in further detail in Volume 1, Chapter 4: Environmental Impact Assessment Methodology.

8.8.3 The criteria for defining magnitude in this chapter are outlined in Table 8.12. Each assessment considered the spatial extent, duration, frequency and reversibility of impact when determining magnitude which are outlined within the magnitude section of each impact assessment (e.g. a duration of hours or days would be considered for most receptors to be of short term duration, which is likely to result in a low magnitude of impact).

Table 8.12: Definition of Terms relating to Magnitude of Impact

Magnitude of Impact	Definition
High	Loss of resource and/or quality and integrity of resource; severe damage to key characteristics, features or elements (Adverse)
	Large scale or major improvement or resource quality; extensive restoration or enhancement; major improvement of attribute quality (Beneficial)
Medium	Loss of resource, but not adversely affecting integrity of resource; partial loss of/damage to key characteristics, features or elements (Adverse)
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality (Beneficial)
Low	Some measurable change in attributes, quality or vulnerability, minor loss or, or alteration to, one (maybe more) key characteristics, features or elements (Adverse)
	Minor benefit to, or addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk of negative impact occurring (Beneficial)
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements (Adverse)
	Very minor benefit to, or positive addition of one or more characteristics, features or elements (Beneficial)

8.8.4 The criteria for defining overall sensitivity of receptors in this chapter, which are a combination of their value, vulnerability and recoverability, are outlined in Table 8.13.

Table 8.13: Definition of Terms Relating to the Sensitivity of the Receptor

Sensitivity of the Receptor	Definition
Very High	Very high importance and rarity, international receptor with no potential or very limited potential for recovery
High	High importance and rarity, international and/or national receptor and limited potential for recovery
Medium	High or medium importance and rarity, regional receptor, and potential for recovery
Low	Low or medium importance and rarity, local receptor and high potential for recovery
Negligible	Very low importance and rarity, local receptor and very high potential for recovery

8.8.5 The magnitude of the impact and the sensitivity of the receptor are combined when determining the significance of the effect upon benthic ecology. The particular method employed for this assessment is presented in Table 8.14 and Table 8.15.

8.8.6 Where a range is suggested for the significance of effect, for example, minor to moderate, it is possible that this may span the significance threshold. The technical specialist's professional judgement has been applied to determine which outcome defines the most likely effect, which takes in to account the magnitude of impact and the sensitivity of the receptor. Where professional judgement is applied to quantify final significance from a range, the assessment will set out the factors that result in the final assessment of significance. These factors may include the likelihood that an effect will occur, data certainty and relevant information about the wider environmental context.

8.8.7 The EIA Regulations require the identification and reporting of significant environmental effects. For the purposes of this assessment:

- a level of moderate or more will be considered a 'significant' effect in terms of the EIA Regulations; and
- a level of minor or less will be considered 'not significant' in terms of the EIA Regulations.

Table 8.14: Matrix Used for the Assessment of the Significance of the Effect

Sensitivity of Receptor	Magnitude of Impact			
	Negligible	**Low**	**Medium**	**High**
Negligible	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	Negligible or Minor	Minor	Moderate	Moderate or Major
High	Minor	Minor or Moderate	Moderate or Major	Major
Very High	Minor	Moderate or Major	Major	Major

Table 8.15: Definition of Significance

Impact	Justification
Negligible	No effects or those that are beneath levels of perception, within normal bounds of variation, or within the margin of forecasting error.
Minor	These beneficial or adverse effects are generally, but not exclusively, raised as local factors. They are unlikely to be critical in the decision-making process but are important in enhancing the subsequent design of the Proposed Development.
Moderate	These beneficial or adverse effects have the potential to be important and may influence the decision-making process. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse or beneficial effect on a particular resource or receptor.
Major	These beneficial or adverse effects are very important and are likely to be material in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national, or regional importance. However, a major change in a site or feature of local importance may also enter this category.

Designated Sites

8.8.8 This benthic ecology chapter assesses the likely significant effects in EIA terms on the qualifying feature(s) of Natura 2000 sites (i.e. nature conservation sites in Europe designated under the Habitats or Birds Directives) and/or sites in the UK that comprise the National Site Network (collectively termed 'European sites'), as well as Ramsar sites as described within Section 8.6 of this chapter. The RIAA for the Proposed Development includes the assessment of the potential impacts on the site itself.

8.8.9 Where locally designated sites and national designations (other than European sites) fall within the boundaries of a European site and where qualifying features are the same, only the European site has been taken forward for assessment. Potential impacts on the integrity and conservation status of the locally or nationally designated site are assumed to be inherent within the assessment of the European site so a separate assessment for the local or national site is not undertaken.

8.8.10 However, assessment of the likely significant environmental effects on a local or nationally designated site which falls outside the boundaries of a European site, but within the Local Benthic Ecology Study Area, has been undertaken within this chapter using the EIA methodology.

8.9 Embedded Mitigation

8.9.1 As part of the Proposed Development design process, a number of Embedded Mitigation measures have been proposed to reduce the potential for impacts on benthic ecology (see Table 8.16). They are considered at every stage of the Proposed Development through design and best practice and, as there is a commitment to implementing these measures, these have been considered in the assessment presented in Section 8.10 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures). These embedded measures are considered standard industry practice for this type of development and will be secured through relevant consent condition and associated EMPs.

Table 8.16: Embedded Mitigation Measures Adopted as Part of the Proposed Development

ID*	Embedded Mitigation Measures Adopted as Part of the Proposed Development	Justification
1	Development of, and adherence to, a Cable Specification and Installation Plan (CSIP) post-consent.	The CSIP will outline the technical specifications of the cables in the Proposed Development and describe the relevant cable installation methodology, and identify risks of cable burial, and any measures required to address these risks to limit the disturbance of the seabed as far as practicable.
2	Use of anti-corrosion protective coatings and Scour Protection where there is potential for scour to develop around the Offshore Infrastructure, and it is appropriate to do so.	There is potential for scouring of the seabed sediments to occur through interactions of the metocean regime (including waves, sand, and currents), and the foundations or other artificial structures. This scouring has the

ID*	Embedded Mitigation Measures Adopted as Part of the Proposed Development	Justification
		potential to develop into depressions around the structures, and therefore, to prevent this, the use of Scour Protection will be employed around foundations (as per Volume 1, Chapter 3: Project Description). The Scour Protection has been included in the modelled scenarios used within the assessment of physical processes effects (see Volume 2, Chapter 7: Physical Processes) and within this assessment.
4	Development of, and adherence to, a Cable Burial Risk Assessment (CBRA) and the Cable Burial Assessment (CBA). Implementation, management and monitoring of cable protection, via burial or external protection where adequate burial depth is not feasible, will be undertaken as informed by these assessments. Results of these assessments, and commitments to post construction monitoring, will be provided in the Cable Plan (CaP).	The potential impacts of cable installation can be mitigated through burying cables to a target cable burial depth, as detailed in the CBRA and CBA. This, alongside the cable installation strategy, should provide sufficient depth to avoid most exposure through metocean processes. Details of any required cable protection will be included in the CaP.
5	Development of and adherence to an EMP, including a MPCP and a Biosecurity Plan with commitments to monitoring and actions to minimise INNS.	Measures will be adopted to ensure that the potential for release of pollutants from construction, O&M and decommissioning plant is reduced so far as reasonably practicable. The EMP will include measures that will cover all aspects of environmental management including environmental awareness training, auditing, environmental reporting and waste management. An MPCP will be developed, which will include planning for accidental spills and sources of contaminant releases, and an Biosecurity Plan, to provide measures for controlling the introduction and spread of INNS.
7	Development of, and adherence to, a Construction Method Statement (CMS) along with a Code of Construction Practice (CoCP).	Construction procedures will follow the CMS and CoCP, with measures to control specific health and safety risks identified.
8	All relevant Health and Safety Executive (HSE) procedures will be followed.	As with the CMS, construction procedures will consider all relevant health and safety risks and follow HSE legislation and guidance to mitigate these potential identified risks.
34	Drafting and implementation of a decommissioning programme, prepared in accordance with requirements of the Energy Act 2004, which will set out the extent of infrastructure to be removed as well as the methods and processes which will be used.	The aim of this plan is to adhere to the existing UK and international legislation and guidance (at the time of writing) during the decommissioning phase. This programme will be developed to reduce the amount of long term disturbance to

ID*	Embedded Mitigation Measures Adopted as Part of the Proposed Development	Justification
		the environment as far as reasonably practicable.
40	Creation of a Waste Management Plan (WMP), which will describe the processes for handling and managing any waste materials.	The WMP will set out procedures to ensure all waste processing and handling activities with the potential to affect the environment are appropriately managed.
43	Use of a trenchless technique (e.g. HDD or pipe jack tunnelling) as the Landfall installation option.	Landfall installation methodology (trenchless techniques) will avoid direct impacts to the Intertidal Area.

*see Volume 3, Technical Appendix 4.6: Schedule of Mitigation and Commitments

8.10 Assessment of Significance

8.10.1 Table 8.10 summarises the potential impacts arising from the construction, O&M and decommissioning phases of the Proposed Development, as well as the MDS against which each impact has been assessed. An assessment of the likely significance of the effects of the Proposed Development on the benthic ecology receptors caused by each identified impact is given below.

IMPACT 1 - TEMPORARY HABITAT LOSS AND/OR DISTURBANCE

8.10.2 Temporary habitat loss/disturbance of subtidal and intertidal habitats may occur during activities associated with the construction, O&M and decommissioning phases of the Proposed Development. The MDS for this impact is summarised in Table 8.10.

8.10.3 The relevant MarESA and Feature Activity Sensitivity Tool (FeAST) pressures and their benchmarks which have been used to inform this assessment of effects are:

- Habitat structure changes – removal of substratum (extraction): the benchmark for which is the extraction of substratum to 30 cm. This pressure is considered to be analogous to the impacts associated with sandwave and boulder clearance/relocation and UXO clearance.
- Abrasion/disturbance at the surface of the substratum or seabed: the benchmark for which is damage to surface features (e.g. species and physical structures within the habitat). This pressure corresponds to the impacts associated with jack-up vessel operations, cable installation, and any Offshore Infrastructure temporarily placed on the seabed.
- Penetration and/or disturbance of the substratum subsurface: the benchmark for which is damage to subsurface features (e.g. species and physical structures within the habitat). This pressure corresponds to the impacts associated with cable installation, sandwave clearance, UXO clearance, and jack-up vessel operations.
- Smothering and siltation rate changes (heavy): the benchmark for which is heavy deposition of up to 30 cm of fine material added to the habitat in a single discrete event. This pressure corresponds to impacts associated with sandwave clearance and cable installation.

8.10.4 For the intertidal assessment, the pressures and benchmarks associated with abrasion/disturbance at the surface of the substratum, and penetration and/or disturbance of the substratum surface have not been considered. This is due to the proposed use of trenchless cable installation methods in the Intertidal Area.

Construction Phase

Magnitude of Impact

Subtidal IEFs

8.10.5 The MDS accounts for up to a total of 19,414,805 m^2 of subtidal temporary habitat loss and/or disturbance during the construction phase (Table 8.10), which equates to approximately 6.66% of the Site Boundary. The MDS is based on the total temporary habitat loss and/or disturbance as a result of the following activities in the site preparation and construction phases:

- sandwave clearance and deposit;
- cable installation and boulder clearance;
- jack-up events for the installation of OSPs, Wind Turbine foundations and exit pits;
- exit pit excavation; and
- UXO clearance.

8.10.6 Pre-construction sandwave clearance in preparation of the seabed will account for up to 835,872 m^2 of temporary habitat loss and/or disturbance. Additionally, there will be 8,774,332 m^2 of temporary habitat loss and/or disturbance due to the deposition of dredged material to an assumed uniform depth of 0.5 m. Any mounds of cleared material will erode over time, with the displaced material re-joining the natural sedentary environment. As well as 16,800 m^2 of habitat disturbance as a result of the deposition of trenchless solution exit pit excavation material.

8.10.7 Temporary habitat loss and/or disturbance of up to 9,638,945 m^2 may occur due to cable installation and associated boulder clearance and 330 m^2 from the excavation of exit pits (full details in Table 8.10).

8.10.8 A study by RPS (2019) reviewed the effects of cable installation on subtidal sediments and habitats, drawing on monitoring reports from over 20 UK OWFs. Sandy sediments (e.g. offshore subtidal sands and gravels) were shown to recover quickly following cable installation, with little to no evidence of disturbance in the years following (RPS, 2019). There was some evidence that remnant trenches in coarse and mixed sediments were conspicuous for several years after installation, however these shallow depressions were of limited depth (i.e. tens of centimetres) relative to the surrounding seabed, over a horizontal distance of several metres and therefore did not represent a large shift from the baseline environment (RPS, 2019). Muddy and muddy sand seabed habitats had observable remnant trenches in the years following cable installation, although as with coarse and mixed sediments, these were relatively shallow features (i.e. a few tens of centimetres). The results of the RPS (2019) study suggest that disturbance to sediments within the Site Boundary is likely to be reversible. Post construction monitoring of the Block Island OWF (off the coast of Rhode Island, United States of America) demonstrated that 62% of the trench formed during Offshore Export Cables installation had recovered within four months, and the remainder was partially recovered (Bureau of Ocean Energy Management (BOEM), 2020), further highlighting the reversibility of this impact.

8.10.9 The MDS accounts for a total area of up 148,400 m^2 of temporary habitat loss and/or disturbance due to jack-up vessel footprints (Table 8.10). Depressions in the seabed caused by jack-up vessel usage could last for up to a year or more. For example, monitoring studies at Barrow OWF (Irish Sea) demonstrated that depressions were almost entirely infilled 12 months post construction (Barrow Offshore Windfarm Limited, 2008). Similarly, post construction seafloor disturbance monitoring at the Block Island OWF suggested that depressions from the spud cans of jack-up vessels were expected to fully recover (BOEM, 2020). Jack-up depressions are therefore assessed to likely be temporary features which will persist for a period of months to a small number of years.

8.10.10 In addition, the MDS (Table 8.10) assumes the clearance of up to a total of 40 UXOs within the Site Boundary during site preparation activities, which could result in the formation of craters. The literature provides limited information on this impact currently, however a study undertaken for Norfolk Vanguard OWF identified 21.1 m as the maximum estimated crater diameter following UXO detonation (Ordtek, 2018). Using the maximum crater diameter identified in Ordtek (2018), it is calculated that up to a total of up to 13,987 m^2 of temporary habitat loss and/or disturbance may occur. This value has not been included in the total disturbance presented above (Paragraph 8.10.5), as the footprint for UXO clearance will likely overlap with the area subject to temporary habitat disturbance from other site preparation activities. Any craters created during detonation are expected to gradually backfill by natural processes, the speed of which would depend on the sediment transport regimes in the area.

8.10.11 The duration of the offshore construction phase of the Proposed Development is up to five years (2031 to 2036). Within this maximum construction phase, construction activities are anticipated to occur intermittently, spread out across the construction window and impacting only a small proportion of the Proposed Development area at any one time.

8.10.12 The impact is predicted to be of local spatial extent, medium term duration, intermittent and of high reversibility. It is predicted that the impact will affect the majority of the receptors directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.10.13 There is no impact in the Intertidal Area as cables will be installed via a trenchless technique (e.g. HDD) with exit pits located below MLWS and above MHWS. Therefore, there is no further consideration of the intertidal IEFs in relation to this impact.

Qualifying Features of an MPA

8.10.14 As only the Proposed Development's ZoI overlaps with the Firth of Forth Banks MPA and the impact of temporary habitat loss and/or disturbance will only occur within the Site Boundary, the relevant features of the MPA (i.e. Ocean quahog) will not be assessed in relation to this impact.

Sensitivity of the Receptor

8.10.15 The sensitivities of the IEFs to temporary habitat loss and disturbance are presented in Table 8.17. These sensitivities are based on the MarESA and FeAST (where applicable). Where the sensitivity of the IEF differs either between the MarESA and FeAST or between representative biotopes within an IEF, a precautionary approach considering the highest sensitivity has been taken.

Subtidal IEFs

8.10.16 The three representative biotopes for the offshore subtidal sands and gravels IEF were deemed to have an overall medium sensitivity to temporary habitat loss and disturbance based on information presented in the MarESA and FeAST (Tillin and Watson, 2023; Tillin and Watson, 2024a). They have no resistance to the pressure removal of substratum (extraction) as benthic species associated with the biotopes will be extracted with the sediment (Tillin and Watson, 2023; Tillin and Watson, 2024a). Additionally, surface abrasion will primarily damage the epifauna associated with these biotopes, such as calcareous tube worms, bryozoans and hydroids and small fragile polychaetes and brittlestars (Tillin and Watson, 2024a), however, some species, such as thick-shelled bivalves, hermit crabs and gastropods have been found to be resilient to surface abrasion in the form of dredging (Thomas, 1975). Activities that disturb the surface and penetrate the subsurface would remove/damage characterising species within the direct area of impact (Tillin and Watson, 2023; Tillin and Watson, 2024a). Trawling studies (Gilkinson *et al.*, 2005; Kenchington *et al.*, 2011) and the comparative study by Capasso *et al.* (2009) suggest that the species present in these biotopes are either robust or buried within sediments or are adapted to habitats with frequent disturbance (natural or anthropogenic), and therefore relatively tolerant of penetration and disturbance of the sediments. The characterising species of these biotopes are also likely to be able to escape from heavy siltation (e.g. small bivalves, such as *Donax* sp., could migrate up to 20 cm in sand, and for *Tellina* sp., approximately 50 cm in sand and approximately 40 cm in mud (Bijkerk, 1988)).

8.10.17 The two representative biotopes for the offshore muddy and mixed sediments IEF were deemed to have an overall medium sensitivity to temporary habitat loss and disturbance based on information presented in the MarESA and FeAST (Tillin *et al.*, 2023). The potential effect of this impact on the offshore muddy and mixed sediments IEF will be the same as described for the offshore subtidal sands and gravels IEF in Paragraph 8.10.16.

8.10.18 The subtidal sands and gravels IEF were deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

8.10.19 The offshore muddy and mixed sediments IEF were deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Table 8.17: Sensitivity of the Benthic Subtidal and Intertidal Habitat IEFs to Temporary Habitat Loss and/or Disturbance

IEF	Representative Biotopes/Species	Sensitivity to Defined MarESA and FeAST Pressure				Overall Sensitivity
		Habitat Structure Changes – Removal of Substratum (Extraction)	Abrasion/Disturbance of the Surface of the Substratum or Seabed	Penetration or Disturbance of the Substratum Subsurface	Smothering and Siltation Rate Changes (Heavy)	
Subtidal						
Offshore subtidal sands and gravels	SS.SSa.CFiSa.EpusOborApri SS.SSa.OSa SS.SCS.CCS.MedLumVen	MarESA: Medium FeAST: High	MarESA: Low FeAST: Medium to High	MarESA: Low FeAST: Medium to High	MarESA: Medium FeAST: Medium to High	Medium
Offshore muddy and mixed sediments	SS.SSa.CMuSa.AalbNuc SS.SSa.CMuSa	MarESA: Medium FeAST: N/A	MarESA: Low FeAST: N/A	MarESA: Low FeAST: N/A	MarESA: Medium FeAST: N/A	Medium

Significance of the Effect

Subtidal IEFs

8.10.20 For the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.10.21 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

O&M Phase

Magnitude of Impact

Subtidal IEFs

8.10.22 The MDS accounts for up to 11,688,813 m^2 of temporary habitat loss and/or disturbance during the up to 30 year life cycle of the Proposed Development (Table 8.10), representing 4.01% of the total Site Boundary. It should be noted that only a small proportion of the total temporary habitat loss and/or disturbance is likely to occur at any one time during the Proposed Development life cycle. Therefore, individual maintenance activities will be small scale, intermittent events. The MDS is based on the total temporary habitat loss and/or disturbance as a result of the following events in the O&M phase:

- Disturbance caused by the repair and reburial of IACs, Interconnector Cables and Offshore Export Cables.

8.10.23 These activities will affect benthic habitats in the immediate vicinity of these operations, with the disturbance similar to that identified for cable installation in the construction phase above.

8.10.24 The impact is predicted to be of local spatial extent, long term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of the Receptor

Subtidal IEFs

8.10.25 The sensitivities of all subtidal IEFs are considered to be as previously described for the construction phase (see Table 8.17 and Paragraphs 8.10.16 and 8.10.17).

8.10.26 The subtidal sands and gravels IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

8.10.27 The offshore muddy and mixed sediments IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Significance of the Effect

Subtidal IEFs

8.10.28 For the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.10.29 No Additional Mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.

Decommissioning Phase

Magnitude of Impact

Subtidal IEFs

8.10.30 The approach for decommissioning is yet to be determined and therefore no footprint of temporary habitat loss and/or disturbance could be calculated. For the purposes of this MDS, the total removal of all Offshore Infrastructure, including buried cables and cable protection, has been assumed. This represents the largest potential area for temporary habitat loss and/or disturbance (Table 8.10), with the exact programme to be submitted to MD-LOT for consultation and approval.

8.10.31 The impacts of decommissioning methods are assumed to be similar to those used during construction, with the magnitude of temporary habitat loss and/or disturbance not being greater than that set out for the assessment in the construction phase of the Proposed Development.

8.10.32 The impact is predicted to be of local spatial extent, medium term duration, intermittent and of high reversibility. It is predicted that the impact will affect the majority of the receptors directly. The magnitude is therefore, considered to be low.

Sensitivity of the Receptor

Subtidal IEFs

8.10.33 The sensitivities of all subtidal IEFs are considered to be as previously described for the construction phase (see Table 8.17 and Paragraphs 8.10.16 and 8.10.17).

8.10.34 The subtidal sands and gravels IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

8.10.35 The offshore muddy and mixed sediments IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Significance of the Effect

Subtidal IEFs

8.10.36 For the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.10.37 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

IMPACT 2 – LONG TERM HABITAT LOSS AND/OR DISTURBANCE

8.10.38 Long term habitat loss and/or disturbance will occur during the construction, O&M, and decommissioning phases of the Proposed Development. The MDS for this impact is summarised in Table 8.10. This impact does not represent a complete removal of habitat, but rather a physical change from a predominantly sandy sedimentary habitat to an artificial, hard substratum.

8.10.39 The relevant MarESA and FeAST pressures and their benchmarks which have been used to inform this assessment of effect are:

- 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.

8.10.40 The effects of long term habitat loss and/or disturbance are assessed here, however, the potential for colonisation of hard substrate installed has been assessed below (Paragraph 8.10.184) in the colonisation of hard substrate impact. Further, while long term habitat loss and/or disturbance persist into the decommissioning phase through Offshore Infrastructure that is left *in situ*, the potential effects to benthic ecology due to the removal of Offshore Infrastructure in the decommissioning phase has been assessed separately in the removal of hard substrates impact below (Paragraph 8.10.205).

Construction and O&M Phase

Magnitude of Impact

Subtidal IEFs

8.10.41 The MDS accounts for up to a total of 2,251,000 m^2 of long term habitat loss and disturbance as Offshore Infrastructure is installed during the construction phase, which will persist into the O&M phase (Table 8.10). This represents 0.77% of the total Site Boundary. The MDS is based on the total long term habitat loss and disturbance as a result of the installation of the following Offshore Infrastructure:

- OSP and Wind Turbine foundations and associated Scour Protection; and
- IAC, Interconnector Cable and Offshore Export Cables protection and cable crossing protection.

8.10.42 The long term habitat loss and/or disturbance impact will occur during the construction phase and will be continuous throughout the up to 30 year O&M phase.

8.10.43 The impact is predicted to be of local spatial extent, long term duration, continuous and of low reversibility during the lifetime of the Proposed

Development (up to 30 years). It is predicted that the impact will affect the majority of receptors directly. The magnitude is therefore considered to be low.

Intertidal IEFs

8.10.44 Trenchless techniques will be used for cable installation at the Landfall and therefore there will be no long term habitat loss and/or disturbance to intertidal habitats as a result of construction and O&M activities. The effect of long term habitat loss and/or disturbance on benthic intertidal receptors is therefore not considered further.

Qualifying Features of an MPA

8.10.45 As only the Proposed Development's ZoI overlaps with the Firth of Forth Banks MPA and the impact of long term habitat loss will only occur within the Site Boundary, the relevant features of the MPA (i.e. Ocean quahog) will not be assessed in relation to this impact.

Sensitivity of the Receptor

8.10.46 The sensitivity of the IEFs to long term habitat loss is presented in Table 8.18, based on the MarESA and FeAST sensitivity assessments.

Subtidal IEFs

8.10.47 The biotopes which are representative of the offshore subtidal sands and gravels IEF are concluded to be of high sensitivity overall (Table 8.18). A change to hard substratum would alter the characteristics of the biotopes, which is based on a sedimentary substrate, resulting in the loss of characterising species (such as pea urchin *E. pusillus*, the polychaete *O. borealis, M. fragilis* and *Glycera lapidum,* as well as the bivalve *A. prismatica*) (Tillin and Watson, 2023; Tillin and Watson, 2024a).

8.10.48 Similarly, the offshore muddy and mixed sediments IEF also requires a primarily sedimentary habitat, and physical change to hard substratum would represent habitat loss for the affected communities (including species such as the bivalves *A. alba* and *N. nitidosa*) (Tillin, 2022).

8.10.49 The offshore subtidal sands and gravel IEF is deemed to be of high vulnerability, low recoverability and regional value. The sensitivity of the receptor is therefore, considered to be high.

8.10.50 The offshore muddy and mixed sediments IEF is deemed to be of high vulnerability, low recoverability and regional value. The sensitivity of the receptor is therefore, considered to be high.

Table 8.18: Sensitivity of the Benthic Subtidal and Intertidal Habitat IEFs to Long Term Habitat Loss and/or Disturbance

IEF	Representative Biotopes/Species	Physical change (to another seabed type)	Overall Sensitivity
Subtidal			
Offshore subtidal sands and gravels	SS.SSa.CFiSa.EpusOborApri SS.SSa.OSa SS.SCS.CCS.MedLumVen	MarESA: High FeAST: Medium to High	High
Offshore muddy and mixed sediments	SS.SSa.CMuSa.AalbNuc SS.SSa.CMuSa	MarESA: High FeAST: N/A	High

Significance of the Effect

Subtidal IEFs

8.10.51 For the offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be high. The effect will therefore be of a minor to moderate adverse significance. Given the small footprint of the long term habitat loss and/or disturbance compared to the area covered by the Site Boundary, the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.10.52 No Additional Mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.

Decommissioning Phase

Magnitude of Impact

Subtidal IEFs

8.10.53 The approach for decommissioning is yet to be determined. Therefore, this MDS accounts for the maximum seabed footprint of Offshore Infrastructure that could remain *in situ,* as the worst case scenario, with a total of up to 2,251,000 m^2 of long term habitat loss and disturbance which will persist into and beyond the decommissioning phase. This represents 0.77% of the total area of the Site Boundary.

8.10.54 The impact is predicted to be of local spatial extent, long term duration, continuous and of low reversibility. It is predicted that the impact will affect the receptors directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.10.55 Trenchless techniques will be used for cable removal at the Landfall and, therefore, there will be no long term habitat loss and/or disturbance to intertidal habitats as a result of decommissioning activities. The effect of long term habitat loss and/or disturbance on benthic intertidal receptors is, therefore, not considered further.

Sensitivity of the Receptor

Subtidal IEFs

8.10.56 The sensitivities of all subtidal IEFs are considered to be as previously described for the construction phase (see Table 8.18 and Paragraphs 8.10.47 and 8.10.48).

8.10.57 The offshore subtidal sands and gravel IEF is deemed to be of high vulnerability, low recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be high.

8.10.58 The offshore muddy and mixed sediments IEF is deemed to be of high vulnerability, low recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be high.

Significance of the Effect

Subtidal IEFs

8.10.59 For the offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be high. The effect will therefore be of a minor to moderate adverse significance. Given the small footprint of the long term habitat loss and/or disturbance compared to the area covered by the Site Boundary, the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.10.60 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

IMPACT 3 – CHANGES TO SSCs, BED LEVELS AND SEDIMENT TYPES

8.10.61 Increased SSCs and associated deposition are predicted to occur during the construction phase due to drilling for pile installation, IAC, Interconnector Cable and Offshore Export Cables installation, sandwave clearance, and trenchless techniques and drilling fluid release (see Table 8.10). This impact may occur during the O&M phase due to cable repair and during the decommissioning phase due to removal of Offshore Infrastructure.

8.10.62 The benchmarks for the relevant MarESA and FeAST pressures which have been used to inform this impact assessment across all IEFs are:

- Changes in suspended solids (water clarity): the benchmark for which is a change in one rank on the Water Framework Directive scale (e.g. from clear to intermediate for one year, caused by activities disturbing sediment or organic particulate material and mobilising it into the water column such as dredging, disposal at sea, cable and pipeline burial).
- Smothering and siltation rate changes (light): the benchmark for light deposition is up to 5 cm of fine material added to the habitat in a single discrete event.
- Smothering and siltation rate changes (heavy): the benchmark for which is heavy deposition of up to 30 cm of fine material added to the seabed in a single discrete event.

8.10.63 Physical processes modelling, presented in full in Volume 3, Technical Appendix 7.3: Physical Processes Technical Assessment, has been used to inform the assessment of potential increased SSCs and associated deposition.

Construction Phase

Magnitude of Impact

Subtidal IEFs and Qualifying Features of an MPA

8.10.64 The site preparation activities and installation of Offshore Infrastructure associated with the Proposed Development may lead to increased SSCs and associated deposition. During the construction phase, these activities will include drilling for pile installation, IAC, Interconnector Cable and Offshore Export Cables installation, sandwave levelling, trenchless techniques and drilling fluid release (Table 8.10).

8.10.65 Drilling action for pile installation may result in up to 318,086 m^3 of drill arisings, from up to 40 drilled piles. This will result in a localised and temporary plume of elevated SSC, which will be advected in the direction of the ambient tidal currents, broadly aligned to the coast, and is expected to be dispersed to relatively low concentrations within hours of release, and to background concentrations within a few tidal cycles.

8.10.66 The IAC, Interconnector Cable and Offshore Export Cables installation will involve installations in trenches of up to 6 m width with an average depth of 1.5 m, and a v-shaped profile. Installation may occur using an MFE, with a pre-lay trenching rate of 400 m per hour. This involves the installation of a total of 151 km of IAC and 36 km of Interconnector Cables in contact with the seabed. Offshore Export Cables installation may involve up to three cable installations for a total of 70 km of cables in contact with the seabed.

8.10.67 Sandwave levelling for IAC, Interconnector Cable and Offshore Export Cables installation may cover areas defined in Table 8.10, with associated volumes of displaced sediment. Levelling will be undertaken using a mass flow excavator and/or a dredger. The physical processes modelling was undertaken for a mass flow excavator for both sandwave levelling and cable installation. This modelling found that SSCs could increase to cause there to be more sediment than water for a very short period of time within 5 m of the excavator activity, with the plumes expected to be vertically and horizontally dispersed to less than 1,000 mg/l within tens of metres. The SSCs are expected to reach less than 5 mg/l in all locations within three days of the cessation of excavation.

8.10.68 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.10.69 Trenchless techniques and drilling fluid release (at Landfall) may occur at three exit pits to be installed in the nearshore offshore area of the Export Cable Corridor. The exit pit extraction may result in a volume of up to 2,800 m^3 of excavated material per pit, for a total of 8,400 m^3 of excavated material. The drilling fluid release may result in the release of up to 2,870 m^3 drilling mud per pit, for a total of up to 8,610 m^3 of drilling mud, with an assumed conservative maximum bentonite concentration of 100,000 mg/l (Table 8.10). The drilling fluid may remain in suspension for several hours to days and will disperse to not measurable concentrations over time by wave and tidal action. The drilling fluid lubricating clay may accumulate in the trenchless techniques if it is slightly denser than surrounding seawater or may move over the adjacent seabed downslope under gravity in an offshore direction.

8.10.70 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of the Receptor

8.10.71 The sensitivities of the IEFs to the defined MarESA and FeAST pressures are presented in Table 8.19.

Subtidal IEFs

8.10.72 The three representative biotopes for the offshore subtidal sands and gravels IEF were deemed to have an overall medium sensitivity to increased SSCs and associated deposition, based on information presented in the MarESA and FeAST (Tillin and Watson, 2023; Tillin and Watson, 2024a). The SS.SSa.CFiSa.EpusOborApri and SS.SCS.CCS.MedLumVen biotopes are particularly sensitive to heavy smothering and siltation rate changes, with a benchmark of 30 cm of fine material deposited in one event, as it exceeds the overburden for some small bivalve species such as *Donax sp*. (Bijkerk, 1988). Most bivalve species are capable of burrowing through sediment to feed, such as *A. alba*, which are capable of upwardly migrating if lightly buried by additional sediment (Schafer, 1972), and polychaetes such as *Nephtys hombergii* can successfully migrate through up to 4 cm of material (Powilleit *et al.*, 2009). This is however an energetically costly activity. Additionally, some species, such as the bivalve *Tellina pygmaea* and the polychaetes *Spio filicornis* and *Spiophanes bombyx*, are sensitive to strong fluctuations in sedimentation, but their populations recover relatively quickly (Gittenberger and Van Loon, 2011).

8.10.73 The two representative biotopes for the offshore muddy and mixed sediments IEF were deemed to have an overall medium sensitivity to increased SSCs and associated deposition based on information presented in the MarESA and FeAST (Tillin *et al.*, 2023). The characterising, suspension feeding bivalves are likely to be tolerant of short term increases in turbidity following storms and other natural events. With the bivalves and polychaetes exhibiting the same levels of resilience to light smothering as described above, however heavy smothering (up to 30 cm) approaches the overburden limit for some species of small bivalve (Tillin *et al.*, 2023).

8.10.74 Based on this assessment, these IEFs are likely to have an overall high resilience to this impact and will recover quickly to baseline conditions.

8.10.75 The offshore subtidal sands and gravels IEF is deemed to be of low vulnerability, medium recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

8.10.76 The offshore muddy and mixed sediments IEF is deemed to be of low vulnerability, medium recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Qualifying Features of an MPA

8.10.77 Ocean quahog is assessed as not sensitive to increased SSCs and associated deposition, as they are commonly located in silty sediments in sheltered to wave exposed conditions (Tyler-Walters and Sabatini, 2017), and adapted to deposit feeding in sedimentary environments (Morton, 2011). In the more wave exposed conditions, the surface of the sediment is probably regularly mobilised, with moderate to high levels of sediment accretion, and therefore an increase in turbidity may not adversely affect the species, and it can also avoid sudden changes by burrowing for several days (Tyler-Walters and Sabatini, 2017). In terms of burial or smothering, this species has been noted as surviving with very little impact when buried under 1.5 m of sediment (Powilleit *et al.*, 2006), with a similar population structure to pre-burial conditions noted two years later, with no apparent change in growth rates. Individuals of the species were able to burrow to the surface of 32 cm to 41 cm of sediment in a laboratory setting (Powilleit *et al.*, 2009). This indicates a high resistance to this impact, with a high speed of recovery. The FeAST highlights that this species uses a short inhalant siphon at the sediment surface for feeding and respiration (Taylor, 1976) which may be susceptible to heavy siltation and burial, with a high sensitivity applied. However, this is a low confidence assessment and more recent research has indicated that this species has resilience to smothering and burial (Powilleit *et al.*, 2009; Powilleit *et al.*, 2006).

8.10.78 The ocean quahog IEF is deemed to be of low vulnerability, high recoverability and regional value. The sensitivity of the receptor is therefore, considered to be negligible.

Intertidal IEFs

8.10.79 The tide-swept algal communities IEF include a range of intertidal biotopes with differing sensitivities. This IEF is assessed as high using the most sensitive biotopes (LR.LLR.F.Fserr, LR.MLR.BF.Fser, LR.LLR.F.Asc.FS and LR.MLR.BF.Fser.R) to the smothering and siltation pressure, as this provides the most precautionary approach. The LR.LLR.F.Fves biotope has medium sensitivity to all three pressures, with increased SSCs decreasing photosynthetic capacity of *F. vesiculosus*, therefore adversely impacting carbon accumulation (Middleboe *et al.*, 2006), and potentially causing a net decline in *F. vesiculosus* biomass in the impacted area (Kouts *et al.*, 2006). Also, sedimentation and burial have been shown to cause decreases in recruitment of *F. vesiculosus* (Eriksson and Johansson, 2003), and mortality in established germlings (Berger *et al.*, 2003). Other common algal species are less sensitive to this impact, with *F. serratus* present adapted for some high turbidity locations (Chapman, 1995), and *F. spiralis* potentially being above the waterline for up to 90% of the time and therefore not having sensitivity to changes in water clarity (Madsen and Maberly, 1990).

8.10.80 Kelp beds, based on the biotope IR.MIR.KR.Lhyp.Ft, are assessed to have a high overall sensitivity to increased SSCs and associated deposition. This is due to the sensitivity of this biotope to reductions in light available for photosynthesis, with a reduction in photosynthetic activity of 50% when turbidity increases, although evidence does show *L. hyperborea* sporophytes growing in light limited environments (Christie *et al.*, 1998). This indicates a variable range of vulnerability to a reduction in light availability through increased SSCs. Burial under 5 cm of sediment has the potential to impact gametophyte survival and influence holdfast fauna (Stamp *et al.*, 2023), but evidence shows that buried gametophytes will resume growth or maturation within one month of conditions returning to an undisturbed baseline (Dieck, 1993).

8.10.81 The intertidal rocky and mixed sediment communities IEF include a range of intertidal biotopes with differing sensitivities. This IEF is assessed as medium using the most sensitive biotopes (LR.HLR.MusB.Sem.FvesR and LR.HLR.MusB.Sem.LitX) to the smothering and siltation pressure, as this provides the most precautionary approach. These biotopes are resistant to increases in suspended sediments which may temporarily clog respiratory and feeding organs of suspension feeders such as *Semibalanus balanoides*, however the increase may also enhance food supply (Tillin *et al.*, 2024b; Tillin and Watson, 2024b). Due to the fixed nature of the characterising species, *S. balanoides* and *Patella vulgata*, they are unable to escape light or heavy smothering, therefore preventing feeding or respiration. Even small deposits of sediments are likely to result in local removal of limpets. Due to the wave action characteristic of this habitat, however, it is likely the sediment will be rapidly mobilised, alleviating the effect of smothering (Tillin *et al.*, 2024b; Tillin and Watson, 2024b).

8.10.82 The tide-swept algal communities IEF is deemed to be of high vulnerability, high recoverability and regional value. The sensitivity of the receptor is therefore, considered to be high.

8.10.83 The kelp beds IEF is deemed to be of high vulnerability, medium recoverability and regional value. The sensitivity of the receptor is therefore, considered to be high.

8.10.84 The intertidal rocky and mixed sediment communities IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is therefore, considered to be medium.

Table 8.19: Sensitivity of the Benthic Subtidal and Intertidal Habitat IEFs to Increased SSCs and Associated Deposition

IEF	Representative Biotopes/Species	Changes in Suspended Solids (Water Clarity)	Smothering and Siltation Rate Changes (Light)	Smother and Siltation Rate Changes (Heavy)	Overall Sensitivity
Subtidal					
Offshore subtidal sands and gravels	SS.SSa.CFiSa.EpusOborApri SS.SSa.OSa SS.SCS.CCS.MedLumVen	MarESA: Low FeAST: Not sensitive	MarESA: Low FeAST: Medium	MarESA: Medium FeAST: Medium	Medium
Offshore muddy and mixed sediments	SS.SSa.CMuSa.AalbNuc SS.SSa.CMuSa	MarESA: Low FeAST: N/A	MarESA: Low FeAST: N/A	MarESA: Medium FeAST: N/A	Medium
Qualifying Features of an MPA					
Ocean quahog	*A. islandica*	MarESA: Not sensitive FeAST: Not exposed	MarESA: Not sensitive FeAST: Not sensitive	Not sensitive FeAST: High (addressed in sensitivity assessment Paragraph 8.10.77)	Negligible
Intertidal					
Tide-swept algal communities	LR.LLR.F.Fves LR.LLR.F.Fspi LR.LLR.F.Fserr LR.MLR.BF.Fser LR.LLR.F.Asc.FS LR.FLR.Eph.Ulv LR.MLR.BF.Fser.R	MarESA: Medium FeAST: Low	MarESA: Medium FeAST: Low	MarESA: High FeAST: Low	High
Kelp beds	IR.MIR.KR.Lhyp.Ft	MarESA: Medium FeAST: Low	MarESA: Not Sensitive FeAST: Not sensitive	MarESA: High FeAST: Low	High
Intertidal rocky and mixed sediment communities	LR.HLR.MusB.Sem.FvesR LR.HLR.MusB.Sem.LitX LR.HLR.FR.Osm LS.LMx	MarESA: Low FeAST: N/A	MarESA: Medium FeAST: N/A	MarESA: Medium FeAST: N/A	Medium

Significance of the Effect

Subtidal IEFs

8.10.85 For the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will therefore be of **Minor** adverse significance, which is not significant in EIA terms.

Qualifying Features of an MPA

8.10.86 The ocean quahog IEF has a magnitude that is deemed to be low, and the sensitivity of the receptor is considered to be negligible. The effect will therefore be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Intertidal IEFs

8.10.87 For the tide-swept algal communities IEF, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be high. The effect will therefore be of minor to moderate adverse significance. The sensitivity of the receptor is assessed as high as a precautionary measure based on a single benchmark for one biotope. Therefore, based on expert judgement the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

8.10.88 For the kelp beds IEF, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be high. The effect will therefore be of minor to moderate adverse significance. The sensitivity of the receptor is assessed as high as a precautionary measure based on a single benchmark for one biotope. Therefore, based on expert judgement the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

8.10.89 For the intertidal rocky and mixed sediment communities IEF, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will therefore be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.10.90 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

O&M Phase

8.10.91 The potential increased SSCs and associated deposition impact was not scoped in for assessment during the O&M phase in Volume 3, Technical Appendix 7.1: Physical Processes Baseline Environment, with no specific modelling undertaken for this phase. Therefore, a qualitative approach has been used in the assessment of the impact, based on the MDS for the O&M phase being lower than the construction phase.

Magnitude of Impact

8.10.92 O&M activities associated with cable repair events may cause increased SSCs and associated depositions from the undertaking of up to one annual IAC repair over a maximum distance of 4,915 m, up to 0.18 annual Interconnector Cable repair over a maximum distance of 2,040 m and one annual Offshore Export Cable repair, again over a maximum distance of 6,390 m (Table 8.10). The adherence to the CaP and EMP as outlined in Table 8.10 is likely to mitigate any large increases in SSCs and associated deposition and would not be greater than during the construction phase. Specifically, the repair activities will be undertaken using similar methods as during the construction period, but over a much reduced area and timescale, and therefore the sediment plume and sedimentation footprints will be smaller and will return to baseline conditions more quickly than those assessed during the construction phase.

Subtidal IEFs and Qualifying Features of an MPA

8.10.93 The impact is predicted to be of local spatial extent, short term duration (for each individual repair event), intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be negligible.

Intertidal IEFs

8.10.94 The impact is predicted to be of local spatial extent, short term duration (for each individual repair event), intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be negligible.

Sensitivity of the Receptor

Subtidal IEFs

8.10.95 The sensitivity of IEFs are considered to be as previously described for the construction phase (see Table 8.19 and Paragraphs 8.10.72 to 8.10.74).

8.10.96 The offshore subtidal sands and gravels IEF is deemed to be of low vulnerability, medium recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

8.10.97 The offshore muddy and mixed sediments IEF is deemed to be of low vulnerability, medium recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Qualifying Features of an MPA

8.10.98 The sensitivity of IEFs are considered to be as previously described for the construction phase (see Table 8.19 and Paragraph 8.10.77).

8.10.99 The ocean quahog IEF is deemed to be of low vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be negligible.

Intertidal IEFs

8.10.100 The sensitivity of IEFs are considered to be as previously described for the construction phase (see Table 8.19 and Paragraphs 8.10.79 to 8.10.81).

8.10.101 The tide-swept algal communities IEF is deemed to be of high vulnerability, high recoverability and regional value. The sensitivity of the receptor is therefore, considered to be high.

8.10.102 The kelp beds IEF is deemed to be of medium vulnerability, medium recoverability and regional value. The sensitivity of the receptor is therefore, considered to be high.

8.10.103 The intertidal rocky and mixed sediment communities IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is therefore, considered to be medium.

Significance of the Effect

Subtidal IEFs

8.10.104 For offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF, the magnitude of the impact is deemed to be negligible, and the sensitivity of the receptor is considered to be medium. The effect will therefore be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Qualifying Features of an MPA

8.10.105 For ocean quahog, the magnitude of the impact is deemed to be negligible, and the sensitivity of the receptor is considered to be negligible. The effect will therefore be of **Negligible** adverse significance, which is not significant in EIA terms.

Intertidal IEFs

8.10.106 For tide-swept algal communities IEF, the magnitude of the impact is deemed to be negligible, and the sensitivity of the receptor is considered to be high. The effect will therefore be of **Minor** adverse significance, which is not significant in EIA terms.

8.10.107 For kelp beds IEF, the magnitude of the impact is deemed to be negligible, and the sensitivity of the receptor is considered to be high. The effect will therefore be of **Minor** adverse significance, which is not significant in EIA terms.

8.10.108 For intertidal rocky and mixed sediment communities IEF, the magnitude of the impact is deemed to be negligible, and the sensitivity of the receptor is considered to be medium. The effect will therefore be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the effect is concluded to be of **Minor** adverse significance which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.10.109 No Additional Mitigation is considered necessary because the likely effect in the absence of mitigation is not significant in EIA terms.

Decommissioning Phase

Magnitude of Impact

8.10.110 The MDS for decommissioning (Table 8.10) assumes the total removal of Offshore Infrastructure including buried cables and cable protection during this phase, with the exact programme to be submitted to MD-LOT for consultation and approval. The decommissioning methods are assumed to be similar to those used during construction, with the magnitude of increased SSCs and associated deposition not being greater than that set out for the assessment in the construction phase of the Proposed Development.

Subtidal IEFs and Qualifying Features of an MPA

8.10.111 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.

Intertidal IEFs

8.10.112 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be low.

Sensitivity of the Receptor

Subtidal IEFs

8.10.113 The sensitivity of IEFs are considered to be as previously described for the construction phase (see Table 8.19 and Paragraphs 8.10.72 to 8.10.74).

8.10.114 The offshore subtidal sands and gravels IEF is deemed to be of low vulnerability, medium recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

8.10.115 The offshore muddy and mixed sediments IEF is deemed to be of low vulnerability, medium recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Qualifying Features of an MPA

8.10.116 The sensitivity of IEFs are considered to be as previously described for the construction phase (see Table 8.19 and Paragraph 8.10.77).

8.10.117 The ocean quahog IEF is deemed to be of low vulnerability, high recoverability and regional value. The sensitivity of the receptor is therefore, considered to be negligible.

Intertidal IEFs

8.10.118 The sensitivity of IEFs are considered to be as previously described for the construction phase (see Table 8.19 and Paragraphs 8.10.79 to 8.10.81).

8.10.119 The tide-swept algal communities IEF is deemed to be of high vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be high.

8.10.120 The kelp beds IEF is deemed to be of medium vulnerability, medium recoverability and regional value. The sensitivity of the receptor is therefore, considered to be high.

8.10.121 The intertidal rocky and mixed sediment communities IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Significance of the Effect

Subtidal IEFs

8.10.122 For the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Qualifying Features of an MPA

8.10.123 For ocean quahog, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be negligible. The effect will therefore be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Intertidal IEFs

8.10.124 For the tide-swept algal communities IEF, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be high. The effect will therefore be of Minor to Moderate adverse significance. The sensitivity of the receptor is assessed as high as a precautionary measure based on a single benchmark for one biotope. Therefore, based on expert judgement the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

8.10.125 For the kelp beds IEF, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be high. The effect will therefore be of Minor to Moderate adverse significance. The sensitivity of the receptor is assessed as high as a precautionary measure based on a single benchmark for one biotope. Therefore, based on expert judgement the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

8.10.126 For the intertidal rocky and mixed sediment communities IEF, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.10.127 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

IMPACT 4 - CHANGES IN PHYSICAL PROCESSES

8.10.128 Changes in physical processes may arise during the O&M and decommissioning phases from the installation of Offshore Infrastructure in the water column, with potential scour effects and changes in sediment transport and wave regimes which could cause impacts on benthic subtidal and intertidal receptors. Physical processes modelling, presented in full in Volume 3, Technical Appendix 7.3: Physical Processes Technical Assessment, has been used to inform the assessment of potential changes in physical processes.

8.10.129 The relevant MarESA pressures and benchmarks used to inform this impact assessment are:

- Changes in local water flow (tidal current): change in peak mean spring bed flow velocity between 0.1 m/s to 0.2 m/s for more than one year. The pressure is associated with activities that have the potential to modify hydrological energy flows. This pressure corresponds to the impacts associated with the presence of cable protection.
- Local wave exposure changes: change in nearshore significant wave height >3% but <5% for one year. This pressure corresponds to the impacts associated with the presence of OWF infrastructure and cable protection.

8.10.130 The relevant FeAST pressures and benchmarks used to inform this impact assessment were:

- Water flow (tidal current) changes – local: the benchmark for this pressure is the peak mean spring tide flow change of greater than 0.1 m/s over an area >1 km2 or 50% of the width of the water body for >1 year.
- Wave exposure changes – local: the benchmark for this pressure is a change in nearshore significant wave height >3% for one year.

O&M Phase

Magnitude of Impact

Subtidal IEFs and Qualifying Features of an MPA

8.10.131 In terms of tidal currents and water levels, the potential for localised changes in current speed is spatially limited to narrow wakes of slightly reduced current speed and proportionally increased turbulence, extending downstream of individual foundations. Changes to current speed at the resolution of the model (length scales greater than 100 m) will be less than 0.05 m/s (10%), which is very small in absolute and relative terms. The wake signature dissipates with distance downstream, becoming <5% reduction within approximately 300 m of the Wind Turbine foundation structures and within approximately 700 m of OSP foundation structures.

8.10.132 In terms of changes to wave regimes, the Proposed Development has the potential to impact wave height, period, and direction through interaction of the waves with foundation structures. Assessment of potential changes have been undertaken in comparison to an existing baseline and has been informed by the ABPmer SEASTATES wave hindcast database, with modelling indicating absolute wave height may be progressively decreased with distance travelled by waves through the Array Area, up to a reduction of 7.5% to 10% compared to baseline conditions. Outside of the Array Area, the full range of change to wave directions and return periods is considered to be <5%, with wave height and regime beginning to recover immediately downwind of the Array Area.

8.10.133 Installation of cable protection could result in a local increase in the elevation of the seabed. Cable protection would be placed onto the seabed surface above the cable and therefore could directly trap sediment, locally impacting down drift locations. Following installation and under favourable conditions, an initial period of sediment accumulation would be expected to occur against cable protection measures which could have a height of up to 2 m above the seabed. This accumulation would likely create a smooth slope against the cable protection. The process of wedge formation may take place over a period of a few weeks to months, depending on rates of sediment transport.

8.10.134 For all areas in which cable protection is used (including where sandwaves are present), it is not expected that the presence of the cable protection devices will continuously affect patterns of sediment transport following the initial period of accumulation. It follows that any changes on seabed morphology away from the cable protection will also be very small. The extent of the cable protection measures does not constitute a continuous blockage along the Export Cable Corridor.

8.10.135 The impact is predicted to be of local spatial extent, long term duration, continuous and of low reversibility during the lifetime of the Proposed Development (up to 30 years). It is predicted that the impact will affect the receptors directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.10.136 Trenchless techniques will be used for cable installation at the Landfall and therefore there will be no changes in physical processes for intertidal habitats, with the effects of this impact restricted to the Array Area. The effect of changes in physical processes on benthic intertidal receptors is therefore not considered further.

Sensitivity of the Receptor

8.10.137 The sensitivity of the IEFs to changes in physical processes is presented in Table 8.20, based on the MarESA and FeAST sensitivity assessments.

Subtidal IEFs

8.10.138 The offshore subtidal sands and gravels IEF is considered to not be sensitive to this impact (Table 8.20), as the characterising communities can be found in a variety of water flow conditions. The change in water flow may alter the local topography, leading to shifts in species abundance (Tillin and Watson, 2023, Tillin and Watson, 2024a). Changes within the benchmark for this pressure are however unlikely to affect communities associated with these biotopes as they are found in a range of sediment (Tillin and Watson, 2024a). Regarding wave action, these biotopes are sublittoral habitats and therefore are not directly exposed to wave action, therefore any changes in wave exposure is unlikely to result in any notable change in conditions for these biotopes (Tillin and Watson, 2023, Tillin and Watson, 2024a).

8.10.139 The offshore muddy and mixed sediments is considered to not be sensitive to this impact (Table 8.20), as the characterising communities can be found in a variety of water flow conditions and sedimentary compositions (Tillin *et al.*, 2023). Regarding wave action, these biotopes are sublittoral habitats and therefore are not directly exposed to wave action, therefore any changes in wave exposure is unlikely to result in any notable change in conditions for these biotopes (Tillin *et al.*, 2023).

8.10.140 The offshore subtidal sands and gravels IEF is deemed to be of no vulnerability, high recoverability and regional value. The sensitivity of the receptor is therefore, considered to be negligible.

8.10.141 The offshore muddy and mixed sediments IEF is deemed to be of no vulnerability, high recoverability and regional value. The sensitivity of the receptor is therefore, considered to be negligible.

Qualifying Features of an MPA

8.10.142 Ocean quahog adults which are buried at sufficient depth, are unlikely to be impacted by changes to either physical processes pressure, but larvae and juveniles may be damaged or prevented from settling if exposed to changed water flow (Witbaard and Bergman, 2003), with recoverability of adults to this impact considered to be very high. Wave exposure changes may cause coarse sediments to become unstable and difficult to burrow in, but this will lack the fine particles which would otherwise clog gills and filtering mechanisms (Earll and Erwin, 1983).

8.10.143 The ocean quahog IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Table 8.20: Sensitivity of the Benthic Subtidal and Intertidal Habitat IEFs to Changes in Physical Processes

IEF	Representative Biotopes/Species	Changes in Local Water Flow (Tidal Current)	Local Wave Exposure Changes	Overall Sensitivity
Subtidal				
Offshore subtidal sands and gravels	SS.SSa.CFiSa.EpusOborApri SS.SSa.OSa SS.SCS.CCS.MedLumVen	MarESA: Not sensitive FeAST: Not sensitive	MarESA: Not sensitive FeAST: Not sensitive	Negligible
Offshore muddy and mixed sediments	SS.SSa.CMuSa.AalbNuc SS.SSa.CMuSa	MarESA: Not sensitive FeAST: N/A	MarESA: Not sensitive FeAST: N/A	Negligible
Qualifying Features of an MPA				
Ocean quahog	*A. islandica*	MarESA: Not sensitive FeAST: Low	MarESA: Not sensitive FeAST: Medium	Medium

Significance of the Effect

Subtidal IEFs

8.10.144 For the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the effect has been concluded to be of **Negligible** adverse significance, which is not significant in EIA terms. This has been determined as a result of the lack of vulnerability of the relevant IEFs in regard to the changes associated with this impact.

Qualifying Features of an MPA

8.10.145 The ocean quahog IEF has a magnitude that is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will therefore be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.10.146 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Decommissioning Phase

Magnitude of Impact

Subtidal IEFs

8.10.147 In the decommissioning phase the MDS accounts for scour and cable protection as well as cable crossings being left *in situ*, with the Wind Turbine and OSP foundations being removed at the end of the operational lifetime of the Proposed Development. As a result of the Wind Turbine and OSP foundation removal, the main component extending into the water column, the impacts on the wave regime and tidal currents will be greatly reduced compared to the O&M phase (see Paragraphs 8.10.131 and 8.10.135).

Intertidal IEFs

8.10.148 Trenchless techniques will be used for cable installation at the Landfall and therefore there will be no changes in physical processes for intertidal habitats, with the effects of this impact restricted to the Array Area. The effect of changes in physical processes on benthic intertidal receptors is therefore not considered further.

Sensitivity of the Receptor

Subtidal IEFs

8.10.149 The sensitivities of all IEFs are considered to be as previously described for the O&M phase (see Table 8.20 and Paragraphs 8.10.138 and 8.10.134).

8.10.150 The offshore subtidal sands and gravels IEF is deemed to be of no vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be negligible.

8.10.151 The offshore muddy and mixed sediments IEF is deemed to be of no vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be negligible.

Qualifying Features of an MPA

8.10.152 The sensitivities of all IEFs are considered to be as previously described for the O&M phase (see Table 8.20 and Paragraph 8.10.142).

8.10.153 The ocean quahog IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is therefore, considered to be medium.

Significance of the Effect

Subtidal IEFs

8.10.154 For the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the effect has been concluded to be of Negligible adverse significance, which is not significant in EIA terms. This has been determined based on the reduced activity expected in the decommissioning phase resulting from in a limited magnitude.

Qualifying Features of an MPA

8.10.155 The ocean quahog IEF has a magnitude that is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will therefore be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.10.156 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

IMPACT 5 - INCREASED RISK OF INTRODUCTION AND SPREAD OF INNS

8.10.157 Vessels used during the construction, O&M and decommissioning phases of the Proposed Development have the potential to transport INNS. These species could potentially settle and establish on introduced hard substrate. The relevant MarESA pressure and its benchmark which has been used to inform this impact assessment is:

- Introduction or spread of INNS: the benchmark for which is the introduction of one or more INNS.

8.10.158 Similarly, the FeAST pressure and its benchmark which has been used to inform this impact assessment is:

- Introduction or spread of non-indigenous species and translocations (competition): the benchmark for which is the direct or indirect introduction of invasive non-indigenous species and their subsequent spreading and out-competing of native species.

Construction, O&M and Decommissioning Phases

Magnitude of Impact

8.10.159 During the construction phase, the MDS accounts for up to 2,120 vessel round trips associated with site preparation, Wind Turbine installation, OSP installation, and IAC and Interconnector Cable and Export Cables installation (Table 8.10). The vessels provide vectors for potential introduction or spread of INNS into the habitats within the Local Benthic Ecology Study Area. The decommissioning phase will likely be of the same or smaller magnitude, depending on the removal activities. Also, the introduction of up to 2,750,020 m^2 of hard structures (assessed separately in Paragraphs 8.10.184 *et seq.*) could provide new habitat for INNS to colonise throughout the construction phase, into the O&M phase and also the decommissioning phase, if Offshore Infrastructure is left *in situ*.

8.10.160 During the O&M phase, the MDS accounts for up to 713 vessel return trips per year. In addition to this, a further number of vessels will undertake another 260 return trips spread over the 30 year O&M phase of the Proposed Development, with these vessels potentially acting as vectors for the introduction and spread of INNS.

8.10.161 There are a number of benthic INNS widespread and established within Scottish waters and the wider North Sea, including:

- Wireweed *Sargassum muticum*;
- Green sea-fingers *Codium fragile* subspecies *fragile*;
- Red alga Dasysiphonia japonica;
- Acorn barnacle *Austrominius modestus*;
- Japanese skeleton shrimp *Caprella mutica*;
- Leathery sea squirt *Styela clava*;
- Orange tipped sea squirt *Corella eumyota*; and
- Orange ripple bryozoan *Schizoporella japonica* (NatureScot, 2023).

8.10.162 However, no INNS were recorded during the site-specific surveys for the Proposed Development (see Volume 3, Technical Appendix 8.1: Benthic Ecology Technical Report).

8.10.163 It is anticipated that vessels involved in site preparation and Offshore Infrastructure installation during the construction phase may utilise ports and harbours on the east coasts of Scotland, and therefore the potential for introduction and spread of INNS from outside of this area will be reduced. However, some INNS, such as the acorn barnacle, are known to spread as fouling on ships, and these could be introduced to the Local Benthic Ecology Study Area through these vessels. Although most vessels will utilise ports and harbours on the east coast of Scotland, delivery of some materials to site may take place directly from fabrication yards located in international ports or harbours, which could increase risk of introduction or spread of INNS, but all vessels will be required to comply with the Biosecurity Plan.

8.10.164 The Biosecurity Plan, as described in Table 8.16, will contain measures to manage and reduce the potential risk of introduction and spread of INNS as far as reasonably practicable.

<u>Subtidal IEFs</u>

8.10.165 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low for all phases.

Qualifying Features of an MPA

8.10.166 As only the Proposed Development's ZoI overlaps with the Firth of Forth Banks MPA and the impact of increased risk of introduction and spread of INNS is only applicable within the Site Boundary, the relevant features of the MPA (i.e. Ocean quahog) will not be assessed in relation to this impact.

Intertidal IEFs

8.10.167 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low for all phases.

Sensitivity of the Receptor

8.10.168 The sensitivity of the IEFs to increased risk of introduction and spread of INNS is presented in Table 8.21, based on the MarESA and FeAST sensitivity assessments.

Subtidal IEFs

8.10.169 Both the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF are deemed to be of a high sensitivity to the introduction and spread of INNS. This habitat is characterised by mobile sediment, which few INNS may be able to colonise. However, two species (*Crepidula fornicata* and *Didemnum vexillum*) may be of concern (Tillin *et al.*, 2023; Tillin and Watson, 2023; Tillin and Watson, 2024a). Both of these species are known to settle on stones or other hard substrates (e.g. bivalve shells) in sediment, which can lead to the formation of dense carpets which smother other bivalves and alter the seabed habitat (Montaudouin and Sauriau, 1999; Tillin *et al.*, 2020; Valentine *et al.*, 2007), although both of these species express a preference for gravel substrates rather than mobile sands (Tillin and Watson, 2024a; Valentine *et al.*, 2007).

8.10.170 The offshore subtidal sands and gravels IEF is deemed to be of high vulnerability, low recoverability and regional value. The sensitivity of the receptor is therefore, considered to be high.

8.10.171 The offshore muddy and mixed sediments IEF is deemed to be of medium vulnerability, low recoverability and regional value. The sensitivity of the receptor is therefore, considered to be medium.

Intertidal IEFs

8.10.172 The tide-swept algal communities IEF is deemed to be of medium overall sensitivity to the introduction and spread of INNS. Specifically, the LR.LLR.F.Fspi biotope was found to be highly resistant to invasions by *U. pinnatifida* (Thompson and Schiel, 2012), with no evidence of impacts directly on *F. spiralis* (Perry and d'Avack, 2015a). However, the LR.LLR.F.Fves, LR.LLR.F.Fserr and LR.MLR.BF.Fser biotopes were deemed to have medium sensitivity to this impact, due to the potential to be displaced by *S. muticum* (Staehr *et al.*, 2000), as well as the potential introduction of *D. vexillum,* which can overgrow and displace sessile organisms (Tillin *et al.*, 2020).

8.10.173 For the kelp beds IEF, the characterising species tangle *L. hyperborea* has the potential to be outcompeted by invasive algal species including *Undaria pinnatifida* and *S. muticum* (Stamp *et al.*, 2023). Specifically, *S. muticum* has been noted to replace a range of canopy and understorey algal species (De Bettignies *et al.*, 2021) in wave sheltered conditions (Staehr *et al.*, 2000). If *U. pinnatifida* were to colonise and establish a community, this species also has the potential to outcompete existing kelp bed species, with less tangle recorded in areas of dense *U. pinnatifida* (Heiser *et al.*, 2014), but an equilibrium between these species has been recorded (Stamp *et al.*, 2023) and therefore the overall sensitivity is considered to be medium.

8.10.174 The intertidal rocky and mixed sediment communities IEF is deemed to be of high overall sensitivity to the introduction and spread of INNS. This habitat is assessed to be primarily under threat from the Pacific oyster *Magallana gigas* as they are able to colonise rock in all levels of the Intertidal Area (Herbert *et al.*, 2016), which may result in changes in community depending on density. Hansen *et al.* (2023) suggested that no immediate ecosystem risk is observed where the Pacific oyster occurs sporadically as a result of exposure to moderately exposed wave conditions. In ideal conditions, however, they can form reefs which exceed 200 individuals per m^2 where little of the underlying substratum remains visible (Herbert *et al.*, 2016). The Australasian barnacle *Austrominius modestus* is another species of concern, however, monitoring has shown its overall effect on rocky shores has been small (Raffaelli and Hawkins, 1999). INNS can also alter habitats (ecological engineers), or outcompete native macroalgae. The replacement of red algal turfs by other similar species may lead to some subtle effects on local ecology but at low abundances the biotope would still be recognisable from the description (Tillin, 2016).

8.10.175 The tide-swept algal communities IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

8.10.176 The kelp beds IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

8.10.177 The intertidal rocky and mixed sediment communities IEF is deemed to be of high vulnerability, low recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be high.

Table 8.21: Sensitivity of the Benthic Subtidal and Intertidal Habitat IEFs to Increased Risk of Introduction and Spread of INNS

IEF	Representative Biotopes/Species	Introduction or Spread of INNS (MarESA)	Introduction or Spread of Non-Indigenous Species and Translocations (Competition) (FeAST)	Overall Sensitivity
Subtidal				
Offshore subtidal sands and gravels	SS.SSa.CFiSa.EpusOborApri SS.SSa.OSa SS.SCS.CCS.MedLumVen	High	Not assessed[1]	High
Offshore muddy and mixed sediments	SS.SSa.CMuSa.AalbNuc SS.SSa.CMuSa	Medium	N/A[2]	Medium
Intertidal				
Tide-swept algal communities	LR.LLR.F.Fves LR.LLR.F.Fspi LR.LLR.F.Fserr LR.MLR.BF.Fser LR.LLR.F.Asc.FS LR.FLR.Eph.Ulv LR.MLR.BF.Fser.R	Medium	Not assessed[1]	Medium
Kelp beds	IR.MIR.KR.Lhyp.Ft	Medium	Not assessed[1]	Medium
Intertidal rocky and mixed sediment communities	LR.HLR.MusB.Sem.FvesR LR.HLR.MusB.Sem.LitX LR.HLR.FR.Osm LS.LMx	High	N/A[2]	High

[1] There is insufficient evidence available with which to undertake a sensitivity assessment, although there is an obvious pathway for an interaction between pressure and feature. However, there is not sufficient concern of potential impacts to assess the feature as 'Sensitive' (NatureScot, 2020).
[2] This feature has not been assessed by FeAST.

Significance of the Effect

Subtidal IEFs

8.10.178 For the offshore subtidal sands and gravels IEF, the magnitude is deemed to be low, and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of minor to moderate adverse significance. Based on expert judgement and the adoption of Embedded Mitigation to minimise the potential for the introduction of INNS (Table 8.16), the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

8.10.179 For the offshore muddy and mixed sediments IEF, the magnitude is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Intertidal IEFs

8.10.180 For the tide-swept algal communities IEF, the magnitude is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

8.10.181 For the kelp beds IEF, the magnitude is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

8.10.182 For the intertidal rocky and mixed sediment communities IEF, the magnitude is deemed to be low, and the sensitivity of the receptor is considered to be high. The effect will therefore be of minor to moderate adverse significance. Based on expert judgement and the adoption of Embedded Mitigation measure to minimise the potential for the introduction of INNS (Table 8.16), the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.10.183 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

IMPACT 6 - COLONISATION OF HARD SUBSTRATES

8.10.184 The introduction of Offshore Infrastructure within the Site Boundary may result in the colonisation of foundations, Scour Protection and cable protection, which could lead to local biodiversity changes. The relevant MarESA and FeAST pressures associated with this impact are the same as assessed above for long term habitat loss and/or disturbance:

- 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.

Construction and O&M Phases

Magnitude of Impact

Subtidal IEFs

8.10.185 The MDS accounts for up to a total of 2,705,020 m^2 of hard structure surface area installed throughout the construction phase and persisting into the up to 30 year O&M phase (Table 8.10). The MDS is based on the total introduction of hard substrate a result of the installation of the following Offshore Infrastructure:

- surface area of Wind Turbine and OSP foundations;
- footprint area of Scour Protection from Wind Turbines and OSPs; and
- footprint from IAC, Interconnector Cable and Offshore Export Cables protection and cable crossing protection.

8.10.186 The shift in baseline conditions from soft substrate areas to hard substrate with the introduction of Offshore Infrastructure may produce some potentially beneficial effects. Bender *et al.* (2020) conducted a 12 year monitoring study on artificial foundations installed at the Lysekil research site in Sweden, observing increased biodiversity, abundance of reef species, and total number of species over time. The zonation of colonising communities on offshore installations are typically dominated by mussels, macroalgae, and barnacles near the water surface, essentially creating a new intertidal zone, with filter feed arthropods dominating the mid depths, and anemones in deeper locations (De Mesel *et al.*, 2015; Karlsson *et al.*, 2022). Therefore, there is likely to be an increase in biodiversity and a change compared to the baseline if no hard substrates were present, due to colonisation of the hard substrates within the Proposed Development (Lindeboom *et al.*, 2011).

8.10.187 In addition, the structural complexity of hard substrate, such as OSP foundations and fixed Wind Turbine foundations, may provide refuge and increase feeding opportunities for large and more mobile species. Mavraki *et al.* (2020) demonstrated higher food web complexity associated with zones which had high accumulation of organic material (such as soft substrate or Scour Protection), suggesting potential reef effect benefits from the presence of hard substrate.

8.10.188 Although in terms of increasing biodiversity and enhancing reef effects, this impact is expected to be beneficial, the installation of hard substrate will result in habitat loss of the offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs. However, given the wide availability of suitable habitat and the localised nature of this impact, minor loss or alteration to the soft bottom sediments as a whole is only expected to occur.

8.10.189 The impact is predicted to be of local spatial extent, long term duration, continuous and of low reversibility during the lifetime of the Proposed Development (up to 30 years). It is predicted that the impact will affect the receptors directly. The magnitude is therefore, considered to be low.

Qualifying Features of an MPA

8.10.190 As only the Proposed Development's ZoI overlaps with the Firth of Forth Banks MPA and the impact of colonisation of hard structures is only applicable within the Site Boundary, the relevant features of the MPA (i.e. Ocean quahog) will not be assessed in relation to this impact.

Intertidal IEFs

8.10.191 Cables will be installed at the Landfall via trenchless techniques which means there will be no impact on any intertidal IEFs as there will be no cable protection. Therefore, they are not considered further in this assessment.

Sensitivity of the Receptor

Subtidal IEFs

8.10.192 Colonisation of hard substrate within the Site Boundary will represent a shift in the seabed type and species assemblage. In terms of the MarESA and FeAST, the sensitivities of the IEFs to this impact are previously described for physical change (to another seabed type) in the assessment of long term habitat loss and/or disturbance (see Table 8.18 and Paragraphs 8.10.47 and 8.10.48).

8.10.193 The colonisation of hard substrate within the Site Boundary may have indirect adverse effects on the baseline communities and habitats due to increased predation on, and competition for, the existing baseline species. These effects are difficult to predict, especially as monitoring to date has focused on the colonisation and aggregation of species close to the foundations rather than broad scale studies. The introduction of hard substrate on the seabed removes or modifies existing, sandy and soft bottom habitats, whilst creating new hard habitat. It often replaces an essentially two-dimensional sedimentary seabed with a complex three-dimensional structure, increasing surface area, surface complexity and number of available niches Dannheim *et al.* (2020). Substrates may only be suitable for colonisation once they have weathered, through the loss of any present surface contaminants, the production of biofilms, and the sequence of community development after settlement (Chase, 2015; Thompson *et al.*, 1998).

8.10.194 Some studies have shown no significant effect on the soft sediment environments following the installation of hard substrate. De Backer *et al.* (2020) found no drastic changes within the soft sediment community eight to nine years after the installation of C-power and Belwind OWFs in Belgium. In addition, the species originally inhabiting the sandy substrate were still present and remained dominant in both wind farms (De Backer *et al.*, 2020). During a review of post construction monitoring at the Block Island OWF in the USA, Hutchison *et al.* (2020a) found there to be no strong gradients of change in sediment grain size, enrichment, or benthic macrofauna within 30 m to 90 m distance bands of the Wind Turbines.

8.10.195 Recent post construction monitoring of the Beatrice OWF, Moray Firth, demonstrated extensive biofouling on all Wind Turbines with signs of zonation and successional development (APEM, 2022). Across all the Wind Turbines, plumose anemones *Metridium senile* and tube worms *Spirobranchus triqueter* were the most abundant species, with the highest biomass at -40 m depth (APEM, 2022). The hermit crab *Pagurus bernhardus*, various flatfish species, and common sea urchin were found at the bases of the Wind Turbines with decreasing abundance further from the foundations, indicating a source of food although no biological matter could be seen (APEM, 2022).

8.10.196 All subtidal IEFs are deemed to be of high vulnerability, low recoverability, and regional value. The sensitivities of these receptors are therefore, considered to be high.

Significance of the Effect

Subtidal IEFs

8.10.197 For the offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be high. The effect will therefore be of a Minor to Moderate adverse significance. The potential for increased biodiversity as a result of this impact could be considered to be beneficial, however the introduction of hard substrate would represent some small scale habitat loss. Given the low footprint of the long term habitat loss compared to the Site Boundary, the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.10.198 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Decommissioning Phase

Magnitude of Impact

8.10.199 The MDS accounts for up to a total of 2,232,100 m^2 of hard structures which will be left *in situ* on the seabed, allowing this impact to persist past the decommissioning phase (Table 8.10). The MDS proposes that all scour, cable and cable crossing protection will be left *in situ* (subject to the final material used). This will be reviewed throughout the lifetime of the Proposed Development and good practice guidance will be followed at the time.

8.10.200 The impact is predicted to be of local spatial extent, long term duration, continuous and of low reversibility. It is predicted that the impact will affect the receptors directly. The magnitude is, therefore, considered to be low.

Sensitivity of the Receptor

8.10.201 The sensitivity of all subtidal IEFs are as described for the construction and O&M phase assessment (Paragraph 8.10.192 to 8.10.195).

8.10.202 All subtidal IEFs are deemed to be of high vulnerability, low recoverability, and regional value. The sensitivities of these receptors are, therefore, considered to be high.

Significance of the Effect

8.10.203 For the offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs, the magnitude of the impact is deemed to be low, and the sensitivity of the receptor is considered to be high. The effect will therefore be of a Minor to Moderate adverse significance. The potential for increased biodiversity as a result of this impact could be considered to be beneficial, however the introduction of hard substrate would represent some small scale habitat loss. Given the low footprint of the long term habitat loss compared to the Site Boundary the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.10.204 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

IMPACT 7 - REMOVAL OF HARD SUBSTRATES

8.10.205 The removal of hard substrates in the decommissioning phase may affect the established benthic community associated with the Proposed Development, with the seabed returning to its current sandy sediments. These hard substrate are expected to have been colonised by a range of organisms over the up to 30 year life cycle of the Proposed Development, which has previously been assessed above in the colonisation of hard substrate. The relevant MarESA and FeAST Pressure associated with this impact is the same as assessed above for long term habitat loss and/or disturbance and the colonisation of hard substrate:

- 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.

8.10.206 In this case, however, the physical change to another seabed type refers to change from hard substrate to sedimentary substratum.

Decommissioning Phase

Magnitude of Impact

Subtidal IEFs

8.10.207 The approach for decommissioning is yet to be determined, however, for the purposes of this MDS, the total removal of all Offshore Infrastructure has been assumed, as this represents the largest potential impact, with the exact programme to be submitted to MD-LOT for consultation and approval. Up to a total of 2,705,020 m^2 of hard structure surface area, from the removal of all introduced hard surfaces, as set out in the colonisation of hard substrate impact (Table 8.10 and Paragraph 8.10.199).

8.10.208 The impact is predicted to be of local spatial extent, long term duration, continuous and of low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Qualifying Features of an MPA

8.10.209 As only the Proposed Development's ZoI overlaps with the Firth of Forth Banks MPA and the impact of the removal of hard substrate is only applicable within the Site Boundary, the relevant features of the MPA (i.e. Ocean quahog) will not be assessed in relation to this impact.

Intertidal IEFs

8.10.210 Cables will be installed at the Landfall via trenchless techniques which means there will be no impact on any intertidal IEFs as there will be no cable protection for removal. Therefore, the intertidal IEFs are not considered further in this assessment.

Sensitivity of the Receptor

Subtidal IEFs

8.10.211 Removal of hard structures associated with the Proposed Development will represent a shift in seabed type and species assemblage. In terms of the MarESA and FeAST, the sensitivity of the IEFs to this impact are as previously described for physical change (to another seabed type) in the assessment of long term habitat loss and/or disturbance (see Table 8.18 and Paragraphs 8.10.47 and 8.10.48). All IEFs are assessed as having a high sensitivity to the introduction of hard substrates, as these habitats and species are dependent on sedimentary substrates. However, the removal of hard substrates in the decommissioning phase would allow the gradual return of sedimentary substrates at the former footprints of the installed hard substrate. Therefore, this impact would result in an increase of available habitat for the IEFs.

8.10.212 All IEFs were deemed to be of low vulnerability, high recoverability, and regional value. The sensitivities of the receptors were, therefore, considered to be low.

Significance of the Effect

Subtidal IEFs

8.10.213 For the offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs, the magnitude of the impact is deemed to be low, and the sensitivities of the receptors were considered to be low. The effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the effect has been concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.10.214 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

IMPACT 8 - IMPACTS TO BENTHIC ECOLOGY DUE TO EMF

8.10.215 Impacts to benthic ecology due to EMFs may arise due to the presence and operation of IAC, Interconnector Cable, and Offshore Export Cables.

8.10.216 The evidence base of impacts from EMFs on benthic invertebrates is limited, with research primarily focusing on crustaceans (Hutchison *et al.*, 2020b; Hutchison *et al.*, 2021; Jakubowska-Lehrmann *et al.*, 2025; Scott *et al.*, 2021; Scott *et al.*, 2018). Therefore, there is a knowledge gap concerning the ability of benthic species to detect EMFs, and whether any physiological or behavioural impacts are associated with this exposure (Albert *et al.*, 2020). Due to this limited information, the MarESA and FeAST assessments for the 'electromagnetic changes' pressure were not able to undertake sensitivity assessments on EMF impacts for any of the benthic IEFs (d'Avack *et al.*, 2024; Perry and d'Avack, 2015a; Perry and d'Avack, 2015b; Stamp *et al.*, 2023; Tillin *et al.*, 2024b; Tyler-Walters, 2007; Tyler-Walters and Sabatini, 2017). Therefore, a broad overview of the available evidence base of the potential impact of EMFs on benthic habitats and species is presented in this assessment.

O&M Phase

Magnitude of Impact

8.10.217 EMFs comprise both the electrical fields, measured in microvolts per metre (µV/m) or millivolts per metre (mV/m), and the magnetic fields, measured in microtesla (µT) or milligauss (mG). Within the North Sea, background measurements of the magnetic fields tend to be approximately 50 µT, and the electric field which naturally occurs in this area is approximately 25 µV/m (Tasker *et al.*, 2010). Typically, electrical fields are blocked through the use of conductive sheathing in cables, with the only EMFs therefore emitted into the environment being magnetic fields, and the resultant induced electrical field. Burial of cables is known to reduce the strength of the magnetic field at the seabed surface due to field decay over distance (Snyder *et al.*, 2019). However, it is broadly considered impractical to assume that the cables will always be buried at depths that will reduce both the magnetic and induced electrical fields to below detection levels of benthic marine organisms (Gill *et al.*, 2005; Gill *et al.*, 2009), although this will be undertaken where reasonably practicable.

8.10.218 The levels of EMFs around cables are affected by a variety of design and installation factors, with these including current flow, distance between cables, cable insulation, the number of conductors used, the cable configuration, and burial depth. The flow of electricity associated with an alternating current (AC) cable changes direction (based on the frequency of the AC transmission), and creates a constantly varying electric field in the marine environment surrounding the cable (Huang, 2005).

8.10.219 The strength of the magnetic field (and induced electrical fields) decreases rapidly in all directions with increased distance from the source. A recent study by Snyder *et al.* (2019) found that burial of IAC and Offshore Export Cables at a depth of 1 m to 2 m reduced the magnetic field at the seabed surface by a factor of four. Similar reductions were recorded for unburied cables which were instead protected by thick concrete mattresses or rock berms (Snyder *et al.*, 2019).

8.10.220 The relationship between voltage, current, and burial depth was investigated by Snyder *et al.* (2019), with the results of this analysis presented in Table 8.22. This analysis quantified the magnetic and induced electric field levels expected near two types of undersea power cables, directly above and at a distance of 3 m to 7.5 m laterally from the cables. Broadly, EMF levels decrease 1 m in any direction away from any point directly above the cable, with burial to a target depth of at least 1 m, reducing the EMF levels reaching surface benthos. At a distance of 3 m to 7.5 m from the cable, the EMF levels are comparable at the seafloor and 1 m away from the seafloor, indicating that the EMFs have a very limited range of effect.

Table 8.22: Typical EMF Levels over AC Undersea Power Cables from Offshore Wind Energy Projects (Snyder *et al.*, 2019).

Power Cable Type	Directly Above Cable		3 m to 7.5 m Laterally Away from Cable	
	1 m Above Seafloor	At Seafloor	1 m Above Seafloor	At Seafloor
Magnetic field levels (mG)				
Inter-array	5 to 15	20 to 65	<0.1 to 7	<0.1 to 10
Offshore Export Cables	10 to 40	20 to 165	<0.1 to 12	1 to 15
Induced electric field levels (mV/m)				
Inter-array	0.1 to 1.2	1.0 to 1.7	0.01 to 0.9	0.01 to 1.1
Offshore Export Cables	0.2 to 2.0	1.9 to 3.7	0.02 to 1.1	0.04 to 1.3

8.10.221 During the O&M phase of the Proposed Development, there will be up to 151 km of 132 kV IAC, up to 36 km of 275 kV Interconnector Cables, and up to 210 km of 275 kV Offshore Export Cables (up to three Offshore Export Cables, with a maximum length of 70 km each) (Table 8.10). Where feasible, a minimum burial depth of 0.5 m applies to all cables, however, there will be a target burial depth of 1.5 m. Where burial is not possible, cable protection will be used, accounting for up to 1,985,000 m^2 of cable protection along export, interconnector, and IAC, and up to 81,000 m^2 of cable crossing protection, which could reduce the EMF levels emitted into the benthic environment.

Subtidal IEFs

8.10.222 The impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility when cables are removed or are no longer operating in the decommissioning phase. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be negligible.

Qualifying Features of an MPA

8.10.223 As only the Proposed Development's ZoI overlaps with the Firth of Forth Banks MPA and the impact of EMF is only applicable within the Site Boundary, the relevant features of the MPA (i.e. Ocean quahog) will not be assessed in relation to this impact.

Intertidal IEFs

8.10.224 The impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility when cables are removed or are no longer operating in the decommissioning phase. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be negligible.

Sensitivity of the Receptor

Subtidal and Intertidal IEFs

8.10.225 A study by Chapman *et al.* (2023) presented the findings on the behavioural and physiological responses of two echinoderms (common starfish *Asterias rubens* and common sea urchin *Echinus esculentus*), velvet swimming crab *Necora puber*, and common periwinkle *Littorina littorea* to EMFs from subsea power cables. This represents the first study on the effects of EMFs on common sea urchin, although previous studies have demonstrated developmental delay in the embryos of painted urchin *Lytechinus pictus* and purple urchin *Strongylocentrotus purpuratus* due to EMF exposure between 10 μT to 100,000 μT (Cameron *et al.*, 1993; Levin and Ernst, 1997; Zimmerman *et al.*, 1990). The Chapman *et al.* (2023) study exposed specimens to EMFs of 500 μT for 24 hours, and found no significant behavioural or physiological responses in any of the species investigated. Similarly, Bochert and Zettler (2006) found that exposure to an artificial static EMF of approximately 2,700 μT for 22 hours in laboratory conditions had no effect on common starfish distribution. This study (Bochert and Zettler, 2006) also exposed ragworm *Hediste diversicolor* and the isopod crustacean *Saduria entomon* to the same environmental conditions, with ragworm distribution similarly unaffected by the EMF levels. Only one third of *S. entomon* individuals were recorded near to the EMF source after 22 hours, compared to the control group population, which was evenly distributed throughout the enclosure, suggesting a potential avoidance of EMFs in this species (Bochert and Zettler, 2006). Field diving surveys of two submarine power cables in southern California found no preferential attraction or repulsion of invertebrate species including the starfish *Patiria miniata* and *Pisaster* spp. from the submarine cables (Love *et al.*, 2017).

8.10.226 Effects of EMFs on ragworm were also investigated in a study by Jakubowska *et al.* (2019), which assessed the effect of EMF levels of 1 mT from a cable of 50 Hz for eight days on the avoidance behaviour, burrowing, and physiology (food consumption, respiration, and extraction of ammonia) of ragworm (Jakubowska *et al.*, 2019). No behaviour of either avoidance of or attraction to the EMF source was recorded, and there were no changes in food consumption or respiration rates. However, ragworm burrowing activity increased and ammonia excretion was significantly lower when exposed to EMFs, although the mechanisms behind these observations currently remain unclear (Jakubowska *et al.*, 2019). Similarly to ragworm, Albert *et al.* (2022) observed no change in the feeding behaviour of *Mytilus edulis* exposed to artificial magnetic field treatment of 300 μT.

8.10.227 In addition, genotoxic and cytotoxic effects (i.e. effects which could cause DNA and cellular damage, respectively) of 50 Hz 1 mT EMFs over 12 days were investigated for ragworm and the bivalve Baltic tellin *Macoma balthica* (Stankevičiūtė *et al.*, 2019). Exposure to EMFs did not induce any significant cytotoxic responses in ragworm, however a significant increase in frequency of cell abnormalities was recorded for Baltic tellin, which suggests potentially damaging cytotoxic effects (Stankevičiūtė *et al.*, 2019). Both ragworm and Baltic tellin displayed genotoxic effects as a result of EMF exposure, measured by increased formation of micronuclei and nuclear buds, which are markers of DNA damage such as chromosomal loss and mitotic disruption.

8.10.228 Although echinoderms, bivalves, and polychaetes are significant species within the representative biotopes of the offshore subtidal sands and gravels IEF, the evidence available indicates that impacts are variable between species. These impacts can range from no effect on distribution or feeding strategies, to impacts including oxidative stress and cytotoxic damage to cells.

8.10.229 As no IEFs are directly assessed within the literature, and the evidence of impacts varies, a precautionary assessment of medium vulnerability, medium recoverability, and regional to international value has been applied to all IEFs. This is likely to be over-precautionary, as studies typically use EMF levels greater than would typically be associated with buried or protected undersea cables. Also, some of the studies (such as Chapman *et al*. (2023) and Bochert and Zettler (2006)) found little to no impact on the species in their assessments. The sensitivities of the receptors were therefore considered to be medium.

Significance of the Effect

Subtidal IEFs

8.10.230 For the offshore sands and gravels, and offshore muddy and mixed sediments IEFs, the magnitude is deemed to be negligible, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the effect has been concluded to be of **Minor** adverse significance, which is not significant in EIA terms. This has been determined based on the precautionary approach to the sensitivity of the relevant benthic species as well as the spatially limited extent of this impact.

Intertidal IEFs

8.10.231 For the tide-swept algal communities, kelp beds and intertidal rocky and mixed sediment communities IEFs, the magnitude is deemed to be negligible, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the effect has been concluded to be of **Minor** adverse significance, which is not significant in EIA terms. This has been determined based on the precautionary approach to the sensitivity of the relevant benthic species as well as the spatially limited extent of this impact.

Additional Mitigation and Residual Effect

8.10.232 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

IMPACT 9 – IMPACTS TO BENTHIC ECOLOGY DUE TO HEAT FROM SUBSEA ELECTRICAL CABLES

8.10.233 The presence and operation of inter-array and interconnector cables within the Proposed Development may lead to localised heating of seabed affecting subtidal IEFs.

8.10.234 The benchmark for the relevant MarESA pressure which has been used to inform this impact assessment is described here:

- Temperature increase (local): An increase of 5°C for one month, or 2°C for one year.

O&M Phase

Magnitude of Impact

8.10.235 Submarine power cables such as those to be installed for the Proposed Development generate heat through resistive heating, which is caused by energy loss as electrical currents flow through the cables, warming the surrounding environment. High voltage cables are used to minimise the amount of energy lost as heat which in turn minimises the environmental warming effect. Where submarine power cables are buried, the surrounding sediment may be heated. The cables, however, have negligible capability to heat the overlying water column because of the very high heat capacity of water (the amount of energy needed to result in a temperature change).

8.10.236 There is little research on the heat dissipation effect resulting from subsea cables in the field as well as its effect on benthic receptors. Meißner *et al*. (2007) conducted a field study at Nysted Offshore Windfarm in Denmark. This study tested the difference in sediment temperature between a control site and a site 25 cm away from the cable. Results showed a 2°C maximum difference between sites with a mean difference of 1°C, with similar results for a HVAC 33 kV cable and HVAC 132 kV cable (low and high voltage cables respectively).

8.10.237 Additionally, the potential impact of seabed temperature rise as a result of buried cables has been considered during a project to bury a submarine High Voltage Direct Current cable between New England and Long Island, New York. The project estimated that the rise in temperature at the seabed immediately above the buried cable to be just 0.19°C (BERR, 2008). The seasonal temperature range in the North Sea is approximately 10°C (Yang and Wu, 2024), therefore any change similar to those observed by the previously described studies would fall within the natural seasonal variation of this region.

8.10.238 A number of environmental factors have been identified which change the way that heat from subsea cables will dissipate. One of them being the nature of sediment that the cable is buried in. A lab-based study by Emeana *et al*. (2016) investigated the thermal regime around high voltage submarine cables using a heat source in a large tank to simulate seafloor conditions. The research identified that when the heat source was buried in fine clay/silt sediments it had a conductive heat transfer mode, only raising temperatures in the immediate radius of the cable. When the heat source was buried in fine permeable sands they observed convective heat transfer when the heat sources surface temperature reached over 20°C above the ambient temperature resulting in temperature change up to 1 m above the heat sources surface (when the heat source was buried at 1 m). In coarse sands convection occurred at a lower temperature (>9°C) and increases in fluid temp were detectable over 1 m above the heat sources surface. This study however was conducted in a laboratory without the influence of water flow which, in an offshore environment, would quickly dissipate the effects of heat emissions (Worzyk, 2009).

8.10.239 During the O&M phase of the Proposed Development, there will be up to 151 km of 132 kV IAC, up to 36 km of 275 kV Interconnector Cables, and up to 210 km of 275 kV Offshore Export Cables (up to three Offshore Export Cables, with a maximum length of 70 km each) (Table 8.10). Where feasible, a minimum burial depth of 0.5 m applies to all cables, however, there will be a target burial depth of 1.5 m. Where burial is not possible, cable protection will be used, accounting for up to 1,985,000 m^2 of cable protection along export, interconnector, and IAC, and up to 81,000 m^2 of cable crossing protection, which could reduce the heat emitted into the benthic environment.

Subtidal IEFs

8.10.240 The impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility when cables are removed or are no longer operating in the decommissioning phase. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be negligible.

Qualifying Features of an MPA

8.10.241 As only the Proposed Development's ZoI overlaps with the Firth of Forth Banks MPA and the impact of EMF is only applicable within the Site Boundary, the relevant features of the MPA (i.e. Ocean quahog) will not be assessed in relation to this impact.

Intertidal IEFs

8.10.242 The impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility when cables are removed or are no longer operating in the decommissioning phase. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be negligible.

Sensitivity of the Receptor

Subtidal IEFs

8.10.243 Both the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF biotopes have a low sensitivity to local temperature increase as increases of this magnitude are well within their natural temperature ranges (Tillin *et al*., 2023; Tillin and Watson, 2023). It was noted that UK assemblages in fine sand and muddy sands share characteristics with communities in the Mediterranean where temperatures are much higher than in the UK, therefore it is considered that continuous temperate increases within this range would be tolerate by species with ranges which include the Mediterranean.

8.10.244 The subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF were deemed to be of low vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be low.

Intertidal IEFs

8.10.245 Both the tide-swept algal communities IEF and intertidal rocky and mixed sediment communities IEF were determined to not be sensitive to local increases in temperature as they are both exposed to extremes of high and low air temperatures during the tidal cycle (Tillin *et al*., 2024a; Tillin *et al*., 2024b; Perry *et al*., 2024). Furthermore, the characteristic species of these communities are common throughout the UK where they are exposed to temperature differences much greater than those which may result from subsea cables.

8.10.246 The kelp beds IEF has a medium sensitivity to local changes in temperature due to the sensitivity of their recruitment and grow cycle to temperature. *Laminaria hyperborea* recruitment would be impaired at a sustained temperature increase of above 17°C (Kain, 1971). However, the temperature tolerances for *Laminaria hyperborea* is seasonally variable, with more sensitivity to temperature change in winter months than summer months (Birkett *et al*., 1998). Furthermore, temperature increases beyond the thermal optimum for kelp can negatively affect photosynthesis in kelps, however this is usually experienced in combination with a decrease in light availability. Overall, a chronic change (2°C for a year) outside the normal range for a year may reduce recruitment and growth, resulting in a minor loss in the population of kelp, especially in winter months (Stamp *et al*., 2023).

8.10.247 The tide-swept algal communities IEF and intertidal rocky and mixed sediment communities IEF were deemed to be of low vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be low.

8.10.248 The kelp beds IEF was deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Significance of the Effect

Subtidal IEFs

8.10.249 For the offshore sands and gravels, and offshore muddy and mixed sediments IEFs, the magnitude is deemed to be negligible, and the sensitivity of the receptor is considered to be low. The effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the effect has been concluded to be of **Minor** adverse significance, which is not significant in EIA terms. This has been determined based on the precautionary approach to the sensitivity of the relevant benthic species as well as the spatially limited extent of this impact.

Intertidal IEFs

8.10.250 For the tide-swept algal communities and intertidal rocky and mixed sediment communities IEFs, the magnitude is deemed to be negligible, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the effect has been concluded to be of **Minor** adverse significance, which is not significant in EIA terms. This has been determined based on the precautionary approach to the sensitivity of the relevant benthic species as well as the spatially limited extent of this impact.

8.10.251 For the kelp beds IEF, the magnitude is deemed to be negligible, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the effect has been concluded to be of **Minor** adverse significance, which is not significant in EIA terms. This has been determined based on the precautionary approach to the sensitivity of the relevant benthic species as well as the spatially limited extent of this impact.

Additional Mitigation and Residual Effect

8.10.252 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

8.11 Inter-Related Effects

8.11.1 A description of the likely inter-related effects arising from the Proposed Development on benthic ecology is provided in Volume 2, Chapter 23: Inter-Related Effects.

8.11.2 Inter-relationships are considered to be the impacts and associated effects of different aspects of Bowdun OWF on the same receptor. Inter-related effects are considered to be either:

- Lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of Bowdun OWF (construction, O&M and decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three project stages (e.g. underwater sound effects from piling, operational Wind Turbines, vessels and decommissioning);
- Receptor-led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on Infrastructure and Other Users, such as displacement of recreational activities and impacts to cables or pipelines or restrictions on access to these assets, may interact to produce a different, or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects may be short-term, temporary or transient effects, or incorporate longer-term effects.

8.11.3 For benthic ecology, the following potential impacts have been considered within the inter-related assessment:

- temporary habitat loss and/or disturbance;
- long term habitat loss and/or disturbance;
- changes to SSC, bed levels and sediment type;
- changes in physical processes;
- increased risk of introduction and spread of INNS;

- colonisation of hard substrate;
- removal of hard substrates; and
- impacts to benthic ecology due to EMF.

8.11.4 Table 8.23 lists the inter-related effects (project lifetime effects) that are predicted to arise during the construction, O&M phase, and decommissioning of the Proposed Development and also the inter-related effects from multiple effects interacting across all phases (receptor-led effects) that are predicted to arise for benthic ecology receptors.

8.11.5 Effects on benthic ecology also have the potential to have effects on other receptors and these effects are fully considered in the topic-specific chapters. These receptors and effects are:

- fish and shellfish ecology (see Volume 2, Chapter 9: Fish and Shellfish Ecology);
    - temporary (during construction, O&M and decommissioning phases), long term (during O&M phase only) and permanent habitat alteration (post decommissioning) habitat loss and disturbance;
- marine mammals (see Volume 2, Chapter 10: Marine Mammals);
    - effects on marine mammals due to altered prey availability; and
- offshore ornithology (see Volume 2, Chapter 11: Offshore Ornithology);
    - changes to prey availability.

Table 8.23: Summary of Likely Significant Inter-Related Effects for Benthic Ecology from Individual Effects Occurring Across the Construction, O&M and Decommissioning Phase of the Proposed Development (Project Lifetime Effects) and from Multiple Effects Interacting Across all Phases (Receptor-led Effects)

Description of Impact	Phase*			Likely Significant Inter-Related Effects
	C	O	D	
Project Lifetime Effects				
Temporary habitat loss and/or disturbance	✓	✓	✓	When habitat loss or disturbance is considered additively across all phases, the total area of habitat affected is larger than when considered across an individual phase (i.e. just construction). However, temporary and long term loss and/or disturbance will be highly localised to the vicinity of the activities during each phase of the Proposed Development. Individual activities resulting in temporary habitat loss and disturbance will occur intermittently throughout this time with only a small proportion of the total area of habitat being impacted at any one time. The predominantly sand and coarse sediment habitats that are most likely to be affected are typical of, and widespread throughout, the Regional Benthic Ecology Study Area and North Sea. Further, all benthic habitats are predicted to recover. There is the potential for repeat disturbance to occur during the O&M phase, although it was predicted that the communities will have fully recovered from construction impacts by this time. Therefore, across the lifetime of the project, the effects on benthic ecology receptors are not anticipated to interact in such a way as to result in inter-related effects of greater significance than the assessments presented for each individual phase. As a result, the inter-related effects are of **Minor** adverse significance which is not significant in EIA terms.
Long term habitat loss and/or disturbance	✓	✓	✓	
Changes to SSC, bed levels and sediment type	✓	✓	✓	The majority of seabed disturbance (resulting in highest SSC/deposition) will occur during the construction and decommissioning phases, with any effects being short lived and intermittent across each phase. Benthic IEFs potentially affected by increased SSC and deposition are likely to have recovered in the intervening period between phases. Due to this and the negligible to high sensitivity (and/or high recoverability) of the species and habitats in question, the interaction of these impacts across the stages of the Proposed Development lifecycle is predicted to result in an effect of Minor significance. Therefore, across the lifetime of the Proposed Development, the effects on benthic ecology receptors are not anticipated to interact in such a way as to result in inter-related effects of greater significance then the assessments presented for each individual phase. As a result, the inter-related effects are of **Minor** adverse significance which is not significant in EIA terms.
Changes in physical processes	×	✓	✓	Any effects due to changes in physical processes across the phases of the Proposed Development are likely to be highly localised (i.e. largely within the Array Area), with benthic ecology receptors having low sensitivity (and/or high recoverability) to the scale of changes predicted. Therefore, across the lifetime of the Proposed Development, the effects on benthic ecology receptors are not anticipated to interact in such a way as to result in inter-related effects of greater significance then the assessments presented for each individual phase. As a result, the inter-related effects are of **Minor** adverse significance which is not significant in EIA terms.
Colonisation of hard substrate	✓	✓	✓	Introduction of hard substrate and subsequent colonisation will be highly localised to the vicinity of the introduced hard substrate during each phase of the Proposed Development. The predominantly sand and coarse sediment habitats that are most likely to be affected are typical of, and widespread throughout, the Regional Benthic Ecology Study Area and North Sea. Therefore, across the lifetime of the Proposed Development, the effects on benthic ecology receptors are not anticipated to interact in such a way as to result in inter-related effects of greater significance than the assessments presented for each individual phase. As a result, the inter-related effects are of **Minor** adverse significance which is not significant in EIA terms.
Increased risk of introduction and spread of INNS	✓	✓	✓	Although vessels associated with all phases of the Proposed Development (potentially from countries of origin other than the UK) may facilitate the spread of INNS, this effect will predominantly arise during the O&M phase as many INNS will require the hard substrate to be in place to provide substrate on which to settle. It should be noted that infaunal INNS may occur. However, Embedded Mitigation includes the implementation of a Biosecurity Plan as part of the EMP (see Table 8.16). This will require that the risk of potential introduction and spread of INNS will be reduced as far as practicable across all phases. Therefore, across the lifetime of the Proposed Development, the effects on benthic ecology receptors are not anticipated to interact in such a way as to result in inter-related effects of greater significance than the assessments presented for each individual phase. As a result, the inter-related effects are of **Minor** adverse significance which is not significant in EIA terms.
Removal of hard substrates	×	×	✓	This effect will arise during the decommissioning phase only; therefore, no likely significant inter-related effects are anticipated across the lifetime of the Proposed Development.
Impacts to benthic ecology due to EMFs	×	✓	×	This effect will arise during the O&M phase only; therefore, no likely significant inter-related effects are anticipated across the lifetime of the Proposed Development.

Receptor-led Effects

There is the potential for spatial and temporal interactions between the effects arising from temporary and long term habitat loss and/or disturbance, and increased SSCs and associated deposition effects on benthic habitats during the lifetime of the Proposed Development.

Based on best available evidence, published guidance and professional judgement of experienced marine ecologists, the greatest potential for inter-related impacts is predicted to arise through the interaction of the following:

- direct (both temporary and permanent) habitat loss and/or disturbance from the activities and Offshore infrastructure detailed in the MDS; and
- indirect habitat disturbance due to increased SSCs and associated deposition, and changes to physical processes.

These individual impacts were assigned a significance of Negligible to Minor as standalone impacts and although the potential inter-related impacts may arise (i.e. spatial and temporal overlap of direct habitat disturbance), It was predicted that this will not be any more significant than the individual impacts in isolation. This is because the combined area of habitat potentially affected would typically be restricted to the Site Boundary, the habitats affected are widespread across the Regional Benthic Ecology Study Area and, where temporary disturbance occurs, full recovery of the benthos is predicted. In addition, any effects due

Description of Impact	Phase*			Likely Significant Inter-Related Effects
	C	O	D	
to changes in physical processes are likely to be limited, both in extent (i.e. largely within the Array Area) and also in magnitude, with benthic ecology receptors having low sensitivity to the scale of changes predicted. As such, these interactions are predicted to be no greater than the individual effects assessed in isolation. As a result, the receptor-led effects are of a **Minor** adverse significance which is not significant in EIA terms.				

*Proposed Development Phase refers to construction (C), O&M (O) and decommissioning (D).

8.12 Cumulative Effects Assessment

Methodology

8.12.1 The CEA assesses the impact associated with the Proposed Development together with other relevant projects and activities. Cumulative effects are defined as the effect of the Proposed Development in combination with the effects from a number of different projects, on the same receptor or resource. Further details on CEA methodology are provided in Volume 1, Chapter 4: Environmental Impact Assessment Methodology.

8.12.2 The projects selected as relevant to the CEA presented within this chapter are based upon the results of a screening exercise (see Volume 3, Technical Appendix 4.4: Cumulative Effects Assessment - Screening). Volume 3, Technical Appendix 4.4: Cumulative Effects Assessment - Screening provides further information in relation to other projects and how this information is obtained and applied to the assessment. Each project has been considered on a case-by-case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.

8.12.3 In undertaking the CEA for the Proposed Development, it is important to bear in mind that other projects under consideration will have differing potential for proceeding to an operational stage and hence a differing potential to ultimately contribute to a cumulative impact alongside the Proposed Development. Therefore, a tiered approach has been adopted. This provides a framework for placing relative weight upon the potential for each project included in the CEA to ultimately be realised, based upon the project's current stage of maturity and certainty in the projects' parameters. The tiered approach which will be utilised within the Proposed Development CEA employs the following tiers:

- Tier 1 – The onshore elements of the Project;
- Tier 2 – Projects that have an application submitted, are consented, under construction or operational to the extent not already captured with the baseline;
- Tier 3 – Projects which have submitted a scoping report and/or have received a scoping opinion; and
- Tier 4 – Reasonably foreseeable projects including those with Crown Estate Scotland option or lease agreements.

8.12.4 The specific projects scoped into the CEA for benthic ecology, are outlined in Table 8.24.

8.12.5 The range of potential cumulative impacts that are identified and included in Table 8.24, is a subset of those considered for the Proposed Development alone assessment. This is because some of the potential impacts identified and assessed for the Proposed Development alone, are localised and temporary in nature. It is considered therefore, that these potential impacts have limited or no potential to interact with similar changes associated with other plans or projects. These have therefore been scoped out of the CEA.

8.12.6 Some of the potential impacts considered within the Proposed Development alone assessment are specific to a particular phase of development (e.g. construction, O&M or decommissioning). Where the potential for cumulative effects with other projects only have potential to occur where there is spatial or temporal overlap with the Proposed Development during certain phases of development, impacts associated with a certain phase may be omitted from further consideration where no projects have been identified that have the potential for cumulative effects during this period.

8.12.7 For the impacts of increased SSCs and associated deposition and changes to physical processes, the CEA screening buffer used in Volume 2, Chapter 7: Physical Processes was used to identify relevant projects (this CEA screening buffer is the same as the Local Benthic Subtidal Ecology Study Area). This is because the assessment for this impact is based on that presented in Volume 2, Chapter 7: Physical Processes. For all other impacts a buffer of 50 km has been implemented, which is suitably precautionary given the localised nature of the impacts. These buffers were presented during scoping and agreed upon through the Scoping Opinion process (see Table 8.5). These buffers were applied to both the Array Area and the Export Cable Corridor, so there were some projects screened into the CEA that were within these buffers from one but not the other. As a precaution, any projects that were within these buffers from either the Array Area or Export Cable Corridor were included for consideration in the CEA, even if they fell outwith the buffer for one.

Table 8.24: List of Other Projects Considered within the CEA for Benthic Ecology

Project	Status	Distance from Proposed Development (km)	Description of Project	Dates of Construction (If Applicable)	Dates of Operation (If Applicable)	Overlap with the Proposed Development
Tier 1						
Tier 1: The onshore elements of The Project have no direct impact pathway and have not been brought forwards to the CEA for benthic ecology.						
Tier 2						
Offshore Wind Projects and Associated Cables						
Kincardine OWF	Operational	7.63	Kincardine OWF is consented for up to 7 Wind Turbines with 6 currently operational. Capacity of 50 MW.	N/A	2021-2045	The O&M and decommissioning phases of this project have the potential to overlap with the construction and O&M phases of the Proposed Development.
Seagreen 1A Project	Consented	19.47	Seagreen 1A is made up of the 36 remaining Wind Turbines consented as part of the Seagreen 1 Offshore Wind Farm. Seagreen 1A submitted a variation in consent to allow construction to take place between 2029 and 2032.	2029-2032	2033-2057	The construction, O&M, and decommissioning phases of this project have the potential to overlap with the construction and O&M phases of the Proposed Development.
Seagreen 1 OWF	Operational	19.88	Seagreen 1 Offshore Wind Farm consists of up to 114 Wind Turbines at a capacity of 1,075 MW. Seagreen was consented with permission to install 150 Wind Turbines. The remaining 36 Wind Turbines are consented but not yet constructed (Seagreen 1A project).	N/A	2023-2047	The O&M and decommissioning phases of this project has the potential to overlap with the construction and O&M phases of the Proposed Development.
Inch Cape OWF	Under Construction	23.40	Inch Cape OWF is consented for up to 72 Wind Turbines with a maximum generating capacity of 1,100 MW.	2025-2026	2027-2051	The O&M and decommissioning phases of this project has the potential to overlap with the construction, O&M and possibly the decommissioning phases (due to the uncertainty in the operational period of Inch Cape OWF) of the Proposed Development.
Ossian OWF	Application submitted but not yet determined	25.36	The Ossian Floating Wind project is proposed for up to 265 floating Wind Turbines with a capacity of 3,600 MW.	2031-2038	2039-2073	The construction, O&M and decommissioning phases of this project has the potential to overlap with the construction, O&M and decommissioning phases of the Proposed Development.
Aberdeen OWF	Operational	34.71	Aberdeen OWF consists of up to 11 Wind Turbines at a capacity of 96.8 MW.	N/A	2018-2042	The O&M and decommissioning phases of this project has the

Project	Status	Distance from Proposed Development (km)	Description of Project	Dates of Construction (If Applicable)	Dates of Operation (If Applicable)	Overlap with the Proposed Development
						potential to overlap with the construction and O&M phases of the Proposed Development.
Hywind Scotland Wind Farm (Buchan Deep Demo)	Operational	44.43	Floating OWF with 5 Wind Turbines and 30 MW installed capacity.	N/A	2017-2037	The O&M and decommissioning phases of this project has the potential to overlap with the construction and O&M phases of the Proposed Development.
Berwick Bank OWF	Consented	46.53	Berwick Bank OWF is proposed for up to 307 Wind Turbines with a capacity of up to 4,100 MW with an operational lifetime of 35 years.	2027-2032	2033-2067	The construction, O&M and decommissioning phases of this project has the potential to overlap with the construction and O&M phases of the Proposed Development.
Berwick Bank Offshore Transmission Owners (OFTO)	Consented	46.53	Berwick Bank transmission is proposed for up to four cables with an operational lifetime of 35 years.	2026-2029	2030-2064	The O&M and decommissioning phases of this project has the potential to overlap with the construction and O&M phases of the Proposed Development.
Marine Aggregates and Disposal Sites						
Stonehaven B (Site ID: FO007)	Open	11.38	Disposal site	N/A	Ongoing	Ongoing dredging activity associated with these marine aggregates and disposal projects may overlap with the construction and possibly the O&M phases of the Proposed Development. There is limited information on dredging parameters publicly available, however, they have been included as a precaution. These have been collectively referred to as the 'Tier 2 marine aggregates and disposal projects' henceforth, for brevity.
Stonehaven (Site ID: FO003)	Open	11.95	Disposal site	N/A	Ongoing	
Montrose (Site ID: FO010)	Open	18.30	Disposal site	N/A	Ongoing	
Aberdeen (Site ID: CR110)	Open	25.35	Disposal site	N/A	Ongoing	
Arbroath (Site ID: FO020)	Open	33.37	Disposal site	N/A	Ongoing	
Cables and Pipelines						
Eastern Green Link 2	Under construction	0	2 GW subsea cable connecting Peterhead in Aberdeenshire and Drax in North Yorkshire.	2024-2028	2029-Unknown	The O&M and decommissioning phases of this project has the potential to overlap with the construction, O&M and decommissioning phases of the Proposed Development.

Project	Status	Distance from Proposed Development (km)	Description of Project	Dates of Construction (If Applicable)	Dates of Operation (If Applicable)	Overlap with the Proposed Development
Forties to Cruden Bay (PL721)	Operational	39.31	170 km oil pipeline from the Forties C platform to Cruden bay	N/A	Ongoing	The O&M and decommissioning phases of this project have the potential to overlap with the construction, O&M and decommissioning phases of the Proposed Development.
Tier 3						
Offshore Wind Projects and Associated Cables						
Morven Hawthorn Pit Grid Connection Project	Pre-Application	1.81	Consists of the onshore and offshore infrastructure associated with the Morven OWF. Up to six export cables with a capacity of 525 kV.	2029-2032	2033-Unknown	There may be temporal overlap between all phases of this cable project and those of the Proposed Development.
Morven North OWF	Pre-Application	10.03	Morven North Offshore Wind Array Project is proposed for up to 96 Wind Turbines at a capacity of 1,500 MW.	2030-2036	2037-2061	There may be temporal overlap between all phases of this OWF project and those of the Proposed Development.
Morven South OWF	Pre-Application	43.61	Morven South offshore Wind Array Project is proposed for up to 95 Wind Turbines at a capacity of 1,500 MW.	2030-2036	2037-2061	There may be temporal overlap between all phases of this OWF project and those of the Proposed Development.
Ossian Transmission Infrastructure	Pre-Application	25.28	Up to six export cables with a maximum total length of offshore cable route of 509 km. Anticipated application submission in the latter half of 2026. Operational lifetime 35 years.	2030-2033	2034-2067	There may be temporal overlap between all phases of this cable project and those of the Proposed Development.
Cables and Pipelines						
Eastern Green Link 3	Pre-Application	6.28	The project comprises a 2 GW system linking Aberdeenshire in Scotland and Lincolnshire in England. Approximately 575 km of subsea High Voltage Direct Current cable from Lincolnshire to a proposed Landfall at Sandford Bay, Peterhead.	2028 - 2030	2031-Unknown	All phases of this project have the potential overlap with all phases of the Proposed Development.
Eastern Green Link 5	Pre-Application	72.2 (to the determined portion of the cable; the final route based on the landfall location has not yet been determined)	Eastern Green Link 5 is a new primarily offshore high voltage electricity link between Scotland and England. Approximately 555 km of subsea HVDC cable from the Lincolnshire coastline to Scotland. Cable landfall in Scotland to be confirmed.	2030-2034	2035-Unknown	There may be temporal overlap between all phases of this OWF project and those of the Proposed Development.

Project	Status	Distance from Proposed Development (km)	Description of Project	Dates of Construction (If Applicable)	Dates of Operation (If Applicable)	Overlap with the Proposed Development
Tier 4						
Offshore Wind Projects and Associated Cables						
Flora Floating Wind Farm	Pre-Application	46.83	Innovation and Targeted Oil and Gas site 4 is proposed for up to 50 MW.	Unknown	Unknown	There may be temporal overlap between all phases of this OWF project and those of the Proposed Development.

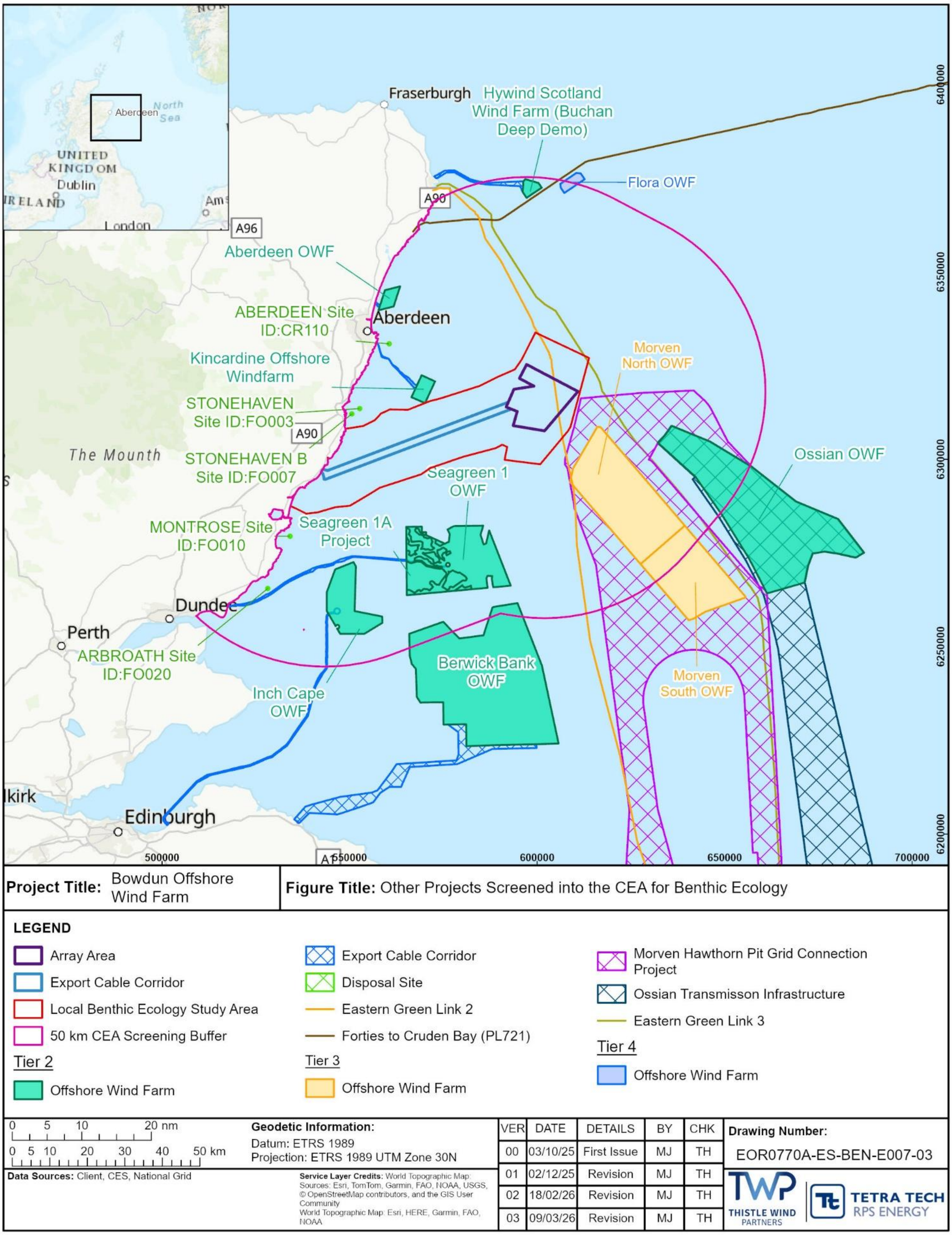

Figure 8.8: Other Projects Screened into the Cumulative Effects Assessment for Benthic Ecology

Maximum Design Scenario

8.12.8 The MDS identified in Table 8.25 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. The cumulative effects presented and assessed in this section have been selected from the details provided in Volume 1, Chapter 3: Project Description as well as the information available on other projects (see Volume 3, Technical Appendix 4.4: Cumulative Effects Assessment - Screening), to inform a 'maximum design scenario'. Any other development scenario within the PDE, will result in the same, or less, level of environmental effect.

Table 8.25: MDS Considered for Each Impact as part of the Assessment of Likely Significant Cumulative Effects on Benthic Ecology

<table>
<tr><th rowspan="2">Potential Cumulative Effect</th><th colspan="3">Phase*</th><th rowspan="2">MDS</th><th rowspan="2">Justification</th></tr>
<tr><th>C</th><th>O</th><th>D</th></tr>
<tr><td>Temporary Habitat Loss and Disturbance</td><td>✓</td><td>✓</td><td>✓</td><td>The MDS is as detailed for the Proposed Development alone in Table 8.10, cumulatively with the following projects:

Tier 2
Offshore Wind Projects and Associated Cables
• Kincardine OWF (O&M and decommissioning phases);
• Seagreen 1A Project (construction, O&M and decommissioning phases);
• Seagreen 1 OWF (O&M and decommissioning phases);
• Ossian OWF (construction, O&M and decommissioning phases);
• Hywind Scotland OWF (O&M and decommissioning phases);
• Berwick Bank OWF (construction, O&M and decommissioning phases); and
• Berwick Bank OFTO (O&M and decommissioning phases).
Marine Aggregates and Disposal
• Tier 2 marine aggregates and disposal projects (ongoing dredging activities).
Cables and Pipelines
• Eastern Green Link 2 (O&M and decommissioning phases); and
Tier 3
Offshore Wind Projects and Associated Cables
• Morven Hawthorn Pit Grid Connection Project (all phases);
• Morven North OWF (all phases);</td><td>A precautionary buffer of 50 km was used to screen in plans and projects from the CEA long list into the CEA for this impact.

The Tier 2, Tier 3, and Tier 4 projects detailed in the previous column have been screened in as they have the potential to cause temporary habitat loss and/or disturbance within their respective footprints and therefore require consideration at a cumulative scale with the Proposed Development.

Tier 2 projects which have not assessed this impact (or the parameters associated with it) have not been included in the CEA. For example, the O&M phase of the Aberdeen OWF overlaps temporally with the Proposed Development; however, Aberdeen OWF do not assess this impact in their O&M phase. Additionally, Inch Cape Offshore Windfarm has not been included in this assessment as it does not assess this impact.</td></tr>
</table>

Potential Cumulative Effect	Phase*			MDS	Justification
	C	O	D		
				• Morven South OWF (all phases); and • Ossian Transmission Infrastructure (all phases). Cables and Pipelines • Eastern Green Link 3 (all phases); and • Eastern Green Link 5. (all phases). **Tier 4** Offshore Wind Projects and Associated Cables • Flora Floating Wind Farm (all phases).	
Long term habitat loss and/or disturbance	✓	✓	✓	The MDS is as detailed for the Proposed Development alone in Table 8.10, cumulatively with the following projects: **Tier 2** Offshore Wind Projects and Associated Cables • Seagreen 1A Project (construction, O&M, and decommissioning phases); • Inch Cape OWF (O&M and decommissioning phases); • Ossian OWF (O&M and decommissioning phases); • Hywind Scotland OWF (O&M and decommissioning phases); and • Berwick Bank Wind Farm (construction, O&M and decommissioning phases). **Tier 3** Offshore Wind Projects and Associated Cables • Morven Hawthorn Pit Grid Connection Project (all phases); • Morven North OWF (all phases); • Morven South OWF (all phases); and • Ossian Transmission Infrastructure (all phases). Cables and Pipelines	A precautionary buffer of 50 km was used to screen in plans and projects from the CEA long list into the CEA for this impact. The Tier 2, Tier 3, and Tier 4 projects detailed in the previous column have been screened in as they have the potential to cause long term habitat loss and/or disturbance within their respective footprints and therefore require consideration at a cumulative scale with the Proposed Development.

Potential Cumulative Effect	Phase*			MDS	Justification
	C	O	D		
				• Eastern Green Link 3 (all phases); and • Eastern Green Link 5 (all phases). **Tier 4** Offshore Wind Projects and Associated Cables • Flora Floating Wind Farm (all phases).	
Changes to SSC, bed levels and sediment types	✓	×	×	The MDS is as detailed for the Proposed Development alone in Table 8.10, cumulatively with the following projects: **Tier 2** Offshore Wind Projects and Associated Cables • Ossian OWF (construction phase). **Tier 3** Offshore Wind Projects and Associated Cables • Morven North OWF (construction phase); and • Morven South OWF (construction phase). **Tier 4** No projects identified.	This impact was informed by Volume 2, Chapter 7: Physical Processes. Therefore, the projects included in the CEA for this impact include only those considered for the same impact in the CEA in Volume 2, Chapter 7: Physical Processes. The screening buffer used was one Spring Tidal Ellipse and also incorporated any projects within Benholm Beach (see Volume 2, Chapter 7: Physical Processes for further detail). The O&M and decommissioning phases of this impact have not been carried forward from the project alone assessment as they were concluded to have a negligible impact and therefore are unlikely to interact with neighbouring projects, resulting in a cumulative impact. The Tier 2 and Tier 3 projects detailed in the previous column have been screened in as they have the potential to result in increased SSCs and associated deposition, and therefore require consideration at a cumulative scale with the Proposed Development.

Potential Cumulative Effect	Phase*			MDS	Justification
	C	O	D		
Changes in physical processes	×	✓	✓	The MDS is as detailed for the Proposed Development alone in Table 8.10, cumulatively with the following projects: **Tier 2** Offshore Wind Projects and Associated Cables • Kincardine OWF (O&M and decommissioning phases); • Seagreen 1 OWF (O&M and decommissioning phases); • Ossian OWF (O&M and decommissioning phases); and • Aberdeen OWF (O&M and decommissioning phases). **Tier 3** Offshore Wind Projects and Associated Cables • Morven North OWF (all phases); and • Morven South OWF (all phases). **Tier 4** No projects identified.	This impact was informed by Volume 2, Chapter 7: Physical Processes. Therefore, the projects included in the CEA for this impact include only those considered for the same impact in the CEA in Volume 2, Chapter 7: Physical Processes. The screening buffer used was one Spring Tidal Ellipse and also incorporated any projects within Benholm Beach (see Volume 2, Chapter 7: Physical Processes for further detail). The Tier 2 and Tier 3 projects detailed in the previous column have been screened in as they have the potential to result in changes to physical processes, and therefore require consideration at a cumulative scale with the Proposed Development.
Increased risk of introduction and spread of INNS	✓	✓	✓	The MDS is as detailed for the Proposed Development alone in Table 8.10, cumulatively with the following projects: **Tier 2** Offshore Wind Projects and Associated Cables • Kincardine OWF (O&M and decommissioning phases); • Seagreen 1A Project (construction, O&M, and decommissioning phases); • Seagreen 1 OWF (O&M and decommissioning phases);	A precautionary buffer of 50 km was used to screen in plans and projects from the CEA long list into the CEA for this impact. The Tier 2, Tier 3, and Tier 4 projects detailed in the previous column have been screened in as they have the potential increased risk of introduction and spread of INNS and therefore require consideration at a cumulative scale with the Proposed Development.

Potential Cumulative Effect	**Phase***			**MDS**	**Justification**
	C	**O**	**D**		
				• Ossian OWF (all phases); • Hywind Scotland OWF (O&M and decommissioning phases); and • Berwick Bank OWF (construction, O&M and decommissioning phases). Marine Aggregates and Disposal • Tier 2 marine aggregates and disposal projects (ongoing dredging activities). **Tier 3** Offshore Wind Projects and Associated Cables • Morven Hawthorn Pit Grid Connection Project; • Morven North OWF; • Morven South OWF; • Ossian Transmission Infrastructure; and • Eastern Green Link 5. **Tier 4** Offshore Wind Projects and Associated Cables • Flora Floating Wind Farm.	
Colonisation of hard structures	✓	✓	✓	The MDS is as detailed for the Proposed Development alone in Table 8.10, cumulatively with the following projects: **Tier 2** Offshore Wind Projects and Associated Cables • Seagreen 1A Project (construction, O&M, and decommissioning phases); • Inch Cape OWF (O&M and decommissioning phases); • Ossian OWF (all phases);	A precautionary buffer of 50 km was used to screen in plans and projects from the CEA long list into the CEA for this impact. The Tier 2, Tier 3, and Tier 4 projects detailed in the previous column have been screened in as they have the potential to introduce artificial hard habitats within their respective footprints and therefore require consideration at a cumulative scale with the Proposed Development.

Potential Cumulative Effect	Phase*			MDS	Justification
	C	O	D		
				• Hywind Scotland OWF (O&M and decommissioning phases); and • Berwick Bank Wind Farm (construction, O&M and decommissioning phases). **Tier 3** Offshore Wind Projects and Associated Cables • Morven Hawthorn Pit Grid Connection Project (all phases); • Morven North OWF (all phases); • Morven South OWF (all phases); and • Ossian Transmission Infrastructure (all phases). Cables and Pipelines • Eastern Green Link 3 (all phases); and • Eastern Green Link 5. **Tier 4** Offshore Wind Projects and Associated Cables • Flora Floating Wind Farm (all phases).	
Removal of hard substrates	×	×	✓	The MDS is as detailed for the Proposed Development alone in Table 8.10, cumulatively with the following projects: **Tier 2** Pipelines • Forties to Cruden Bay (PL721) (decommissioning phases). **Tier 3** Offshore Wind Projects and Associated Cables • Morven Hawthorn Pit Grid Connection Project (decommissioning phase);	A precautionary buffer of 50 km was used to screen in plans and projects from the CEA long list into the CEA for this impact. The Tier 2, Tier 3, and Tier 4 projects detailed in the previous column have been screened in as they have the potential to remove hard substrates during the Proposed Developments decommissioning phase and therefore require consideration at a cumulative scale with the Proposed Development.

Potential Cumulative Effect	Phase*			MDS	Justification
	C	O	D		
				• Morven North OWF (decommissioning phase); • Morven South OWF (decommissioning phase); and • Ossian Transmission Infrastructure (decommissioning phase). Cables and Pipelines • Eastern Green Link 3 (decommissioning phase); and • Eastern Green Link 5 (decommissioning phase). **Tier 4** Offshore Wind Projects and Associated Cables • Flora Floating Wind Farm (decommissioning phase).	
Impacts to benthic ecology due to EMF	×	✓	×	The MDS is as detailed for the Proposed Development alone in Table 8.10, cumulatively with the following projects: **Tier 2** Offshore Wind Projects and Associated Cables • Kincardine OWF (O&M phase); • Seagreen 1A Project (O&M phase); • Seagreen 1 OWF (O&M phase); • Inch Cape OWF (O&M phase); • Ossian OWF (O&M phase); • Aberdeen OWF (O&M phase); • Hywind Scotland OWF (O&M phase); and • Berwick Bank OWF (O&M phase). Cables and Pipelines • Eastern Green Link 2 (O&M phase)	A precautionary buffer of 50 km was used to screen in plans and projects from the CEA long list into the CEA for this impact. The Tier 2, Tier 3, and Tier 4 projects detailed in the previous column have been screened in as they have the potential to release EMFs and therefore require consideration at a cumulative scale with the Proposed Development.

Potential Cumulative Effect	Phase*			MDS	Justification
	C	O	D		
				Tier 3 Offshore Wind Projects and Associated Cables • Morven Hawthorn Pit Grid Connection Project (O&M phase); • Morven North OWF (O&M phase); • Morven South OWF (O&M phase); and • Ossian Transmission Infrastructure (O&M phase). Cables and Pipelines • Eastern Green Link 3 (O&M phase); and • Eastern Green Link 5 (O&M phase). **Tier 4** Offshore Wind Projects and Associated Cables • Flora Floating Wind Farm (O&M phase).	
Impacts to Benthic Ecology Due to Heat from Subsea Electrical Cables	×	✓	×	The MDS is as detailed for the Proposed Development alone in Table 8.10, cumulatively with the following projects: **Tier 2** Offshore Wind Projects and Associated Cables • Kincardine OWF (O&M phase); • Seagreen 1A Project (O&M phase); • Seagreen 1 OWF (O&M phase); • Inch Cape OWF (O&M phase); • Ossian OWF (O&M phase); • Aberdeen OWF (O&M phase); • Hywind Scotland OWF (O&M phase); and • Berwick Bank OWF (O&M phase).	A precautionary buffer of 50 km was used to screen in plans and projects from the CEA long list into the CEA for this impact. The Tier 2, Tier 3, and Tier 4 projects detailed in the previous column have been screened in as they have the potential to release heat and therefore require consideration at a cumulative scale with the Proposed Development.

Potential Cumulative Effect	Phase*			MDS	Justification
	C	O	D		
				Cables and Pipelines • Eastern Green Link 2 (O&M phase) **Tier 3** Offshore Wind Projects and Associated Cables • Morven Hawthorn Pit Grid Connection Project (O&M phase); • Morven North OWF (O&M phase); • Morven South OWF (O&M phase); and • Ossian Transmission Infrastructure (O&M phase). Cables and Pipelines • Eastern Green Link 3 (O&M phase); and • Eastern Green Link 5 (O&M phase). **Tier 4** Offshore Wind Projects and Associated Cables • Flora Floating Wind Farm (O&M phase).	

* Project Phase refers to construction (C), O&M (O) and decommissioning (D).

Cumulative Effects Assessment

8.12.9 An assessment of the likely significance of the cumulative effects of the Proposed Development upon benthic ecology receptors arising from each identified impact is given below. No Tier 1 projects were identified which could have a cumulative significant impact alongside the Proposed Development for any phase of any of the assessed impacts.

TEMPORARY HABITAT LOSS AND/OR DISTURBANCE

Tier 2

Construction Phase

Magnitude of Impact

8.12.10 There are several Tier 2 projects with the potential for cumulative temporary habitat loss and/or disturbance during the construction phase of the Proposed Development (Table 8.26). The maximum cumulative temporary habitat loss and/or disturbance associated with the Tier 2 projects together with the construction phase of the Proposed Development is estimated at up to 236,088,833 m^2 (Table 8.26). This represents up to 1.48%% of the 50 km CEA screening buffer applied and up to 1.24% of the Regional Benthic Ecology Study Area. This may be an underestimation due to the lack of information available on footprints of temporary habitat loss and/or disturbance for some of the Tier 2 projects (see Table 8.26). However, it is important to note that the cumulative footprint will not be one continuous area, but comprised of isolated areas of temporary habitat loss and/or disturbance across the 50 km CEA screening buffer. The cumulative magnitude of impact of the Proposed Development with the Tier 2 projects is therefore considered robust and not expected to represent a material additional impact to that defined for the assessment of the Proposed Development alone.

8.12.11 Site preparation and construction activities associated with the Proposed Development are anticipated to occur intermittently. They will be spread out across the full allotted construction timeframe with only a small proportion of the MDS footprint for this impact being affected at any one time. It is likely that this will be similar for the activities at the Tier 2 projects which may also result in temporary habitat loss and/or disturbance during this phase. There will be no spatial overlap between the Site Boundary and the majority of the Tier 2 projects, except Eastern Green Link 2 (See Figure 8.8 and Table 8.24), with this overlap limited to the locations that this cable intersects with the Proposed Development.

Table 8.26: Cumulative Footprint of Temporary Habitat Loss and/or Disturbance for the Tier 2 Projects Overlapping with the Construction Phase of the Proposed Development

Project	MDS (m^2)	Component Parts of Temporary Habitat Loss and/or Disturbance	Reference
Proposed Development	19,414,805	See Table 8.10	N/A
Offshore Wind Projects and Associated Cables			
Kincardine OWF	O&M: 129,000	Seabed preparation, cable installation, anchoring, trench for start of the export cable, and cable protection installation.	Kincardine OWF Limited (2016)
Seagreen 1A Project	Construction and O&M: Unquantified	Jetting, ploughing or mechanical trenching techniques for cable installation with a maximum working width of 100 m.	Seagreen 1A (2021)
Seagreen 1 OWF	O&M: 358,100	Use of jack-up vessels for maintenance.	Seagreen Wind Energy Limited (2012)
Ossian OWF	Construction: 49,948,548 (Potential for additional 5,190 due to crater formation form the clearance of UXO (not included in Ossian OWF habitat loss total, but included in below calculation)	Jack-up vessel use, anchoring, seabed preparation, and cable installation.	Ossian OWFL (2024a)
	O&M: 51,411,500	Jack-up vessels and cable repair and reburial.	
Hywind Scotland OWF	O&M: No impact predicted in this phase	N/A	Statoil (2015)
Berwick Bank OWF	Construction: 113,974,700	Foundation installation, jack-up vessel use, anchoring, seabed preparation, and cable installation.	SSE Renewables (2022)

Project	MDS (m^2)	Component Parts of Temporary Habitat Loss and/or Disturbance	Reference
	O&M: 989,000	Major component replacements, access ladder replacement, and cable repair and reburial.	
Marine Aggregates and Disposal			
Tier 2 marine aggregates and disposal projects	Ongoing dredging activities: there are no footprints of disturbance available for any of these projects. However, due to the limited nature of aggregates and disposal sites, these are not expected to be similar to nor exceed the footprints of temporary disturbance listed above for the Proposed Development and other Tier 2 OWF projects.	Dredging and disposal activities.	N/A
Cables and Pipelines			
Eastern Green Link 2	O&M: Not quantified	Cable maintenance.	National Grid (2022)
Total (Proposed Development and Tier 2 Projects)	236,088,833		

Subtidal IEFs

8.12.12 The cumulative impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the cumulative impact will affect the receptor directly. The magnitude is therefore, considered to be low.

Sensitivity of Receptor

Subtidal IEFs

8.12.13 The sensitivities of the IEFs are as previously described for the alone assessment (Paragraphs 8.10.18 and 8.10.19).

8.12.14 The subtidal sands and gravels IEF and offshore muddy and mixed sediment IEF are deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Significance of Effect

Subtidal IEFs

8.12.15 Overall, for the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.16 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

O&M Phase

Magnitude of Impact

8.12.17 There are several Tier 2 projects with the potential for cumulative temporary habitat loss and/or disturbance during the O&M phase of the Proposed Development (Table 8.25). The maximum cumulative temporary habitat loss and/or disturbance associated with the Tier 2 projects together with the O&M phase of the Proposed Development is estimated at up to 99,018,613 m^2 (Table 8.25). This represents up to 0.62% of the 50 km CEA screening buffer applied and up to 0.52% of the Regional Benthic Ecology Study Area. This may be an underestimation due to the lack of information available on footprints of temporary habitat loss and/or disturbance during the O&M phase for most of the Tier 2 projects (Table 8.27). It is important to note that the cumulative footprint will not be one continuous area, but comprised of isolated areas of temporary habitat loss and/or disturbance across the 50 km CEA screening buffer. The cumulative magnitude of impact of the Proposed Development with the Tier 2 projects is therefore not expected to represent a material additional impact to that defined for the assessment of the Proposed Development alone.

8.12.18 O&M activities resulting in temporary habitat loss and/or disturbance associated with the Proposed Development are anticipated to occur intermittently. They will be spread out across the full 30 year O&M phase with only a small proportion of the MDS footprint for this impact being affected at any one time. It is likely that this will be similar for the activities at the Tier 2 projects which may also result in temporary habitat loss and/or disturbance during this phrase. There will be no spatial overlap between the Site Boundary and the majority of the Tier 2 projects, except some of the operational cable and pipeline projects (Table 8.24).

Table 8.27: Cumulative Footprint of Temporary Habitat Loss and/or Disturbance for the Tier 2 Projects Overlapping with the O&M Phase of the Proposed Development

Project	MDS (m^2)	Component Parts of Temporary Habitat Loss and/or Disturbance	Reference
Proposed Development	11,688,813	See Table 8.10	N/A
Offshore Wind Projects and Associated Cables			
Kincardine OWF	O&M: 129,000	Seabed preparation, cable installation, anchoring, trench for start of the export cable, and cable protection installation.	Kincardine OWF Limited (2016)
	Decommissioning: Not quantified	Removal of cables, mooring lines and anchors.	
Seagreen 1A Project	Construction: Not quantified	Seabed preparation, cable installation, anchoring, cable protection installation.	Seagreen 1A (2021)
	O&M: Not quantified	Maintenance activities	
	Decommissioning: Not assessed	N/A	
Seagreen 1 OWF	O&M: 358,100	Use of jack-up vessels for maintenance.	Seagreen Wind Energy Limited (2012)
	Decommissioning: Not quantified	Removal of all cabling and built structures.	
Ossian OWF	O&M: 51,411,500	Jack-up vessels and cable repair and reburial.	Ossian OWFL (2024a)
Hywind Scotland OWF	O&M: No impact predicted in this phase	N/A	Statoil (2015)
	Decommissioning: Not assessed		
Berwick Bank OWF	O&M: 989,000	Major component replacements, access ladder replacement, and cable repair and reburial.	SSE Renewables (2022)
	Decommissioning: 34,571,200	Foundation removal, jack-up vessels, removal of cables, anchor placement and removal of cable ducts.	

Project	MDS (m^2)	Component Parts of Temporary Habitat Loss and/or Disturbance	Reference
Marine Aggregates and Disposal			
Tier 2 marine aggregates and disposal projects	Ongoing dredging activities: there are no footprints of disturbance available for any of these projects. However, due to the limited nature of aggregates and disposal sites, these are not expected to be similar to nor exceed the footprints of temporary disturbance listed above for the Proposed Development and other Tier 2 OWF projects.	Dredging and disposal activities.	N/A
Cables and Pipelines			
Eastern Green Link 2	O&M: Not quantified	Cable maintenance.	National Grid (2022)
	Decommissioning: Not quantified	Potential effects the same as route preparation and cable installation.	
Total (Proposed Development and Tier 2 Projects)	99,018,613		

Subtidal IEFs

8.12.19 The cumulative impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the cumulative impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of Receptor

Subtidal IEFs

8.12.20 The sensitivities of the IEFs are as previously described for the alone assessment (Paragraphs 8.10.18 and 8.10.19).

8.12.21 The subtidal sands and gravels IEF and offshore muddy and mixed sediment IEF are deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Significance of Effect

Subtidal IEFs

8.12.22 Overall, for the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.23 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Decommissioning Phase

Magnitude of Impact

8.12.24 There are several Tier 2 projects with the potential for cumulative temporary habitat loss and/or disturbance during the decommissioning phase of the Proposed Development (Table 8.25). The maximum cumulative temporary habitat loss and/or disturbance associated with the Tier 2 projects is not quantified for this impact as it is not quantified for the Proposed Development in this phase (Table 8.28). However Ossian OWF have quantified this impact in the decommissioning phase and determine that there may be 43,200 m^2 of temporary habitat disturbance/loss (Ossian OWFL, 2024b). It is important to note that the cumulative footprint will not be one continuous area, but comprised of isolated areas of temporary habitat loss and/or disturbance across the 50 km CEA screening buffer. The cumulative magnitude of impact of the Proposed Development with the Tier 2 projects is therefore not expected to represent a material additional impact to that defined for the assessment of the Proposed Development alone.

8.12.25 Decommissioning activities resulting in temporary habitat loss and/or disturbance associated with the Proposed Development are anticipated to occur intermittently, with only a small proportion of the MDS footprint for this impact being affected at any one time. It is likely that this will be similar for the activities at the Tier 2 projects which may also result in temporary habitat loss and/or disturbance during this phrase. There will be no spatial overlap between the Site Boundary and the majority of the Tier 2 projects, except one of the operational cable projects (Eastern Green Link 2).

Table 8.28: Cumulative Footprint of Temporary Habitat Loss and/or Disturbance for the Tier 2 Projects Overlapping with the Decommissioning Phase of the Proposed Development

Project	MDS (m²)	Component Parts of Temporary Habitat Loss and/or Disturbance	Reference
Proposed Development	Not quantified	See Table 8.10	N/A
Offshore Wind Projects and Associated Cables			
Ossian OWF	O&M: 51,411,500	Jack-up vessels and cable repair and reburial.	Ossian OWFL (2024a)
	Decommissioning: 43,200	Foundation removal, jack-up vessels, removal of cables, anchor placement and removal of cable ducts.	
Marine Aggregates and Disposal			
Tier 2 marine aggregates and disposal projects	Ongoing dredging activities: there are no footprints of disturbance available for any of these projects. However, due to the limited nature of aggregates and disposal sites, these are not expected to be similar to nor exceed the footprints of temporary disturbance listed above for the Proposed Development and other Tier 2 OWF projects.	Dredging and disposal activities.	N/A
Cables and Pipelines			
Eastern Green Link 2	O&M: Not quantified	Cable maintenance.	National Grid (2022)
	Decommissioning: Not quantified	Potential effects the same as route preparation and cable installation.	
Total (Proposed Development and Tier 2 Projects)	N/A		

Subtidal IEFs

8.12.26 The cumulative impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the cumulative impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of Receptor

Subtidal IEFs

8.12.27 The sensitivities of the IEFs are as previously described for the alone assessment (Paragraphs 8.10.18 and 8.10.19).

8.12.28 The subtidal sands and gravels IEF and offshore muddy and mixed sediment IEF are deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is therefore, considered to be medium.

Significance of Effect

Subtidal IEFs

8.12.29 Overall, for the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.30 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Tier 3

Construction Phase

Magnitude of Impact

8.12.31 There are six Tier 3 projects with the potential for cumulative temporary habitat loss and/or disturbance during the construction phase of the Proposed Development. It is not possible to quantify the effect of these projects as they are all in the scoping stage and, therefore, there is limited information available regarding the magnitude of their impact:

- Morven North OWF;
- Morven South OWF;
- Morven Hawthorn Pit Grid Connection Project;
- Ossian Transmission Infrastructure Project;
- Eastern Green Link 3; and
- Eastern Green Link 5 (Table 8.25).

8.12.32 The Morven North and South OWFs has the potential to be in its construction or O&M phase during the Proposed Developments construction phase. The Morven North and South OWFs may cause temporary habitat disturbance as a result of site preparation activities in advance of installation activities, cable installation activities (including UXO clearance, pre-cabling seabed clearance and anchor placements), and placement of spud-can legs from jack-up operations (MvOWL, 2023). Temporary habitat loss/disturbance may occur during the O&M phase as a result of operations (e.g. cable repair/reburial, use of jack-up vessels to facilitate Wind Turbine component repairs, etc.) (MvOWL, 2023).

8.12.33 The Morven Hawthorn Pit Grid Connection Project has the potential to be in its construction or O&M phase during the Proposed Developments construction phase. The Morven Hawthorn Pit Grid Connection Project may cause temporary habitat disturbance as a result of construction activities that interact with the seabed and in the O&M phase, minor repair and reburial events only, with much smaller areas of disturbance expected than during the construction (EnBW, 2024).

8.12.34 The Ossian Transmission Infrastructure Project has the potential to be in its construction or O&M phase during the Proposed Development's construction phase. During construction phase the Ossian Transmission Infrastructure Project may cause temporary habitat loss or disturbance as a result of site preparation activities (including potential UXO clearance) in advance of cable installation, including anchor placements and pre-cabling seabed clearance (Ossian OWFL, 2025). The Ossian Transmission Infrastructure Project scoping report does not anticipate any temporary habitat loss or disturbance in its O&M phase (Ossian OWFL, 2025).

8.12.35 Eastern Green Link 3 has the potential to be in its construction or O&M phase during the Proposed Developments construction phase. Eastern Green Link 3 may cause temporary habitat disturbance as a result of construction activities that interact with the seabed and in the O&M phase, minor repair and reburial events only, with much smaller areas of disturbance expected than during the construction (Scottish and Southern Electricity Networks (SSEN) Transmission, 2023). The impacts from Eastern Green Link 5 will be similar to projects such as Eastern Green Link 2 (National Grid, 2022).

Subtidal IEFs

8.12.36 The cumulative impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the cumulative impact will affect the receptor directly. The magnitude is therefore, considered to be low.

Sensitivity of Receptor

Subtidal IEFs

8.12.37 The sensitivities of the IEFs are as previously described for the alone assessment (Paragraphs 8.10.18 and 8.10.19).

8.12.38 The subtidal sands and gravels IEF and offshore muddy and mixed sediment IEF are deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Significance of Effect

Subtidal IEFs

8.12.39 Overall, for the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.40 No Additional Mitigation is considered necessary because the likely effect in the absence of mitigation (beyond the Embedded Mitigation outlined in Section 8.9) is not significant in EIA terms.

O&M Phase

Magnitude of Impact

8.12.41 There are six Tier 3 projects with the potential for cumulative temporary habitat loss and/or disturbance during the O&M phase of the Proposed Development. It is not possible to quantify the effect of these projects as they are all in the scoping stage and therefore there is limited information available regarding the magnitude of their impact:

- Morven North OWF;
- Morven South OWF;
- Morven Hawthorn Pit Grid Connection Project;
- Ossian Transmission Infrastructure Project; and
- Eastern Green Link 3; and
- Eastern Green Link 5 (Table 8.25).

8.12.42 The Morven North and South OWFs has the potential to be in its construction, O&M or decommissioning phase during the Proposed Developments O&M phase. The Morven North and South OWFs may cause temporary habitat disturbance as a result of site preparation activities in advance of installation activities, cable installation activities (including UXO clearance, pre-cabling seabed clearance and anchor placements), and placement of spud-can legs from jack-up operations (MvOWL, 2023). Temporary habitat loss/disturbance may occur during the O&M phase as a result of operations (e.g. cable repair/reburial, use of jack-up vessels to facilitate Wind Turbine component repairs, etc.) (MvOWL, 2023). The scoping report does not discuss the activities in the decommissioning phase which may result in temporary habitat loss or disturbance.

8.12.43 The Morven Hawthorn Pit Grid Connection Project has the potential to be in its construction, O&M or decommissioning phase during the Proposed Developments O&M phase. The Morven Hawthorn Pit Grid Connection Project may cause temporary habitat disturbance as a result of construction activities that interact with the seabed and in the O&M phase, minor repair and reburial events only, with much smaller areas of disturbance expected than during the construction (EnBW, 2024). Removal of joint bays and cable protection may result in temporary habitat disturbance during the decommissioning phase (EnBW, 2024).

8.12.44 The Ossian Transmission Infrastructure Project has the potential to be in its construction, O&M or decommissioning phase during the Proposed

Developments O&M phase. During construction phase the Ossian Transmission Infrastructure Project may cause temporary habitat loss or disturbance as a result of site preparation activities (including potential UXO clearance) in advance of cable installation, including anchor placements and pre-cabling seabed clearance (Ossian OWFL, 2025). The Ossian Transmission Infrastructure Project scoping report does not anticipate any temporary habitat loss or disturbance in its O&M phase, whereas removal of cables and cable protection may result in temporary habitat disturbance during the decommissioning phase (Ossian OWFL, 2025).

8.12.45 Eastern Green Link 3 has the potential to be in its O&M phase during the Proposed Developments O&M phase. Eastern Green Link 3 may cause temporary habitat disturbance as a result of its O&M phase, minor repair and reburial events only, with much smaller areas of disturbance expected than during the construction (SSEN Transmission, 2023). The impacts from Eastern Green Link 5 will be similar to projects such as Eastern Green Link 2 (National Grid, 2022).

Subtidal IEFs

8.12.46 The cumulative impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the cumulative impact will affect the receptor directly. The magnitude is therefore, considered to be low.

Sensitivity of Receptor

Subtidal IEFs

8.12.47 The sensitivities of the IEFs are as previously described for the alone assessment (Paragraphs 8.10.18 and 8.10.19).

8.12.48 The subtidal sands and gravels IEF and offshore muddy and mixed sediment IEF are deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Significance of Effect

Subtidal IEFs

8.12.49 Overall, for the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.50 No Additional Mitigation is considered necessary because the likely effect in the absence of mitigation (beyond the Embedded Mitigation outlined in Section 8.9) is not significant in EIA terms.

Decommissioning Phase

Magnitude of Impact

8.12.51 There are four Tier 3 projects with the potential for cumulative temporary habitat loss and/or disturbance during the decommissioning phase of the

Proposed Development. It is not possible to quantify the effect of these projects as they are all in the scoping stage and therefore there is limited information available regarding the magnitude of their impact.

8.12.52 The Morven North and South OWFs has the potential to be in its O&M or decommissioning phase during the Proposed Developments decommissioning phase. The Morven North and South OWFs may cause temporary habitat disturbance in the O&M phase as a result of operations (e.g. cable repair/reburial, use of jack-up vessels to facilitate Wind Turbine component repairs, etc.) (MvOWL, 2023). The scoping report does not discuss the activities in the decommissioning phase which may result in temporary habitat loss or disturbance.

8.12.53 The Morven Hawthorn Pit Grid Connection Project has the potential to be in its O&M or decommissioning phase during the Proposed Developments decommissioning phase. The Morven Hawthorn Pit Grid Connection Project may cause temporary habitat disturbance in the O&M phase as a result of minor repair and reburial events (EnBW, 2024). Removal of joint bays and cable protection may result in temporary habitat disturbance during the decommissioning phase (EnBW, 2024).

8.12.54 The Ossian Transmission Infrastructure Project has the potential to be in its O&M or decommissioning phase during the Proposed Developments decommissioning phase. The Ossian Transmission Infrastructure Project scoping report does not anticipate any temporary habitat loss or disturbance in its O&M phase, whereas removal of cables and cable protection may result in temporary habitat disturbance during the decommissioning phase (Ossian OWFL, 2025).

8.12.55 Eastern Green Link 3 has the potential to be in its O&M phase during the Proposed Developments decommissioning phase. Eastern Green Link 3 may cause temporary habitat disturbance as a result of its O&M phase, minor repair and reburial events only, with much smaller areas of disturbance expected than during the construction, or decommissioning activities which will result in similar levels of disturbance to the construction phase (SSEN Transmission, 2023). The impacts from Eastern Green Link 5 will be similar to projects such as Eastern Green Link 2 (National Grid, 2022).

Subtidal IEFs

8.12.56 The cumulative impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the cumulative impact will affect the receptor directly. The magnitude is therefore, considered to be low.

<u>Sensitivity of Receptor</u>

Subtidal IEFs

8.12.57 The sensitivities of the IEFs are as previously described for the alone assessment (Paragraphs 8.10.18 and 8.10.19).

8.12.58 The subtidal sands and gravels IEF and offshore muddy and mixed sediment IEF are deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is therefore, considered to be medium.

Significance of Effect

Subtidal IEFs

8.12.59 Overall, for the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.60 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Tier 4

Construction, O&M and Decommissioning Phase

Magnitude of Impact

8.12.61 There is one Tier 4 project with the potential for cumulative temporary habitat loss and/or disturbance during the construction phase of the Proposed Development. The Flora Floating Wind Farm is currently in the pre-application stage and therefore there is little known about the potential impacts associated with this project. It is however likely the impacts from the Flora Floating Wind Farm will be similar to that of Ossian OWF which is also a floating project but on a much smaller scale as Ossian OWF has a capacity of 3.6 GW and the Flora Floating Wind Farm has a maximum capacity of 50 MW (North Sea Transmission Authority, 2025).

Subtidal IEFs

8.12.62 The cumulative impact is predicted to be of local spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the cumulative impact will affect the receptor directly. The magnitude is therefore, considered to be low.

Sensitivity of Receptor

Subtidal IEFs

8.12.63 The sensitivities of the IEFs are as previously described for the alone assessment (Paragraphs 8.10.18 and 8.10.19).

8.12.64 The subtidal sands and gravels IEF and offshore muddy and mixed sediment IEF are deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is therefore, considered to be medium.

Significance of Effect

Subtidal IEFs

8.12.65 Overall, for the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.66 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

LONG TERM HABITAT LOSS AND/OR DISTURBANCE

Tier 2

Construction, O&M and Decommissioning Phases

8.12.67 There are five Tier 2 projects with the potential for cumulative long term habitat loss and/or disturbance during the construction, O&M and decommissioning phases of the Proposed Development:

- Seagreen 1A Project;
- Inch Cape OWF;
- Ossian OWF;
- Hywind Scotland OWF;
- Berwick Bank Wind Farm (Table 8.25).

8.12.68 The maximum cumulative long term habitat loss and/or disturbance associated with the Tier 2 projects together with that of the Proposed Development is estimated at up to 32,293,334 m^2 (Table 8.29). This represents up to 0.17% of the 50 km Regional Benthic Ecology Study Area applied and up to 0.20% of the Benthic Subtidal Ecology Study Area. It is important to note that the cumulative footprint of 30.36 km^2 will not be one continuous area but comprised of isolated areas of habitat loss and/or disturbance across the 50 km CEA screening buffer. There will also be no spatial overlap between the Site Boundary and the majority of the Tier 2 projects, except Eastern Green Link 2 (see Figure 8.8 and Table 8.29), with this overlap limited to the locations that this cable intersects with the Proposed Development. The cumulative magnitude of impact of the Proposed Development with the Tier 2 projects is therefore not expected to represent a material additional impact to that defined for the assessment of the Proposed Development alone.

8.12.69 It is important to note that the cumulative footprint will not be one continuous area but comprised of isolated areas of long-term habitat loss and/or disturbance across the 50 km CEA screening buffer. There will also be no spatial overlap between the Site Boundary and the Tier 2 projects (Figure 8.8). The cumulative magnitude of impact of the Tier 2 projects, therefore, represents no additional material impact to that defined for the assessment of the Proposed Development alone.

Table 8.29: Cumulative Footprint of Long term Habitat Loss and/or Disturbance for the Tier 2 Projects Overlapping with the Construction, O&M, and Decommissioning Phases of the Proposed Development

Project	MDS (m^2)	Component Parts of Long term Habitat Loss and/or Disturbance	Reference
Proposed Development	2,251,000	See Table 8.10	N/A
Offshore Wind Projects and Associated Cables			
Seagreen 1A Project	Construction and O&M: Unquantified.	Cable protection along 20% of cable route with a maximum width of 6 m.	Seagreen 1A (2021)
Inch Cape OWF	O&M: 2,470,000	Footprint of Wind Turbine foundations, OSPs, met masts, cable and Scour Protection.	Inch Cape Offshore Limited (2018)
Ossian OWF	Construction and O&M: 19,270,958	Footprint of mooring lines, Scour Protection, cable protection and OSP jacket foundations (footprint of dynamic cables, mid-water mooring lines and floating foundations not included).	Ossian OWFL (2024)
Hywind Scotland OWF	O&M: 272,520	Continued presence of Wind Turbine anchors, cables, Scour Protection (rock dump and/or concrete mattresses) and cable protection.	Statoil (2015)
Berwick Bank Wind Farm	All phases: 7,798,856	Suction caisson and suction caisson jacket foundations, Scour Protection and cable protection if left *in situ*.	SSE Renewables (2022)
Berwick Bank OFTO	O&M: up to 230,000 (Scottish waters)	(Potential for) Cable protection removal.	SSE Renewables (2023)
Total (Proposed Development and Tier 2 Projects)	**32,293,334**		

Subtidal IEFs

8.12.70 The cumulative impact is predicted to be of local spatial extent, long term duration, intermittent and high reversibility. It is predicted that the cumulative impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of Receptor

Subtidal IEFs

8.12.71 The sensitivities of the IEFs are as previously described for the alone assessment (Paragraphs 8.10.47 and 8.10.50).

8.12.72 The offshore subtidal sands and gravel IEF and offshore muddy and mixed sediments IEF is deemed to be of high vulnerability, low recoverability and regional value. The sensitivity of the receptor is therefore, considered to be high.

Significance of Effect

Subtidal IEFs

8.12.73 Overall, for the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of a Minor to Moderate adverse. Given the low footprint of the cumulative long term habitat loss and/or disturbance compared to both the CEA buffer and Regional Benthic Ecology Study Area, the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.74 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Tier 3

Construction, O&M and Decommissioning Phases

Magnitude of Impact

8.12.75 There are six Tier 3 projects with the potential for cumulative long term habitat loss and/or disturbance during the construction, O&M and decommissioning phases of the Proposed Development:

- Morven Hawthorn Pit Grid Connection Project (possibly in its construction, O&M and decommissioning phases);
- Morven North OWF (possibly in its construction, O&M and decommissioning phases);
- Morven South OWF (possibly in its construction, O&M and decommissioning phases);
- Ossian Transmission Infrastructure (possibly in its construction, O&M and decommissioning phases); and
- Eastern Green Link 3 (possibly in its construction, O&M and decommissioning phases); and

- Eastern Green Link 5 (possibly in its construction, O&M and decommissioning phases) (Table 8.25).

8.12.76 As Tier 3 projects, there are no publicly available parameters to define footprints of long term habitat loss and/or disturbance and cannot be combined with the Proposed Development. Long term habitat loss and/or disturbance associated with the Morven North and South OWFs are expected to be similar in nature and extent to that calculated for the Proposed Development. Footprints of impact associated with the Morven Hawthorn Pit Grid Connection Project, Ossian Transmission Infrastructure, Eastern Green Link 3, and Eastern Green Link 5 are likely to be of a lower extent to those calculated for the Proposed Development.

8.12.77 It is important to note that the cumulative footprint will not be one continuous area, but comprised of isolated areas of long term habitat loss and/or disturbance across the 50 km CEA screening buffer. There will also be no spatial overlap between the Site Boundary and the Tier 3 projects (Figure 8.8). The cumulative magnitude of impact of the Tier 3 projects, therefore, represents no additional material impact to that defined for the assessment of the Proposed Development alone.

Subtidal IEFs

8.12.78 The cumulative impact is predicted to be of local spatial extent, long term duration, intermittent and high reversibility. It is predicted that the cumulative impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of Receptor

Subtidal IEFs

8.12.79 The sensitivities of the IEFs are as previously described for the alone assessment (Paragraphs 8.10.47 and 8.10.50).

8.12.80 The offshore subtidal sands and gravel IEF and offshore muddy and mixed sediments IEF is deemed to be of high vulnerability, low recoverability and regional value. The sensitivity of the receptor is therefore, considered to be high.

Significance of Effect

Subtidal IEFs

8.12.81 Overall, for the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of a minor to moderate adverse. Given the low footprint of the cumulative long term habitat loss and/or disturbance compared to both the CEA buffer and Regional Benthic Ecology Study Area, the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.82 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Tier 4

Construction, O&M and Decommissioning Phases

Magnitude of Impact

8.12.83 In addition to the Tier 2 and Tier 3 projects, there is one Tier 4 project with the potential for cumulative long term habitat loss and/or disturbance during the construction, O&M, and decommissioning phases of the Proposed Development:

- Flora Floating Wind Farm (possibly in its construction, O&M and decommissioning phases) (Table 8.25).

8.12.84 As a Tier 4 project, there are no publicly available parameters to define footprints of long term habitat loss and/or disturbance and cannot be combined with those of the Proposed Development and the Tier 3 projects.

8.12.85 It is possible that the construction, O&M and/or decommissioning phases of this project could overlap with the construction, O&M and/or decommissioning phases of the Proposed Development. However, given that this is a Tier 4 project, there is no information on the footprints of long term habitat loss and/or disturbance currently available. It has reasonably been assumed that these would be of a lesser extent to those associated with the Proposed Development as the Flora Floating Wind Farm has a maximum capacity of 50 MW compared to the 1 GW capacity of the Proposed Development (Table 8.10).

8.12.86 As with the Tier 3 projects, it is important to note that the cumulative footprint will not be one continuous area, but comprised of isolated areas of long term habitat loss and/or disturbance across the 50 km CEA screening buffer. The cumulative magnitude of impact of the Tier 4 project, therefore, represents no additional material impact to that defined for the assessment of the Proposed Development alone, and cumulatively with the Tier 3 projects.

Subtidal IEFs

8.12.87 The cumulative impact is predicted to be of local spatial extent, long term duration, intermittent and high reversibility. It is predicted that the cumulative impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of Receptor

Subtidal IEFs

8.12.88 The sensitivities of the IEFs are as previously described for the alone assessment (Paragraphs 8.10.47 and 8.10.50).

8.12.89 The offshore subtidal sands and gravel IEF and offshore muddy and mixed sediments IEF is deemed to be of high vulnerability, low recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be high.

Significance of Effect

Subtidal IEFs

8.12.90 Overall, for the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The effect will, therefore, be of a minor to moderate adverse significance. Given the likely low footprint of the long term habitat loss and/or disturbance compared to the CEA Study Area the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.91 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

CHANGES TO SSC, BED LEVELS AND SEDIMENT TYPE

Tier 2

Construction Phase

8.12.92 The construction periods of Ossian OWF and the Proposed Development may overlap. Consequently, sediment-disturbing activities such as drilling foundations, MFE sandwave clearance, and dredging could occur simultaneously. This overlap may potentially result in cumulative changes in SSC and bed levels.

Magnitude of Impact

8.12.93 The Ossian array area is located approximately 25 km to the east of the Array Area. The distance between the two projects is greater than the extent of the Spring Tidal Ellipse and they are not aligned in the direction of the tidal axis. Therefore, this suggests any cumulative impacts are very unlikely. This conclusion is underpinned by and consistent with the relevant available guidance, notably Brooks *et al.* (2018).

Subtidal IEFs and Qualifying Features of an MPA

8.12.94 The cumulative impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the cumulative impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.12.95 The cumulative impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the cumulative impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of Receptor

Subtidal IEFs

8.12.96 The sensitivities of the IEFs are as previously described for the alone assessment (see Table 8.19 and Paragraphs 8.10.72 to 8.10.74).

8.12.97 The offshore subtidal sands and gravels IEF is deemed to be of low vulnerability, medium recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

8.12.98 The offshore muddy and mixed sediments IEF is deemed to be of low vulnerability, medium recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Qualifying Features of an MPA

8.12.99 The sensitivity of IEFs is considered to be as previously described for the construction phase (see Table 8.19 and Paragraph 8.10.77).

8.12.100 The ocean quahog IEF is deemed to be of low vulnerability, high recoverability and regional value. The sensitivity of the receptor is therefore, considered to be negligible.

Intertidal IEFs

8.12.101 The sensitivities of the IEFs are as previously described for the alone assessment (see Table 8.19 and Paragraphs 8.10.79 to 8.10.81).

8.12.102 The tide-swept algal communities IEF is deemed to be of high vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be high.

8.12.103 The kelp beds IEF is deemed to be of medium vulnerability, medium recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be high.

8.12.104 The intertidal rocky and mixed sediment communities IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Significance of Effect

Subtidal IEFs

8.12.105 For offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the cumulative effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Qualifying Features of an MPA

8.12.106 For the ocean quahog the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Intertidal IEFs

8.12.107 For tide-swept algal communities IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The cumulative effect will therefore be of **Minor** adverse significance, which is not significant in EIA terms.

8.12.108 For kelp beds IEF, the magnitude of the cumulative effect is deemed to be negligible, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

8.12.109 For intertidal rocky and mixed sediment communities IEF, the magnitude of the cumulative effect is deemed to be negligible, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the cumulative effect is concluded to be of **Minor** adverse significance which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.110 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Tier 3

Construction Phase

8.12.111 The construction period of the closest neighbouring OWFs, Morven North OWF, Morven South OWF and the Proposed Development may overlap. Consequently, sediment-disturbing activities Consequently, sediment-disturbing activities such as drilling foundations, MFE sandwave clearance, and dredging could occur simultaneously. This overlap may potentially result in cumulative changes in SSC and bed levels.

Magnitude of Impact

8.12.112 The Morven North and South array areas are located approximately 10 km to the south-east of the Array Area. The distance between the two projects is greater than the extent of the Spring Tidal Ellipse and they are not aligned in along the direction of the tidal axis. This is confirmed by the modelled scenarios (presented in Volume 3, Technical Appendix 7.3: Physical Processes Technical Assessment) that show the limited spatial footprint and transient nature of the plumes created from disturbance activities in these individual locations. This therefore suggests any cumulative impacts are very unlikely and will be of low magnitude and short duration if they do occur. There are no designated sites located in the potential area of cumulative influence between releases originating from the Morven North OWF, Morven South OWF and the Proposed Development (Array Area and Export Cable Corridor).

Subtidal IEFs and Qualifying Features of an MPA

8.12.113 The cumulative impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the cumulative impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.12.114 The cumulative impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the cumulative impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of Receptor

Subtidal IEFs

8.12.115 The sensitivities of the IEFs are as previously described for the alone assessment (see Table 8.19 and Paragraphs 8.10.72 to 8.10.74).

8.12.116 The offshore subtidal sands and gravels IEF is deemed to be of low vulnerability, medium recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

8.12.117 The offshore muddy and mixed sediments IEF is deemed to be of low vulnerability, medium recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Qualifying Features of an MPA

8.12.118 The sensitivity of IEFs are considered to be as previously described for the construction phase (see Table 8.19 and Paragraph 8.10.77).

8.12.119 The ocean quahog IEF is deemed to be of low vulnerability, high recoverability and regional value. The sensitivity of the receptor is therefore, considered to be negligible.

Intertidal IEFs

8.12.120 The sensitivities of the IEFs are as previously described for the alone assessment (see Table 8.19 and Paragraphs 8.10.79 to 8.10.81).

8.12.121 The tide-swept algal communities IEF is deemed to be of high vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be high.

8.12.122 The kelp beds IEF is deemed to be of medium vulnerability, medium recoverability and regional value. The sensitivity of the receptor is therefore, considered to be high.

8.12.123 The intertidal rocky and mixed sediment communities IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Significance of Effect

Subtidal IEFs

8.12.124 For offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the cumulative effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Qualifying Features of an MPA

8.12.125 For the ocean quahog the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be negligible. The cumulative effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Intertidal IEFs

8.12.126 For tide-swept algal communities IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

8.12.127 For kelp beds IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

8.12.128 For intertidal rocky and mixed sediment communities IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will therefore be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the cumulative effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.129 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

CHANGES IN PHYSICAL PROCESSES

8.12.130 As for the alone assessment, changes in physical processes may arise during the O&M and decommissioning phases of the projects screened into the CEA. These include potential scour effects and changes in sediment transport and wave regimes. This impact has been informed by the CEA presented in Volume 2, Chapter 7: Physical Processes.

Tier 2

O&M and Decommissioning Phases

Magnitude of Impact

8.12.131 There are four Tier 2 projects identified with the potential to have a cumulative effect associated with changes in physical processes in the O&M and decommissioning phases of the Proposed Development:

- Kincardine OWF;
- Seagreen 1 OWF;

- Ossian OWF; and
- Aberdeen OWF (Table 8.25).

8.12.132 However, as detailed in Volume 2, Chapter 7: Physical Processes, these four projects do not have the potential to cause the following changes in physical processes:

- changes in seabed morphology;
- morphological change at the coast;
- changes to the wave and tidal regime (Both projects would only have the potential to cause very localised changes, with minimal potential for cumulative interaction with the Proposed Development);
- sediment transport (Both projects only have the potential to cause very localised changes to sediment transport, with minimal potential for cumulative interaction with the Proposed Development); and
- stratification and frontal systems (as it will not influence regional-scale water column mixing processes).

8.12.133 As such and as per Volume 2, Chapter 7: Physical Processes, these Tier 2 projects have not been considered further in the CEA.

Subtidal IEFs and Qualifying Features of an MPA

8.12.134 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and of low reversibility during the lifetime of the Proposed Development (up to 30 years). It is predicted that the cumulative impact will affect the receptors directly. The magnitude is, therefore, considered to be low.

<u>Sensitivity of Receptor</u>

Subtidal IEFs

8.12.135 The sensitivities of the IEFs are as previously described for the alone assessment (see Table 8.20 and Paragraphs 8.10.138 and 8.10.139).

8.12.136 The offshore subtidal sands and gravels IEF is deemed to be of no vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be negligible.

8.12.137 The offshore muddy and mixed sediments IEF is deemed to be of no vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be negligible.

Qualifying Features of an MPA

8.12.138 The sensitivities of the IEFs are as previously described for the alone assessment (see Table 8.20 and Paragraph 8.10.142).

8.12.139 The ocean quahog IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is therefore, considered to be medium.

Significance of Effect

Subtidal IEFs

8.12.140 For the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the effect has been concluded to be of **Negligible** adverse significance, which is not significant in EIA terms. This has been determined as a result of the lack of vulnerability of the relevant IEFs in regard to the changes associated with this impact.

Qualifying Features of an MPA

8.12.141 The ocean quahog IEF has a cumulative magnitude that is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will therefore be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.142 No Additional Mitigation is considered necessary because the likely effect in the absence of mitigation (beyond the Embedded Mitigation outlined in Section 8.9) is not significant in EIA terms.

Tier 3

O&M and Decommissioning Phases

Magnitude of Impact

8.12.143 There are two Tier 3 project identified with the potential to have a cumulative effect associated with changes in physical processes in the O&M and decommissioning phases of the Proposed Development: Morven North OWF and Morven South OWF (Table 8.25).

8.12.144 The Morven North OWF and Morven South OWF are in the planning phase and within the Physical Processes Study Area. Potential cumulative changes to the tidal/wave/sediment transport regime arising from the operational presence of the Proposed Development and the Morven North and South OWFs are considered. The potential for these cumulative changes to impact either designated areas of seabed or the coast are discussed in Paragraph 8.12.131.

8.12.145 Potential changes to tidal currents, wave patterns, sediment transport regimes and water levels are considered to be pathways of effect, rather than an impact on receptors, and as such, it is not appropriate to carry out an assessment of significance which determines the magnitude of effect to them. Instead, this section focuses on describing the spatial and temporal nature of change to them, with the potential for associated impacts to marine biodiversity assessed in other chapters.

8.12.146 The cumulative impact of the Morven North and South OWFs was considered alongside the Tier 2 OWFs within the Physical Processes Study Area, therefore is covered in the section above (Paragraph 8.12.131).

Subtidal IEFs and Qualifying Features of an MPA

8.12.147 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and of low reversibility during the lifetime of the Proposed Development (up to 30 years). It is predicted that the cumulative impact will affect the receptors directly. The magnitude is, therefore, considered to be low.

Sensitivity of Receptor

Subtidal IEFs

8.12.148 The sensitivities of the IEFs are as previously described for the alone assessment (see Table 8.20 and Paragraphs 8.10.138 and 8.10.139).

8.12.149 The offshore subtidal sands and gravels IEF is deemed to be of no vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be negligible.

8.12.150 The offshore muddy and mixed sediments IEF is deemed to be of no vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be negligible.

Qualifying Features of an MPA

8.12.151 The sensitivities of the IEFs are as previously described for the alone assessment (see Table 8.20 and Paragraph 8.10.142).

8.12.152 The ocean quahog IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is therefore, considered to be medium.

Significance of Effect

Subtidal IEFs

8.12.153 For the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be negligible. The effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the effect has been concluded to be of **Negligible** adverse significance, which is not significant in EIA terms. This has been determined as a result of the lack of vulnerability of the relevant IEFs in regard to the changes associated with this impact.

Qualifying Features of an MPA

8.12.154 The ocean quahog IEF has a cumulative magnitude that is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will therefore be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.155 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

INCREASED RISK OF INTRODUCTION AND SPREAD OF INNS

Tier 2

Construction, O&M, and Decommissioning Phases

Magnitude of Impact

8.12.156 There are several Tier 2 projects with the potential for cumulative increased risk of introduction and spread of INNS during all three phases of the Proposed Development (Table 8.25). As for the Proposed Development alone, the cumulative MDS for this impact is comprised of the maximum cumulative footprint for hard substrates installed and the maximum number of vessel movements for each project.

8.12.157 In addition, vessel movements associated with the Proposed Development and the Tier 2 projects may act as vectors for the introduction and spread of INNS. As detailed in Table 8.30, detailed vessel parameters were available for some Tier 2 projects, but not all. Therefore, total vessel movements/number of vessels on site at one time have not been summed for the Proposed Development and the Tier 2 projects, as it may be an underestimation. Many of the vessels associated with the Tier 2 projects are likely to come to and from the vicinity of the Regional Benthic Ecology Study Area. Therefore, the potential for introduction of INNS from outside this region is reduced.

8.12.158 As described in Section 8.9, a Biosecurity Plan will be implemented, which aims to manage and reduce the potential risk of introduction and spread of INNS as far as reasonably practicable. In addition to this, the relevant vessels associated with the Proposed Development will be required to comply with the IMO ballast water management guidelines, which will help reduce the risk of potential introduction and spread of INNS as far as practicable. Similar mitigation measures are likely to be applied to the Tier 2 projects, as they are industry standard.

8.12.159 Overall, the cumulative impact is predicted to be of local spatial extent, long term duration, intermittent (in terms of potential invasions), and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Table 8.30: Cumulative Footprint for Increased Risk of Introduction and Spread of INNS for the Tier 2 Projects Overlapping with the Construction, O&M and Decommissioning Phases of the Proposed Development

Project	MDS	Potential for Increased Risk of Introduction and Spread of INNS	Reference
Proposed Development	Construction and O&M: • 2,705,020 m^2 of hard substrate installed in the construction phase, which will persist into the O&M phase; • up to 2,120 vessel round trips during the construction phase; and • up to 713 vessel round trips per year (21,390 over the up to 30 year O&M phase, with an additional 260 vessel round trips across the 30 years).	See Table 8.10	N/A
	Decommissioning: • 2,232,100 m^2 of hard substrate left *in situ* on the seabed; and • assumed to be lesser than or equal to those required for the construction phase.		
Offshore Wind Projects and Associated Cables			
Kincardine OWF	O&M and Decommissioning: the hard structures are part of baseline as they are installed before the Proposed Development construction phase and O&M or decommissioning vessel trips have not been quantified or assessed.	N/A	Kincardine OWF Limited (2016)
Seagreen 1A Project	This project may install cable protection along a maximum of 20% of its route at a maximum width of 6 m.	• Hard substrate installation in the construction phase.	Seagreen 1A (2021)
Seagreen 1 OWF	O&M and Decommissioning: the hard structures are part of baseline as they are installed before the Proposed Development construction phase and O&M or decommissioning vessel trips have not been quantified.	N/A	Seagreen Wind Energy Limited (2012)

Project	MDS	Potential for Increased Risk of Introduction and Spread of INNS	Reference
Ossian OWF	O&M: • Up to 19,270,958 m^2 of hard substrate will be installed on the seabed during the construction phase; and • up to 508 vessel round trips per year (17,780 over the up to 35 year O&M phase).	• Hard substrate installation in the construction phase; and • Vessel movements associated with the O&M phase.	Ossian OWFL (2024b)
Hywind Scotland OWF	O&M and Decommissioning: the hard structures are part of baseline as they are installed before the Proposed Development construction phase and O&M or decommissioning vessel trips have not been quantified however infrastructure inspections will occur at intervals of one every four years using remotely operated vehicles.	• Vessel movements associated with the O&M phase.	Statoil (2015)
Berwick Bank OWF	Construction and O&M: • Up to 10,198,971 m^2 of hard structures; and • up to 11,481 vessel round trips during the construction phase • up to 2,324 vessel round trips per year in the O&M phase.	• Vessel movements associated with the O&M phase.	SSE Renewables (2022)
	Decommissioning: • up to 11,481 vessel round trips.	• Vessel movements associated with the decommissioning phase.	

Sensitivity of Receptor

Subtidal IEFs

8.12.160 The sensitivities of the IEFs are as previously described for the alone assessment (see Table 8.21 and Paragraph 8.10.169).

8.12.161 The offshore subtidal sands and gravels IEF is deemed to be of high vulnerability, low recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be high.

8.12.162 The offshore muddy and mixed sediments IEF is deemed to be of medium vulnerability, low recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Intertidal IEFs

8.12.163 The sensitivities of the IEFs are as previously described for the alone assessment (see Table 8.21 and Paragraphs 8.10.172 and 8.10.174).

8.12.164 The tide-swept algal communities IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

8.12.165 The kelp beds IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

8.12.166 The intertidal rocky and mixed sediment communities IEF is deemed to be of high vulnerability, low recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be high.

Significance of Effect

Subtidal IEFs

8.12.167 For the offshore subtidal sands and gravels IEF and offshore muddy and mixed sediments IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of a Minor to Moderate adverse significance. Given the use of Embedded Mitigation to minimise the potential introduction of INNS the cumulative effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Intertidal IEFs

8.12.168 For the tide-swept algal communities IEF, the magnitude of the cumulative effect is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

8.12.169 For the kelp beds IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

8.12.170 For the intertidal rocky and mixed sediment communities IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of a Minor to Moderate adverse significance. Given the use of Embedded Mitigation to minimise the potential introduction of INNS the cumulative effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.171 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Tier 3

Construction, O&M, and Decommissioning Phases

Magnitude of Impact

8.12.172 In addition to the Proposed Development and the Tier 2 projects, there are five Tier 3 projects identified with the potential for cumulative impact:

- Morven Hawthorn Pit Grid Connection Project;
- Morven North OWF;
- Morven South OWF; and
- Ossian Transmission Infrastructure; and
- Eastern Green Link 5 (Table 8.25).

8.12.173 As Tier 3 projects, there is no information in the public domain about the footprints of hard substrate installed and vessel movements. However, those associated with the Morven North and South OWFs are likely to be similar in nature to the Proposed Development or the other Tier 2 OWF projects detailed in Table 8.25. Given the smaller scale of the Morven Hawthorn Pit Grid Connection Project, Ossian Transmission Infrastructure, and Eastern Green Link 5 in comparison to an OWF, these Tier 3 projects are considered likely to have a lower footprint of hard substrate installed and lower vessel numbers than the Proposed Development and the Tier 2 OWFs. In addition, the Tier 3 projects are likely to have Embedded Mitigation measures, such as a Biosecurity Plan and compliance with IMO ballast water management guidelines, which will reduce the potential for cumulative effect.

8.12.174 Therefore, the cumulative impact is predicted to be of local spatial extent, long term duration, intermittent (in terms of potential invasions), and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of Receptor

Subtidal IEFs

8.12.175 The sensitivities of the IEFs are as previously described for the alone assessment (see Table 8.21 and Paragraph 8.10.169).

8.12.176 The offshore subtidal sands and gravels IEF is deemed to be of high vulnerability, low recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be high.

8.12.177 The offshore muddy and mixed sediments IEF is deemed to be of medium vulnerability, low recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Intertidal IEFs

8.12.178 The sensitivities of the IEFs are as previously described for the alone assessment (see Table 8.21 and Paragraphs 8.10.172 and 8.10.174).

8.12.179 The tide-swept algal communities IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

8.12.180 The kelp beds IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

8.12.181 The intertidal rocky and mixed sediment communities IEF is deemed to be of high vulnerability, low recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be high.

Significance of Effect

Subtidal IEFs

8.12.182 For the offshore subtidal sands and gravels IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of a Minor to Moderate adverse significance. Given the use of Embedded Mitigation to minimise the potential introduction of INNS the cumulative effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

8.12.183 For the offshore muddy and mixed sediments IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Intertidal IEFs

8.12.184 For the tide-swept algal communities IEF, the magnitude of the cumulative effect is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

8.12.185 For the kelp beds IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

8.12.186 For the intertidal rocky and mixed sediment communities IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of a Minor to Moderate adverse significance. Given the use of Embedded Mitigation to minimise the potential introduction of INNS the cumulative effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.187 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Tier 4

Construction, O&M, and Decommissioning Phases

Magnitude of Impact

8.12.188 In addition to the Tier 2 and Tier 3 projects, there is one Tier 4 project identified with the potential for cumulative impact:

- Flora Floating Wind Farm in all phases (Table 8.24).

8.12.189 Similar to the Tier 3 projects, there is no information in the public domain about the footprint of hard substrate installed and vessel movements. However, given that the Tier 4 project is an OWF, they may be similar to those associated with the other Tier 2 OWF projects detailed in Table 8.30.

8.12.190 In addition, the Tier 4 project is likely to have Embedded Mitigation measures, such as a Biosecurity Plan and compliance with IMO ballast water management guidelines, which will reduce the potential for cumulative effect.

8.12.191 Therefore, the cumulative impact is predicted to be of local spatial extent, long term duration, intermittent (in terms of potential invasions), and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of Receptor

Subtidal IEFs

8.12.192 The sensitivities of the IEFs are as previously described for the alone assessment (see Table 8.21 and Paragraph 8.10.169).

8.12.193 The offshore subtidal sands and gravels IEF is deemed to be of high vulnerability, low recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be high.

8.12.194 The offshore muddy and mixed sediments IEF is deemed to be of medium vulnerability, low recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

Intertidal IEFs

8.12.195 The sensitivities of the IEFs are as previously described for the alone assessment (see Table 8.21 and Paragraphs 8.10.172 and 8.10.174).

8.12.196 The tide-swept algal communities IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

8.12.197 The kelp beds IEF is deemed to be of medium vulnerability, high recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be medium.

8.12.198 The intertidal rocky and mixed sediment communities IEF is deemed to be of high vulnerability, low recoverability and regional value. The sensitivity of the receptor is, therefore, considered to be high.

Significance of Effect

Subtidal IEFs

8.12.199 For the offshore subtidal sands and gravels IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of a Minor to Moderate adverse significance. Given the use of Embedded Mitigation to minimise the potential introduction of INNS the cumulative effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

8.12.200 For the offshore muddy and mixed sediments IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Intertidal IEFs

8.12.201 For the tide-swept algal communities IEF, the magnitude of the cumulative effect is deemed to be low and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

8.12.202 For the kelp beds IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

8.12.203 For the intertidal rocky and mixed sediment communities IEF, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of a minor to moderate adverse significance. Given the use of Embedded Mitigation to minimise the potential introduction of INNS the cumulative effect is concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.204 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

COLONISATION OF HARD SUBSTRATE

Tier 2

Construction, O&M Phases

Magnitude of Impact

Subtidal IEFs

8.12.205 There are five Tier 2 projects with the potential for cumulative colonisation of hard substrate during the construction and O&M phases of the Proposed Development:

- Seagreen 1A project;
- Inch Cape OWF;
- Ossian OWF;
- Hywind Scotland OWF; and
- Berwick Bank Wind Farm (Table 8.25).

8.12.206 The maximum cumulative footprint for colonisation of hard substrate associated with the Tier 2 projects together with the construction and O&M phases of the Proposed Development is estimated at up to 35,147,469 m^2 (Table 8.31). This represents up to 0.18% of the Regional Benthic Ecology Study Area and up to 0.22% of the Benthic Subtidal Ecology Study Area.

8.12.207 It is important to note that the cumulative footprint will not be one continuous area, but comprised of isolated areas of colonisation of hard substrate across the 50 km CEA screening buffer. The cumulative magnitude of impact of the Tier 3 projects, therefore, represents no additional material impact to that defined for the assessment of the Proposed Development alone.

Table 8.31: Cumulative Footprint of Colonisation of Hard Substrate for the Tier 2 Projects Overlapping with the Construction and O&M Phase of the Proposed Development

Project	MDS (m^2)	Hard Substrate Present	Reference
Proposed Development	2,705,020	See Table 8.10	N/A
Offshore Wind Projects and Associated Cables			
Seagreen 1A Project	Construction and O&M: Unquantified.	Cable protection along 20% of cable route with a maximum width of 6 m.	Seagreen 1A (2021)
Inch Cape OWF	O&M: 2,470,000	Footprint of Wind Turbine foundations, OSPs, met masts, cable and Scour Protection.	Inch Cape Offshore Limited (2018)
Ossian OWF	Construction and O&M: 19,270,958	Footprint of mooring lines, Scour Protection, cable protection and OSP jacket foundations (footprint of dynamic cables, mid-water mooring lines and floating foundations not included).	Ossian OWFL (2024)
Hywind Scotland OWF	O&M: 272,520	Continued presence of Wind Turbine anchors, cables, Scour Protection (rock dump and/or concrete mattresses) and cable protection.	Statoil (2015)
Berwick Bank Wind Farm	O&M: 10,198,971	Wind Turbines and OSP jacket foundations, Scour Protection and cable protection.	SSE Renewables (2022)
Berwick Bank OFTO	O&M: Up to 230,000	Cable protection.	SSE Renewables (2023)
Total (Proposed Development and Tier 2 Projects)	**35,147,469**		

8.12.208 As outlined in Paragraph 8.10.188 for the Proposed Development alone, this impact is expected to be beneficial in terms of increasing biodiversity and enhancing reef effects. However, it also presents some measurable but minor long-term loss of and/or alteration to the affected areas of seabed within the Site Boundary, but less so within the Regional Benthic Ecology Study Area. There will be no spatial overlap between the Site Boundary and the Tier 2 projects (Figure 8.8).

8.12.209 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and of low reversibility during the lifetime of the Proposed Development (up to 30 years). It is predicted that the impact will affect the receptors directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.12.210 Cables will be installed at the Landfall via trenchless techniques, meaning there will be no impact on any intertidal IEFs as there will be no cable protection. Therefore, they are not considered further in this assessment.

Sensitivity of Receptor

Subtidal IEFs

8.12.211 The sensitivities of the IEFs are as previously described for the alone assessment (Paragraphs 8.10.192 to 8.10.195).

8.12.212 All subtidal IEFs are deemed to be of high vulnerability, low recoverability, and regional value. The sensitivities of these receptors are therefore, considered to be high.

Significance of Effect

Subtidal IEFs

8.12.213 Overall, for the offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of a Minor to Moderate adverse significance. Given the low footprint of the cumulative introduction of hard substrate compared to both the CEA buffer and Regional Benthic Ecology Study Area, the effect is concluded to be of **Minor** adverse significance, which was not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.214 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Decommissioning Phase

8.12.215 There were two Tier 2 projects with the potential for cumulative colonisation of hard substrate during the decommissioning phase of the Proposed Development (Table 8.32). The maximum cumulative footprint for the colonisation of hard substrate associated with the Tier 2 projects together with the decommissioning phase of the Proposed Development is estimated at up to 29,469,164 m^2 (Table 8.32). This represents up to 0.18% of the 50 km CEA screening buffer applied and up to 0.15% of the Regional Benthic Ecology Study Area.

8.12.216 It is important to note that the cumulative footprint of 29.10 km^2 will not be one continuous area but comprised of isolated areas of colonisation of hard substrate across the 50 km CEA screening buffer. The cumulative magnitude of impact of the Proposed Development with the Tier 2 projects is therefore not expected to represent a material additional impact to that defined for the assessment of the Proposed Development alone.

8.12.217 Finalised decommissioning plans are not available/quantified for the Proposed Development and Tier 2 projects. For the Proposed Development MDS it is currently proposed that all Scour Protection, cable protection, and cable crossing protection will be left *in situ*. This will be reviewed throughout the lifetime of the Proposed Development and good practise guidance will be followed at the time. For the Tier 2 projects, although infrastructure may be removed during their respective decommissioning phases, as a precautionary measure it has been assumed that the cumulative footprint of hard substrate will persist into and beyond the decommissioning phase of the Proposed Development.

Table 8.32: Cumulative Footprint of Colonisation of Hard Substrate for the Tier 2 Projects Overlapping with the Decommissioning Phase of the Proposed Development

Project	MDS (m^2)	Hard Substrate Present	Reference
Proposed Development	2,705,020	See Table 8.10	N/A
Offshore Wind Projects and Associated Cables			
Berwick Bank	Decommissioning: 7,493,186	Scour Protection and cable protection, if left *in situ*.	SSE Renewables (2022)
Ossian OWF	O&M: 19,270,958	Floating foundations, dynamic cables, jack-up vessel use, anchoring, seabed preparation, and cable installation.	Ossian OWFL (2024)
Total (Proposed Development and Tier 2 Projects)	**29,469,164**		

8.12.218 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and of low reversibility during the lifetime of the Proposed Development (up to 30 years). It is predicted that the impact will affect the receptors directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.12.219 Cables will be removed at the Landfall via trenchless techniques, meaning there will be no impact on any intertidal IEFs as there will be no cable protection. Therefore, they are not considered further in this assessment.

Sensitivity of Receptor

Subtidal IEFs

8.12.220 The sensitivities of the IEFs are as previously described for the alone assessment (Paragraphs 8.10.192 to 8.10.195).

8.12.221 All subtidal IEFs are deemed to be of high vulnerability, low recoverability, and regional value. The sensitivities of these receptors are therefore, considered to be high.

Significance of Effect

Subtidal IEFs

8.12.222 Overall, for the offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of a Minor to Moderate adverse significance. Given the low footprint of the cumulative introduction of hard substrate compared to both the CEA buffer and Regional Benthic Ecology Study Area, the effect is concluded to be of **Minor** adverse significance, which was not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.223 No Additional Mitigation is considered necessary because the likely effect in the absence of mitigation (beyond the Embedded Mitigation outlined in Section 8.9) is not significant in EIA terms.

Tier 3

Construction, O&M Phases

Magnitude of Impact

Subtidal IEFs

8.12.224 There are six Tier 3 projects with the potential for cumulative colonisation of hard substrate during the construction and O&M phases of the Proposed Development:

- Morven Hawthorn Pit Grid Connection Project (possibly in its construction, O&M and decommissioning phases);
- Morven North OWF (possibly in its construction, O&M and decommissioning phases);
- Morven South OWF (possibly in its construction, O&M and decommissioning phases);
- Ossian Transmission Infrastructure (possibly in its construction, O&M and decommissioning phases);
- Eastern Green Link 3; and
- Easter Green Link 5 (Table 8.25).

8.12.225 As Tier 3 projects, there are no publicly available parameters to define footprints of the hard substrate and cannot be combined with those of the

Proposed Development. The introduction of hard substrate and subsequent colonisation associated with the Morven North and South OWFs are expected to be similar in nature and extent to that calculated for the Proposed Development as detailed in Section 8.10. Footprints of impact associated with the Morven Hawthorn Pit Grid Connection Project, the Ossian Transmission Infrastructure, Eastern Green Link 3, and Eastern Green Link 5 are likely to be of a lower extent to those calculated for the Proposed Development.

8.12.226 It is important to note that the cumulative footprint will not be one continuous area, but comprised of isolated areas of colonisation of hard substrate across the 50 km CEA screening buffer. The cumulative magnitude of impact of the Tier 3 projects, therefore, represents no additional material impact to that defined for the assessment of the Proposed Development alone.

8.12.227 As outlined in Paragraph 8.10.188 for the Proposed Development alone, this impact is expected to be beneficial in terms of increasing biodiversity and enhancing reef effects. However, it also presents some measurable but minor long-term loss of and/or alteration to the affected areas of seabed within the Site Boundary, but less so within the Regional Benthic Ecology Study Area. There will be no spatial overlap between the Site Boundary and the Tier 3 projects (Figure 8.8).

8.12.228 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and of low reversibility during the lifetime of the Proposed Development (up to 30 years). It is predicted that the impact will affect the receptors directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.12.229 Cables will be installed at the Landfall via trenchless techniques, meaning there will be no impact on any intertidal IEFs as there will be no cable protection. Therefore, they are not considered further in this assessment.

Sensitivity of Receptor

Subtidal IEFs

8.12.230 The sensitivities of the IEFs are as previously described for the alone assessment (Paragraphs 8.10.192 to 8.10.195).

8.12.231 All subtidal IEFs are deemed to be of high vulnerability, low recoverability, and regional value. The sensitivities of these receptors are therefore, considered to be high.

Significance of Effect

Subtidal IEFs

8.12.232 Overall, for the offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of a Minor to Moderate adverse significance. Given the low footprint of the cumulative introduction of hard substrate compared to both the CEA buffer and Regional Benthic Ecology Study Area, the effect is concluded to be of **Minor** adverse significance, which was not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.233 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Decommissioning Phase

Magnitude of Impact

Subtidal IEFs

8.12.234 There are six Tier 3 projects with the potential for cumulative colonisation of hard substrate during the decommissioning phase of the Proposed Development:

- Morven Hawthorn Pit Grid Connection Project (possibly in its construction, O&M and decommissioning phases);
- Morven North OWF (possibly in its construction, O&M and decommissioning phases);
- Morven South OWF (possibly in its construction, O&M and decommissioning phases);
- Ossian Transmission Infrastructure (possibly in its construction, O&M and decommissioning phases);
- Eastern Green Link 3; and
- Eastern Green Link 5 (Table 8.25).

8.12.235 As Tier 3 projects, there are no publicly available parameters to define footprints of the hard substrate and cannot be combined with those of the Proposed Development. The introduction of hard substrate and subsequent colonisation associated with the Morven North and South OWF are expected to be similar in nature and extent to that calculated for the Proposed Development as detailed in Section 8.10. Footprints of impact associated with the Morven Hawthorn Pit Grid Connection Project, the Ossian Transmission Infrastructure, Eastern Green Link 3, and Eastern Green Link 5 are likely to be of a lower extent to those calculated for the Proposed Development.

8.12.236 It is important to note that the cumulative footprint will not be one continuous area, but comprised of isolated areas of colonisation of hard substrate across the 50 km CEA screening buffer. The cumulative magnitude of impact of the Tier 3 projects, therefore, represents no additional material impact to that defined for the assessment of the Proposed Development alone.

8.12.237 As outlined in Paragraph 8.10.188 for the Proposed Development alone, this impact is expected to be beneficial in terms of increasing biodiversity and enhancing reef effects. However, it also presents some measurable but minor long-term loss of and/or alteration to the affected areas of seabed within the Site Boundary, but less so within the Regional Benthic Ecology Study Area. There will be no spatial overlap between the Site Boundary and the Tier 3 projects (Figure 8.8).

8.12.238 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and of low reversibility. It is predicted that the impact will affect the receptors directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.12.239 Cables will be installed at the Landfall via trenchless techniques, meaning there will be no impact on any intertidal IEFs as there will be no cable protection. Therefore, they are not considered further in this assessment.

Sensitivity of Receptor

Subtidal IEFs

8.12.240 The sensitivities of the IEFs are as previously described for the alone assessment (Paragraphs 8.10.192 to 8.10.195).

8.12.241 All subtidal IEFs are deemed to be of high vulnerability, low recoverability, and regional value. The sensitivities of these receptors are therefore, considered to be high.

Significance of Effect

Subtidal IEFs

8.12.242 Overall, for the offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of a Minor to Moderate adverse significance. Given the low footprint of the cumulative introduction of hard substrate compared to both the CEA buffer and Regional Benthic Ecology Study Area, the effect is concluded to be of **Minor** adverse significance, which was not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.243 No Additional Mitigation is considered necessary because the likely effect in the absence of mitigation (beyond the Embedded Mitigation outlined in Section 8.9) is not significant in EIA terms.

Tier 4

Construction, O&M Phases

Magnitude of Impact

Subtidal IEFs

8.12.244 In addition to the Tier 2 and Tier 3 projects, there is one Tier 4 project with the potential for cumulative colonisation of hard substrate during the construction and O&M phases of the Proposed Development:

- Flora Floating Wind Farm (possibly in its construction, O&M and decommissioning phases) (Table 8.25).

8.12.245 As a Tier 4 project, there are no publicly available parameters to define footprint of the hard substrate and this cannot be combined with those of the Proposed Development and the Tier 3 projects.

8.12.246 The colonisation of hard substrate associated with the Flora Floating Wind Farm is expected to be similar in nature and extent to that calculated for the Proposed Development, as detailed in Section 8.10, and cumulatively with the Tier 3 projects.

8.12.247 As with the Tier 3 projects, it is important to note that the cumulative footprint will not be one continuous area, but comprised of isolated areas of colonisation of hard substrate across the 50 km CEA screening buffer. The cumulative magnitude of impact of the Tier 3 projects, therefore, represents no additional material impact to that defined for the assessment of the Proposed Development alone.

8.12.248 As outlined in Paragraph 8.10.188 for the Proposed Development alone, this impact is expected to be beneficial in terms of increasing biodiversity and enhancing reef effects. However, it also presents some measurable but minor long term loss of and/or alteration to the affected areas of seabed within the Site Boundary, but less so within the Regional Benthic Ecology Study Area. There will be no spatial overlap between the Site Boundary and the Tier 4 project (Figure 8.8).

8.12.249 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and of low reversibility. It is predicted that the impact will affect the receptors directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.12.250 Cables will be installed at the Landfall via trenchless techniques, meaning there will be no impact on any intertidal IEFs as there will be no cable protection. Therefore, they are not considered further in this assessment.

Sensitivity of Receptor

Subtidal IEFs

8.12.251 The sensitivities of the IEFs are as previously described for the alone assessment (Paragraphs 8.10.192 to 8.10.195).

8.12.252 All subtidal IEFs are deemed to be of high vulnerability, low recoverability, and regional value. The sensitivities of these receptors are therefore, considered to be high.

Significance of Effect

Subtidal IEFs

8.12.253 Overall, for the offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of a Minor to Moderate adverse significance. Given the low footprint of the cumulative introduction of hard substrate compared to both the CEA buffer and Regional Benthic Ecology Study Area, the effect is concluded to be of **Minor** adverse significance, which was not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.254 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Decommissioning Phase

Magnitude of Impact

Subtidal IEFs

8.12.255 In addition to the Tier 3 projects, there is one Tier 4 project with the potential for cumulative colonisation of hard substrate during the decommissioning phase of the Proposed Development:

- Flora Floating Wind Farm (possibly in its construction, O&M and decommissioning phases) (Table 8.25).

8.12.256 As a Tier 4 project, there are no publicly available parameters to define the footprint of the colonisation of hard substrate and cannot be combined with those of the Proposed Development. The colonisation of hard substrate associated with the Flora Floating Wind Farm is expected to be similar in nature and extent to that calculated for the Proposed Development, as detailed in Section 8.10, and cumulatively with the Tier 3 projects.

8.12.257 As with the Tier 2 and 3 projects, it is important to note that the cumulative footprint will not be one continuous area, but comprised of isolated areas of colonisation of hard substrate across the 50 km CEA screening buffer. The cumulative magnitude of impact of the Tier 3 projects, therefore, represents no additional material impact to that defined for the assessment of the Proposed Development alone.

8.12.258 As outlined in Paragraph 8.10.188 for the Proposed Development alone, this impact is expected to be beneficial in terms of increasing biodiversity and enhancing reef effects. However, it also presents some measurable but minor long term loss of and/or alteration to the affected areas of seabed within the Site Boundary, but less so within the Regional Benthic Ecology Study Area. There will be no spatial overlap between the Site Boundary and the Tier 4 project (Figure 8.8).

8.12.259 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and of low reversibility. It is predicted that the impact will affect the receptors directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.12.260 Cables will be installed at the Landfall via trenchless techniques, meaning there will be no impact on any intertidal IEFs as there will be no cable protection. Therefore, they are not considered further in this assessment.

Sensitivity of Receptor

Subtidal IEFs

8.12.261 The sensitivities of the IEFs are as previously described for the alone assessment (Paragraphs 8.10.192 to 8.10.195).

8.12.262 All subtidal IEFs are deemed to be of high vulnerability, low recoverability, and regional value. The sensitivities of these receptors are therefore, considered to be high.

Significance of Effect

Subtidal IEFs

8.12.263 Overall, for the offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be high. The cumulative effect will, therefore, be of a Minor to Moderate adverse significance. Given the low footprint of the cumulative introduction of hard substrate compared to both the CEA buffer and Regional Benthic Ecology Study Area, the effect is concluded to be of **Minor** adverse significance, which was not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.264 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

REMOVAL OF HARD SUBSTRATE

8.12.265 As described in Paragraph 8.10.205, the removal of hard substrates in the decommissioning phase may affect the established benthic community associated with the Proposed Development, with the seabed returning to its current sandy sediments.

Tier 2

Decommissioning Phase

Magnitude of Impact

8.12.266 There is one Tier 2 project with the potential for cumulative removal of hard substrates during the decommissioning phase of the Proposed Development (Table 8.25). None of the projects in this tier quantify the mount of hard substrate which they remove in their decommissioning phase therefore it is not possible to provide a potential cumulative value beyond what is shown in the project alone assessment (Section 8.10).

8.12.267 The Forties to Cruden Bay pipeline may undertake decommissioning during the Proposed Development decommissioning phase, however, the project has not defined what would be included in this process. However, it is likely that there may be the removal of parts of the pipeline.

8.12.268 It is important to note that the cumulative footprint will not be one continuous area, but comprised of isolated areas of removal of hard substrates across the 50 km CEA screening buffer. The cumulative magnitude of impact of the Proposed Development with the Tier 2 projects is therefore not expected to represent a material additional impact to that defined for the assessment of the Proposed Development alone.

Subtidal IEFs

8.12.269 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.12.270 Cables will be installed at the Landfall via trenchless techniques, meaning there will be no impact on any intertidal IEFs as there will be no cable protection for removal. Therefore, they are not considered further in this assessment.

Sensitivity of Receptors

Subtidal IEFs

8.12.271 The sensitivities of all IEFs are as previously described for the alone assessment (Paragraphs 8.10.211 and 8.10.212).

8.12.272 All IEFs were deemed to be of low vulnerability, high recoverability, and regional value. The sensitivities of the receptors were, therefore, considered to be low.

Significance of Effect

Subtidal IEFs

8.12.273 Overall, for the offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be low. The cumulative effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the cumulative effect was concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.274 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Tier 3

Decommissioning Phase

Magnitude of Impact

8.12.275 In addition to the Tier 2 project, there are six Tier 3 projects with the potential for cumulative removal of hard substrates during the decommissioning phase of the Proposed Development:

- Morven Hawthorn Pit Grid Connection Project (possibly in its decommissioning phase);
- Morven North OWF (possibly in its decommissioning phase);
- Morven South OWF (possibly in its decommissioning phase);
- Ossian Transmission Infrastructure (possibly in its decommissioning phase); and
- Eastern Green Link 3 (possibly in its decommissioning phase); and

- Eastern Green Link 5 (possibly in its decommissioning phase) (Table 8.25).

8.12.276 As Tier 3 projects, there are no publicly available parameters to define footprints of removal of hard substrate and cannot be combined with those of the Proposed Development and the Tier 2 project. Removal of hard structures associated with the Morven North and South OWFs are expected to be similar in nature and extent to that calculated for the Proposed Development. Footprints of impact associated with the Morven Hawthorn Pit Grid Connection Project, Ossian Transmission Infrastructure, Eastern Green Link 3, and Eastern Green Link 5 are likely to be of a lower extent to those calculated for the Proposed Development (Section 8.10).

8.12.277 As with the Tier 2 project, it is important to note that the removal of hard structures associated with the Tier 3 projects will not be one continuous area, but comprised of isolated removal of hard structures over the 50 km CEA screening buffer. The cumulative magnitude of impact of the Tier 3 projects, therefore, represents no additional material impact to that defined for the assessment of the Proposed Development alone, and cumulatively with the Tier 2 project.

Subtidal IEFs

8.12.278 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.12.279 Cables will be installed at the Landfall via trenchless techniques, meaning there will be no impact on any intertidal IEFs as there will be no cable protection for removal. Therefore, they are not considered further in this assessment.

Sensitivity of Receptors

8.12.280 The sensitivities of all IEFs are as previously described for the alone assessment (Paragraphs 8.10.211 and 8.10.212).

8.12.281 All IEFs were deemed to be of low vulnerability, high recoverability, and regional value. The sensitivities of the receptors were, therefore, considered to be low.

Significance of Effect

Subtidal IEFs

8.12.282 Overall, for the offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be low. The cumulative effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the cumulative effect was concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.283 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Tier 4

Decommissioning Phase

Magnitude of Impact

8.12.284 In addition to the Tier 2 and 3 projects, there is one Tier 4 project with the potential for cumulative removal of hard substrates during the decommissioning phase of the Proposed Development:

- Flora Floating Wind Farm (possibly in its decommissioning phase (Table 8.25).

8.12.285 As this is a Tier 4 project, there are no publicly available parameters to define footprints of removal of hard structures and cannot be combined with those of the Proposed Development and the Tier 2 and 3 projects. Removal of hard structures associated with the Flora Floating Wind Farm is expected to be similar in nature and extent to that calculated for the Proposed Development (Section 8.10).

8.12.286 As with the Tier 2 and 3 projects, it is important to note that the removal of hard structures associated with the Tier 4 project will not be one continuous area, but comprised of isolated removal of hard structures over the 50 km CEA screening buffer. The cumulative magnitude of impact of the Tier 4 project, therefore, represents no additional material impact to that defined for the assessment of the Proposed Development alone, and cumulatively with the Tier 2 and 3 projects.

Subtidal IEFs

8.12.287 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and low reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.12.288 Cables will be installed at the Landfall via trenchless techniques, meaning there will be no impact on any intertidal IEFs as there will be no cable protection for removal. Therefore, they are not considered further in this assessment.

Sensitivity of Receptors

8.12.289 The sensitivities of all IEFs are as previously described for the alone assessment (Paragraphs 8.10.211 and 8.10.212).

8.12.290 All IEFs were deemed to be of low vulnerability, high recoverability, and regional value. The sensitivities of the receptors were, therefore, considered to be low.

Significance of Effect

Subtidal IEFs

8.12.291 Overall, for the offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs, the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be low. The cumulative effect will, therefore, be of Negligible to Minor adverse significance. Based on expert judgement and adopting a precautionary approach, the cumulative effect was concluded to be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.292 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

IMPACTS TO BENTHIC ECOLOGY DUE TO EMF

Tier 2

O&M Phase

Magnitude of Impact

8.12.293 There are several Tier 2 projects with the potential for cumulative EMF impacts during the O&M phase of the Proposed Development (Table 8.25). As for the Proposed Development alone, subsea cables associated with these Tier 2 projects could release EMFs into the marine environment. The maximum cumulative length of subsea cables of the Tier 2 projects together with the Proposed Development is estimated at up to 6,777 km (Table 8.33).

8.12.294 Other cable parameters, such as voltage and burial depth, vary between the Proposed Development and the Tier 2 projects and are not possible to combine into one cumulative value, unlike maximum cable lengths. However, cable burial and/or cable protection measures are outlined within the EIAs for the Tier 2 projects, such as those detailed in Table 8.10 for the Proposed Development.

8.12.295 EMFs emitted by subsea cables are influenced by a variety of design and installation factors, including distance between cables, cable sheathing, number of conductors, and internal cable configuration. The intensity of EMF from subsea cables decreases at approximately the inverse square/power of the distance away from the cable (Hutchison *et al.*, 2021). This attenuation is applicable to buried, unburied, and dynamic cables (Hutchison *et al.*, 2021). Therefore, the cumulative magnitude of impact with the Tier 2 projects is likely to be highly localised to within metres to tens of metres from cables.

Table 8.33: Cumulative Potential Sources of EMFs for the Tier 2 Projects within the O&M Phase of the Proposed Development

Project	MDS	Source of EMFs	Reference
Proposed Development	397 km	IACs, Interconnector Cables and Offshore Export Cables.	N/A
Offshore Wind Projects and Associated Cables			
Kincardine OWF	O&M: Up to 30 km of Export Cables and up to 30 km of IACs.	IACs and Export Cables.	Kincardine OWF Limited (2016)
Seagreen 1A Project	O&M: Up to 110 km of Export Cables.	Export Cables.	Seagreen 1A (2021)
Seagreen 1 OWF	O&M: Up to 530 km Export Cables and up to 710 km of IACs.	IACs and Export Cables.	Seagreen Wind Energy Limited (2018)
Inch Cape OWF	O&M: Up to 498 km Export Cables and up to 353 km of IACs.	IACs and Export Cables.	Inch Cape Offshore Limited (2018)
Ossian OWF	O&M: Up to 1,497 km of IACs.	IACs.	Ossian OWFL (2024b)
Aberdeen OWF	O&M: Up to 13 km of IACs and up to 26 km of Export Cables.	IACs and Export Cables.	European Offshore Wind Deployment Centre (2011b)
Hywind Scotland OWF	O&M: Up to 15 km of IACs and up to 35 km of Export Cables.	IACs and Export Cables.	Statoil (2015)
Berwick Bank OWF	O&M: Up to 1,225 km of IACs and up to 872 km of Export Cables.	IACs and Export Cables.	SSE Renewables (2022)
Cables and Pipelines			
Eastern Green Link 2	O&M: 436 km of Interconnector Cable.	Interconnector Cable.	(National Grid (2022)
Total cable length (Proposed Development and Tier 2 projects)	6,777 km		

Subtidal IEFs

8.12.296 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility (as cables will be removed and/or de-powered during the decommissioning phase). It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.12.297 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility (as cables will be removed and/or de-powered during the decommissioning phase). It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of Receptors

8.12.298 The sensitivities of all IEFs are as previously described for the alone assessment (Paragraph 8.10.225 to 8.10.229).

Significance of Effect

Subtidal IEFs

8.12.299 For the offshore sands and gravels, and offshore muddy and mixed sediments IEFs the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Intertidal IEFs

8.12.300 For the tide-swept algal communities, kelp beds and intertidal rocky and mixed sediment communities IEFs, the magnitude is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.301 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Tier 3

O&M Phase

Magnitude of Impact

8.12.302 As Tier 3 projects, there were no specific cable parameters publicly available for any of the projects (e.g. lengths of cables, burial depths, cable protection). However, cable burial and/or cable protection measures are likely to be included within these projects as industry standard, such as detailed in Table 8.10 for the Proposed Development. Tier 3 projects identified with a potential for cumulative impact:

- Morven Hawthorn Pit Grid Connection Project,
- Morven North OWF,
- Morven South OWF,
- Ossian Transmission Infrastructure;
- Eastern Green Link 3; and
- Eastern Green Link 5 (Table 8.25).

8.12.303 EMFs emitted by subsea cables are influenced by a variety of design and installation factors, including distance between cables, cable sheathing, number of conductors, and internal cable configuration. The intensity of EMF from subsea cables decreases at approximately the inverse square/power of the distance away from the cable (Hutchison *et al.*, 2021). This attenuation is applicable to buried, unburied, and dynamic cables (Hutchison *et al.*, 2021). Therefore, the cumulative magnitude of impact with the Tier 3 projects is likely to be highly localised to within metres to tens of metres from cables.

Subtidal IEFs

8.12.304 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility (as cables will be removed and/or de-powered during the decommissioning phase). It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.12.305 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility (as cables will be removed and/or de-powered during the decommissioning phase). It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of Receptors

8.12.306 The sensitivities of all IEFs are as previously described for the alone assessment (Paragraph 8.10.225 to 8.10.229).

Significance of Effect

Subtidal IEFs

8.12.307 For the offshore sands and gravels, and offshore muddy and mixed sediments, IEFs the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Intertidal IEFs

8.12.308 For the tide-swept algal communities, kelp beds and intertidal rocky and mixed sediment communities IEFs, the magnitude is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will therefore be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.309 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Tier 4

O&M Phase

Magnitude of Impact

8.12.310 In addition to the Tier 2 and 3 projects, there is one Tier 4 project identified with a potential for cumulative impact. This is the Flora Floating Wind Farm (Table 8.25). As a Tier 4 project, there are no specific cable parameters publicly available (e.g. lengths of cables, burial depths, cable protection). However, cable burial and/or cable protection measures are likely to be included within these projects as industry standard, such as detailed in Table 8.10 for the Proposed Development.

8.12.311 EMFs emitted by subsea cables are influenced by a variety of design and installation factors, including distance between cables, cable sheathing, number of conductors, and internal cable configuration. The intensity of EMF from subsea cables decreases at approximately the inverse square/power of the distance away from the cable (Hutchison *et al.*, 2021). This attenuation is applicable to buried, unburied, and dynamic cables (Hutchison *et al.*, 2021). Therefore, the cumulative magnitude of impact with the Tier 4 project is likely to be highly localised to within metres to tens of metres from cables.

Subtidal IEFs

8.12.312 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility (as cables will be removed and/or de-powered during the decommissioning phase). It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.12.313 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility (as cables will be removed and/or de-powered during the decommissioning phase). It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of Receptors

8.12.314 The sensitivities of all IEFs are as previously described for the alone assessment (Paragraph 8.10.225 to 8.10.229).

Significance of Effect

Subtidal IEFs

8.12.315 For the offshore sands and gravels, and offshore muddy and mixed sediments IEFs the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Intertidal IEFs

8.12.316 For the tide-swept algal communities, kelp beds and intertidal rocky and mixed sediment communities IEFs, the magnitude is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will therefore be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.317 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

IMPACTS TO BENTHIC ECOLOGY DUE TO HEAT FROM SUBSEA CABLES

Tier 2

O&M Phase

Magnitude of Impact

8.12.318 There are several Tier 2 projects with the potential for cumulative heat impacts during the O&M phase of the Proposed Development (Table 8.25). As for the Proposed Development alone, subsea cables associated with these Tier 2 projects could release heat into the marine environment. The maximum cumulative length of subsea cables of the Tier 2 projects together with the Proposed Development is estimated at up to 6,777 km (Table 8.33).

8.12.319 Other cable parameters, such as voltage and burial depth, vary between the Proposed Development and the Tier 2 projects and are not possible to combine into one cumulative value, unlike maximum cable lengths. However, cable burial and/or cable protection measures are outlined within the EIAs for the Tier 2 projects, such as those detailed in Table 8.10 for the Proposed Development.

8.12.320 The thermal emissions created by these subsea cables are influenced by a variety of design factors, including cable burial depth, cable sheathing and number of conductors. The intensity of heat emissions however is likely to be similar between cables, and any heat that is emitted will quickly dissipate into the overlaying water column due to the very high heat capacity of water. Therefore, the cumulative magnitude of impact with the Tier 2 projects is likely to be highly localised to within metres from cables.

Subtidal IEFs

8.12.321 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility (as cables will be removed and/or de-powered during the decommissioning phase). It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.12.322 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility (as cables will be removed and/or de-powered during the decommissioning phase). It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of Receptors

8.12.323 The sensitivities of all IEFs are as previously described for the alone assessment (Paragraph 8.10.243 to 8.10.248).

Significance of Effect

Subtidal IEFs

8.12.324 For the offshore sands and gravels, and offshore muddy and mixed sediments IEFs the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Intertidal IEFs

8.12.325 For the tide-swept algal communities, kelp beds and intertidal rocky and mixed sediment communities IEFs, the magnitude is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.326 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Tier 3

O&M Phase

Magnitude of Impact

8.12.327 In addition to the Tier 2 projects, the only Tier 3 projects identified with a potential for cumulative impact were the Morven Hawthorn Pit Grid Connection Project, Morven North OWF, Morven South OWF, Ossian Transmission Infrastructure, Eastern Green Link 3, and Eastern Green Link 5 (Table 8.25). As Tier 3 projects, there were no specific cable parameters publicly available for any of the projects (e.g. lengths of cables, burial depths, cable protection). However, cable burial and/or cable protection measures are likely to be included within these projects as industry standard, such as detailed in Table 8.10 for the Proposed Development.

8.12.328 As noted in paragraph 8.12.320, thermal emissions are likely to have a negligible impact due to the likely quick dissipation of any thermal emissions.

Subtidal IEFs

8.12.329 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility (as cables will be removed and/or de-powered during the decommissioning phase). It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.12.330 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility (as cables will be removed and/or de-powered during the decommissioning phase). It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of Receptors

8.12.331 The sensitivities of all IEFs are as previously described for the alone assessment (Paragraph 8.10.243 to 8.10.248).

Significance of Effect

Subtidal IEFs

8.12.332 For the offshore sands and gravels, and offshore muddy and mixed sediments, IEFs the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Intertidal IEFs

8.12.333 For the tide-swept algal communities, kelp beds and intertidal rocky and mixed sediment communities IEFs, the magnitude is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will therefore be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.334 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

Tier 4

O&M Phase

Magnitude of Impact

8.12.335 In addition to the Tier 2 and 3 projects, there is one Tier 4 project identified with a potential for cumulative impact, and this is the Flora Floating Wind Farm (Table 8.25). As a Tier 4 project, there are no specific cable parameters publicly available (e.g. lengths of cables, burial depths, cable protection). However, cable burial and/or cable protection measures are likely to be included within these projects as industry standard, such as detailed in Table 8.10 for the Proposed Development.

8.12.336 As noted in paragraph 8.12.320, thermal emissions are likely to have a negligible impact due to the likely quick dissipation of any thermal emissions.

Subtidal IEFs

8.12.337 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility (as cables will be removed and/or de-powered during the decommissioning phase). It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Intertidal IEFs

8.12.338 The cumulative impact is predicted to be of local spatial extent, long term duration, continuous and high reversibility (as cables will be removed and/or de-powered during the decommissioning phase). It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be low.

Sensitivity of Receptors

8.12.339 The sensitivities of all IEFs are as previously described for the alone assessment (Paragraph 8.10.243 to 8.10.248).

Significance of Effect

Subtidal IEFs

8.12.340 For the offshore sands and gravels, and offshore muddy and mixed sediments IEFs the magnitude of the cumulative effect is deemed to be low, and the sensitivity of the receptor is considered to be medium. The cumulative effect will, therefore, be of **Minor** adverse significance, which is not significant in EIA terms.

Intertidal IEFs

8.12.341 For the tide-swept algal communities, kelp beds and intertidal rocky and mixed sediment communities IEFs, the magnitude is deemed to be low, and the sensitivity of the receptor is considered to be medium. The effect will therefore be of **Minor** adverse significance, which is not significant in EIA terms.

Additional Mitigation and Residual Effect

8.12.342 No Additional Mitigation is considered necessary because the likely effect in the absence of Additional Mitigation is not significant in EIA terms.

8.13 Proposed Monitoring

8.13.1 No project specific monitoring measures are proposed given that no significant impacts are predicted from the Proposed Development alone or cumulatively with other plans and projects.

8.14 Transboundary Effects

8.14.1 A screening of transboundary effects has been carried out (see Volume 3, Technical Appendix 4.5: Transboundary Effects Screening) and has identified that there are no likely significant transboundary effects with regard to benthic ecology from the Proposed Development upon the interests of European Economic Area (EEA) states.

8.15 Summary of Impacts, Mitigation, Likely Significant Environmental Effects and Monitoring

8.15.1 Information on benthic ecology within the Local Benthic Ecology Study Area was collected through a detailed desktop study (Table 8.6) and through site-specific surveys (Table 8.7). This information is summarised in Section 8.6.

8.15.2 Table 8.34 presents a summary of the potential impacts, Embedded Mitigation and the conclusion of likely significant environmental effects in EIA terms in respect to benthic ecology. The impacts assessed include:

- temporary habitat loss and/or disturbance;
- long term habitat loss and/or disturbance;
- changes to SSC, bed levels and sediment types;
- changes in physical processes;
- increased risk of introduction and spread of INNS;
- colonisation of hard substrate;

- removal of hard substrates;
- impacts to benthic ecology due to EMF; and
- impacts to benthic ecology due to heat from subsea cables.

8.15.3 Overall, it is concluded that there will be no likely significant environmental effects arising from the Proposed Development during the construction, O&M or decommissioning phases.

8.15.4 Table 8.35 presents a summary of the potential impacts, Embedded Mitigation and the conclusion of likely significant environmental effects on benthic ecology in EIA terms. The cumulative effects assessed include:

- cumulative temporary habitat loss and/or disturbance;
- cumulative long term habitat loss and/or disturbance;
- cumulative changes to SSC, bed levels and sediment types;
- cumulative changes in physical processes;
- cumulative increased risk of introduction and spread of INNS;
- cumulative colonisation of hard substrate;
- cumulative removal of hard substrates;
- cumulative impacts to benthic ecology due to EMF; and
- impacts to benthic ecology due to heat from subsea cables.

8.15.5 Overall, it is concluded that there will be no likely significant cumulative effects from the Proposed Development alongside other projects.

8.15.6 No likely significant transboundary effects have been identified in regard to effects of the Proposed Development.

Table 8.34: Summary of Assessment of Significance

Description of Impact	Embedded Mitigation ID	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Additional Mitigation	Significance Residual Effect	Proposed Monitoring
Construction Phase							
Impact 1: Temporary habitat loss and/or disturbance	5	All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: Medium	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Impact 2: Long term habitat loss and/or disturbance		All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: High	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Impact 3: Changes to SSC, bed levels and sediment type	1	All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: Medium Ocean quahog IEF: Negligible Tide-swept algal communities, kelp beds IEF: High Intertidal rocky and mixed sediment communities IEF: Medium	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Impact 5: Increased risk of introduction and spread of INNS	5	All IEFs: Low	Offshore subtidal sands and gravels IEF: High Offshore muddy and mixed sediments IEFs: Medium Tide-swept algal communities, kelp beds IEF: Medium Intertidal rocky and mixed sediment communities IEF: High	All IEFs: Minor adverse	None Proposed	Minor adverse	None

Description of Impact	Embedded Mitigation ID	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Additional Mitigation	Significance Residual Effect	Proposed Monitoring
Impact 6: Colonisation of hard substrate	5	All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: High	All IEFs: Minor adverse	None Proposed	Minor adverse	None
O&M Phase							
Impact 1: Temporary habitat loss and/or disturbance	5	All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: Medium	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Impact 2: Long term habitat loss and/or disturbance		All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: High	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Impact 3: Changes to SSC, bed levels and sediment type	1	All IEFs: Negligible	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: Medium Ocean quahog IEF: Negligible Tide-swept algal communities, kelp beds IEF: High Intertidal rocky and mixed sediment communities IEF: Medium	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Impact 4: Changes in physical processes	N/A	All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: Negligible Ocean quahog IEF: Medium	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: Negligible adverse	None Proposed	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: Negligible adverse	None

Description of Impact	Embedded Mitigation ID	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Additional Mitigation	Significance Residual Effect	Proposed Monitoring
				Ocean quahog IEF: Minor adverse		Ocean quahog IEF: Minor adverse	
Impact 5: Increased risk of introduction and spread of INNS	5	All IEFs: Low	Offshore subtidal sands and gravels IEF: High Offshore muddy and mixed sediments IEFs: Medium Tide-swept algal communities, kelp beds IEF: Medium Intertidal rocky and mixed sediment communities IEF: High	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Impact 6: Colonisation of hard substrate		All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: High	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Impact 8: Impacts to benthic ecology due to EMFs	1	All IEFs: Negligible	Offshore subtidal sands and gravels and offshore muddy and mixed sediments, tide-swept algal communities, kelp beds and intertidal rocky and mixed sediment communities IEFs: Medium	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Impact 9: Impacts to benthic ecology due to heat from subsea cables	1	All IEFs: Negligible	Offshore subtidal sands and gravels and offshore muddy and mixed sediments, tide-swept algal communities, kelp beds and intertidal rocky and mixed sediment communities IEFs: Low Kelp beds IEF: Medium	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Decommissioning Phase							

Description of Impact	Embedded Mitigation ID	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Additional Mitigation	Significance Residual Effect	Proposed Monitoring
Impact 1: Temporary habitat loss and/or disturbance	5	All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: Medium	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Impact 2: Long term habitat loss and/or disturbance		All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: High	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Impact 3: Changes to SSC, bed levels and sediment type	1	All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: Medium Ocean quahog IEF: Negligible Tide-swept algal communities, kelp beds IEF: High Intertidal rocky and mixed sediment communities IEF: Medium	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Impact 5: Increased risk of introduction and spread of INNS	5	All IEFs: Low	Offshore subtidal sands and gravels IEF: High Offshore muddy and mixed sediments IEFs: Medium Tide-swept algal communities, kelp beds IEF: Medium Intertidal rocky and mixed sediment communities IEF: High	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Impact 6: Colonisation of hard substrate		All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: High	All IEFs: Minor adverse	None Proposed	Minor adverse	None

Description of Impact	Embedded Mitigation ID	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Additional Mitigation	Significance Residual Effect	Proposed Monitoring
Impact 7: Removal of hard substrates		All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: Low	All IEFs: Minor adverse	None Proposed	Minor adverse	None

Table 8.35: Summary of Cumulative Effects Assessment

Description of Impact	Phase	CEA Tier	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Additional Mitigation	Significance Residual Effect	Proposed Monitoring
Temporary habitat loss and/or disturbance	Construction	Tier 2, Tier 3 and Tier 4	All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: Medium	All IEFs: Minor adverse	None Proposed	Minor adverse	None
	O&M		All IEFs: Low		All IEFs: Minor adverse			
	Decommissioning		All IEFs: Low		All IEFs: Minor adverse			
Long term habitat loss and/or disturbance	Construction, O&M and decommissioning	Tier 2, Tier 3 and Tier 4	All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: High	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Changes to SSC, bed levels and sediment type	Construction	Tier 2 and Tier 3	All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: Medium Ocean quahog IEF: Negligible	All IEFs: Minor adverse	None Proposed	Minor adverse	None
	O&M		All IEFs: Low		All IEFs: Minor adverse			
	Decommissioning		All IEFs: Low		All IEFs: Minor adverse			

Description of Impact	Phase	CEA Tier	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Additional Mitigation	Significance Residual Effect	Proposed Monitoring
				Tide-swept algal communities, kelp beds IEF: High Intertidal rocky and mixed sediment communities IEF: Medium				
Changes in physical processes	O&M and decommissioning	Tier 2 (No Tier 1, Tier 3 and Tier 4 projects identified for this impact)	All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: Negligible Ocean quahog IEF: Medium	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Increased risk of introduction and spread of INNS	Construction, O&M and decommissioning	Tier 2, Tier 3 and Tier 4	All IEFs: Low	Offshore subtidal sands and gravels IEF: High Offshore muddy and mixed sediments IEFs: Medium Tide-swept algal communities, kelp beds IEF: Medium Intertidal rocky and mixed sediment communities IEF: High	All IEFs: Minor adverse	None Proposed	Minor adverse	None

Description of Impact	Phase	CEA Tier	Magnitude of Impact	Sensitivity of Receptor	Significance of Effect	Additional Mitigation	Significance Residual Effect	Proposed Monitoring
Colonisation of hard substrate	Construction and O&M	Tier 2, Tier 3 and Tier 4	All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: High	All IEFs: Minor adverse	None Proposed	Minor adverse	None
	Decommissioning		All IEFs: Low		All IEFs: Minor adverse			
Removal of hard substrates	Decommissioning	Tier 2, Tier 3 and Tier 4	All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: Low	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Impacts to benthic ecology due to EMFs	O&M	Tier 2, Tier 3 and Tier 4	All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments IEFs: Medium	All IEFs: Minor adverse	None Proposed	Minor adverse	None
Impacts to benthic ecology due to heat from subsea cables	O&M	Tier 2, Tier 3 and Tier 4	All IEFs: Low	Offshore subtidal sands and gravels and offshore muddy and mixed sediments, tide-swept algal communities, kelp beds and intertidal rocky and mixed sediment communities IEFs: Low Kelp beds IEF: Medium	All IEFs: Minor adverse	None Proposed	Minor adverse	None

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