Cenos Offshore Windfarm Limited

Cenos EIA

Chapter 10 – Benthic Ecology

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CONTENTS

ACRONYMS 5

GLOSSARY 9

10 BENTHIC ECOLOGY 15
10.1 Introduction 15
10.2 Legislation, policy, and guidance 16
10.3 Scoping and consultation 17
10.4 Baseline characterisation 40
10.4.1 Study Area 40
10.4.2 Data sources 40
10.4.3 Project site specific surveys 42
10.4.4 Existing baseline 44
10.4.5 Future baseline 94
10.4.6 Summary and key sensitivities 95
10.4.7 Data gaps and uncertainties 97
10.5 Impact assessment methodology 98
10.5.1 Impacts requiring assessment 98
10.5.2 Impacts scoped out of the assessment 99
10.5.3 Assessment methodology 100
10.5.4 Embedded mitigation 102
10.5.5 Worst-case scenario 108
10.5.6 Quantification of impacts 119
10.6 Assessment of potential effects 128
10.6.1 Potential effects during construction 128
10.6.2 Potential effects during operation and maintenance 155
10.6.3 Potential effects during decommissioning 172
10.6.4 Summary of potential effects 173
10.7 Assessment of cumulative effects 181
10.7.1 Introduction 181
10.7.2 Cumulative construction effects 184
10.7.3 Cumulative operation and maintenance effects 187
10.7.4 Cumulative decommissioning effects 190
10.7.5 Summary of cumulative effects 190
10.8 Inter-related effects 194
10.8.1 Inter-related effects between Project phases 194
10.8.2 Inter-related effects within a Project phase 194
10.8.3 Inter-relationships 195
10.8.4 Onward Development Connections 196
10.9 Ecosystem assessment 196
10.10 Whole Project assessment 197

10.11 Transboundary effects 197
10.12 Summary of mitigation and monitoring 197
10.13 References 198

ACRONYMS

ACRONYM	DEFINITION
BAP	Biodiversity Action Plan
BGS	British Geological Survey
BSL	Benthic Solutions Ltd
BWM	Ballast Water Management
CaP	Cable Plan
CATS	Central Area Transmission System
CBRA	Cable Burial Risk Assessment
CCME	Canadian Council of Ministers of the Environment
CES	Crown Estate Scotland
CIEEM	Chartered Institute of Ecology and Environmental Management
CMS	Construction Method Statement
CNS	Central North Sea
CPT	Core Penetration Test
CTD	Conductivity, Temperature, and Depth
DDV	Drop Down Video
DEFRA	Department for Environment, Food and Rural Affairs
DoL	Depth of Lowering
DP	Dynamic Positioning
DSLP	Development Specification and Layout Plan
DVV	Dual Van Veen
EAC	Environmental Assessment Criteria
eDNA	Environmental Deoxyribonucleic Acid
EICC	Export/Import Cable Corridor
EEA	European Economic Area
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMF	Electromagnetic Field
EMP	Environmental Management Plan
ERL	Effects Range Low
EU	European Union
EUNIS	European Nature Information System

ACRONYM	DEFINITION
FeAST	Feature Activity Sensitivity Tool
FTU	Floating Turbine Unit
GEN	General Policy
GMF	Geomagnetic Field
GW	Giggawatt
HC	Hydrocarbons
HD	High Definition
HDD	Horizontal Directional Drilling
HG	Hamon Grab
HM	Heavy Metals
HOD	High Order Detonation
HRA	Habitats Regulation Appraisal
HVAC	High Voltage Alternating Current
HVDC	High Voltage Directional Current
IAC	Inter-Array Cable
IMO	International Maritime Organisation
INNS	Invasive Non-Native Species
INNSMP	Invasive Non-Native Species Management Plan
INTOG	Innovation and Targeted Oil & Gas
IUCN	International Union for Conservation of Nature and Natural Resources
JNCC	Joint Nature Conservation Committee
JUV	Jack-Up Vessel
km	Kilometre
KP	Kilometre Point
LAT	Lowest Astronomical Tide
LOD	Low Order Deflagration
LSE	Likely Significant Effect
MarESA	Marine Evidence based Sensitivity Assessment
MARPOL	Marine Pollution Convention
MAU	Marine Directorate Marine Analytical Unit
MBES	Multibeam Echo Sounder
MD-LOT	Marine Directorate Licensing Operations Team
MD-SEDD	Marine Directorate Science, Evidence, Data and Digital Portfolio

ACRONYM	DEFINITION
MDAC	Methane-Derived Authigenic Carbonates
MEEB	Measures of Equivalent Environmental Benefit
MHWS	Mean High Water Springs
MLA	Marine Licence Application
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MPA	Marine Protected Area
MPCP	Marine Pollution Contingency Plan
MSS	Marine Scotland Science
MW	Megawatt
NBN	National Biodiversity Network
NCMPA	Nature Conservation Marine Protected Area
NM	Nautical Mile
NOAA	National Oceanic and Atmospheric Administration
OMP	Operations and Maintenance Programme
OOA	Offshore Operators Association
OSCP	Offshore Substation and Converter Platform
OSPAR	Oslo and Paris convention
OWF	Offshore Wind Farm
PAH	Polycyclic Aromatic Hydrocarbons
PBDE	Polybrominated Diphenyl Ether
PCBs	Polychlorinated Biphenyls
PDE	Project Design Envelope
PEL	Probable Effect Level
PLGR	Pre-Lay Grapnel Run
PMF	Priority Marine Feature
PSA	Particle Size Analysis
PSD	Particle Size Distribution
QSR	Quality Status Report
RLB	Red Line Boundary
SAC	Special Area of Conservation
SACFOR	Superabundant, Abundant, Common, Frequent, Occasional, Rare
SBL	Scottish Biodiversity List

ACRONYM	DEFINITION
SBP	Sub-Bottom Profiler
SEPA	Scottish Environment Protection Agency
SOPEP	Ship Oil Pollution Emergency Plans
SS	Supporting Study
SSC	Suspended Sediment Concentration
SSS	Side Scan Sonar
TEL	Threshold Effect Level
THC	Total Hydrocarbon Content
TLP	Tension Leg Platform
TOC	Total Organic Carbon
TOG	Targeted Oil and Gas
TOM	Total Organic Matter
UHR	Ultra High-Resolution
UK	United Kingdom
UKBAP	UK Biodiversity Action Plan
UKCS	United Kingdom Continental Shelf
UKOOA	United Kingdom Offshore Operators Association
USA	United States of America
UXO	Unexploded Ordnance
WROV	Work Class Remotely Operated Vehicle
WTG	Wind Turbine Generator
ZoI	Zone of Influence

GLOSSARY

TERM	DEFINITION
2023 Scoping Opinion	Scoping Opinion received in June 2023, superseded by the 2024 Scoping Opinion.
2023 Scoping Report	Environmental Impact Assessment (EIA) Scoping Report submitted in 2023, superseded by the 2024 Scoping Report.
2024 Scoping Opinion	Scoping Opinion received in September 2024, superseding the 2023 Scoping Opinion.
2024 Scoping Report	EIA Scoping Report submitted in April 2024, superseding the 2023 Scoping Report.
Area of Opportunity	The area in which the limits of electricity transmission via High Voltage Alternating Current (HVAC) cables can reach oil and gas assets for decarbonisation. This area is based on assets within a 100 kilometre (km) radius of the Array Area.
Array Area	The area within which the Wind Turbine Generators (WTGs), floating substructures, moorings and anchors, Offshore Substation Converter Platforms (OSCPs) and Inter-Array Cables (IAC) will be present.
Cenos Offshore Windfarm ('the Project')	'The Project' is the term used to describe Cenos Offshore Windfarm. The Project is a floating offshore windfarm located in the North Sea, with a generating capacity of up to 1,350 Megawatts (MW). The Project which defines the Red Line Boundary (RLB) for the Section 36 Consent and Marine Licence Applications (MLA), includes all offshore components seaward of Mean High Water Springs (MHWS) (WTGs, OSCPs, cables, floating substructures moorings and anchors and all other associated infrastructure). The Project is the focus of this Environmental Impact Assessment Report (EIAR).
Cenos Offshore Windfarm Ltd. (The Applicant)	The Applicant for the Section 36 Consent and associated Marine Licences.
Cumulative Assessment	The consideration of potential impacts that could occur cumulatively with other relevant projects, plans, and activities that could result in a cumulative effect on receptors.

TERM	DEFINITION
Developer	Cenos Offshore Windfarm Ltd., a Joint Venture between Flotation Energy and Vårgrønn As (Vårgrønn).
Environmental Impact Assessment (EIA)	The statutory process of evaluating the likely significant environmental effects of a proposed project or development. Assessment of the potential impact of the proposed Project on the physical, biological and human environment during construction, operation and maintenance and decommissioning.
Environmental Impact Assessment Regulations	This term is used to refer to the Environmental Impact Assessment Regulations which are of relevance to the Project. This includes the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017, the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended); and the Marine Works (Environmental Impact Assessment) Regulations 2007.
Environmental Impact Assessment Report	A report documenting the findings of the EIA for the Project in accordance with relevant EIA Regulations.
Export/Import Cable	High voltage cable used to export/import power between the OSCPs and Landfall.
Export/Import Cable Bundle (EICB)	Comprising two Export/Import Cables and one fibre-optic cable bundled in a single trench.
Export/Import Cable Corridor (EICC)	The area within which the Export/Import Cable Route will be planned and the Export/Import Cable will be laid, from the perimeter of the Array Area to MHWS.
Export/Import Cable Route	The area within the Export/Import Export Corridor (EICC) within which the Export/Import Cable Bundle (EICB) is laid, from the perimeter of the Array Area to MHWS.
Floating Turbine Unit (FTU)	The equipment associated with electricity generation comprising the WTG, the floating substructure which supports the WTG, mooring system and the dynamic section of the IAC.
Flotation Energy	Joint venture partner in Cenos Offshore Windfarm Ltd.

TERM	DEFINITION
Habitats Regulations	The Habitats Directive (Directive 92/43/ECC) and the Wild Birds Directive (Directive 2009/147/EC) were transposed into Scottish Law by the Conservation (Natural Habitats &c) Regulations 1994 ('Habitats Regulations') (up to 12 NM); by the Conservation of Offshore Marine Habitats and Species Regulations 2017 ('Offshore Marine Regulations') (beyond 12 NM); the Conservation of Habitats and Species Regulations 2017 (of relevance to consents under Section 36 of the Electricity Act 1989); the Offshore Petroleum Activities (Conservation of Habitats) Regulations 2001; and the Wildlife and Countryside Act 1981. The Habitats Regulations set out the stages of the Habitats Regulations Appraisal (HRA) process required to assess the potential impacts of a proposed project on European Sites (Special Areas of Conservation, Special Protection Areas, candidate SACs and SPAs and Ramsar Sites).
Habitats Regulations Appraisal	The assessment of the impacts of implementing a plan or policy on a European Site, the purpose being to consider the impacts of a project against conservation objectives of the site and to ascertain whether it would adversely affect the integrity of the site.
High Voltage Alternating Current (HVAC)	Refers to high voltage electricity in Alternating Current (AC) form which is produced by the WTGs and flows through the IAC system to the OSCPs. HVAC may also be used for onward power transmission from the OSCPs to assets or to shore over shorter distances.
High Voltage Direct Current (HVDC)	Refers to high voltage electricity in Direct Current (DC) form which is converted from HVAC to HVDC at the OSCPs and transmitted to shore over longer distances.
Horizontal Directional Drilling (HDD)	An engineering technique for laying cables that avoids open trenches by drilling between two locations beneath the ground's surface.
Innovation and Targeted Oil & Gas (INTOG)	In November 2022, the Crown Estate Scotland (CES) announced the Innovation and Targeted Oil & Gas (INTOG) Leasing Round, to help enable this sector-wide commitment to decarbonisation. INTOG allowed developers to apply for seabed rights to develop offshore windfarms for the purpose of providing low carbon electricity to power oil and gas installations and help to decarbonise the sector. Cenos is an INTOG project and in November 2023 secured an Exclusivity Agreement as part of the INTOG leasing round.
Inter-Array Cable (IAC)	The cables which connect the WTGs to the OSCPs. WTGs may be connected with IACs into a hub or in series as a 'string' or a 'loop' such that

TERM	DEFINITION
	power from the connected WTGs is gathered to the OSCPs via a single cable.
Joint Venture	The commercial partnership between Flotation Energy and Vårgrønn, the shareholders which hold the Exclusivity Agreement with CES to develop the Cenos site as an INTOG project.
Landfall	The area where the Export/Import Cable from the Array Area will be brought ashore. The interface between the offshore and onshore environments.
Marine Licence	Licence required for certain activities in the marine environment and granted under the Marine and Coastal Access Act 2009 and/or the Marine (Scotland) Act 2010.
Marine Protected Area (MPA)	Marine sites protected at the national level under the Marine (Scotland) Act 2010 out to 12 NM, and the Marine and Coastal Access Act 2009 between 12-200 NM. In Scotland MPAs are areas of sea and seabed defined so as to protect habitats, wildlife, geology, underseas landforms, historic shipwrecks and to demonstrate sustainable management of the sea.
Marine Protected Area (MPA) Assessment	A three-step process for determining whether there is a significant risk that a proposed development could hinder the achievement of the conservation objectives of an MPA.
Mean High Water Springs (MHWS)	The height of Mean High Water Springs is the average throughout the year, of two successive high waters, during a 24-hour period in each month when the range of the tide is at its greatest.
Mean Low Water Springs (MLWS)	The height of Mean Low Water Springs is the average throughout a year of the heights of two successive low waters during periods of 24 hours (approximately once a fortnight).
Mitigation Measures	Measures considered within the topic-specific chapters in order to avoid impacts or reduce them to acceptable levels. • Primary mitigation - measures that are an inherent part of the design of the Project which reduce or avoid the likelihood or magnitude of an adverse environmental effect, including location or design; • Secondary mitigation – additional measures implemented to further reduce environmental effects to 'not significant' levels (where appropriate) and do not form part of the fundamental design of the Project; and

TERM	DEFINITION
	• Tertiary mitigation – measures that are implemented in accordance with industry standard practice or to meet legislative requirements and are independent of the EIA (i.e. they would be implemented regardless of the findings of the EIA). Primary and tertiary mitigation are referred to as embedded mitigation. Secondary mitigation is referred to as additional mitigation.
Mooring System	Comprising the mooring lines and anchors, the mooring system connects the floating substructure to the seabed, provides station-keeping capability for the floating substructure and contributes to the stability of the floating substructure and WTG.
Nature Conservation Marine Protected Area (NCMPA)	MPA designated by Scottish Ministers in the interests of nature conservation under the Marine (Scotland) Act 2010.
Offshore Substation Converter Platforms (OSCPs)	An offshore platform on a fixed jacket substructure, containing electrical equipment to aggregate the power from the WTGs and convert power between HVAC and HVDC for export/import via the export/import cable to/from the shore. The OSCPs will also act as power distribution stations for the Oil & Gas platforms.
Onward Development	Transmission projects which are anticipated to be brought forward for development by 3rd party oil and gas operators to enable electrification of assets via electricity generated by the Project. All Onward Development will subject to separate marine licensing and permitting requirements.
Onward Development Area	The area within which oil and gas assets would have the potential to be electrified by the Project.
Onward Development Connections	Oil and gas assets located in the waters surrounding the Array Area will be electrified via transmission infrastructure which will connect to the Project's OSCPs. These transmission cables are referred to as Onward Development Connections.
Project Area	The area that encompasses both the Array Area and EICC.
Project Design Envelope	A description of the range of possible elements that make up the Project design options under consideration and that are assessed as part of the EIA for the Project.
Study Area	Receptor specific area where potential impacts from the Project could occur.

TERM	DEFINITION
Transboundary Assessment	The consideration of impacts from the Project which have the potential to have a significant effect on another European Economic Area (EEA) state's environment. Where there is a potential for a transboundary effect, as a result of the Project, these are assessed within the relevant EIA chapter.
Transmission Infrastructure	The infrastructure responsible for moving electricity from generating stations to substations, load areas, assets and the electrical grid, comprising the OSCPs, and associated substructure, and the Export/Import Cable.
Vårgrønn As (Vårgrønn)	Joint venture partner in Cenos Offshore Windfarm Ltd.
Wind Turbine Generator (WTG)	The equipment associated with electricity generation from available wind resource, comprising the surface components located above the supporting substructure (e.g., tower, nacelle, hub, blades, and any necessary power transformation equipment, generators, and switchgears).
Worst-Case Scenario	The worst-case scenario based on the Project Design Envelope which varies by receptor and/or impact pathway identified.

10 BENTHIC ECOLOGY

10.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) presents the Benthic Ecology receptors of relevance to the Project and assesses the potential impacts from the construction, operation and maintenance and decommissioning of the Project on these receptors. Where required, mitigation is proposed, and the residual impacts and their significance are assessed. Potential cumulative impacts are also considered.

Table 10-1 below provides a list of all the supporting studies which relate to and should be read in conjunction with the Benthic Ecology impact assessment. All supporting studies are appended to this EIAR.

Table 10-1 Supporting studies

DETAILS OF STUDY	SUPPORTING STUDIES AND LOCATION (WHERE RELEVANT)
Marine & Physical Processes Modelling Report	EIAR Vol. 4, Appendix 7
Environmental Habitat Assessment Report – Offshore Wind Farm (OWF)	EIAR Vol. 4, Appendix 8
Environmental Habitat Assessment Report - EICC	EIAR Vol. 4, Appendix 9
Environmental Baseline and Habitat Assessment Report – Inshore EICC	EIAR Vol. 4, Appendix 10
Environmental Baseline Report - OWF	EIAR Vol. 4, Appendix 11
Environmental Baseline Report - EICC	EIAR Vol. 4, Appendix 12
Benthic eDNA Analysis Report	EIAR Vol. 4, Appendix 13
EMF Assessment Report Vol. 1	EIAR Vol. 4, Appendix 14A
EMF Assessment Report Vol. 2	EIAR Vol. 4, Appendix 14B

The impact assessment presented herein draws upon information presented within other impact assessments within this EIAR, including:

- EIAR Vol. 3, Chapter 8: Marine Geology, Oceanography, and Coastal Processes – assesses the impacts of temporary increases in Suspended Sediment Concentrations (SSC) and associated sediment deposition. Changes in SSC and deposition can have an impact on benthic species by resulting in habitat disturbance, changes in sediment properties and smothering;
- EIAR Vol. 3, Chapter 9: Marine Water and Sediment Quality – assesses the impacts associated with changes in water quality. These changes can result in indirect impacts on benthic species, including spawning habitats, which may be sensitive to water quality, sediment disturbance, and contamination; and

- EIAR Vol. 3, Chapter 13: Fish and Shellfish Ecology – assesses the impacts of the Project on important fish and shellfish species. This chapter will be used to provide further information on the spatial distribution of benthic species, particularly shellfish such as *Nephrops norvegicus* within the Project Area.

Where information from other chapters is used to inform the impact assessment, reference to the relevant EIAR Chapter is given.

The following specialists have contributed to the assessment:

- John Spence, Xodus Group; and
- Georgios Kazanidis, Xodus Group.

10.2 Legislation, policy, and guidance

The wider marine planning, legislation, policy and guidance is discussed in EIAR Vol. 2, Chapter 3: Policy and Legislative Context. The following legislation, policy, and guidance are relevant to the assessment of impacts and effects from the Project on Benthic Ecology receptors:

- Legislation:
  - International:
    - International Convention for the Control and Management of Ship's Ballast Water and Sediments (Ballast Water Management Convention) 2004; and
    - Convention for the Protection of the Marine Environment of the North-East Atlantic (The Oslo and Paris convention (OSPAR) Convention for the Protection of the Marine environment of the North-East Atlantic).
  - National
    - Conservation (Natural Habitats, &c.) Regulations 1994 (as amended);
    - Conservation of Offshore Marine Habitats and Species Regulations 2017 ('Habitats Regulations') (as amended);
    - Nature Conservation (Scotland) Act 2004 (as amended);
    - Marine (Scotland) Act 2010; and
    - Marine and Coastal Access Act 2009.
- Policy:
  - Scotland's National Planning Framework 4 (Scottish Government, 2023a): it sets out Scotland's spatial principles, regional priorities, national developments and national planning policy;
  - UK Marine Policy Statement (UK Government, 2011)): framework for preparing Marine Plans and taking decisions affecting the marine environment.;
  - Scotland's National Marine Plan[1] (Scottish Government, 2015a): this plan contains policies that relate to the management of both Scottish inshore waters (out to 12 Nautical Miles (NM)) and offshore waters (12 to 200 NM);

[1] *Following the most recent review of the National Marine Plan in 2021, the Scottish Ministers announced, in 2022, their intention to update the National Marine Plan. This update is underway but has not yet reached a draft consultation stage. A stakeholder engagement strategy and statement of public participation was published in August 2024.*

  - United Kingdom (UK) post-2010 Biodiversity Framework (supersedes the UK Biodiversity Action Plan (UKBAP)) (Joint Nature Conservation Committee (JNCC) and Department for Environment, Food and Rural Affairs (DEFRA), 2012);

Scottish Biodiversity strategy: A route map to 2020 (Scottish Government, 2015b); and

- The following policies within Scotland's National Marine Plan (specifically apply to this Benthic Ecology assessment:
  - General Policy (GEN) 9 Natural heritage: *Development and use of the marine environment must: (a) Comply with legal requirements for protected areas and protected species; (b) Not result in significant impact on the national status of Priority Marine Features (PMFs); and (c) Protect, and, where appropriate, enhance the health of the marine area*; and
  - GEN 10 Invasive non-native species*: 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.*

- Guidance:
  - Descriptions of Scottish PMFs (Tyler-Walters *et al.*, 2016);
  - Guidelines for ecological impact assessment in the UK and Ireland (Chartered Institute of Ecology and Environmental Management (CIEEM), 2018);
  - Natural England and JNCC advice on key sensitivities of habitats and Marine Protected Areas (MPA) in English Waters to OWF cabling within Proposed Round 4 leasing areas (Natural England and JNCC, 2019); and Guidance on marine non-native species (NatureScot, 2024a).

10.3 Scoping and consultation

Stakeholder consultation has been ongoing throughout the Environmental Impact Assessment (EIA) and has played an important part in ensuring the scope of the baseline characterisation and impact assessment is appropriate with respect to the Project and the requirements of the regulators and their advisors.

A Scoping Workshop was held on the 29th February 2024 (as detailed in EIAR Vol. 2, Chapter 1: Introduction). Relevant points specific to Benthic Ecology are provided in Table 10-2 below, which sets out how these points have been addressed within the EIAR.

The 2024 Scoping Report was submitted to Marine Directorate – Licensing Operations Team (MD-LOT) in April 2024, relevant stakeholders were consulted. The Scoping Opinion was received in September 2024. The 2024 Scoping Report and Scoping Opinion supersedes the 2023 Scoping Report and Scoping Opinion for the Project. Relevant comments from the Scoping Opinion and other consultation specific to Benthic Ecology are provided in Table 10-2 below, which provides a high-level response on how these comments have been addressed within the EIAR.

On the 2nd October 2024, Xodus contacted JNCC, placing a request for access to GIS data related to the spatial extent of designated habitats (sublittoral mud, sublittoral sand) and abundance of ocean quahog (*Arctica islandica*) in the East of Gannet and Montrose Fields NCMPA. Access to this GIS data was provided on the 3rd October 2024.

No further pre or post scoping consultation has been undertaken in relation to Benthic Ecology.

Table 10-2 Comments from the Scoping Opinion relevant to Benthic Ecology

CONSULTEE	COMMENT	RESPONSE
Scottish Ministers	The Developer considers the potential impact of the Proposed Development on Benthic Ecology receptors in chapter 9 of the Scoping Report. The Scottish Ministers are content with the study area as set out in Section 9.3 of the Scoping Report.	Noted. This Chapter has used a Zone of Influence (ZoI) of 20 kilometre (km) (Section 10.4.1).
Scottish Ministers	Data sources are listed in table 9.3 of the Scoping Report, the Scottish Ministers refer the Developer to the NatureScot representation for an additional data source to be used in the EIA Report. With regard to surveys in relation to ocean quahog, the Scottish Ministers advise that any survey strategy must be agreed with NatureScot and JNCC prior to commencing and refer the Developer to the joint NatureScot and JNCC representation in this regard.	The recommendation from NatureScot for an additional data source to be used in the EIAR has been incorporated (please see reply below to NatureScot comment). Noted. The Applicant acknowledges the NatureScot and JNCC representation comment in terms of survey strategy (please see response to the below comment from NatureScot in terms of Inshore Survey Strategy).
Scottish Ministers	The Developer sets out the potential impacts to be scoped in and out of the EIA Report in table 9-6 of the Scoping Report. The Scottish Ministers advise that temporary impacts to the seabed and benthic habitats, long-term impacts to the seabed and benthic habitats and introduction of hard substrate in a predominantly sedimentary environment should be scoped in for all phases of the Proposed Development. Additionally, the Scottish Ministers advise that removal of hard structures during decommissioning resulting in loss of colonised surfaces should be scoped in for assessment in the EIA Report and remediation of mooring and anchor depressions should also be assessed in the EIA Report as a permanent impact.	The 'temporary impacts to the seabed and benthic habitats' have been scoped in and assessed for the construction (Table 10-9, Section 10.6.1), and operation and maintenance (Table 10-9, Section 10.6.2)) phases of the Project. The 'long-term impacts to the seabed and benthic habitats' and 'introduction of hard substrates in a predominantly sedimentary environment' have been scoped in and assessed for the construction and for the operation and maintenance phases (Table 10-9, Section 10.6.2.3). It is acknowledged that although the introduction of hard substrates can take place during the construction phase it is during the operation and maintenance phase that any potential long-term environmental impacts will take place (and potentially during / after decommissioning for any infrastructure that may be left in situ). Since it is a single impact occurring

CONSULTEE	COMMENT	RESPONSE
	In relation to potential for landfall works to disturb intertidal habitats and species, the Scottish Ministers agree that this can be scoped out provided Horizontal Directional Drilling ("HDD") is the installation method and there are no other activities that have the potential to impact the intertidal region. Furthermore, the Scottish Ministers direct the Developer to the advice provided by NatureScot in its representation in relation to sources for introduction of invasive non-native species and advise that this is taken forward into the EIA Report. This advice is in line with the joint NatureScot and JNCC representation and the Developer is directed to this representation, particularly in relation to scoping of impacts, and advised that this is given full consideration in the EIA Report.	across different phases, with the majority occurring during operation and maintenance phase, it is assessed once in that phase to avoid duplication. There are no specific remediation measures for the possible effects from mooring and anchors – the Project focuses on the design of the windfarm to reduce or avoid seabed impacts as much as possible. E.g., catenary moorings have been removed, for the semi-taut mooring, and the chain length/area in contact with the seabed has been limited as far as possible. The Project is also still actively pursuing the option of a taut mooring system, which would have no seabed contact. At decommissioning all mooring lines would be removed. Piles would be removed or will be cut 3 m below the mudline. The worst-case scenario can be seen in Table 10-14 and Table 10-15. In the Scoping Report, the impact pathways 'Introduction of hard substrates in a predominantly sedimentary environment' and 'Increased predation' were presented as two separate impact pathways. As they are regarded to be closely associated, in this chapter they have been as assessed as a single impact pathway entitled 'Introduction of hard substrates in a predominantly sedimentary environment / increased predation' (Table 10-9, Section 10.6.2.3). The impact pathway 'Removal of hard structures during decommissioning resulting in loss of colonised surfaces' has been scoped in and assessed for the decommissioning phase (Table 10-9, Section 10.6.3). Any potential environmental impacts associated with mooring chains and anchors have been assessed as long-term impacts (Section 10.6.2.2).

CONSULTEE	COMMENT	RESPONSE
		Interactions with the intertidal zone / Benthic Ecology receptors in the intertidal zone will be avoided because the Export/Import Cable will be installed by HDD with the exit point located 190 m from the cliff. Therefore, there will be no interaction with intertidal benthic receptors. The Applicant acknowledges the advice provided by NatureScot and JNCC in their representation in relation to sources for introduction of INNS. Please see our reply below to NatureScot comment about 'Impact pathways' (Section 10.6.1.3). The assessment of potential impacts from INNS is presented in Section 10.6.1.3 and Section 10.6.2.6.
Scottish Ministers	The Scottish Ministers are content with the proposed approach to assessment as set out in Section 9.11 of the Scoping Report. The Developer acknowledges in Section 9.6 of the Scoping Report that scour protection may be required around the foundations, the Scottish Ministers advise that this must be considered in the EIA Report in relation to the resulting impact that scour protection will have on the East of Gannet and Montrose Fields NCMPA. Furthermore, the Scottish Ministers advise that the EIA Report include a standalone assessment of the East of Gannet and Montrose Fields NCMPA. This must be a comprehensive assessment considering the features of the site and their conservation objectives and include consideration of all relevant activities within the NCMPA. Assessment of potential impacts must be against each designated feature within the NCMPA. The Scottish Ministers note that JNCC intend to publish a new	This Chapter has followed the same approach to assessment (Section 10.5) as was set out in the Scoping Report. As outlined in Volume 2 Chapter 5 Project Description the risk of sediment scour around the anchors for the Floating Turbine Units (FTUs) is low and scour protection will most likely not be required. If scour protection / mitigation is required, rock dumping shall not be considered. Scour protection methods may include scour reduction Vortex Induced Vibration strakes and tubular sleeves, with no additional seabed footprint to the existing maximum seabed area detailed for the piles. Scour as an impact pathway has therefore not been included in this assessment (Table 10-14 and Table 10-15). A comprehensive, standalone MPA Assessment has been provided.

CONSULTEE	COMMENT	RESPONSE
	conservation advice package imminently and this must be considered in the assessment. To allow for a clearer understanding of the potential impact to the NCMPA, the Scottish Ministers advise any maps identify the NCMPA boundary. If significant effects on the conservation objectives of the NCMPA are identified then the Developer should consider proposing potential Measures of Equivalent Environmental Benefit to be submitted alongside the EIA Report. The Scottish Ministers advise that the Developer engage fully with NatureScot and JNCC regarding its approach to the assessment.	
Scottish Ministers	In relation to the cumulative impact assessment, the Scottish Ministers advise that this should include all impacts which may arise from the Proposed Development and also impacts which could be identified as minimal for the Proposed Development alone but may have a greater impact when considered cumulatively. An example of such is Electro-Magnetic Field ("EMF") impacts which the Scottish Ministers advise must be scoped into the cumulative impact assessment and refer the Developer to the joint JNCC and NatureScot representation in this regard.	The assessment of cumulative effects has been completed (Section 10.7).
Scottish Ministers	With regard to mitigation, the Scottish Ministers acknowledge the embedded mitigations measures as outlined in table 9-5 of the Scoping Report and agree that this is suitable for managing and mitigating effects of the Proposed Development on Benthic Ecology receptors. However, further mitigation may be required dependent on the outcome of the assessment in the EIA Report. This is in line with the NatureScot representation.	Embedded mitigation measures and monitoring measures are detailed in Table 10-13 in Section 10.5.4. The impact assessment concludes no significant effects and therefore secondary mitigation measures are not required. The conclusions of the impact assessment are shown in Table 10-19 (Section 10.6.4).
Scottish Ministers	The Scottish Ministers agree with the Developer's proposal to scope out Benthic Ecology for assessment of transboundary impacts.	There is no potential for transboundary impacts upon Benthic Ecology receptors due to construction, operation and maintenance and decommissioning of the Project. The potential impacts are localised and are not expected to affect other EEA states. This is primarily due to the fact that

CONSULTEE	COMMENT	RESPONSE
		the Project is entirely within the UKCS with a localised footprint. Transboundary effects have been scoped out of this Benthic Ecology assessment.
Scottish Ministers	With regard to the HRA Screening Report, the Scottish Ministers are content with the identification of a single site, Buchan Ness to Collieston Coast SAC, designated for Annex 1 habitats, as having connectivity to the Proposed Development and agree with the conclusion reached by the Developer that there is no potential for Likely Significant Effect ("LSE") on the qualifying feature of this site from the Proposed Development. This is in line with the NatureScot representation.	Noted. The Buchan Ness to Collieston Coast SAC has been scoped out and not assessed further.
Scottish Ministers	During the construction phase of the OSCP, the Applicant will need to consider the vessels involved, in particular their mooring requirements (if any) or rock stabilisation for jack up vessels, and what seabed impact that would have within the NCMPA.	No rock stabilisation requirements are anticipated: spud can sizing aims to ensure adequate soil strength for the stability of the Jack-Up Vessel (JUV). A JUV will be used in support of OSCPs commissioning while Dynamic Positioning (DP) vessels will be used in support of other activities e.g. IACs installation and FTU installation (mooring hook-up).
Scottish Ministers	The Applicant will need to consider the seabed impact of additional stabilisation (rock dump) for jack up vessels within NCMPA. This would be considered a permanent impact to the environment.	No rock stabilisation requirements are anticipated: spud can sizing aims to ensure adequate soil strength for the stability of the JUV. A JUV will be used in support of OSCPs commissioning while DP vessels will be used in support of other activities e.g. IACs installation and FTU installation (mooring hook-up).
NatureScot	Study Area The Study Area for the Benthic Ecology assessment is detailed in Section 9.3 of the Scoping Report. We agree with the Zone of Influence (ZoI) of 20 km, based on the approximate extent of two mean tidal excursions.	Noted. This chapter has used a ZoI of 20 km (Section 10.4.1).
NatureScot	Baseline characterisation We agree that the data sources listed in Table 9-3, which include existing data sources and site-specific surveys, are sufficient to inform the Benthic	The report from Pearce, B. and Kimber, J. (2020), has been included in Table 10-1 with Supporting Studies.

CONSULTEE	COMMENT	RESPONSE
	Ecology baseline. We also recommend the following as a useful information source: Pearce, B. and Kimber, J. (2020). 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. Scottish Marine and Freshwater Science. Vol 11, No 17	
NatureScot	Inshore survey strategy As is explained in Section 9.5, we note that the Project is undertaking an inshore survey in 2024 to re-validate the existing NorthConnect data used by the Project to support the baseline characterisation of the inshore Export/Import Cable Corridor (EICC), from HDD exit point to 12 nm spanning a 500 m corridor. We are aware that this survey took place in March 2024. The survey employed a hull mounted Multibeam Echosounder (MBES) to assess changes to the seabed, and drop-down video (DDV) transects to assess changes to key habitats and species. We have previously provided advice to the Applicant on this survey (by email on 21st March and 16th April 2024). Overall, we were content with the inshore survey strategy proposal.	Noted. An inshore survey took place in March 2024 (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). This survey included geophysical (MBES) acquisition across a 150 m corridor along the full EICC from the HDD point to 12 NM spanning a 150 m corridor. Ground-truthing camera transects were undertaken to investigate the habitats present, particularly in areas of high reflectivity. Findings from this survey have been incorporated in Section 10.4 (e.g., Section 10.4.3.2.2).
NatureScot	Other comments As noted by JNCC, we consider that there is currently no single method that effectively surveys or monitors the population status of *Arctica islandica* (ocean quahog) in situ. We therefore would suggest that developers do not undertake any systematic survey for *A. islandica* unless agreed with the regulator or consultees. We recommend that where possible, this species is avoided as much as practically possible by	As suggested, no systematic survey has been undertaken for ocean quahog. Where possible, areas of high aggregations of this species will be avoided by the Project. Reductions in the worst-case assumptions of seabed footprint between EIA Scoping in 2024 and this EIAR can be found in EIAR Vol. 2, Chapter 4: Site Selection and Consideration of Alternatives and EIAR Vol. 2, Chapter 5: Project Description. In summary, minimisation of seabed footprint has been achieved by:

CONSULTEE	COMMENT	RESPONSE
	minimising the seabed footprint of the Project or avoiding known areas of high concentrations.	• A commitment to minimising rock protection within the East of Gannet and Montrose Fields NCMPA (restricting rock placement within the Array Area to crossings and the base of the OSCPs only). It should be mentioned that rock protection will take place out with the East of Gannet and Montrose Fields NCMPA (see Table 10-14 and Table 10-15); • No use of rock as scour protection for OSCPs foundations. Scour protection methods to include scour reduction strakes and tubular sleeves, with no additional seabed footprint to the existing seabed area of the OSCPs mudmats / piles. Also, no scour protection assumed for FTU foundations. • A reduction in worst-case assumptions for Export/Import Cable and IACs trench corridor widths; and • A reduction in worst-case assumptions for seabed disturbance from FTU sub-structure chains and anchors.
NatureScot	Note that in paragraph 9.5.2.18, the NCMPA name is incorrect. It should be East of Gannet and Montrose Fields NCMPA.	This chapter refers to the East of Gannet and Montrose Fields NCMPA.
NatureScot	Impact pathways The potential impacts on Benthic Ecology are summarised in Table 9-6. We are generally content that all potential impacts have been identified for benthic receptors. One exception is for the "introduction of INNS" impact pathway, the justification provided in Table 9-6 only includes Invasive Non-Native Species (INNS) from vessels and hard substrate for cable protection. Other sources may include, for example, floating structures which may be towed into position and / or towed during maintenance activities (if required), and wet storage of floating structures (if required). Even if floating substructures / units will be towed from a UK port, there are still	Potential impacts from the introduction of INNS have been assessed (Section 10.6.1.3 and Section 10.6.2.6). This chapter has assessed INNS-related potential impacts for vessels, towing of floating infrastructures, pre-laying of infrastructure prior to being installed as well as the potential role of hard substrates acting as a stepping stone for the dispersal of INNS. (Section 10.6.1.3 and Section 10.6.2.6).

CONSULTEE	COMMENT	RESPONSE
	INNS present in certain ports around the UK which could pose a risk if transferred elsewhere in UK waters. Therefore, INNS from any source should be scoped in, not just vessels and hard substrate. Moreover, the potential for offshore wind farms to act as stepping stones for INNS should be considered in the EIA Report. Although there are mitigation measures (i.e. management plans) which can help reduce the risks, there is still a lot of uncertainty around their effectiveness to reduce the spread of INNS.	
NatureScot	Impact pathways As noted by JNCC, "temporary impacts to the seabed and benthic habitats" should be screened in for the operation and maintenance phase due to potential use of jack up vessels and / or anchorage of vessels during planned and unplanned maintenance and for wet storage of cables when devices need to be taken ashore for repair. These activities were all highlighted in previous Sections of the Scoping Report. In addition, "long term impacts to the seabed and benthic habitats" should be screened in for all phases due to the use of materials (e.g. rock dump) for stabilisation, protection (including scour protection), and remediation that will be required and should be considered a permanent impact, although these have not been addressed in the Scoping Report. Infrastructure that will not be removed at decommissioning (e.g. cables, piles, or anchor parts) will also have a long-term permanent impact. Remediation of mooring and anchor depressions within the offshore deep sea mud habitat has, with other industries, required a substantial quantity of rock dump which has not been accounted for here.	Temporary impacts to the seabed and benthic habitats during the operation and maintenance phase have been screened in, where appropriate (Table 10-9, Section 10.6.2.1). The 'long-term impacts to the seabed and benthic habitats' have been scoped in and assessed for the construction and for the operation and maintenance phases (Table 10-9, Section 10.6.2.2). It is acknowledged that although the introduction of hard substrates can take place during the construction phase it is during the operation and maintenance phase that any potential long-term environmental impacts will take place (and potentially during / after decommissioning for any infrastructure that may be left in situ). Since it is a single impact occurring across different phases, with the majority occurring during operation and maintenance phase, it is assessed once in that phase to avoid duplication.

CONSULTEE	COMMENT	RESPONSE
NatureScot	Impact pathways The impact pathway "introduction of hard substrate in a predominantly sedimentary environment" should be screened in for all phases for the same reasoning as that detailed for 'long term impacts to the seabed and benthic habitats' (see above comment), for example with respect to rock dump.	The impact pathway 'Introduction of hard substrate in a predominantly sedimentary environment' has been scoped in and assessed for the 'Construction' (Table 10-9, Section 10.6.1.3) and the 'Operation and Maintenance' phases (Table 10-9, Section 10.6.2.3). It is acknowledged that although the introduction of hard substrates in a predominantly sedimentary environment can take place during the construction phase it is during the operation and maintenance phase that any potential long-term environmental impacts will take place (and potentially during / after decommissioning for any infrastructure that may be left in situ). Since it is a single impact occurring across different phases, with the long-term effect occurring throughout the operation and maintenance phase, it is assessed once in that phase to avoid duplication. In the Scoping Report, the impact pathways 'Introduction of hard substrates in a predominantly sedimentary environment' and 'Increased predation' were presented as two separate impact pathways. As they are regarded to be closely associated, in this chapter they have been as assessed as a single impact pathway entitled 'Introduction of hard substrates in a predominantly sedimentary environment / increased predation' (Table 10-9, Section 10.6.2.3).
NatureScot	Impact pathways Provided that Horizontal Directional Drilling (HDD) is used and there are no other activities that have the potential to impact the intertidal region, we agree that "landfall works may disturb intertidal habitats and species" can be scoped out of the assessment.	Interactions with Benthic Ecology receptors in the intertidal zone will be avoided because the Export/Import Cable will be installed by HDD.

CONSULTEE	COMMENT	RESPONSE
NatureScot	Impact pathways We also agree that "accidental spills to the marine environment" can be scoped out of the assessment. This advice is based on the inclusion of standard and well-established preventative measures confirmed as embedded mitigation.	Accidental releases to the marine environment have been scoped out of this assessment. All mitigation measures are detailed in Section 10.5.4 (Table 10-13).
NatureScot	Impact pathways In Appendix 5F, Section 1.2.2.7, the Applicant states that they are seeking further discussion with a view to scoping out EMF. The summary in Section 1.2.3.2 of Appendix 5F states that EMF is scoped out for benthic invertebrates. This contradicts Table 9-6 of the Scoping Report, which suggests it is scoped in for the operation and maintenance phase. We advise that impacts of EMF on benthic invertebrates should be scoped in, based on the uncertainties around impacts, and especially given the size of the development. Even if the assessment is only qualitative, this will give some idea of the significance of the impact and the need for mitigation and monitoring.	The impact pathway 'Potential effects from EMF and heat generated by cables' is scoped in for the operation and maintenance phase and includes an assessment of potential effects on benthic invertebrates (Section 10.6.2.5).
NatureScot	Impact pathways In the written advice we provided after the Cenos Scoping Workshop (2nd April 2024, by email), it was advised by JNCC and NatureScot that the "removal of hard structures during decommissioning resulting in loss of colonised surfaces" impact pathway should be scoped in, even if it can only be assessed qualitatively. This was advised because we do not have a good understanding of how, when, or if the habitats will return to their pre-impact states. The Applicant has proposed to scope this impact pathway out, however we disagree with the justification provided that the	Following guidance from JNCC and NatureScot the impact pathway 'Removal of hard structures during decommissioning resulting in loss of colonised surfaces' has now been scoped in (Section 10.6.3.1).

CONSULTEE	COMMENT	RESPONSE
	removal of introduced hard substrates represents a return to pre-impact conditions and will promote re-establishment of the soft substrate communities characteristic of the area.	
NatureScot	Approach to assessment Yes, we are content with the proposed approach to assessment, based on the sensitivity and magnitude criteria described in Section 9.11 and Chapter 5. The Applicant is proposing to use the MPA Screening Assessment guidance by the Marine Management Organisation (MMO). It was previously agreed with JNCC that this is a suitable approach for the MPA assessment. Note that in paragraph 9.11.1.7 the NCMPA name is incorrect. It should be East of Gannet and Montrose Fields NCMPA.	The assessment approach followed in this chapter follows the approach described in the Scoping Report e.g., the use of the Guidelines for ecological impact assessment in the UK and Ireland (CIEEM, 2018) and the sensitivity assessments for benthic habitats and species as presented in the MarESA sensitivity assessment (MarLIN, 2024) and FeAST (2024) (Section 10.5). The MPA Assessment uses the MMO Marine Conservation Zone Screening Assessment guidance (MMO, 2013), as agreed. Noted, this chapter refers to East of Gannet and Montrose Fields NCMPA.
NatureScot	Approach to assessment *Basis of Assessment* The key assumptions upon which the Benthic Ecology scoping assessment is based are listed in Section 9.6. JNCC welcomes the acknowledgement that scour protection may be required around the base of foundations, noting that this contradicts the text from paragraph 3.5.2.19. The Applicant will need to consider this and the resulting impact that scour protection will have on the East of Gannet and Montrose Fields NCMPA.	As outlined in EIAR Vol. 2, Chapter 5: Project Description rock would not be used as scour protection for OSCPs foundations. Scour protection methods would include scour reduction strakes and tubular sleeves, with no additional seabed footprint to the existing seabed area of the OSCPs mudmats / piles. No scour protection is assumed for FTU foundations. This impact pathway has been removed from this assessment (Table 10-14 and Table 10-15).

CONSULTEE	COMMENT	RESPONSE
NatureScot	Cumulative Assessment Potential cumulative effects are discussed in Section 9.9. We note that it is stated that the cumulative effects assessment for Benthic Ecology will specifically consider seabed disturbance and consequent effects on benthos within the EICC (if nearby cable or pipeline routes are identified within 20 km), and the cumulative footprint of development within the East of Gannet and Montrose Fields NCMPA. This may be pre-empting findings of the individual assessment. JNCC agrees that the cumulative footprint of development within the East of Gannet and Montrose Fields NCMPA should be considered. However, the cumulative impacts mentioned for the EICC should also be applied to the Array Area. The cumulative effects assessment should include all impacts which may arise from the development and not be limited to the three impacts highlighted in Section 9.9. Furthermore, it should also include any impacts which could be identified as minimal for the individual development but may have impacts when considered cumulatively (such as EMF). Regarding EMF, we have observed a tendency for wind farm projects to reach a no significant effect conclusion for electromagnetic field (EMF) impacts from a cumulative perspective. However, noting the proposed number of offshore wind developments in Scottish waters, we are concerned that the spatial and temporal scale is not being sufficiently considered cumulatively across the network of cables, including those out with of the proposed development. Thus, we advise that EMF impacts are considered in the cumulative assessment.	The assessment of cumulative effects has been completed (Section 10.7).

CONSULTEE	COMMENT	RESPONSE
NatureScot	Mitigation and monitoring In principle, the high-level approach outlined is appropriate to enable an assessment of the potential impacts of the project on Benthic Ecology. The outcome of the assessment will indicate where there are Benthic Ecology impacts and what mitigation may be required. Therefore, we are unable to comment on how this approach relates to mitigation of impacts until we have sight of the results of the impact assessment. We are unsure what is meant by "technical and environmental constraints on the Project".	The approach to the assessment of the potential impacts of the Project on Benthic Ecology receptors is detailed in Section 10.5 and the results of the impact assessment are presented in Section 10.6 of this chapter. The EIAR has been developed using Project engineering and environmental baseline parameters (see e.g. EIAR Vol. 2, Chapter 5: Project Description and Section 10.4) . The terms 'technical and environmental constraints' relate to how 'technical and environmental parameters' influence Project design and mitigation.
NatureScot	Mitigation and monitoring The embedded mitigation measures are detailed in Section 9.7 of the Scoping Report. In principle, we agree that the embedded mitigation measures described provide a suitable means for managing and mitigating the potential effects of the Project on Benthic Ecology receptors. However, we note that most proposed mitigation measures are based around future plans rather than specific measures. In addition, further mitigation and monitoring may be needed if impacts are predicted. Where possible, we encourage consideration of collaborating and contributing to strategic monitoring of EMF impacts from cables (for example, through ScotMER), to help build understanding of these poorly understood impacts.	Embedded mitigation measures and monitoring measures are detailed in Table 10-13 in Section 10.5.4 EMF studies have been undertaken. Please see EIAR Vol. 4, Appendix 14A: EMF Assessment Report Vol. 1 and EIAR Vol. 4, Appendix 14B: EMF Assessment Report Vol. 2. For contribution to ScotMER please see Section 10.4.7.

CONSULTEE	COMMENT	RESPONSE
NatureScot	Transboundary impacts Potential transboundary effects on Benthic Ecology is considered in Section 9.10 of the Scoping Report and Appendix 5D: Transboundary Screening Matrix. We agree that Benthic Ecology should be scoped out for the assessment of transboundary effects.	There is no potential for transboundary impacts upon Benthic Ecology receptors due to construction, operation and maintenance and decommissioning of the Project. The potential impacts are localised and are not expected to affect other EEA states. This is primarily due to the fact that the Project is entirely within the UKCS with a localised footprint. Transboundary effects have been scoped out of this Benthic Ecology assessment.
NatureScot	Summary – Paragraph 9.12.1.5 As noted by JNCC, a clear distinction of all impacts and footprints need to be provided for the East of Gannet and Montrose Fields NCMPA and Turbot Bank NCMPA to allow for accurate assessment of the overall impact. We take this opportunity to emphasise the importance of assessing all potential operational impact pathways in combination with the Site Information Centre documents on the JNCC website for East of Gannet and Montrose Fields NCMPA[2] and Turbot Bank NCMPA[3]. Where assessment of potential impacts occur, they must be on a per-feature basis.	The potential impacts of the Project on Turbot Bank NCMPA's sandeel are assessed in the EIAR Vol. 3, Chapter 13: Fish and Shellfish Ecology and the MPA Assessment. An assessment of proposed operations on the designated features of the NCMPAs is presented in the MPA Assessment. In this chapter, information about the Project seabed footprint in NCMPAs has been included, where relevant (e.g., Section 10.5.6.3, Section 10.6.1 and Section 10.6.2).
JNCC	East of Gannet and Montrose Fields NCMPA This NCMPA is designated for "Offshore deep sea muds" and "Ocean quahog aggregations (including sands and gravels as their supporting habitat)" with the Array Area positioned within the 'Offshore deep sea mud' habitat. The current conservation objective for the 'Offshore deep sea mud' habitat is to 'Recover' the structure and function and to	The new conservation advice package for East of Gannet and Montrose Fields NCMPA (JNCC, 2024) has been taken into account. The MPA Assessment considers the conservation objectives for the NCMPA using the new conservation advice package (JNCC, 2024). This chapter assesses all potential operational impact-pathways in combination with the Site Information documents on the JNCC website.

[2] https://jncc.gov.uk/our-work/east-of-gannet-and-montrose-fields-mpa/
[3] https://jncc.gov.uk/our-work/turbot-bank-mpa/

CONSULTEE	COMMENT	RESPONSE
	'Conserve' both the extent and distribution and supporting processes. The current conservation objective for the 'Ocean quahog aggregations (including sands and gravels as their supporting habitat)' is 'Conserve'. It should be noted that a new conservation advice package for this NCMPA will be published early to mid Q2 2024 which will need to be taken into consideration in the environmental impact assessment. We take this opportunity to emphasise the importance of assessing all potential operational impact-pathways in combination with the Site Information Centre documents on the JNCC website[4].	
JNCC	East of Gannet and Montrose Fields NCMPA As the project is entirely within the East of Gannet and Montrose Fields NCMPA, a comprehensive, standalone NCMPA assessment will be needed, which fully considers the features of the site and their conservation objectives. The standalone NCMPA assessment, against the conservation objectives for the features of the site, needs to consider all relevant activities (e.g. installation of turbines, anchors, cables and Export/Import Cables, remediation / protection works, decommissioning, etc.) and should ensure all relevant ecological information is included in that assessment. Cross referencing between chapters should be limited or, if used exceptionally, clearly stated. It also must consider cumulative aspects for the site. Where assessment of potential impacts occur, they must be on a per-feature basis, not solely a per site basis. We also highlight at this early stage, the potential, if the proposed development is consented, on the need to implement Measures of Equivalent Environmental Benefit (MEEB) if assessed to have significant effects on the NCMPA conservation objectives.	Quantification of seabed footprint on the designated features of the East of Gannet and Montrose Fields NCMPA has been provided (e.g., Table 10-16, Section 10.5.6.2, Section 10.5.6.3, Section 10.6.1 and Section 10.6.2). A comprehensive, standalone MPA Assessment has been provided. Cross referencing has been limited and where used, clearly stated.

[4] https://jncc.gov.uk/our-work/east-of-gannet-and-montrose-fields-mpa/

CONSULTEE	COMMENT	RESPONSE
JNCC	East of Gannet and Montrose Fields NCMPA As this is an Innovation and Targeted Oil & Gas (INTOG) licenced project with the purpose of decarbonising the offshore oil and gas industry, we would expect to see all cable connections fully detailed within the documentation to allow JNCC to fully assess the impact which this proposed development could have on the East of Gannet and Montrose Fields NCMPA. Clear details of which oil and gas infrastructure the proposed development will be connecting into, proposed cable routing, all crossings, and remediation is crucial information required in this regard throughout all phases of the project. Connections to the oil and gas industry are a fundamental element of the Targeted Oil and Gas (TOG) project, a "project connected directly to oil and gas infrastructure, to provide electricity and reduce the carbon emissions associated with production"[5], and as such this information should be included to allow a complete assessment of potential impacts to the NCMPA. Without details of the onward oil and gas connection routes, it is hard to understand how the project falls within the remits of an INTOG project, as detailed by Crown Estate Scotland, and justifies its location within an NCMPA. It is JNCC's view that without this information, the project alone details are incomplete and therefore unable to be fully assessed (please refer to our comments below on Chapter 1). Impacts of this project are further complicated as there is a delay to the Sectoral Marine Plan Iterative Plan Review, which will include INTOG sites. We (JNCC and NatureScot) have raised concerns relating to this proposed development as part of the Sectoral Marine Plan Iterative Plan Review as to the suitability of siting development within a NCMPA.	The Onward Development Connections for oil and gas decarbonisation will be defined and brought forward by 3rd party oil and gas operators, subject to separate marine licensing and permitting requirements. At this very early stage in the process, the information available about these Onward Development Connections is limited and cannot be confirmed by the Project. In accordance with standard practice and relevant industry guidance, the level of information available means there is insufficient detail to enable inclusion within a cumulative effects assessment. However, recognising industry feedback and a keen interest in this topic from stakeholders, the Applicant has voluntarily provided an assessment of the combined impact of the Project and the potential onward connections. Please refer to EIAR Vol 3, Chapter 22: Statement of Combined Effect for further details. EIAR Vol. 2, Chapter 2: Need for the Project provides justification for this Project.

[5] *Crown Estate Scotland: https://www.crownestatescotland.com/scotlands-property/offshore-wind/intog-leasing-round*

CONSULTEE	COMMENT	RESPONSE
JNCC	East of Gannet and Montrose Fields NCMPA On a number of occasions throughout the document, the Applicant has not referred to the East of Gannet and Montrose Fields NCMPA correctly and / or not detailed the correct designations for this protected site. We have highlighted some of these instances in our advice, but we would strongly suggest that the Applicant ensures that this information is correct throughout all subsequent documentation. Considering the Array Area and parts of the EICC, and additional cabling (not detailed in the documentation) are within this NCMPA, it is disappointing that the Applicant has not prioritised these details.	The correct reference to the East of Gannet and Montrose Fields NCMPA has been used in the EIAR.
JNCC	Turbot Bank NCMPA Turbot Bank NCMPA is designated for "Sandeels". The protected feature of the site ('Sandeels') is considered to be in 'Favourable' condition. The Conservation Objective for the Turbot Bank NCMPA is that the protected feature, 'Sandeels', so far as already in favourable condition, remain in such condition; and so far as not already in favourable condition, be brought into such condition, and remain in such condition. With respect to the 'Sandeels', this means that the quality and quantity of its habitat and the composition of its population are such that they ensure that the population is maintained in numbers which enable it to thrive. We take this opportunity to emphasise the importance of assessing all potential operational impact-pathways in combination with the Site Information Centre documents on the JNCC website[6].	The potential impacts of the Project on the Turbot Bank NCMPA's designated feature, sandeel are assessed in the EIAR Vol. 3, Chapter 13: Fish and Shellfish Ecology. As no direct seabed impacts will occur to this site, an assessment of the Turbot Bank NCMPA is not included in this chapter. The Draft Fisheries Assessment – Turbot Bank NCMPA used a radius of 5 km to capture any potential source-receptor pathways that could impact the site in combination with effects of the fishing activities assessed (Scottish Government, 2024a). This distance is less than the distance between the Turbot Bank NCMPA and the EICC (i.e., 6 km to the south at the closest point). See the MPA Assessment for more information.

[6] https://jncc.gov.uk/our-work/turbot-bank-mpa/

CONSULTEE	COMMENT	RESPONSE
JNCC	As the project is in close proximity to Turbot Bank NCMPA, a comprehensive, standalone MPA assessment will be needed, which considers the features of the site and their conservation objectives. The standalone NCMPA assessment, against the conservation objectives for the site, needs to consider all relevant activities and should ensure all relevant ecological information is included in that assessment. Cross referencing between chapters should be limited or, if used exceptionally, clearly stated. It also must consider cumulative aspects for the site.	A standalone MPA Assessment for the East of Gannet and Montrose Fields NCMPA, Turbot Bank NCMPA, and Southern Trench NCMPA is provided alongside the EIAR to consider all relevant Project activities and cumulative impacts, with limited cross-referencing between chapters.
JNCC	Appendix 5A: Survey Strategy It is not possible for JNCC to comment on the survey sufficiency due to a lack of information provided for sampling and survey stations within the NCMPA. As a minimum, a map needs to be provided detailing all survey locations within the NCMPA boundary and in relation to the Array Area, EICC, and buffer.	Maps in this chapter (Figure 10-4 and Figure 10-7) provide information about sampling and survey stations.
JNCC	Appendix 5A: Survey Strategy Table 1-3: Although information on Drop Down Video (DDV) and grab samples have been provided along the ECC, details of how many samples were taken within the area of overlap between the ECC and the NCMPA need to be provided to allow for a complete assessment on the appropriateness of survey information within the site.	Maps in this chapter (Figure 10-4 and Figure 10-7) provide information about the spatial distribution / number of sampling stations in the EICC and Array Area that intersect with the East of Gannett and Montrose Fields NCMPA.
JNCC	Appendix 5E: Marine Protected Area Screening Assessment Table 1-1: The comment listed in this table from JNCC was not related to the EIA Scoping Report and was in fact related to a standalone application for a survey. This error has been raised with the Applicant previously by email on 5 February 2024 and subsequently on 20 February	This comment is addressed as part of the MPA Assessment.

CONSULTEE	COMMENT	RESPONSE
	2024 and was subsequently acknowledged by the Applicant with an assurance that it would be corrected. To reiterate those comments from the original communication, our position would be that we feel that including this line of advice within this table is misleading with lines prior to and subsequent lines all related to the project level 2023 EIA Scoping Report. We would therefore request, again, that they are removed from the table in its current format. We would suggest that if the information is deemed important to the project, that an additional table is created to capture that information in the correct context.	
JNCC	Appendix 5E: Marine Protected Area Screening Assessment Table 1-2: The column heading 'Protected features' should be changed to 'Designated features'. 'Protected Features' can imply a much larger number of species and / or habitats that are present within the NCMPA but which the NCMPA is not designated for. Table 1-2: The designated features listed for this site are incorrect. The site is designated for "Offshore deep sea muds" and "Ocean quahog aggregations (including sands and gravels as their supporting habitat)". Table 1-2: Due to the increased anthropogenic activity within East of Gannet and Montrose Fields NCMPA, JNCC are in the process of updating the site conservation objectives. It is expected that these will be available towards early to mid Q2 2024 and will need to be taken into consideration in the environmental impact assessment. Table 1-2: The designated features listed for East of Gannet and Montrose Fields NCMPA are incorrect. The site is designated for "Offshore deep sea	Noted. These comments have been addressed in the MPA Assessment.

CONSULTEE	COMMENT	RESPONSE
	muds" and "Ocean quahog aggregations (including sands and gravels as their supporting habitat)". We suggest that this column is checked against each Site Information Centre and updated for all listed Sites.	
JNCC	Appendix 5E: Marine Protected Area Screening Assessment Table 1-3: For benthic features receptors, "Direct impact / disturbance leading to temporary or long-term habitat loss" and "Alterations to the local habitat through introduction of hard surfaces" should be screened in for all phases. The Applicant has not fully addressed the use of hard materials, such as rock dump, for aspects of protection, stabilisation, scour, and remediation. These introductions would be considered a permanent impact to the habitat and permanent change of habitat. This comment also applies to Table 1-4 for East of Gannet and Montrose Fields NCMPA of the same Appendix and subsequently an update to Table 1-5.	The impact pathway 'Temporary impacts to the seabed and benthic habitats'; have been scoped in both for the construction and operation and maintenance phases (Sections 10.6.1.1 and 10.6.2.1, Table 10-9). The impact pathway 'Long-term impacts to the seabed and benthic habitats' have been scoped in only for the operation and maintenance phase (Section 10.6.2.2, Table 10-9).; as described above it is acknowledged that infrastructure / hard substrates are installed during the construction phase but actually any potential impacts take place during the operation and maintenance phase. The impact pathway 'Introduction of hard substrates in a predominantly sedimentary environment…' has been scoped in for both construction and operation and maintenance phases (Table 10-9) and assessed under the operation and maintenance phase (Section 10.6.2.2).
	Table 1-3: Although JNCC agree with the potential impact "Localised damage to sensitive epifauna (e.g., seapens) due to operational mooring lines", it is very specific relating to operational mooring lines only. Has the Applicant considered instances of mooring lines during construction and decommissioning, for example in relation with the OSCP(s)? These should be taken into account.	The assessment of potential environmental impacts during the operation and maintenance phase has assessed fully the potential long-term effects arising from the installation of infrastructure and hard substrates (Table 10-9, Section 10.6.2.2). Mooring lines will be used only with FTUs (please see Table 10-14 and Table 10-15). Given that decommissioning activities will largely be a reversal of the installation process, the impacts during decommissioning are expected to be similar in extent or less than those assessed for the construction phase.

CONSULTEE	COMMENT	RESPONSE
		Information about potential effects during decommissioning a provided in Section 10.6.3.
JNCC	Appendix 5E: Marine Protected Area Screening Assessment Table 1-4: Turbot Bank NCMPA has a potential impact of "Direct impact / disturbance leading to temporary or long-term habitat loss" for all three phases. This is not consistent with earlier entries for the same potential impact but for East of Gannet and Montrose Fields NCMPA where the Array Area and part of the ECC is located. Turbot Bank NCMPA is located 6 km away from the ECC according to Table 1-2 which would imply that a direct impact would be less likely at Turbot Bank NCMPA. We suggest that the information within this table (Table 1-4) is critically reviewed and updated for inconsistencies.	Noted. This comment is addressed in the MPA Assessment.
JNCC	Appendix 5E: Marine Protected Area Screening Assessment Table 1-5: The designated features listed for this site are incorrect. The site is designated for "Offshore deep sea muds" and "Ocean quahog aggregations (including sands and gravels as their supporting habitat)". Table 1-5: Table 1-5 needs to be updated based on comments from Table 1-3 and Table 1-4 (see above).	The correct designated features are assessed in the EIAR (e.g., Section 10.4.4.4, Section 10.5.6.3, Section 10.6.1, Section 10.6.2).
Scoping Workshop – 29th February 2024		
NatureScot	Non-native species issue. Potential that turbines themselves will have growth of non-native species growing on them and they may be towed	This point has been addressed in Section 10.6.1.1.3 of this chapter.

CONSULTEE	COMMENT	RESPONSE
	to other areas for maintenance. Is there a plan for cleaning them before this happens?	
NatureScot	Where using data or principles of assessment that supported NorthConnect, Cenos needs to include justification or narrative for why it is still relevant.	Benthic Solutions Ltd (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC) has compared the data collected in 2018 for NorthConnect (MMT, 2018) with those collected in 2024. This comparison shows that the outputs from the surveys in 2018 are broadly similar with the outputs from surveys in 2024 (Section 10.4.4.2.3)
NatureScot	Would like to consider in greater detail decommissioning effects relating to habitat loss. Introduction of INNS – addition of hard substrate can act as 'stepping stones' for INNS to be introduced to an area. So would expect to see that scoped in. Scoping in Turbot Bank NCMPA to understand impacts of sediment transport impacts to benthic features of the site. Need to understand sedimentation rates – need certainty that this has been considered and justification provided for scoping out this site.	Potential impacts during decommissioning are addressed in Section 10.6.3 of this chapter. The potential impacts of the Project on sandeel within Turbot Bank NCMPA is assessed in the EIAR Vol. 3, Chapter 13: Fish and Shellfish Ecology. An assessment of proposed activities on the designated features of the NCMPA is presented in the MPA Assessment. A modelling study in relation to suspension and deposition of sediments has been undertaken (EIAR Vol. 4, Appendix 7 – Marine & Physical Processes Modelling Report). The potential effects from increases in suspended sediment concentrations and deposition of sediments are shown in Section 10.6.1.2. An assessment of the proposed activities on the designated features of the Turbot Bank NCMPA is presented in the MPA Assessment.

10.4 Baseline characterisation

This Section outlines the current baseline for Benthic Ecology within the Benthic Ecology Study Area. The baseline has been characterised using site specific surveys, desk-based sources and data sources provided through consultation (Table 10-3).

10.4.1 Study Area

The Benthic Ecology Study Area is defined by the Project Area and a larger area formed by buffers around the Project Area (Figure 10-1).

The Project Area consists of the Array Area and EICC, within which the infrastructure will be installed. The infrastructure includes FTUs consisting of Wind Turbine Generators (WTGs), floating substructures, mooring systems and anchors, in addition to OSCPs and associated foundations, the IACs and Export/Import Cable. This also includes the inshore EICC (0 – 12 NM) along the northeast Aberdeen coast which takes into account the HDD landfall options.

A larger area has been established using a 20 km buffer around the Array Area and the EICC (Figure 10-1) to take into account areas that may be affected by indirect impacts such as sediment suspension and resettlement (also referred to as the ZoI). This is based on the approximate extent of two mean tidal excursions and was agreed by stakeholders in the scoping response from Scottish Ministers, as detailed in Table 10-2.

10.4.2 Data sources

The existing data sets and literature with relevant coverage to the Project, which have been used to inform the baseline characterisation for Benthic Ecology are outlined in Table 10-3. Project specific data obtained and used to inform this topic assessment are presented in Section 10.1.

Table 10-3 Summary of key datasets and reports

TITLE	SOURCE	YEAR	AUTHOR
East of Gannet and Montrose Fields NCMPA Conservation Advice Package	JNCC	2024	JNCC
Southern Trench NCMPA Conservation Advice Package	NatureScot	2024	NatureScot
Marine Evidence-based Sensitivity Assessment (MarESA)	Marine Life Information Network (MarLIN)	2024	Marine Life Information Network (MarLIN)
Feature Activity Sensitivity Tool (FeAST)	FeAST	2024	Scottish Government, NatureScot, Scottish Environmental Protection Agency (SEPA), JNCC
Cenos OWF EIA Scoping Report - Volume I	WSP Environment & Infrastructure Solutions UK Limited	2024	WSP Environment & Infrastructure Solutions UK Limited
Cenos OWF EIA Scoping Report - Volume II: Appendices	WSP Environment & Infrastructure Solutions UK Limited	2024	WSP Environment & Infrastructure Solutions UK Limited
OSPAR Quality Status Report (QSR)	OSPAR[7]	2023	OSPAR
UK Offshore Energy Strategic Environmental Assessment 4 (OESEA4)	DEFRA[8]	2022	DEFRA
EMODnet Map Viewer	EMODnet (European Commission)[9]	2021	European Marine Observation and Data Network (EMODnet)
Southern Trench NCMPA Conservation Advice Package	NatureScot[10]	2020	NatureScot
East of Gannet and Montrose Fields MPA Monitoring Report 2015 (version 2)	JNCC-MSS[11]	2020	McCabe, C., McBreen, F. & O'Connor, J. (2020).
Buchan Ness to Collieston SAC Conservation Advice Package	NatureScot[12]	2019	NatureScot
NorthConnect EIAR	MD-LOT	2018	NorthConnect KS

[7] https://oap.ospar.org/en/ospar-assessments/quality-status-reports/qsr-2023/
[8] https://www.gov.uk/government/consultations/uk-offshore-energy-strategic-environmental-assessment-4-oesea4
[9] https://emodnet.ec.europa.eu/geoviewer/
[10] https://www.nature.scot/doc/possible-nature-conservation-mpa-advice-documents-southern-trench
[11] https://data.jncc.gov.uk/data/78cb6096-16a3-4904-9014-f17fc56d402a/jncc-mss-report-1-v2.pdf
[12] https://apps.snh.gov.uk/sitelink-api/v1/sites/8214/documents/66

TITLE	SOURCE	YEAR	AUTHOR
NorthConnect HVDC Cable Infrastructure EIAR: Volume 1.	NorthConnect KS[13]	2018	NorthConnect KS
CEND19x12: Cruise report for Braemar Pockmarks candidate Special Area Conservation (cSAC), Scanner Pockmark cSAC and Turbot Bank NCMPA proposal	JNCC[14]	2017	JNCC

10.4.3 Project site specific surveys

10.4.3.1 Geophysical survey

10.4.3.1.1 Offshore

Rovco performed a geophysical and environmental survey to help guide future planning for geotechnical investigations and windfarm infrastructure installation within the Array Area between July and September 2023. The geophysical survey acquired MBES, Side Scan Sonar (SSS), magnetometer, Sub-Bottom Profiler (SBP) and 2D ultra-high resolution multichannel seismic data (2D Ultra High-Resolution (UHR)), with associated analysis and reporting. The findings of the geophysical survey in the Array Area are detailed in the 'Geoenvironmental Survey, Cenos OWF Project' (Rovco, 2024a). A summary of key findings from the geophysical survey in the Array Area are given below in Section 10.4.4.1.

The term 'offshore EICC' refers to the part of the EICC that extends beyond 12 NM. Rovco also performed a geophysical and environmental survey of the offshore EICC between July and September 2023. The geophysical survey acquired MBES, SSS, magnetometer, SBP and multi-channel ultra-high resolution seismic data (2D UHR) with associated analysis and reporting. The findings of the geophysical survey in the EICC are detailed in the 'Cenos EICC Geo-environmental Survey' (Rovco, 2024b). A summary of key findings from the geophysical survey in the EICC are given below in Section 10.4.4.1.

10.4.3.1.2 Inshore

The term 'inshore EICC' refers to the part of the EICC that extends from the HDD exit point to 12 NM. MBES and backscatter data were acquired to support the habitat assessment undertaken within the 0-12 NM inshore EICC (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). A survey of the inshore EICC was also undertaken to validate the NorthConnect geophysical / benthic data collected in 2018 (MMT, 2018).

10.4.3.2 Benthic and environmental survey

A benthic and environmental survey including habitat assessment was completed in the Array Area and along the offshore EICC by Rovco and Benthic Solutions Ltd (BSL) between July and September 2023 (EIAR Vol. 4, Appendix 11: Environmental Baseline Report – OWF and EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC). A further habitat assessment survey for the inshore EICC was carried out by SEP Hydrographic Ltd and BSL in March 2024 (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). The paragraphs

[13] https://marine.gov.scot/data/northconnect-hvdc-cable-environmental-impact-assessment-report-volume-1
[14] https://data.jncc.gov.uk/data/14030bfa-8bda-4a20-8dd5-4f93385d6c22/JNCC-Cefas-14A-FINAL-r.pdf

below provide key information about the number of samples collected and analyses carried out for the Array Area, offshore EICC and inshore EICC.

10.4.3.2.1 Offshore

Environmental samples were collected from 30 sites across the Array Area using either a Double Van Veen (DVV) grab or mini-Hamon Grab (HG) (EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF). Ten of these sampling locations were also selected for water sampling at bottom, middle, and surface depths with corresponding Connectivity, Temperature and Depth (CTD) profiles obtained for each. Video footage was collected at 51 sites across the Array Area using BSLMOD4 camera systems in order to ground-truth sampling locations, facilitate the habitat assessment, and ensure robust coverage of the differing habitats identified from review of the acquired geophysical data (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF).

In the Array Area, an Environmental Deoxyribonucleic Acid (eDNA) analysis of sediment samples took also place over the period July – September 2023 (EIAR Vol. 4, Appendix 13: Benthic eDNA Analysis Report). Six of the stations in the Array Area (OWF_02, OWF_18, OWF_24, OWF_32, OWF_33, OWF_42) (Figure 10-4) were selected for the analysis of sediment eDNA. Station selection was undertaken with the intention to provide comprehensive spatial coverage of the Array Area, while ensuring representation of the different sediment types. The eDNA dataset underwent application of a 'benthic' data filter. This 'benthic' filter involved the removal of faunal groups that would not generally be included during traditional benthic macrofauna processing, such as motile fauna and individuals that exist exclusively in the water column and are not representative of environmental conditions at a specific sediment sampling station. These included fish, jellyfish, ctenophores, Chromista, fungi, plants, insects, mud dragons, copepods, Hexanauplia arthropods, ostracods, amoebas, flagellates, and taxa only identified to kingdom, and / or phylum level.

Environmental samples were collected from 20 sites across the EICC using either a DVV grab or mini-HG (EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC). Six of these sampling locations were also selected for water sampling at bottom, middle, and surface depths with corresponding CTD profiles obtained for each. Benthic environmental baseline stations underwent sampling / subsampling for a) particle size distribution (PSD), b) heavy and trace metals (HM), c) hydrocarbons (HC), and d) macrofauna. Video footage was collected at 40 sites across the EICC using camera systems to ground-truth sampling locations, facilitate the habitat assessment and ensure robust coverage of the differing habitats identified from the analysis of the acquired geophysical data (EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC).

10.4.3.2.2 Inshore

The environmental habitat assessment comprised geophysical MBES / backscatter data ground-truthed by video footage and stills. SEP Hydrographic undertook the inshore survey including MBES and Benthic Solutions Ltd managed the environmental aspects (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). Visual data were collected along five camera transects situated within the inshore EICC using a BSL MOD4 camera system fitted with a freshwater lens adaptation to revalidate the habitats identified during surveys carried out in 2018 (MMT, 2018).

In the MMT (2018) surveys a total of three sample locations were used for grab sampling and video / photo documentation, as well as two video transects (Figure 10-9). Video documentation was performed using a Work Class Remotely Operated Vehicle (WROV) mounted DDV camera. Habitats were mapped across the 12 NM section of the EICC route. (MMT, 2018).

10.4.4 Existing baseline

The current baseline environment for Benthic Ecology has been informed primarily by Project site specific surveys (EIAR Vol. 4, Appendix 8: Habitat Assessment Report – OWF, EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC, EIAR Vol. 4, Appendix 11: Environmental Baseline Report – OWF, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC; Rovco, 2024, a, and b) and augmented by a review of literature and available data sources (e.g., European Nature Information System (EUNIS) sediments – Figure 10-1). The following Sections describe the physical characteristics and then discusses the benthic fauna and associated habitats in the Array Area, offshore EICC and inshore EICC.

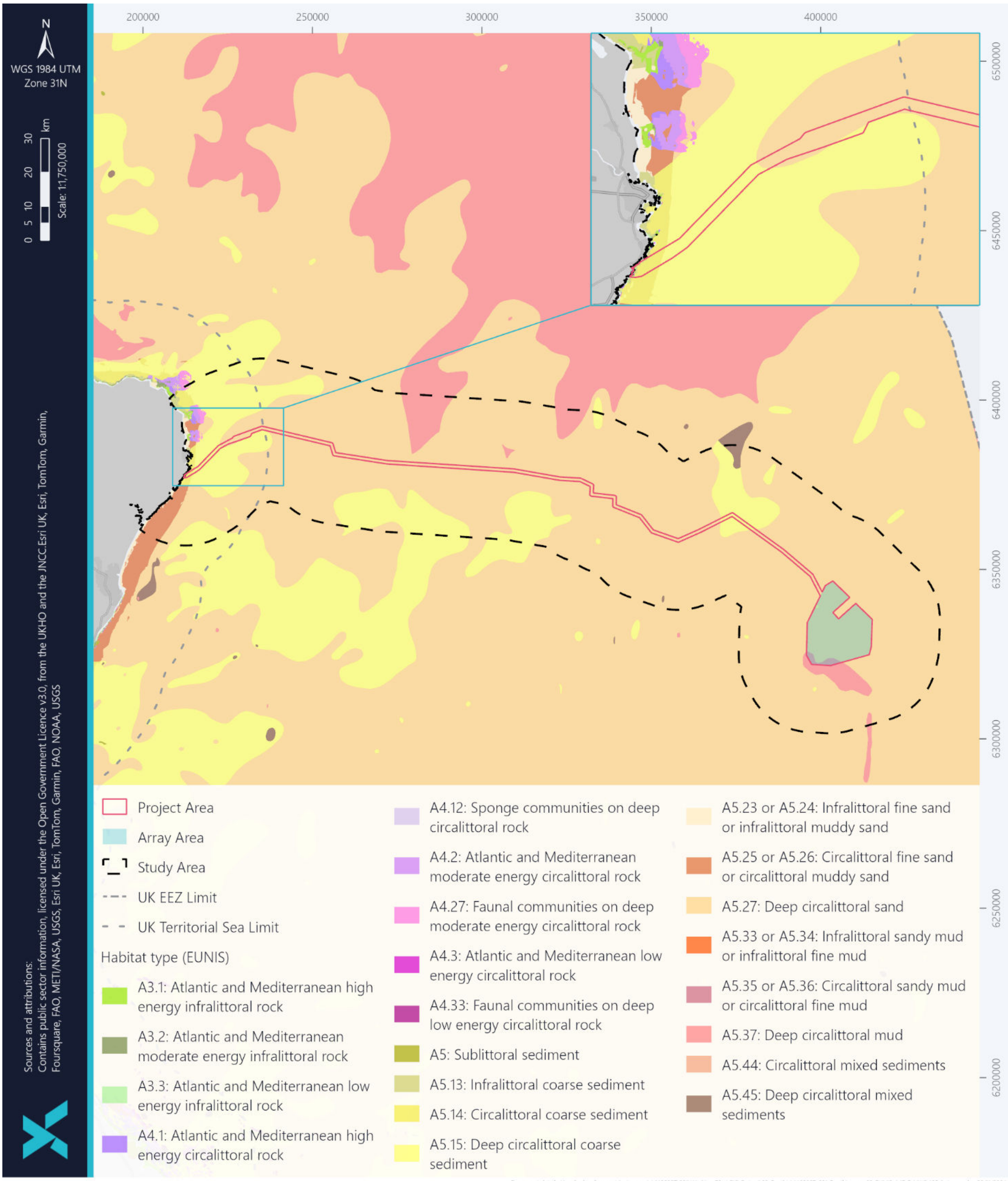

Figure 10-1 Predicted EUNIS sediment types across the Benthic Ecology Study Area

10.4.4.1 Bathymetry and seabed sediments

10.4.4.1.1 Array Area

Bathymetry

The seabed within the Array Area is relatively flat, with water depths across the site ranging from 90-100 m (Rovco, 2024a). The SSS data indicates low to moderate reflectivity across most of the survey area with lower reflectivity areas relating to ambient muddy sand / sand substrate and areas of high reflectivity, which are typically associated with patches of gravel and gravelly sand. To the northwest of the Array Area, the 'Coal Pit Formation' is present in an isolated patch described as sandy silty clay, and silty sand with pebbles, shell fragments and scattered boulders (Rovco, 2024a; EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF).

Seabed sediments

The desk-based study predicts that there are two EUNIS types of sediments within the Array Area i.e. A5.27 'Deep circalittoral sand' and A5.37 'Deep circalittoral mud' (Figure 10-1). These predicted sediments are in partial agreement only with the findings from the site specific surveys as the particle size analysis (PSA) undertaken showed that most stations across the Array Area are primarily composed of sand and muddy sand based on Folk classifications (EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF). AS such, within EIAR Vol. 3, Chapter 8: Marine Geology, Oceanography, and Coastal Processes, the sediments in the Array Area are discussed as being sand dominated but from a Benthic Ecology perspective, the sediments are discussed as being predominantly mud habitats; specifically, when taking into account the macrofaunal analysis from grabs and the habitat assessment from camera transects, the prominent biotope across the Array Area was assigned MD6. 'Offshore circalittoral mud' with relatively low levels of MD.4 'Offshore circalittoral mixed sediment' (Figure 10-2) (EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF). This finding is also consistent with the extensive JNCC survey of the East of Gannet and Montrose field NCMPA from 2015 which reports that the eastern half of the site, which encompasses the Array Area boundary, is broadly comprised of circalittoral mud, while circalittoral sands are prominent in the western portion of the NCMPA (McCabe *et al*. 2020).

Of the 30 stations sampled across the Array Area (Figure 10-4), 28 stations had broadly similar high fines content (30%-50%) and low gravel content. There were two exceptions, with one station (OWF_42) to the southeast that had a much higher gravel content (≥60%) and categorised as muddy sandy gravel. Furthermore, a higher fines content (≥60%) was recorded at one station in the southwest of the Array Area and was described as sandy mud (OWF_49,) (EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF, EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF).

In terms of blue carbon, the greatest contribution of carbonate in the muds is through maceration of foraminifera, this being confined to the deeper water regions of the shelf, whilst in inshore areas the process is dominated by bioerosion (Burrows *et al.*, 2014). The values of carbonate content in the top 10 cm of sediments in the Array Area are predicted to be very low (0-10%) (Burrows *et al.*, 2014; Smeaton *et al.*, 2020). In terms of organic carbon content, muds have among the highest values across habitats; in North Sea samples the mean value of organic carbon is predicted to be 0.88% (ranging from 0.59 to 1.11%) (Smeaton *et al.*, 2020). In terms of sedimentary organic stocks for the Scottish continental shelf, mud is among the habitats with relatively high values of organic carbon (mean value 11.6 megatons) (Smeaton *et al.*, 2020). The mean value of organic carbon density for muds is 5.1 tonnes / hectare (Smeaton *et al.*, 2020). In the Array Area the surficial sediment (0-10 cm) organic carbon density values are predicted to be approximately 4-7 tonnes / hectare (Smeaton *et al.*, 2020).

Scotland's offshore sands and gravel are different to the rest of the UK in that the biogenic carbonate content is higher. British Geological Survey (BGS) sediment samples, taken using surface sediment grabs since the early 1970s and analysed for carbonate content, show that the surface sandy sediments around Scotland comprises 30-90% carbonate (Burrows *et al.*, 2014). The values of carbonate content in the top 10 cm of sediments in the Array Area are predicted to be very low (0-10%) (Burrows *et al.*, 2014; Smeaton *et al.*, 2020); In terms of organic carbon content, the sedimentary types of 'gravelly sand' and 'sandy gravel' have relatively low values of organic carbon density i.e. mean values of 3.5 and 1.8 tonnes / hectare (Smeaton *et al.*, 2020). Further information about blue carbon can be found in the EIAR Vol. 3, Chapter 20: Carbon and Greenhouse Gases.

Site specific surveys in the Array Area showed that Total Organic Carbon (TOC) and Total Organic Matter (TOM) levels are low and consistent across the Array Area with higher levels recorded at stations with higher proportions of fines (EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF). Specifically, the median value of TOC in the Array Area is 0.39% (ranging from 0.22 to 0.51%) while the median value of TOM is 2.1% (ranging from 1.6 to 2.9%) (EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF). More detail of the sediment across the Array Area is provided in EIAR Vol. 4, Appendix 8: Habitat Assessment Report – OWF, EIAR Vol. 4, Appendix 11: Environmental Baseline Report – OWF and in EIAR Vol. 3, Chapter 8: Marine Geology, Oceanography and Coastal Processes and EIAR Vol. 3, Chapter 9: Marine Water and Sediment Quality.

Total Hydrocarbon Content (THC) concentrations are fairly consistent across the Array Area (EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF). Slightly higher THC concentrations are recorded at stations in the southerly area of the Array Area, but concentrations are below upper reference thresholds for the Central North Sea (CNS). Similar to THC, total n-alkane concentration is fairly consistent across the Array Area. Hydrocarbon signatures are indicative of those typically seen for background sediments on the UK Continental Shelf (UKCS) with no sign of anthropogenic contamination (EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF). Total Polycyclic Aromatic Hydrocarbons (PAHs) are moderate with all stations above the United Kingdom Offshore Operators Association (UKOOA) (2001) 50th percentile reference level for background stations in the CNS (109 µg / kg), but all stations being below the 95th percentile reference value (583 µg / kg) (EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF).

The concentration of nine metals are above their respective UK Offshore Operators Association (OOA) CNS 50th percentile reference values for at least ten stations. The reasons driving these relatively high values of metals could be attributed to natural environmental variability, human impacts or a combination. Muddy sediments tend to have naturally higher associated metal (and other contaminants) concentrations (Zhang *et al.*, 2014, van Daele *et al.*, 2024). These same nine metals also have concentrations elevated above their respective UKOOA 95th percentile reference value or their OSPAR Effects Range Low (ERL) thresholds. Arsenic concentrations across ten stations are elevated above the OSPAR ERL reference value of 8.2 mg / kg. Across five of those ten stations, lead and zinc also exceeded National Oceanic and Atmospheric Administration (NOAA) ERL thresholds (EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF).

Figure 10-2 Types of sediments (site specific surveys) and average number of large burrows per m^2 in the Array Area

10.4.4.1.2 Offshore EICC

Bathymetry

Within the 12 NM to Array Area section of the EICC, water depths ranged from 78-107 m below Lowest Astronomical Tide (LAT) (EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC; Rovco, 2024b). The SSS data indicated low to medium reflectivity across most of the EICC survey route with lower reflectivity areas relating to ambient muddy sand / sand / sandy mud substrate. Areas of high reflectivity are typically associated with patches of shell fragments and pebbles or isolated areas of mixed sediment (EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC; Rovco, 2024b).

Seabed sediments

The broad habitat maps compiled from desk-based studies predicted that there are three EUNIS sediment types along the EICC i.e. A5.27 'Deep circalittoral sand', A5.15 'Deep circalittoral coarse sediment' and A5.37 'Deep circalittoral mud' (Figure 10-1). These predicted sediment types are corroborated by the results of PSA, which indicated that the majority of the EICC survey area is composed of sand, with moderate proportions of fines and minimal proportions of gravel (Figure 10-3) (EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC).

The values of carbonate content in the top 10 cm of sediments in the greatest extent of the EICC are predicted to be very low (0-10%) (Burrows *et al.*, 2014; Smeaton *et al.*, 2020); close to the shore, higher values of carbonate contents (approximately 40-50%) are predicted (Smeaton et al., 2020). As regards organic carbon, in the largest part of the EICC the surficial sediment (0-10 cm) organic carbon density has higher values (approximately 4-7 tonnes / hectare) compared to EICC parts that are closer to the shore (0-4 tonnes / hectare) (Smeaton *et al.*, 2020). As regards carbon content in subtidal sands and gravels, for most of the EICC the values of carbonates are predicted to be very low (0-10%) (Burrows *et al.*, 2014; Smeaton *et al.*, 2020); close to the shore, higher values of carbonate contents (approximately 40-50%) are recorded (Smeaton *et al.*, 2020). As regards organic carbon, in the largest extent of the EICC the surficial sediment (0-10 cm) organic carbon density is predicted to be higher (values approximately 4-7 tonnes / hectare) compared to EICC parts that are closer to the shore (0-4 tonnes / hectare) (Smeaton *et al.*, 2020).

Site specific surveys in the EICC showed that TOC and TOM levels are relatively low and consistent across most of the EICC. Based on the surveys carried out in 2024 in the offshore EICC, the median value of TOC is 0.22% (ranging from 0.13 to 0.27%) while the median TOM is 1.25% (ranging from 0.9 to 1.9%) (EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC). In the inshore EICC, studies carried out in 2018 showed that the median of TOC is 0.31% (ranging from 0.23 to 0.35%; values on TOM for inshore EICC are not available) (MMT, 2018). Information about blue carbon on benthic species associated with geogenic reefs is limited compared to those available for sediments. Bryozoans (e.g., the species *F. foliacea*) has been recorded in boulders in the EICC (e.g., EIAR Vol. 4, Appendix 9: Habitat Assessment Report - EICC, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC). Analysis of the carbon content from the dense turf of *F. foliacea* colonies in Orkney, mention an estimated area-specific density of 503 g C / m^2, including both organic carbon (473 g / m^2; approximately 94%) and inorganic carbon (30 g / m^2; approximately 6%) components (Porter *et al.*, 2020). The inorganic carbon fraction only makes up a small fraction of the species total carbon with Porter *et al.* (2020) reporting an inorganic carbon density of 0.3 tonnes inorganic carbon / hectare compared to 6.6 tonnes organic carbon / hectare (Cunningham and Hunt, 2023). Dense beds of ophiuroids may also serve as a stock of carbon (Burrows *et al.*, 2017; Cunningham and Hunt, 2023). Ophiuroid beds have been recorded in the Southern Trench NCMPA (Burrows *et al.*, 2017); however, their contribution to the carbon stocks of that NCMPA are very small (e.g., < 0.01% of standing stock of inorganic and organic carbon) compared to other ecosystem components such as intertidal macroalgae and kelp beds (Burrows *et al.*, 2017).

Further information about blue carbon in the EICC can be found in the EIAR Vol. 3, Chapter 20: Carbon and Greenhouse Gases.

THC concentrations are fairly consistent across the offshore EICC relating to the general sand dominated habitats. Similar to THC, total n-alkane concentration is fairly consistent across the EICC. Gas chromatographic traces showed hydrocarbon signatures indicative of those typically seen for background sediments on the UKCS with no sign of anthropogenic contamination (EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC).

Total PAH levels are low at all stations. Extractable organic halogens, organotin compounds and organochlorine pesticides were below their respective limit of detection at every station. All stations recorded polychlorinated biphenyls (PCBs)either below their respective limits of detection or in low concentrations below OSPAR Environmental Assessment Criteria (EAC) thresholds. The only Polybrominated Diphenyl Ether (PBDE) which is above the detection limit is PBDE 209, but results are low throughout (EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC).

The concentration of seven metals are above their respective UKOOA CNS 50^{th} percentile reference values for at least fifteen stations. Whilst the three of these metals also had concentrations elevated above their respective UKOOA 95^{th} percentile reference value or their OSPAR ERL thresholds. Arsenic concentrations across two stations are elevated above the OSPAR ERL reference value of 8.2mg / kg (EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC).

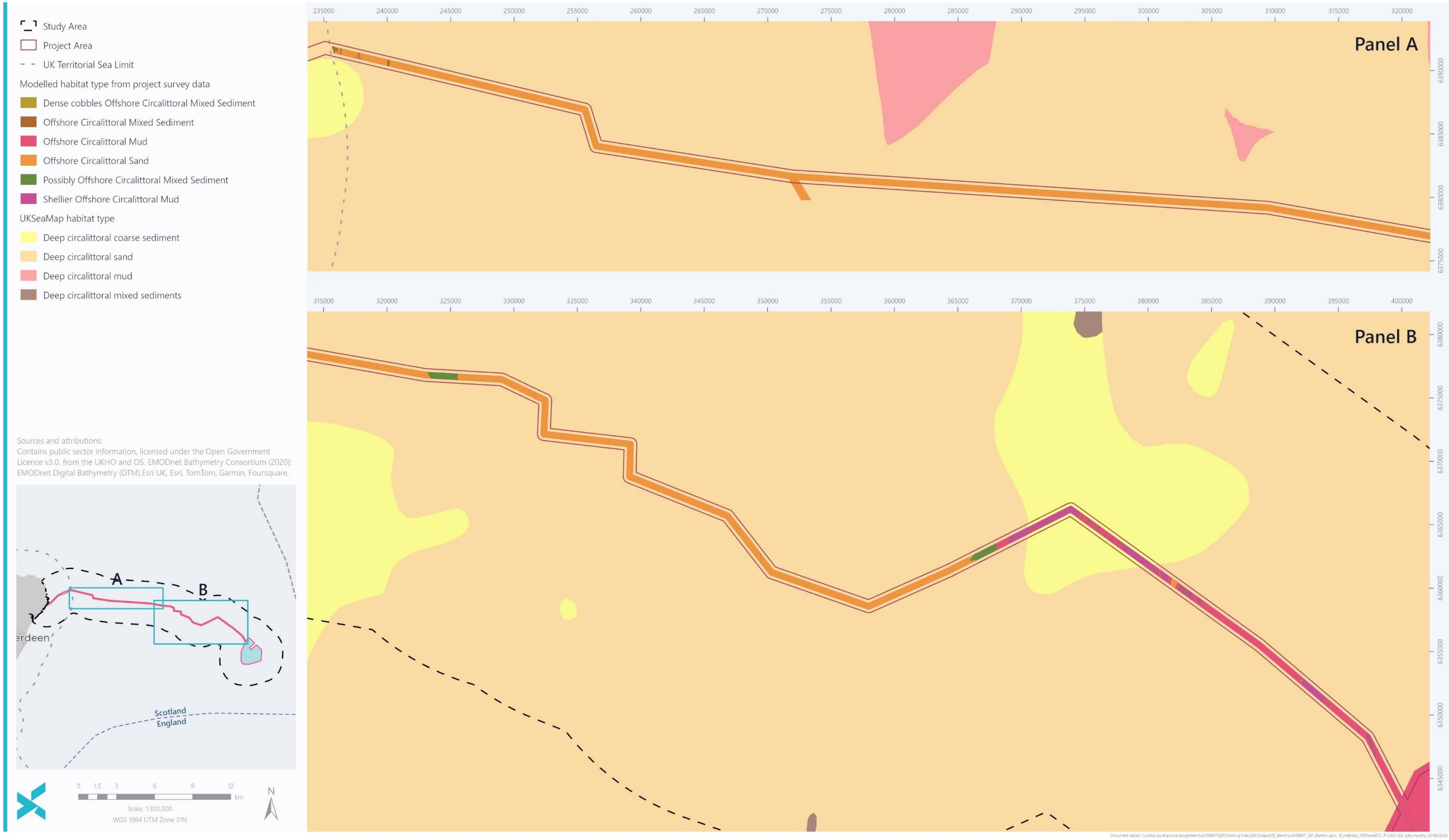

Figure 10-3 Types of sediments (site specific surveys) along the Offshore EICC

10.4.4.1.3 Inshore EICC

Bathymetry

The water depth from the HDD exit point to 12 NM ranges from approximately 10 m to 90 m below LAT with water depth gradually increasing with distance from the shore. The MBES and backscatter data indicates the presence of isolated patches of raised bathymetry, ground-truthed by transects IECC_T04 and IECC_T05, between Kilometre Point (KP) 0 and KP 4 (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC).

Seabed sediments

The broad habitat maps compiled from desk-based studies predicted three main EUNIS sediment types along the inshore EICC i.e. 'A5.27 - Deep circalittoral sand', 'A5.15 - Deep circalittoral coarse sediment' and 'A5.14 - Circalittoral coarse sediment'. An overview of the predicted EUNIS habitats is given in Figure 10-1.

The site specific surveys carried out in 2018 in the inshore EICC using grab samples (stations S01, S02, S03, S04, S05) and camera transects (transects T04 and T05) showed the presence of the sediment types 'A3.1 – Atlantic and Mediterranean high energy infralittoral rock', 'A5.13 – Infralittoral coarse sediment', 'A5.14 - Circalittoral coarse sediment', 'A5.15 – Deep circalittoral coarse sediment', 'A5.25 – Circalittoral fine sand', 'A5.44 – Circalittoral mixed sediment', 'A5.45 Deep circalittoral mixed sediments', and 'A5.611 - *Sabellaria spinulosa* on stable circalittoral mixed sediment' (MMT, 2018). The finding of MMT (2018) regarding the absence of the habitat 'Burrowed mud' in the southern parts of the Southern Trench NCMPA is in agreement with findings from Moore (2017). Specifically, Moore (2017) mentions for three south-eastern sites (STTR07, STTR09, STTR10) at depths of 56-93 m the presence of mixed substrates of sand and gravel with pebbles and cobbles supporting serpulid worms and sparse hydroids, *Alcyonium digitatum* and *F. foliacea*. In the Site STTR10, mixed sediments (and sparse stones) are found, while sites STTR07 and STTR09 had pebbles, cobbles and boulders and the epifauna is slightly richer (including *S. spinulosa*). Moore (2017) also mentions for the southern-eastern arm of the Southern Trench NCMPA the development of dense encrustations of *S. spinulosa*; specifically at the shallowest site (STTR01) off Fraserburgh (45 m depth) bedrock, boulders and cobbles supported a crust of around 80% coverage with patches attaining a thickness of around 2 – 5 cm. *S. spinulosa* tubes were also found to consolidate sediment in the form of pebble-sized blocks or possibly more extensive sheets at a further two offshore mixed gravelly sand sites (STTR04, STTR05) at 77 – 80 m depth. In addition to the presence of mixed-sediment, *S. spinulosa*-dominated habitats in the deeper region of the southern-eastern arm of the Southern Trench NCMPA, clean, tide-rippled, medium sand is recorded at two sites (STTR06, STTR08) at 74 – 85 m depth (Moore, 2017).

The findings of the MMT (2018) surveys are in line with findings from the EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC surveys in the inshore EICC. Specifically, the 2024 site specific surveys in the inshore EICC showed the presence of the sediment types 'Offshore circalittoral sand' (SS.SSa.Osa / MD521), 'Offshore circalittoral coarse sediment' (SS. SCS.OCS / MD321), 'Circalittoral muddy sand' (SS.SSa.CMuSa / MC52), Circalittoral mixed sediment (SS.SMx.CMx / MC421), 'Moderate energy circalittoral rock' (CR.MCR / MC12) and '*S. spinulosa* encrusted circalittoral rock' (CR.MCR.CSab.Sspi / MC2213) (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC) (Figure 10-12). The MBES and backscatter data indicated the presence of isolated patches which are associated with higher backscatter reflectivity and indicated the presence of rocky substrate, which is in line with the MMT (2018) findings. Despite these instances of rocky substrates, the survey revealed the majority of the inshore EICC is relatively featureless and primarily composed of soft low reflective sandy and muddy sediments (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC).

The seabed footage revealed a change in sediment composition with depth as the inshore transects are comprised of finer, muddier sediment (IECC_S01), while the deeper, further from land, camera transects are comprised of coarser, more sand dominated sediments (IECC_S06_A). Despite the general dominance of sandy sediments across the inshore EICC, the rocky substrates (exposed bedrock, boulder and cobble aggregations) observed at IECC_T04 and IECC_T05 indicate isolated patches of coarse and mixed sediment are present within the inshore EICC (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - EICC).

For the MMT (2018) inshore EICC data, metal concentrations are assessed against the Canadian Council of Ministers of the Environment (CCME) guidelines (Probable Effect Level (PEL) / Threshold Effect Level (TEL)). The metal concentrations did not exceed the PEL; however, the third sampling location (i.e. furthest seaward) is above the TEL for As (7.24 mg / kg) recorded at S03 (14.9 mg / kg), S04 (10.9 mg / kg) and S05 (11.7 mg / kg) (MMT, 2018). Additionally, S01 and S05 had elevated Pb concentration at 17.8 and 20.4 mg / kg, respectively (MMT, 2018); however, this did not exceed the TEL (30.2 mg / kg). In terms of hydrocarbons, all five sampling stations did not exceed any thresholds for PAH or THC (MMT, 2018).

10.4.4.2 Benthic species and habitats

10.4.4.2.1 Array Area

<u>Benthic species</u>

Macrofaunal analysis was carried out on the 30 grab samples acquired in August 2023 across the Array Area (Figure 10-4). Subsequent macrofaunal taxonomy of all recovered fauna identified a total of 2,373 individuals (infauna and solitary epifauna) from the 30 samples analysed. Of the 211 taxa recorded, three are colonial epifauna, and 208 are infauna (which includes solitary epifauna), with 95 species of annelid accounting for 57.8% of the total individuals. The Crustacea are represented by 53 species (6% of total individuals), the molluscs by 39 species (28.2% of total individuals), and the echinoderms by nine species (accounting for 1.7% of the total individuals). All other groups are represented by nine species, accounting for 6.2% of the total individuals (EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF).

Analysis of the infaunal and epifaunal communities indicated that infauna is dominant, with epifauna making up a very small but nevertheless important part of the community. Throughout the stations three taxa are considered to be epifaunal and belonged to the phyla Cnidaria and Bryozoa. The highest richness of epifaunal species is found at station OWF_30_A with a total of two taxa identified. The solitary epifauna consisted of three taxa in the phyla Cnidaria and Annelida (EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF).

Number of species per 0.1 m^2 is highly variable, ranging from 36 for station OWF_50, to 86 for station OWF_43. The higher number of individuals at station OWF_42 is due to the presence of the tube-building spionid polychaete, *Pseudopolydora nordica*, which accounted for 32% of the total number of individuals at this station. The species richness, abundance and diversity results showed a moderately diverse and consistently distributed community across all stations, with slight variations in spatial patterns relating to natural variation. Multivariate statistical analysis identified six significantly different macrofaunal groupings within the survey area at a 50% Bray-Curtis similarity level. The differentiation of clusters is identified to be the result of variable abundances of four species *Paramphinome jeffreysii*, *Axinulus croulinensis*, *Adontorhina similis* and *Pseudopolydora Nordica* (EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF).

Conspicuous fauna within the Array Area revealed a moderate diversity and density for an overarching muddy sand dominated seabed, with comparable fauna assemblages across most stations. Sessile fauna assemblages noted across stations included three species of seapens (*Pennatula phosphorea*, *Virgularia mirabilis* and *Funiculina quadrangularis*), several species of anemone (*Cerianthus lloydii*, *Bolocera tuediae*) and scallop (Pectinidae). Mobile fauna included hermit crabs (*Pagurus* sp.), sea stars (Asteroidea, *Asterias rubens*), brittle stars (Ophiuroidea), sea-urchin (Echinoidea), whelk (Buccinidae), Norway lobster (*Nephrops norvegicus*), squat lobster (Munididae), spider crab (Majidae) and sea slugs (Nudibranchia). Free-swimming megafauna mainly consisted of flatfish (Pleuronectiformes), gadoid fish (Gadidae) and the hagfish (*Myxine glutinosa*); with gurnards (Triglidae), squid (Cephalopoda) and rays (Batoidea) also observed on occasion. A notable increase in sessile epifauna including sponges (erect and encrusting morphologies), anemones, barnacles (Cirripedia), Hydrozoa and Bryozoa are associated with areas of mixed sediments owing to the attachment opportunities provided (EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF).

Sediment eDNA analyses (EIAR Vol. 4, Appendix 13: eDNA Analysis Report) revealed a wide range of species sequences from the samples in the Array Area. From these data, 29 different phyla are recorded in the single replicate samples from six stations in the survey area, with 178 different taxa identified. The number of phyla identified through eDNA analysis is more than double than the number of phyla identified in the traditional macrofaunal taxonomy data set. eDNA analyses captured all but three phyla that are recorded in the traditional macrofauna sampling. Ocean quahog was identified in all the eDNA stations, although it was not possible to determine the life stages present from the eDNA analysis.

The filtered benthic eDNA dataset was investigated for potential species that are known to be invasive in the North Sea and UK waters (Harrower *et al.*, 2023). Cross-referencing of the eDNA dataset with the INNS included in the 2023 Indicator List revealed no matches (Harrower *et al.*, 2023, EIAR Vol. 4, Appendix 13: Benthic eDNA Analysis Report).

Overall, the eDNA recovered a much wider biosphere with species and phyla that are not recorded by the macrofaunal sampling and would be difficult to measure by other traditional sampling methods (EIAR Vol. 4, Appendix 13: Benthic eDNA Analysis Report). However, it is also notable that for the dominant macrofaunal phyla (arthropods, annelids and molluscs), many more species were identified from the conventional macrofaunal analysis.

Example images of conspicuous fauna within the Array Area are shown in Figure 10-5. Information about protected species found in the Array Area, is provided in Section 10.4.4.4.

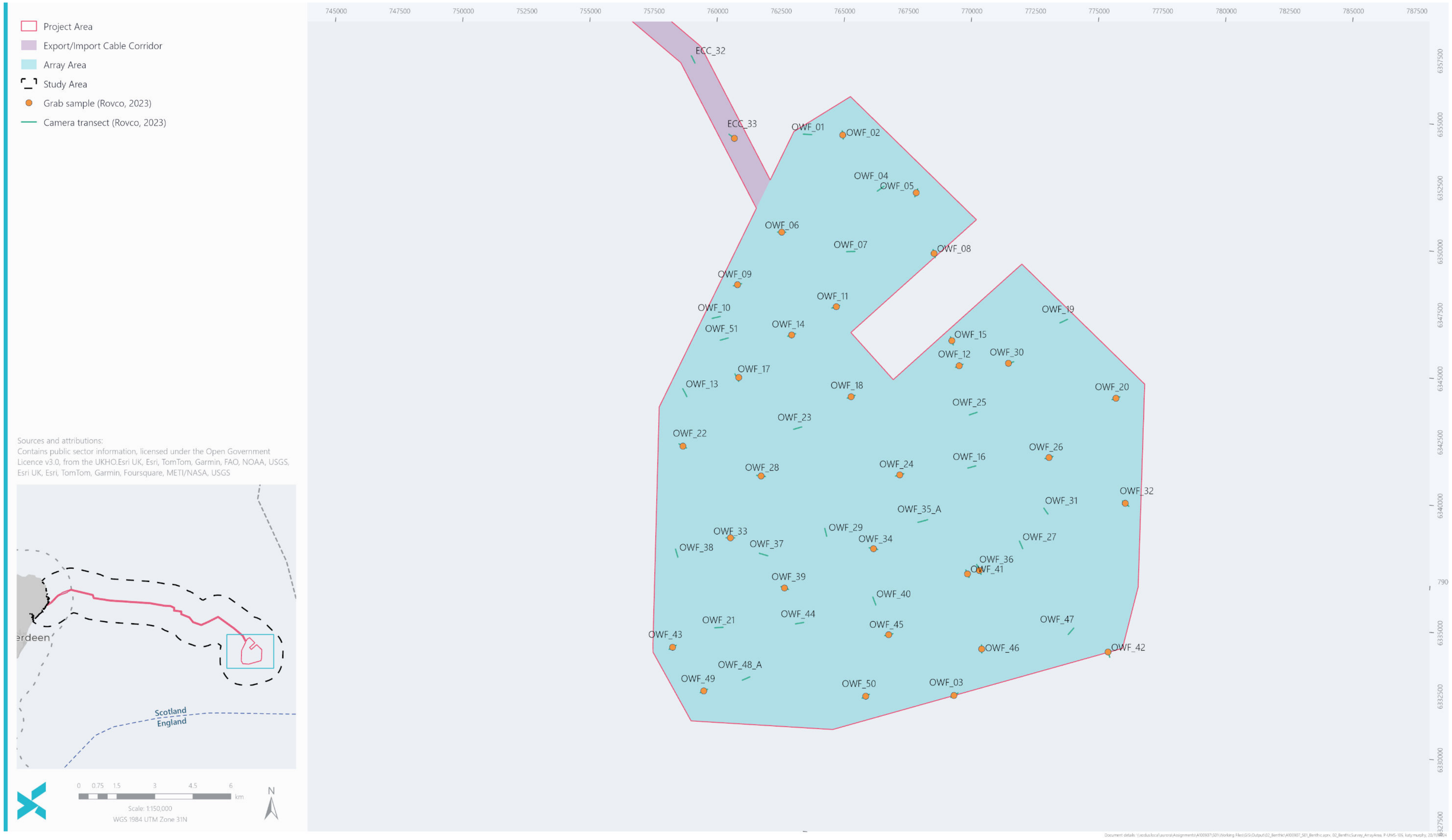

Figure 10-4 Site specific surveys (grab samples and camera transects) in the Array Area

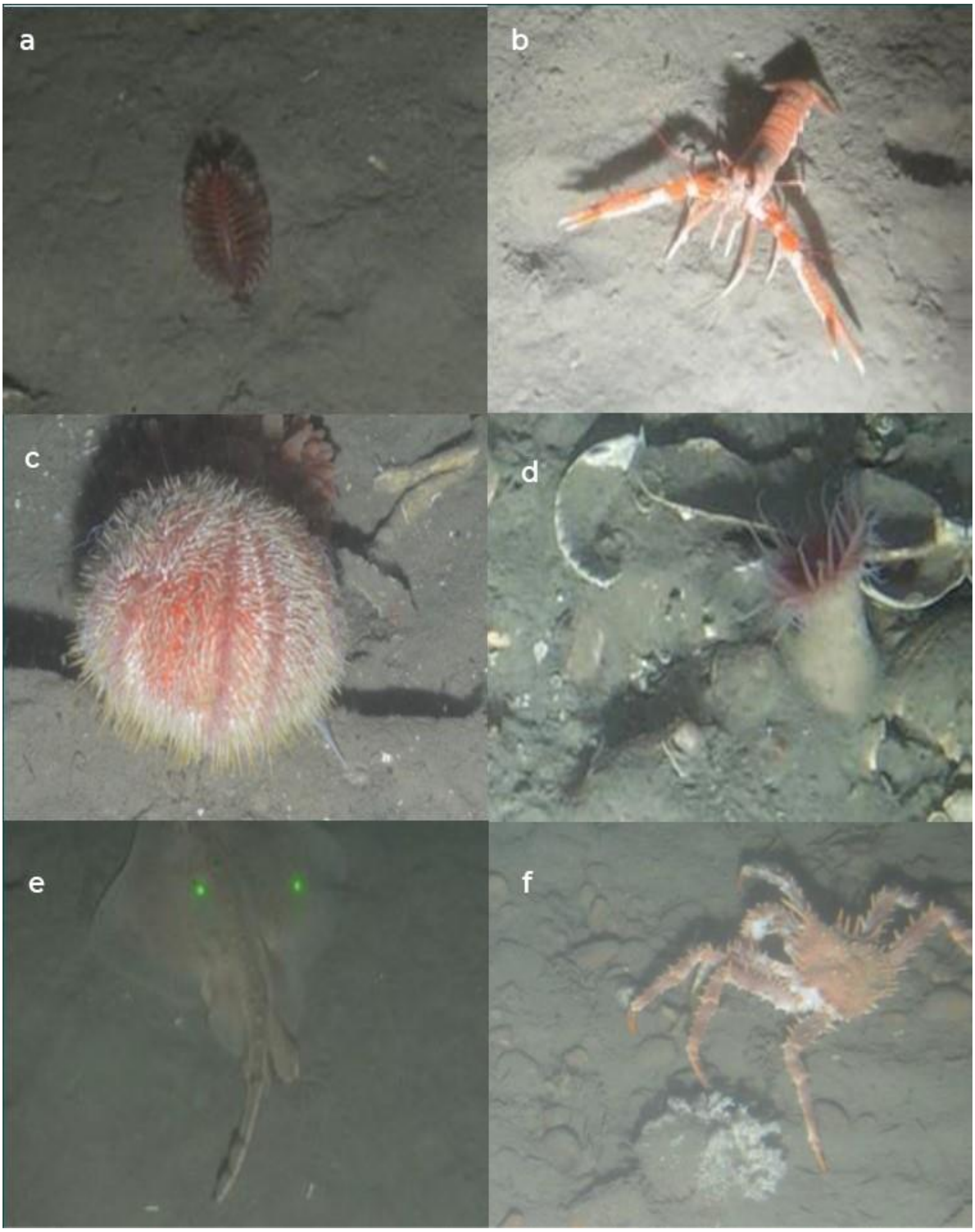

Figure 10-5 Examples of epifaunal species recorded within the Array Area. a) Phosphorescent seapen (Pennatula phosphorea), b) Norway lobster (Nephrops norvegicus), c) Urchin (Echinoidea), d) North Sea tube anemone (Cerianthus lloydii), e) Rajidae (possible Raja clavata), f) spider crab (Majixdae)

Benthic habitats

Two main JNCC habitats are identified across the survey area: "Offshore circalittoral mud" (JNCC: SS.SMu.OMu / MD6) and "Offshore circalittoral mixed Sediment" (JNCC: SS.SMx.OMx / MD4) (Figure 10-2). Based on epifaunal review from the underwater video footage and infaunal dataset review, the level 5 JNCC habitat 'SS.SMu.Omu.PjefThyAfil '*Paramphinome jeffreysii*, *Thyasira* sp. and *Amphiura filiformis* in offshore circalittoral sandy mud / A5.376' is likely to exist across the wider mud dominated survey area. Whereas, the level 5 habitat SS.SMx.OMx.PoVen 'Polychaete-rich deep *Venus* community / A5.451' is likely to exist within the isolated patches of mixed sediment. Examples of the habitats 'Offshore circalittoral mud / MD6' and "Offshore circalittoral mixed sediment / MD4' are shown in Figure 10-6.

Information about designated features (habitats, species) in the Array Area is given in Section 10.4.4.4.

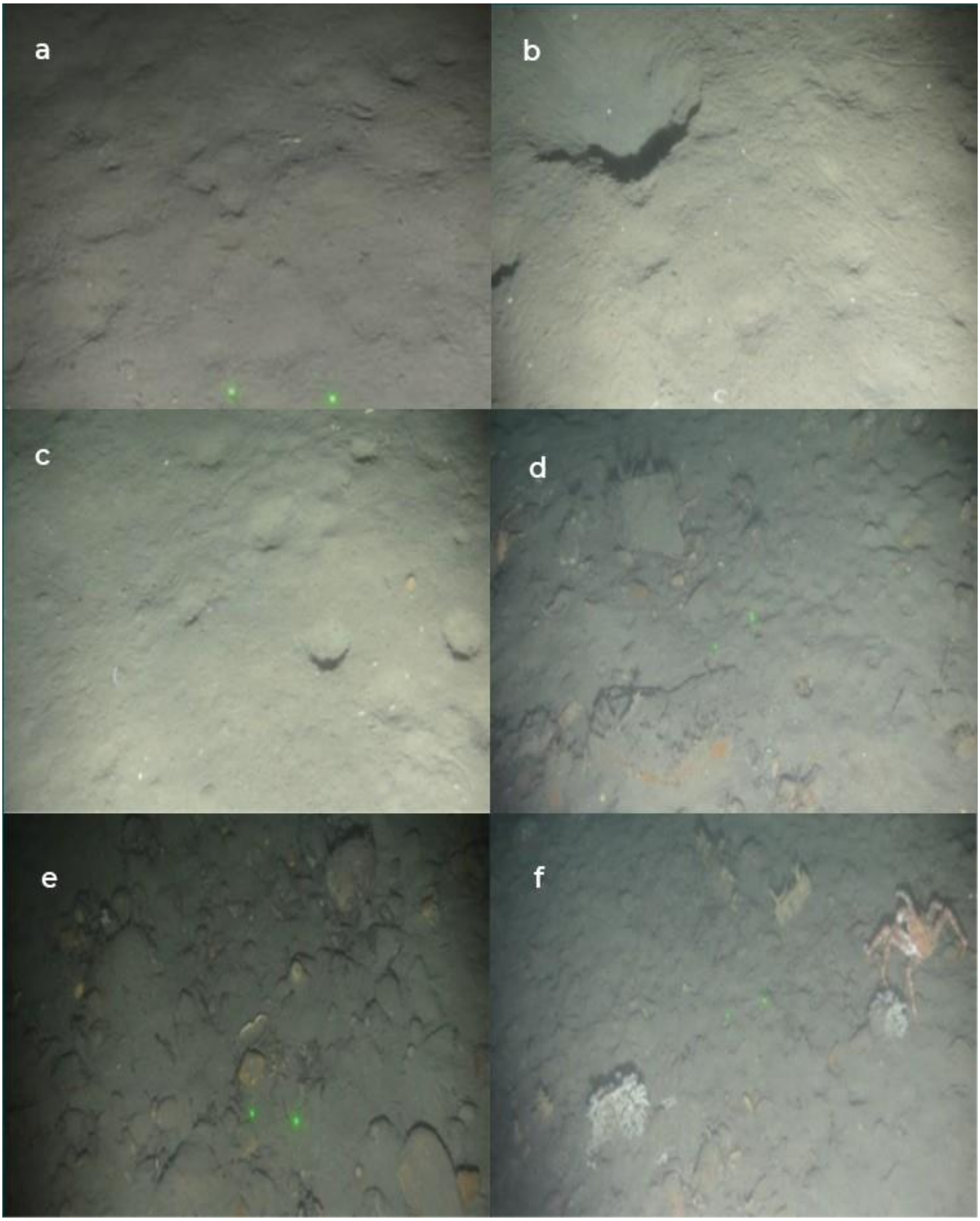

Figure 10-6 Example images of 'Offshore circalittoral mud' (a-c) and 'Offshore circalittoral mixed sediment' (d-f) in the Array Area

10.4.4.2.2 Offshore EICC

Benthic species

Macrofaunal analysis was carried out on 19 grab samples acquired in August to September 2023 along the EICC (Figure 10-7). Subsequent macrofaunal taxonomy of all recovered fauna identified a total of 5,663 individuals (infauna and solitary epifauna) from the 19 samples analysed. Of the 248 taxa recorded, five are colonial epifauna, three are solitary epifauna and 240 are infauna, with 124 species of annelid accounting for 38.3% of the total individuals. The Crustacea are represented by 57 species (12.2% of total individuals), the molluscs by 42 species (6.6% of total individuals), and the echinoderms by eight species (accounting for 19.6% of the total individuals). All other groups are represented by nine species, accounting for 22.2% of the total individuals (EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC).

Analysis of the infaunal and epifaunal communities indicates that infauna is dominant, with epifauna making up a very small but nevertheless important part of the community. Throughout the stations eight taxon are considered to be epifaunal which belonged to the phyla Arthropoda and Cnidaria. The highest richness of epifaunal species is found at stations ECC_06; with a total of 4 taxa identified. The solitary epifauna consisted of three taxa, including Cnidaria (Actiniaria and *P. phosphorea*), Arthropoda (*Verruca stroemia*) with the latter only present within ECC_06 and ECC_27 (EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC).

Conspicuous fauna in the EICC revealed a moderate diversity and density for an overarching sand dominated seabed, with comparable fauna assemblages across most stations. Sessile faunal assemblages noted across stations included three species of seapens (*P. phosphorea*, *V. mirabilis* and *F. quadrangularis*), anemones including *Synarachnactis lloydii* and scallops). Mobile fauna included hermit crabs, sea stars, brittlestars, sea-urchins, whelk, Norway lobster, squat lobster, spider crab and sea slugs. Free-swimming megafauna mainly consisted of unidentified flatfish, lemon sole (*Microstomus kitt*), gadoid fish and the hagfish; with gurnards, and rays (Batoidea) also observed on occasion. A notable increase in sessile epifauna including sponges (erect and encrusting morphologies), anemones, barnacles, Hydrozoa, and Bryozoa are associated with areas of mixed sediments owing to the attachment opportunities provided. Small aggregations of *S. spinulosa* are present across the stable mixed sediment transects (EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC).

Examples of conspicuous epifauna encountered across the EICC are shown in Figure 10-8.

The species richness, abundance, and diversity results showed a moderately diverse and consistently distributed community across all stations, with slight variations in spatial patterns relating to natural variation. Multivariate statistical analysis identified nine significantly different macrofaunal groupings within the survey area at a 25% Bray-Curtis similarity level. The differentiation of clusters is identified to be the result of variable abundances of species including the sea urchin *Echinocyamus pusillus*, the polychaetes *Owenia phoronis*, *Ophelia borealis*, *Paramphinome jeffreysii* and the barnacle *Verucca stroemia* which is associated with gastropod shells (EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC).

Information about protected species found in the offshore EICC, is provided in Section 10.4.4.4.

Figure 10-7 Site specific surveys (grab samples, camera transects) in the offshore EICC

Figure 10-8 Examples of conspicuous epifauna in the offshore EICC. a) hermit crab (Paguridae), b) anemone (Actiniaria), c) Sabellaria spinulosa, d) phosphorescent seapen (Pennatula phosphorea), e) edible sea-urchin (Echinus esculentus), f) common starfish (Asterias rubens)

<u>Benthic habitats</u>

The seabed across the EICC survey area is predominantly comprised of the JNCC / EUNIS habitat classification of SS.SSa.OSa / MD52 'Offshore circalittoral sand' (Figure 10-3). As the EICC route progressed to the east the percentage of fines increased and gradually transitioned into the seabed habitat SS.SMu.OMu / MD62 'Offshore circalittoral mud'. Two variants of SS.SMu.OMu are delineated along the route based on the observed features, seabed texture and reflectivity within the SSS data: 'Offshore circalittoral mud sediment' (SS.SMu.OMu / MD62) and 'Offshore circalittoral mud sediment with frequent patches of shelly mud' (SS.SMu.OMu / MD62). Smaller areas conforming to the JNCC / EUNIS classification of 'Offshore circalittoral mixed sediment' (SS.SMx.OMx / MD42) are identified along the route and are typically characterised by a poorly sorted mosaic of shell fragments and pebbles overlaying the predominant muddy substrate.

Areas of 'Offshore circalittoral sand / MD5' and 'Circalittoral mixed sediment / MC4' identified within the survey area could be considered to represent the UKBAP and Scottish PMF 'Subtidal sands and gravels' habitat.

Information about protected habitats found in the EICC, is provided in Section 10.4.4.4.

10.4.4.2.3 Inshore EICC

<u>Benthic species</u>

Site specific surveys using grabs (stations S01, S02, S03, S04 and S05) and cameras (transects T04 and T05) were carried out in the inshore EICC (MMT, 2018). At S01 the main infaunal species are the polychaetes *Magelona johnstoni* and *Nephtys* spp., the amphipod *Bathyporeia* and the mussel *Fabulina fabula*. These species are all known to be strongly associated to fine sand (MMT, 2018).

In transect T04 *S. spinulosa* tubes are visible on both the hard substrates and in the finer sediment. The cobbles and occasional large boulders in transect T04 are generally rich in epifauna; the species *A. digitatum*, *Flustra foliacea*, and a variety of actiniarians are dominating the habitat. Sea stars (*Asterias rubens*) are also frequently present (MMT, 2018). In sections of the transect T04 where larger and denser cobbles and boulders are found, the epifauna is homogenous and is mainly composed of different species of anemones, *A. rubens* and bryozoans, mainly *F. foliacea*.

In the station S02 cobbles and shell fragments overlaying finer sediment, are found. The main species seen are the anemone *Urticina* sp., sea stars and *S. spinulosa* tubes. In total, 88 different taxa are identified at grab sample location S02. In addition to *S. spinulosa*, the polychaetes *Eumida* sp. and *Harmothoe* sp. are found. 16 different bivalves are found, *Hiatella arctica* being the most numerous. The long-clawed porcelain crab, *Psidia longicornis*, reached 500 ind. / m^2 in one of the replicates.

Bedrock is present across the majority of transect T05, with the abundance of epifauna dominated by *A. digitatum*, and different anemones together with bryozoans *F. foliacea* and *Securiflustra securifrons*; patchy crusts of *S. spinulosa* tubes are present but are abraded and sparse.

In S03 the main sediment type is gravelly sand. No epifauna was visible; the infauna was dominated by different species of polychaetes where *Pisione remota* was the most numerous (MMT, 2018). At S04 sediments are characterised by a mix of sand and fine shell gravel with coarser substrate such as cobbles. Occasional boulders were also found in the data. Ripples are seen in the stills and video footage (MMT, 2018). The epifauna at S04 was generally sparse and associated with cobbles and boulders. The epifauna noted in the video data was dominated by the soft coral *A. digitatum*, bryozoans, barnacle shells and the hydroid *Nemertesia antennina* (MMT, 2018). It also included the seven-armed sea star *Luidia ciliaris*, the crustaceans *Ebalia* sp. and *Munida* sp., and fish of the genus *Callionymus* and family Pleuronectidae. The infauna is dominated by the urchin *Echinocyamus pusillus*, different species of annelids, and bivalves. *S. spinulosa* are found in the grab samples but no aggregations of *S. spinulosa* tubes are seen at the site (MMT, 2018).

Grab sample location S05 is characterised by coarse sand and gravel with components of silt. The epifauna is sparse and dominated by the soft coral *A. digitatum*, bryozoans and hydroids. Other epifaunal species visible in the video data included *Aphrodita aculeata*, *Ebalia* sp., *Atelcyclus* sp., *Munida* sp., *Chaetopterus* sp. tubes, *Henricia* sp., and sponge *Polymastia* sp. Tubes of the sand mason, *Lanice conchilega*, was also noted. *S. spinulosa* was present in the grab sample but no reef formation are visible in video or photos. The *S. spinulosa* abundance in the grab sample was generally low (MMT, 2018).

The MMT (2018) findings on benthic species in the inshore EICC are in line with the EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC findings in the inshore EICC. Specifically, site specific surveys (camera transects) in the inshore EICC (Figure 10-9) revealed a relatively diverse assemblage of marine species, for tidally influenced mobile coarse, fine and mixed sediments, that are represented by various taxonomic groups. A relatively higher abundance and diversity of marine taxa are associated with areas of mixed and coarse sediment due to the increased availability of hard substrates for epifaunal colonisation.

Mobile species observed included echinoderms such as the common starfish, common urchin and crustaceans such as the rugose squat lobster (*Munida rugosa*). Chordata are also present along the inshore survey area with instances of unidentified fish (Actinopterygii), flatfish (Pleuronectiformes; *Pleuronectes platessa*) and common dragonettes. Sandeels (*Ammodytes* sp.) are also potentially identified; however, reduced visibility due to water column turbidity limited the conclusion of their presence across the EICC (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC).

Sessile species are also observed across the inshore EICC and included Cnidaria such as dead man's fingers and unidentified anemones (Actinaria), Bryozoa, and Hydrozoa (*Vesicularia spinosa*, *F. foliacea* and Tubulariidae) and Porifera (unidentified sponges). Aggregations of *S. spinulosa* are also present as encrusting patches of exposed bedrock, with three still images investigated that indicate 'medium' resemblance to Annex I reef (more detail is provided in Section 10.4.4.4.7). Example images of conspicuous fauna within the survey area are presented in Figure 10-10.

Information about protected species in the inshore EICC, is provided in Section 10.4.4.4.

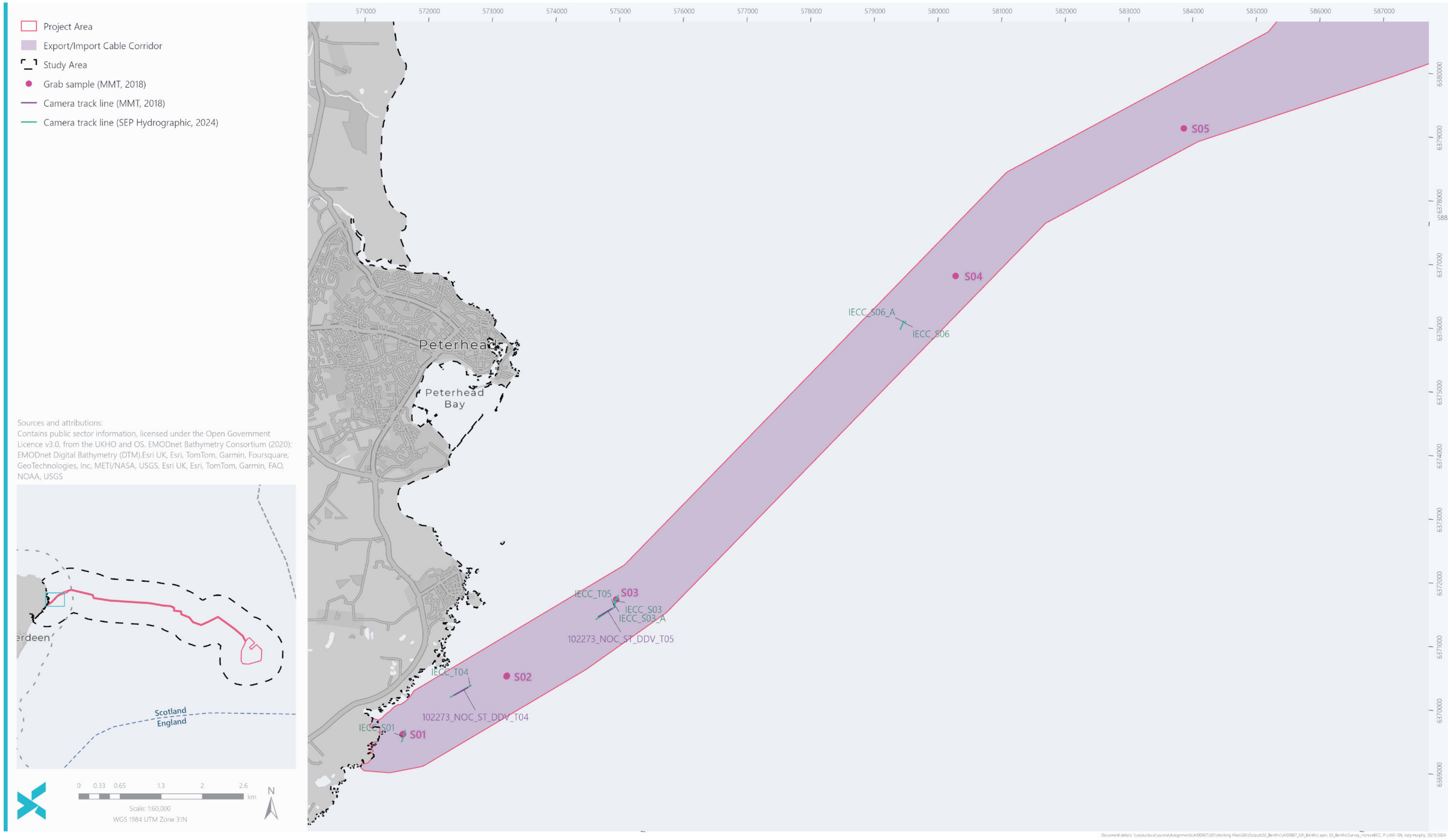

Figure 10-9 Site specific surveys (camera transects and grab samples) in the inshore EICC (surveys in 2018, 2024)

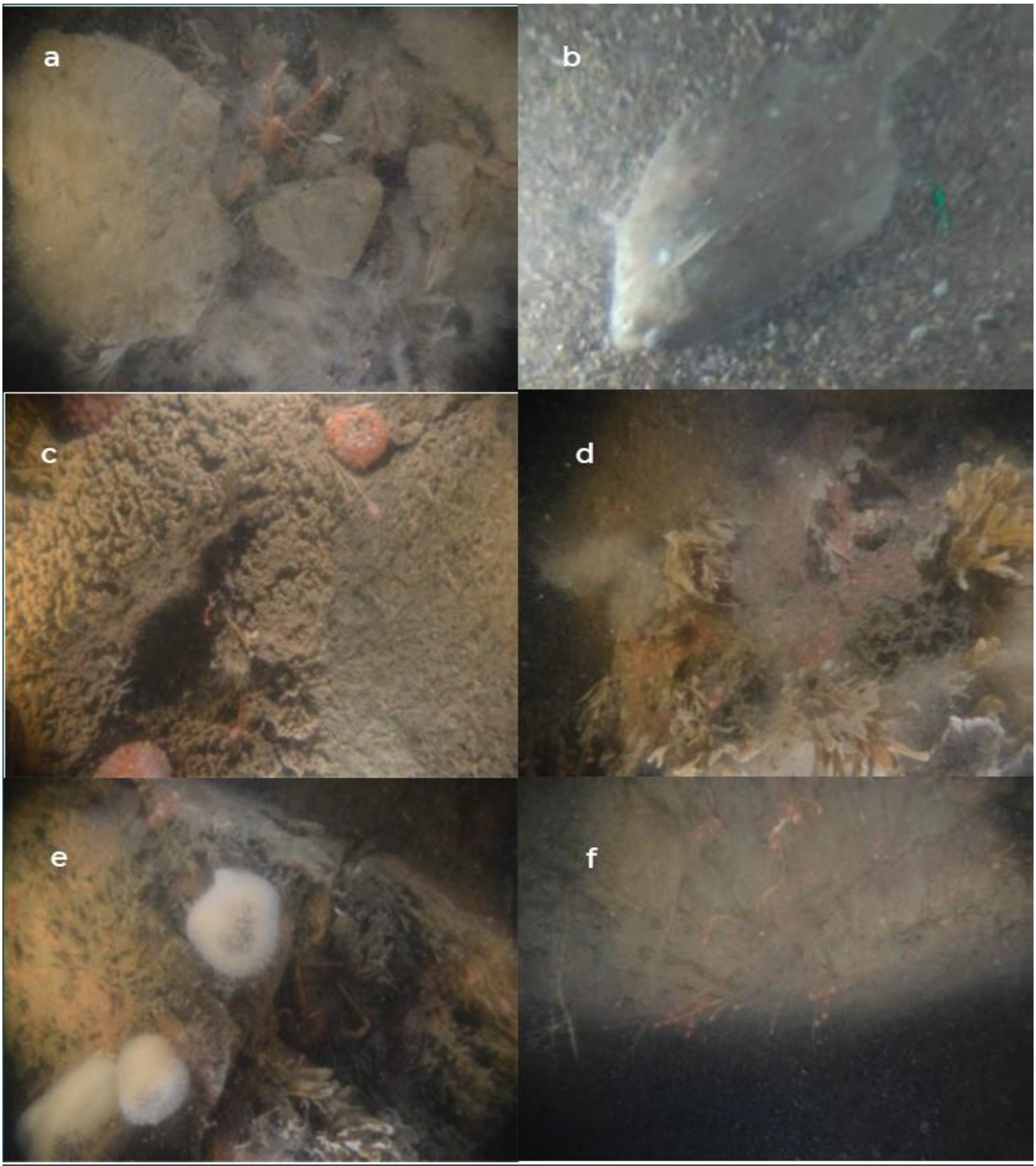

Figure 10-10 Examples of conspicuous epifauna in the inshore EICC: a) Rugose squat lobster (Munida rugosa), b) European plaice (Pleuronectes platessa), c) Sabellaria spinulosa and anemones (Sabellaria spinulosa and Actinaria), d) Hornwrack (Flustra foliacea), e) Dead man's fingers (Alcyonium digitatum), f) Hydroid (Tubulariidae)

Benthic habitats

The habitats recorded in 2018 (MMT, 2018) are broadly in line with the EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC findings in the same area. The habitats recorded in the two surveys are shown in Table 10-4 and example images from the most recent survey are presented in Figure 10-11. Further information about protected habitats in the inshore EICC, is provided in Section 10.4.4.4.

Table 10-4 Habitats recorded in the EICC area in the MMT (2018) and ***EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC***

BROAD HABITAT TYPES	MMT (2018)	EIAR VOL. 4, APPENDIX 9, APPENDIX 10, APPENDIX 12
Atlantic and Mediterranean high energy infralittoral rock (A3.1 / MB1)	YES	NO
Moderate/High energy circalittoral rock	YES biotopes included: • *Urticina felina* and sand-tolerant fauna on sand-scoured or covered circalittoral rock (A4.213) • *S. spinulosa* with a bryozoan turf and barnacles on silty turbid circalittoral rock (A4.2211 / MC128)	YES biotopes included: • Moderate energy circalittoral rock (CR.MCR / MC12) • Mixed faunal turf communities on high energy circalittoral Rock (CR.HCR.Xfa / MC121) • *S. spinulosa* encrusted circalittoral rock (CR.MCR.Csab / MC2213)
Infralittoral coarse sediment (A5.13 / MB3)	YES	NO
Circalittoral coarse sediment	YES biotopes included: • Circalittoral coarse sediment (A5.14 / MC3)	YES biotopes included: • Offshore circalittoral coarse sediment (SS.SCS.OCS / MD321)
Circalittoral mixed sediment	YES biotopes included • Circalittoral mixed sediment (a5.44) (ss.smx.cmx / mc421 • *S. Spinulosa* on stable circalittoral mixed sediment (a5.611 / mc421)	YES biotopes included • Circalittoral mixed sediment (a5.44) (ss.smx.cmx / mc421
Circalittoral sand	YES Related biotopes included: • Circalittoral fine sand (A5.25 / MC5)	YES Related biotopes included • Offshore Circalittoral Sand (SS.SSa.Osa / MD521) • Circalittoral muddy sand (SS.SSa.CMuSa / MC521)

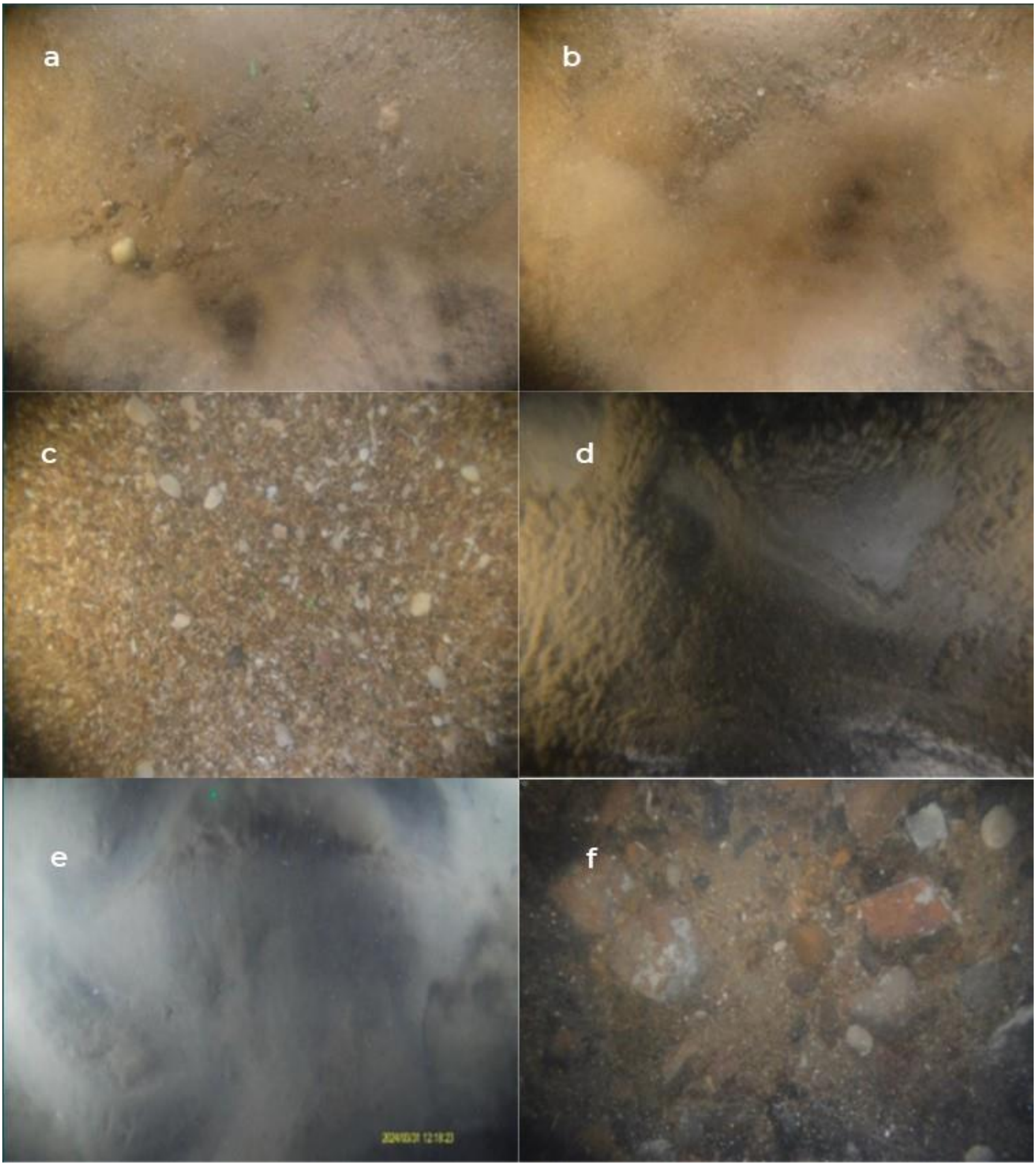

Figure 10-11 Examples of sediment types in the inshore EICC. a-b) Offshore circalittoral sand, c) Offshore circalittoral coarse sediment, d-e) Circalittoral muddy sand, f) Circalittoral mixed sediment.

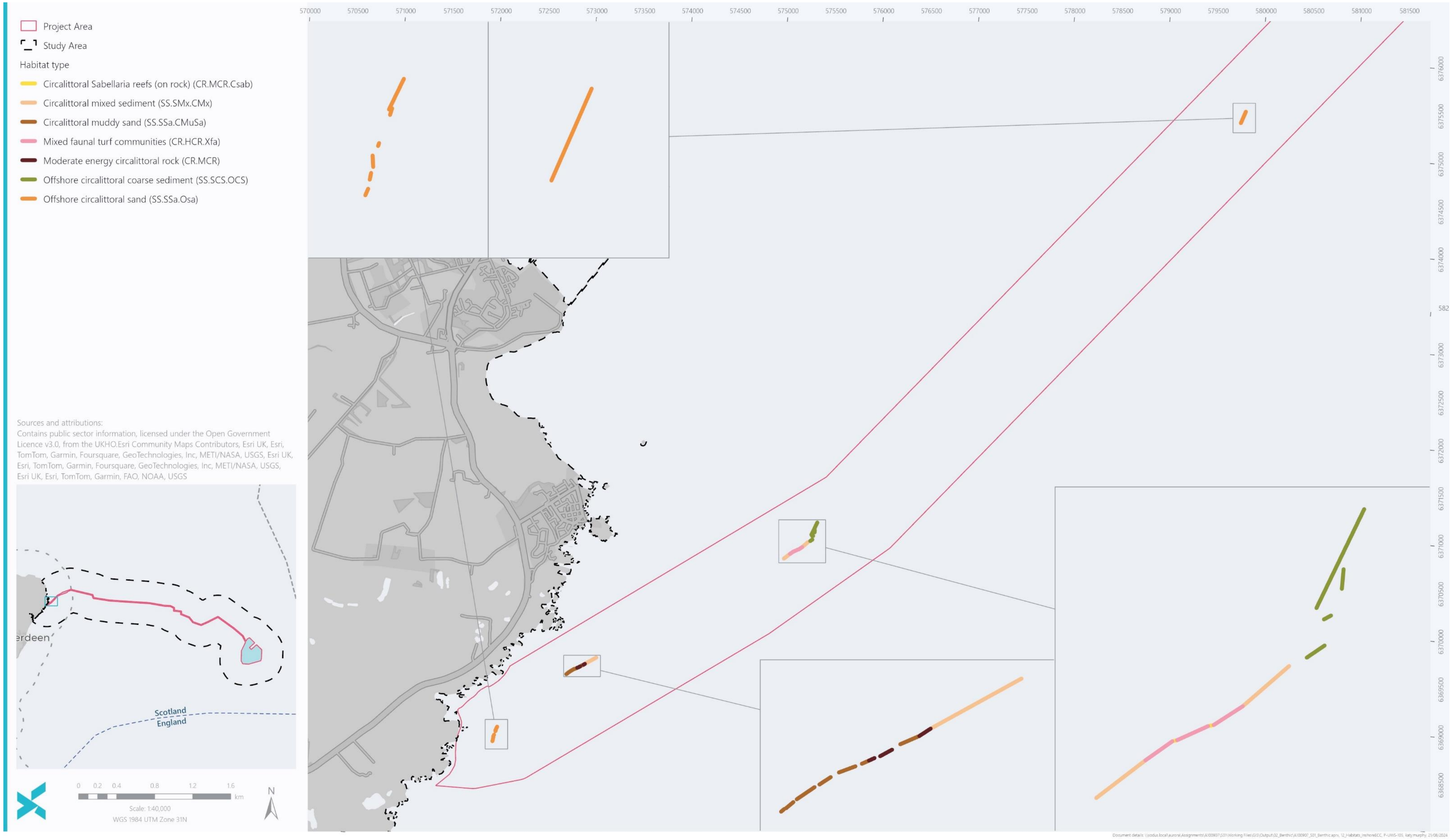

Figure 10-12 Seabed habitats (site specific surveys) in the inshore EICC

10.4.4.3 Designated sites

The NCMPAs East of Gannet and Montrose Fields, Turbot Bank and Southern Trench overlap with the Benthic Ecology Study Area (Figure 10-13). However, it should be noted that the Project Area does not directly intersect with the Turbot Bank NCMPA which lies 6 km to the south of the EICC (Figure 10-13).

East of Gannet and Montrose Fields NCMPA

The Array Area is located within the East of Gannet and Montrose Fields NCMPA (Figure 10-13) which is designated for 'Offshore deep-sea muds' and 'ocean quahog aggregations (including sands and gravels as their supporting habitat)' (JNCC, 2024). The total size of the East of Gannet and Montrose Fields NCMPA is 1,839 km^2 (JNCC, 2024).

Offshore deep-sea muds support a wealth of biological diversity despite often appearing as featureless environments. The most common larger surface-dwelling animals are echinoderms, including sea cucumbers, brittlestars, and sea urchins. Seapens can also be found in offshore deep-sea muds. 'Offshore deep-sea muds' constitute one of the most common deep-water habitats in the UK offshore marine environment (Tyler-Walters *et al.*, 2016). Other mobile species in or on the seabed include various types of 'worms', sea spiders, molluscs, crustaceans, and fish species (Tyler-Walters *et al.*, 2016).

Site specific surveys showed that the Array Area hosts two main JNCC habitats: "Offshore circalittoral mud / MD6" (JNCC: SS.SMu.OMu) and "Offshore circalittoral mixed sediment / MD4" (JNCC: SS.SMx.OMx). Based on epifaunal review from the underwater video footage and infaunal dataset review, the level 5 JNCC habitat 'SS.SMu.Omu.PjefThyAfil '*Paramphinome jeffreysii*, *Thyasira* sp. and *Amphiura filiformis* in offshore circalittoral sandy mud / A5.376' is likely to exist across the wider sand dominated survey area. Whereas, the level 5 habitat SS.SMx.OMx.PoVen 'Polychaete-rich deep *Venus* community / A5.451' is likely to exist within the isolated patches of mixed sediment.

The spatial extent of 'Offshore deep-sea muds' in the East of Gannet and Montrose Fields NCMPA is approximately 900 km^2 (approximately 49% of the NCMPA total size) and the spatial extent of subtidal sands and gravels is approximately 939 km^2 (approximately 51% of the NCMPA total size) (JNCC, 2024).

Site specific surveys in the Array Area found no living adult specimens (>1 cm shell size) of *A. islandica* (ocean quahog). No evidence of their distinct siphons was observed on any of the video footage or still photographs. Taxonomic review identified a total of 109 juveniles (< 1 cm shell size) retained across 22 grab samples (EIAR Vol. 4, Appendix 8: Habitat Assessment Report – OWF, EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF).

Turbot Bank NCMPA

The Turbot Bank NCMPA is approximately 6 km to the south of the offshore EICC (Figure 10-13). It is designated for sandeels and is particularly important for lesser sand eel (*Ammodytes marinus*) which is closely associated with sand habitat. The NCMPA contains the type of sandy sediment with low silt and clay components that sand eels prefer. The sandeels present within Turbot Bank are an important component of the larger sandeel population in the northern North Sea (JNCC, 2018).

The Benthic Ecology Study Area surrounding the EICC overlaps the boundary of the Turbot Bank NCMPA. The EICC does not intersect directly with the Turbot Bank NCMPA (Figure 10-13), however the site specific surveys have shown that the main habitat types within the Study Area in the vicinity of the NCMPA are 'Offshore circalittoral sand'

(SS.SSa.Osa / MD52) and 'Offshore circalittoral mud' (SS.SMu.OMu / MD62) (Figure 10-3) (EIAR Vol. 4, Appendix 9: Habitat Assessment Report - EICC); the former of which is broadly similar with the sandy sediment with low silt and clay components found in the NCMPA.

The potential impacts of the Project on Turbot Bank NCMPA's sandeels are assessed in the EIAR Vol. 3, Chapter 13: Fish and Shellfish Ecology.

Southern Trench NCMPA

The inshore segment of the Benthic Ecology Study Area and EICC intersects the southern portion of the Southern Trench NCMPA (Figure 10-13). This NCMPA is designated for burrowed mud, shelf deeps, Quaternary of Scotland (subglacial tunnel valleys and moraines) and submarine mass movement (slide scars) (NatureScot, 2024b).

The site specific survey revealed the majority of the inshore survey area is relatively featureless and primarily composed soft low reflective sandy and muddy sediments e.g., 'Offshore circalittoral sand' (SS.SSa.Osa / MD521) and 'Circalittoral muddy sand' (SS.SSa.CMuSa / MC521) (Figure 10-11) (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC).

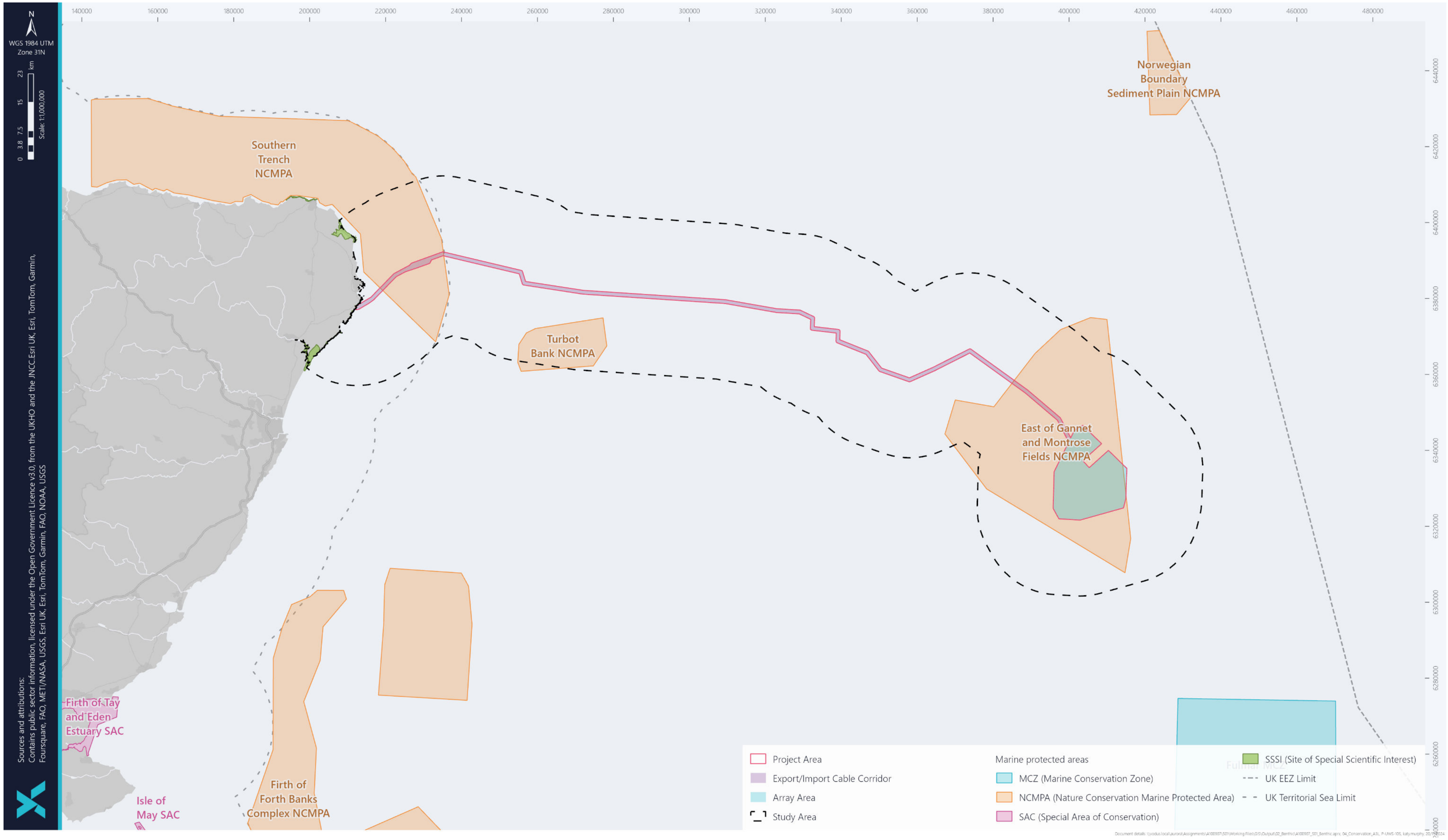

Figure 10-13 Nature Conservation Marine Protected Areas that intersect with the Benthic Ecology Study Area

10.4.4.4 Protected features

10.4.4.4.1 Offshore deep-sea muds

'Offshore deep-sea muds' are a designated habitat in the East of Gannett and Montrose Fields NCMPA (JNCC, 2024). The spatial extent of 'Offshore deep-sea muds' in the NCMPA is approximately 900 km^2 (McCabe *et al.*, 2020; JNCC, 2024).

In the Array Area, one of the two main habitats identified is 'Offshore circalittoral mud' (JNCC: SS.SMu.OMu / MD62) (Figure 10-2). Offshore deep-sea muds are predominantly found in stable deeper / offshore areas where the reduced influence of wave action and / or tidal streams allow fine sediments to settle. These habitats are often dominated by polychaetes and echinoderms, such as *Amphiura* spp., seapens, such as the slender seapen (*V. mirabilis*), and burrowing megafauna, such as the Norway lobster (*N. norvegicus*) (Connor *et al.*, 2004), although polychaetes, sea spiders, molluscs, crustaceans and fish are also found. Bathymetry, current velocity, bottom water-mass distribution and particle size of the mud (clay, silty or sandy) have a significant influence on the distribution and composition of the seabed communities present (JNCC, 2024). Based on epifaunal review from the underwater video footage and infaunal dataset review in the Array Area, the level 5 JNCC habitat 'SS.SMu.Omu.PjefThyAfil '*Paramphinome jeffreysii*, *Thyasira* sp. and *Amphiura filiformis* in offshore circalittoral sandy mud / A5.376' is likely to exist across the wider sand dominated survey area. Examples of the habitat 'Offshore circalittoral mud / MD62' are shown in Figure 10-6. The spatial extent of 'Offshore deep-sea muds' in the Array Area is approximately 333 km^2 (JNCC, 2024), noting that patches of sand and boulders exist within this extent.

In the EICC, 'Offshore circalittoral mud' (JNCC: SS.SMu.OMu / MD62) is one of the three main habitats identified in the site specific surveys (EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC) (Figure 10-3). The spatial extent of 'Offshore deep-sea muds / MD62' in the offshore EICC is 21.16 km^2.

'Offshore deep-sea muds' are not found in the inshore EICC (MMT, 2018, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC).

10.4.4.4.2 Ocean quahog

Ocean quahog is a designated feature in the East of Gannet and Montrose Fields NCMPA (JNCC, 2024) (Figure 10-14). As highlighted in Section 10.4.4.2.1, the eDNA analysis undertaken on the sediments samples across the Array Area detected a widespread presence of ocean quahog (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC; EIAR Vol. 4, Appendix 13: Benthic eDNA Analysis Report). However, the eDNA analysis result can only detect the presence and cannot be used to determine the relative abundance or the age class (i.e. juvenile/adult) of any specimens present. Therefore, higher resolution data on ocean quahog presence and distribution can be derived from the macrofaunal analysis carried out on grab samples and drop down camera data.

In the Array Area, the offshore EICC, and inshore EICC, no adult specimens (> 1 cm shell size) of ocean quahog were identified from grab samples and no evidence of their distinct siphons are observed from analysis of camera footage or stills. In the Array Area, the taxonomic review identified a total of 109 juveniles (< 1 cm shell size) retained across 22 grab samples while in the offshore EICC a total of 21 juveniles (< 1 cm shell size) retained across 8 grab samples (EIAR Vol. 4, Appendix 8: Habitat Assessment Report – OWF, EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC, EIAR Vol. 4,

Appendix 11: Environmental Baseline Report – OWF, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC). Analysis of grab samples in the inshore EICC did not identify adult or juvenile ocean quahog (MMT, 2018).

The relative absence of adult specimens in the Array Area is consistent with findings by JNCC (McCabe *et al.*, 2020) and JNCC (2024) which showed that aggregations of the species are more prominent in the western half of the East of Gannet and Montrose Field NCMPA and are associated with sands and gravels habitats rather than the circalittoral muds in the eastern half within which the Array Area is situated. Nonetheless, it is recognised that muddy sediments are also able to support ocean quahog populations and that adult specimens may occur within the Array Area. Data from the standard grab equipment used may not provide a comprehensive picture of ocean quahog abundance due to the small extent of seabed covered and limited depth of penetration. It has been reported that full retention of >1 cm specimens can be achieved through dredge sampling techniques, albeit these are more damaging to sensitive seabed habitats and species (OSPAR, 2009a)).

Despite these uncertainties, the available evidence suggests that the mud habitat across the Array Area does not support large, densely populated aggregations of ocean quahog, with only a single station recording >10 individual juveniles per 0.1 m^2. Therefore, while adult ocean quahog may be present across the Array Area and the EICC, it is not anticipated that they are present in high numbers as evidenced by the relatively low concentration of juveniles, and absence of adults specimens in the site specific grab samples and no indication of siphons from the drop down cameras.

Figure 10-14 Distribution of 'Offshore deep-sea muds', subtidal sands and gravel and ocean quahog in the Array Area, eastern end of the EICC and the East of Gannet and Montrose Fields NCMPA

10.4.4.4.3 Burrowed mud / Seapens and burrowing megafauna communities

In the Array Area, a combination of environmental factors and faunal information were considered (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF), as outlined in JNCC (2014), in order to determine whether the 'Offshore circalittoral mud' (SS.SSa.OSa / MD62) habitat should be classified as the OSPAR 'Seapen and burrowing megafauna communities'. The results of the burrows assessment revealed the presence of burrows in 44 out of the 51 transects (Figure 10-2) (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF). Large burrows are observed across 42 stations and are categorised as 'Occasional' to 'Common' on the Superabundant, Abundant, Common, Frequent, Occasional, Rare (SACFOR) scale, whereas small burrows are observed at just 21 stations varying in average density from 'Rare' to 'Frequent' (Figure 10-2) (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF). The presence of 'Frequent' or above burrow densities, particularly in the case of large burrows, coupled with the presence of burrowing fauna (*N. norvegicus*) indicates a degree of conformity to the OSPAR 'Seapens and burrowing megafauna communities' and / or the 'Burrowed mud' Scottish PMF (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF).

In the inshore EICC, the visual absence of seapens and burrows indicates that the OSPAR 'Seapen and burrowing megafauna communities' habitat is unlikely to exist (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC).

10.4.4.4.4 Annex I geogenic reefs

In the Array Area numerous boulders or clusters of cobbles and boulders are recorded along seven camera transects. Seabed camera ground-truthing data were assessed for potential stony reef using the criteria proposed by Irving (2009). The analysis of 510 images showed that 419 (77.6%) showed no evidence of stony reef. In terms of stony reef composition or percentage cover for all stills, 87 (16.1%) are classed as 'Not a reef', 4.0 (0.7%) as 'Low reef', none as 'Medium reef', and none as 'High reef'. In terms of elevation, 47 (8.7%) are classed as 'Not a reef', 44 (8.2%) as 'Low reef', none as 'Medium reef', and none as 'High reef'. There are also areas of pebbles and coarse shell fragments, however, they did not meet the specifications of required substratum for stony reef (>64 mm), with 419 (77.6%) classed as 'No reef'. When both composition and elevation were considered, by examining reef 'structure', 87 (16.1%) classed as 'Not a reef', 4.0 (0.7%) as 'Low reef', none as 'Medium reef', and none as 'High reef'. This equates to a total of 4 images (0.7%) showing reefiness of 'Low reef'.

The transects where initial Annex I stony reef assessment suggested presence of 'Low reef' (structure vs epifaunal coverage vs. extent) were further investigated to establish whether hard substrates areas still corresponded to reef-like structures based on the epifauna present (following Golding *et al.*, 2020). The 'Low reef' transect (OWF_51) (Figure 10-4) exhibited predominantly 'Possible reef' characteristics, as the identification of 'Circalittoral mixed sediment' (SS.SMx.CMx / MC421) matched one of the key reef biotopes listed in Golding *et al.* (2020). To evaluate the presence of reef species, epifauna from the still photographs were reviewed from the one occurrence of overall 'Low reef' (structure vs. epifaunal coverage vs. extent). Two taxa observed in the stills are classified as 'Key-reef' species; the cnidarian *A. digitatum* and bryozoan turf. The presence / abundance of desirable reef species included cup corals (*Caryophyllia*). No more than three 'Key reef' species are recorded for the section of 'Low reef', resulting in the classification of "Possible Low reef" with no strong justification to warrant Annex I protection (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF).

The habitat assessment report for the offshore EICC does not mention the presence of Annex I geogenic reefs (EIAR Vol. 4, Appendix 9: Habitat Assessment Report - EICC).

MMT (2018) surveys in the inshore EICC showed that the transect T05 covered predominantly an area of outcropping bedrock. The epifauna was dominant and was characterised by *S. spinulosa* tubes. Hard surfaces without tubes present are covered by different species of bryozoans, hydrozoans and sea anemones. The extent of the bedrock area, seen during transect T05, is estimated at approximately 22,000 m^2 based on SSS interpretation (MMT, 2018).

Similarly to the MMT (2018) findings, boulders, cobbles and exposed bedrock are observed along camera transects in the 2024 inshore EICC surveys i.e. in transects IECC_T04 and IECC_T05 (Figure 10-9) (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). The presence of these geogenic features was subjected to further investigation to assess whether they could be classified as Annex I geogenic reefs (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC).

In total, 56 images were reviewed across transects IECC_T04 and IECC_T05 in the inshore EICC that showed evidence of potential rocky reef (Figure 10-15). Of these images, 31 (54.4%) images contained no evidence of rocky reef. In terms of rocky reef composition or percentage cover for all stills, 35 (61.4%) had <10% bedrock cover which occurred in either the 'Possible reef with sand veneer', 'Reef with sand veneer' and 'Not a reef' categories. A total of 22 (38.6%) stills had >50% bedrock cover which occurred in either the 'Rocky reef with Low Biodiversity' or 'Rocky reef with High Biodiversity' categories. In terms of erect epifaunal coverage, 46 (80.7%) had <50% coverage, while 11 stills (19.3%) had an erect epifaunal coverage of >50%. When both composition and erect epifauna were considered, by examining rocky reef 'structure', a single still (1.7%) was classed as 'Reef with sand veneer', three (9.6%) as 'Possible reef with sand veneer', 13 (22.8%) as 'Rocky reef with high biodiversity', nine (15.8%) as 'Rocky reef with low biodiversity' due to the abundance of turf, desirable and essential reef species. This equates to a total of 26 images (50%) showing appreciable rocky 'reefiness'.

Overall, the results revealed an area of intermittent bedrock spanning transect IECC_T05 which showed characteristics of a 'Rocky reef with high biodiversity' as well as 'Rocky reef with low biodiversity' (Figure 10-15). Whereas, rocky reef is less prominent across transect IECC_T04, which consisted of two still images of 'Possible reef with sand veneer' based on the presence of 'Desirable reef' species (*Asterias rubens* and *Flustra foliacea*) and one still image classified as 'Reef with sand veneer' based on the presence of the 'Key reef' species *A. digitatum* (Figure 10-15).

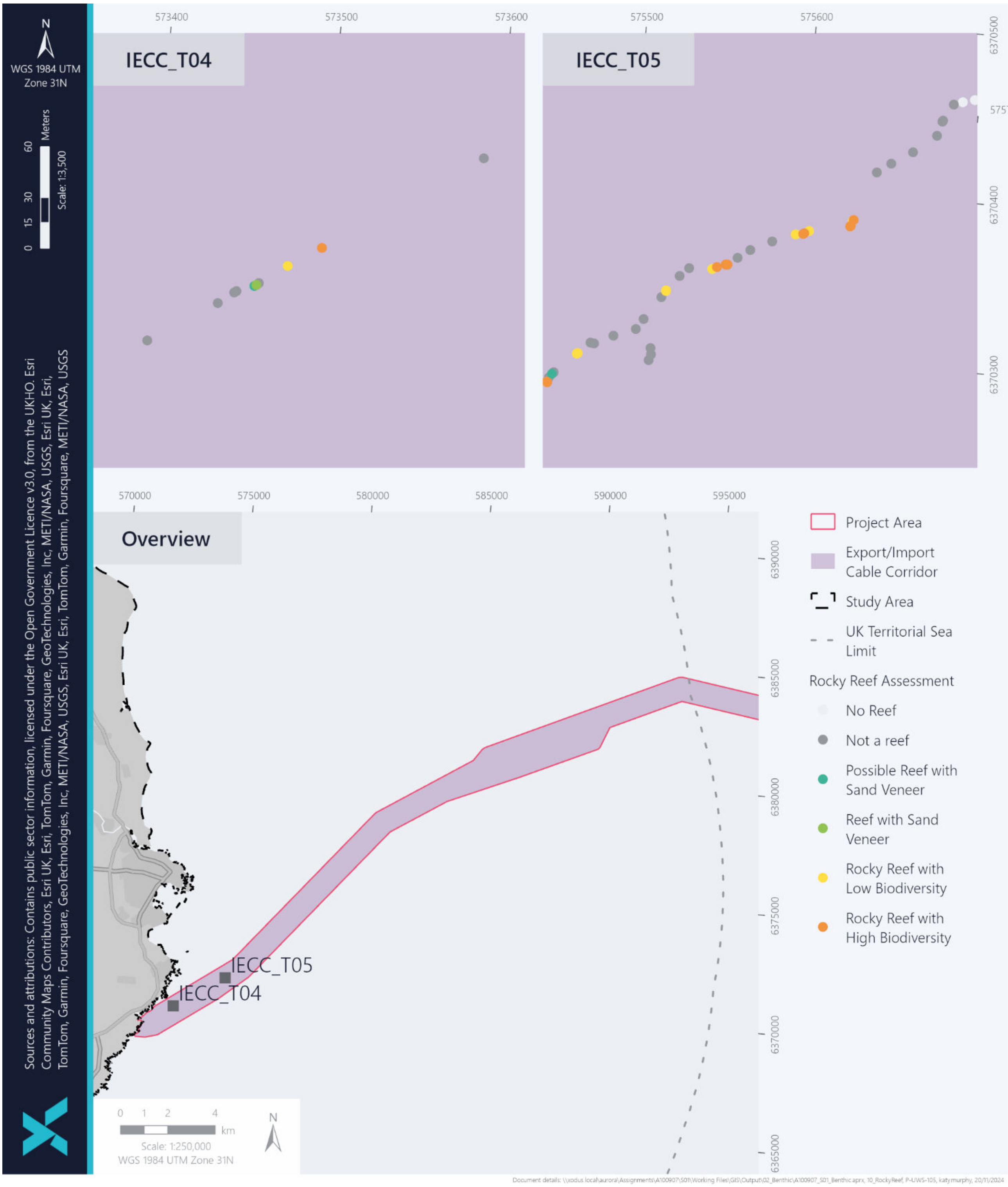

Figure 10-15 Rocky reef assessment in the inshore EICC

10.4.4.4.5 Annex I stony reefs

Surveys in 2018 in the inshore EICC identified an area of till, classified as 'A4.2211 – *S. spinulosa* with a bryozoan turf on silty turbid circalittoral rock' at transect T04 (MMT, 2018). This clast supported stony reef is graded as 'Medium' based on the composition showing a coverage of 40 to 95% and where the elevation is assessed to vary between 0.05 m and 1 m, with a distinct separation from the seabed (MMT, 2018). The extent is assessed to be approximately 70,000 m^2 based on the results of the geophysical survey. The biota associated with the hard surfaces consisted mainly of *S. spinulosa*. The bryozoan *F. foliacea* and sea stars are identified from the video and still images. Since infauna was not sampled in the T04 area, and the epifauna estimation was made only from the still images, the estimation of the composition of epifauna in relation to infauna is very difficult to make (MMT, 2018). At sampling station S02, habitat A5.611, the mixed sediment is not assessed to meet sufficient elevation of the boulders and cobbles present to qualify as a stony reef.

The seabed stills with less than 50% visible rock outcrop collected during the surveys in 2024 in the inshore EICC (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC) were also assessed for potential stony reefs using the criteria proposed by Irving (2009). In total, 106 images were reviewed along the two transects that contained areas of potential stony reef. Of the 106 images reviewed, 30 (28.3%) contained no evidence of stony reef. In terms of stony reef composition or percentage cover for all stills containing evidence of stony reef, 29 (27.4%) are classed as 'Not a reef', 31 (29.2%) as 'Low reef', 12 (11.3%) as 'Medium reef', and four (3.8%) as 'High reef'. In terms of elevation, 30 (28.3%) are classed as 'Not a reef', 25 (23.6%) as 'Low reef', 51 (48.1%) as 'Medium reef', and none are classed as 'High reef'. When both composition and elevation were considered, by examining reef 'structure', 29 (27.4%) are classed as 'Not a reef', 34 (32.1%) as 'Low reef', 13 (12.3%) as 'Medium reef', and none are classed as 'High reef' (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC).

This equates to a total of 47 images (44.3%) showing appreciable reefiness of 'Low reef' and 'Medium reef' (Figure 10-16).

The reef structure (composition vs. elevation vs. epifaunal cover) results formed the second part of the 'reef structure' assessment, which considers the percentage cover of epifauna colonising the cobbles and boulders. Although regarded as being of low ecological value on stony reefs by Golding *et al.* (2020), epifaunal coverage was quantified as total epifauna, including bryozoan / hydrozoan turf, to provide a precautionary approach to stony reef assessment. The mean reefiness (structure vs. epifaunal coverage) was calculated per reef section for each camera transect with a notable presence of cobbles and boulders. The structure vs. epifaunal coverage assessment revealed a relatively similar reef structure as previously described above, with the only notable difference occurring for the patch of reef identified between stills IECC_T04_RA_53 and IECC_T04_RA_55, which was down weighted to 'Not a reef' from its previous designation of 'Low reef' due to <10% epifaunal cover.

Utilising the Irving (2009) guidance, areas of seabed classified as 'Not a reef', based on reef structure (composition vs. elevation vs. epifaunal coverage) would still be 'Not a reef' regardless of whether the extent was < 25 m^2 or > 25 m^2. As such, areas were only calculated for patches of potential stony reef showing mean reefiness (structure vs. epifauna coverage) indicating 'Low reef' structure.

The results are outlined in Table 10-5, with a single patch of reef along transect IECC_T04 between stills IECC_T04_RA_09 and IECC_T04_RA_10 down weighted to 'Not a reef' from 'Medium reef'. Transect IECC_T04 featured one patch of 'Low reef' calculated at 10,656 m^2 and one small patch of 'Medium reef' calculated at 172 m^2. Transect IECC_T05 featured three small patches of 'Low reef' calculated in total as 770 m^2 and one small patch of 'Medium reef' calculated at 71 m^2.

Golding *et al.* (2020) further revised the epifaunal component of stony reef assessment to determine if areas classified as 'Low reef' had strong enough justification to be classed as Annex I stony reef. Areas previously identified as 'Medium reef' were not assessed under the revised epifaunal matrix, as Golding *et al.* (2020) state 'Medium reef' has a strong enough justification to be classified as Annex I stony reef based on its geogenic composition.

Transects where initial stony reef assessments were conducted and revealed the presence of 'Low reef' (structure vs. epifaunal coverage vs. extent) were further investigated to establish whether the hard substrates still corresponded to reef-like structures based on the revised epifaunal criteria. This involved the assignment of 'reef biotopes', the identification of key species and the richness of 'reef species' according to the criteria outlined in Golding *et al.* (2020).

The 'Low reef' patch located within transect IECC_T04 between stills IECC_T04_RA_19 and IECC_T04_RA_49 exhibited predominantly 'Possible reef' characteristics, as the underlying substrate, 'Circalittoral mixed sediment / MC4', aligned with a possible reef biotope (Figure 10-16). Additionally, only a single 'Key' reef species, the cnidarian *A. digitatum* and two 'Desirable' species (*Flustra foliacea* and *Asterias rubens*) were observed. The three 'Low Reef' patches observed across transect IECC_T05 exhibited predominantly 'Possible reef' characteristics. Similarly to IECC_T04, only a single 'Key' reef (*A. digitatum*) species and two 'Desirable' reef species (*F. foliacea* and *A. rubens*) were observed in any of the three patches delineated as 'Low reef', resulting in the classification of "Possible low reef" with no strong justification to warrant Annex I status.

Therefore, based on the stony reef assessment, two small (< 200 m^2) patches of 'Medium reef' (Figure 10-16) were identified across both IECC_T04 and IECC_T05 that could be considered Annex I reef; however, the lack of strong justification indicates that the aforementioned patches of 'Low reef' are unlikely to be considered as Annex I reef (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). The spatial extent of stony reef in the inshore EICC, using the data collected in 2024, is shown in Figure 10-16.

It is noteworthy that the site specific survey across the Array Area also investigated areas of potential stony reef which showed in geophysical data as higher reflectivity and were associated with isolated outcrops of the Coal Pit formation where offshore mixed sediments comprising cobbles and boulders were encountered (EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF). Transects across these areas were assessed based on the Irving (2009) and Golding et al., (2020) criteria. These areas were generally categorised as 'not a reef', however along transect OWF_51 which crossed through the area of highest sonar reflectivity, two stills were seen that could be classified as low stony reef in the northwest of the Array Area (Figure 10-4). The 'Low Reef' transect (OWF_51) exhibited predominantly 'Possible Reef' characteristics, as the identification of 'Circalittoral Mixed Sediment' (SS.SMx.CMx/MC421) matched one of the key reef biotopes listed in Golding et al. (2020). To evaluate the presence of reef species, epifauna from the still photographs were reviewed from the one occurrence of overall 'Low Reef' (structure vs. epifaunal coverage vs. extent). Two taxa observed in the stills classified as 'Key-Reef' species: the Cnidaria *Alcyonium digitatum* and bryozoan turf. The 'Low Reef' section had few desirable reef species, mainly cup corals (Caryophyllia). Given the presence of only up to three 'Key Reef' species in this area, it was categorised as "Possible Low Reef" based on Golding *et al*., (2020) ((EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF) Overall, given that only two still images revealed possible low reef presence, and also that the transect focussed on the highest area of reflectivity, it is considered unlikely that any notable additional reef would be seen in this area and that these areas in the Array Area are not of conservation value.

Table 10-5 Epifaunal reef structure across the inshore EICC survey area including reef extent

<table>
<tr><th>TRANSECT</th><th>STILL ID</th><th>COMPOSITION (%) COVER OF BOULDERS / COBBLES</th><th>ELEVATION (OF BOULDERS / COBBLES IN mm)</th><th>EPIFAUNAL (%) COVER</th><th>REEF EXTENT (m^2)</th><th>REEF STRUCTURE</th></tr>
<tr><td rowspan="8">IECC_T04</td><td>IECC_T04_RA_01</td><td rowspan="2">55</td><td rowspan="2">350</td><td rowspan="2">75</td><td rowspan="2">172</td><td rowspan="2">Medium reef</td></tr>
<tr><td>IECC_T04_RA_05</td></tr>
<tr><td>IECC_T04_RA_09</td><td rowspan="2">88</td><td rowspan="2">180</td><td rowspan="2">100</td><td rowspan="2">18</td><td rowspan="2">Not a reef</td></tr>
<tr><td>ECC_T04_RA_10</td></tr>
<tr><td>IECC_T04_RA_19</td><td rowspan="2">25</td><td rowspan="2">151</td><td rowspan="2">14</td><td rowspan="2">10,655</td><td rowspan="2">Low reef</td></tr>
<tr><td>IECC_T04_RA_49</td></tr>
<tr><td>IECC_T04_RA_53</td><td rowspan="2">30</td><td rowspan="2">117</td><td rowspan="2">2</td><td rowspan="2">8</td><td rowspan="2">Not a reef</td></tr>
<tr><td>IECC_T04_RA_55</td></tr>
<tr><td rowspan="8">IECC_T05</td><td>IECC_T05_RA_06</td><td rowspan="2">15</td><td rowspan="2">100</td><td rowspan="2">27</td><td rowspan="2">80</td><td rowspan="2">Low reef</td></tr>
<tr><td>IECC_T05_RA_08</td></tr>
<tr><td>IECC_T05_RA_12</td><td rowspan="2">58</td><td rowspan="2">101</td><td rowspan="2">54</td><td rowspan="2">71</td><td rowspan="2">Medium reef</td></tr>
<tr><td>IECC_T05_RA_14</td></tr>
<tr><td>IECC_T05_RA_55</td><td rowspan="2">32</td><td rowspan="2">90</td><td rowspan="2">37</td><td rowspan="2">87</td><td rowspan="2">Low reef</td></tr>
<tr><td>IECC_T05_RA_57</td></tr>
<tr><td>IECC_T05_RA_66</td><td rowspan="2">15</td><td rowspan="2">47</td><td rowspan="2">21</td><td rowspan="2">603</td><td rowspan="2">Low reef</td></tr>
<tr><td>IECC_T05_RA_79</td></tr>
</table>

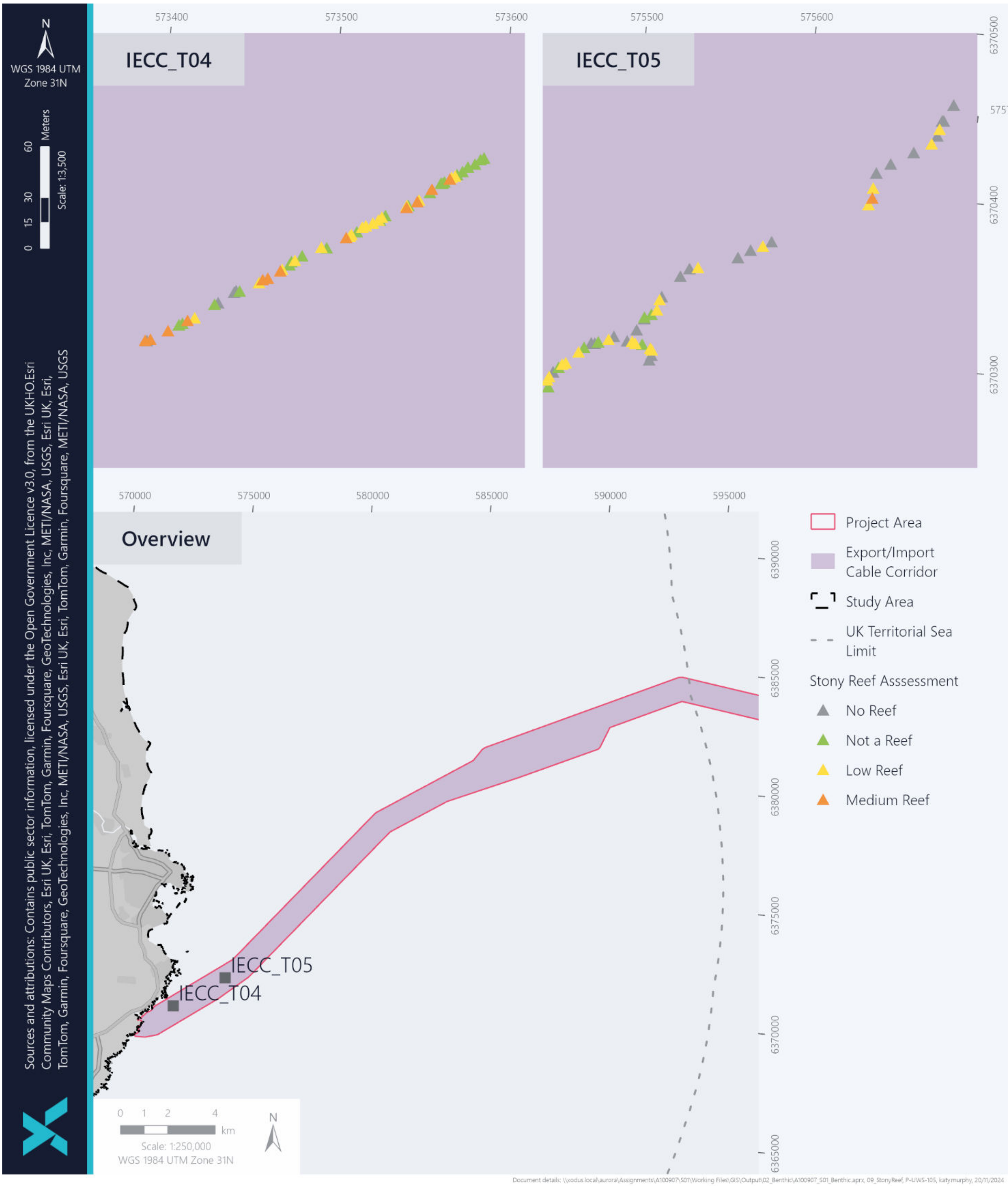

Figure 10-16 Stony reef assessment in the inshore EICC, based on surveys undertaken in 2024

10.4.4.4.6 Subtidal sands and gravels

The subtidal sands and gravels habitat is a priority habitat under the UK BAP and is also listed as a Scottish PMF. This is one of the most common habitats in the UK offshore marine environment and is widespread in Scottish offshore waters (Tyler-Walters et al., 2016). This habitat hosts various species including polychaetes, crustaceans, and fish, which rely on the habitat for breeding, feeding, and shelter. These areas support internationally important fish and shellfish fisheries and provide important ecosystem services by improving water quality and acting as carbon sinks.

The review of the survey data showed that the habitat subtidal sands and gravels is present across the Project. Specifically, 'Circalittoral mixed sediment / MC4' is found in the Array Area (Figure 10-2), 'Circalittoral sand / MC5' and 'Circalittoral mixed sediment / MC4' in the EICC (Figure 10-3) and 'Offshore circalittoral coarse sediment / MD3', 'Offshore circalittoral sand / MD5' and 'Circalittoral muddy sand / A5.26' in the inshore EICC (Figure 10-12) (EIAR Vol. 4, Appendix 8: Habitat Assessment Report – OWF, EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC, EIAR Vol. 4, Appendix 11: Environmental Baseline Report – OWF, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC).

10.4.4.4.7 Annex I biogenic reef (*Sabellaria spinulosa*)

S. spinulosa is a tube-building polychaete worm and can occur as isolated individuals, small aggregations, thin crust-like veneers, or when in large numbers can form hard reef-like structures which can act to stabilise the surrounding seabed (Gibb *et al.*, 2014). As their tubes are built of sand, a high suspended sediment content is essential for growth of reef like structures and the mobile sandy seabed within the survey area may provide this.

S. spinulosa aggregations with reef-like properties have been observed in seabed imagery collected through a variety of sources from the east coast of Scotland with the best examples being located at the Rattray Head and Southern Trench study site (Pearce and Kimber, 2020). These surveys identified discrete clumps of *S. spinulosa* aggregations which are limited in their extent by the available substrate, with well-developed reef 'bommies' occurring on isolated cobbles and boulders in an otherwise fairly featureless soft bottom habitat. The resulting habitat can be considered analogous with discrete coral reef 'bommies' in Australia (Pearce and Kimber, 2020). The Habitat Assessment Report in the Array Area does not mention the presence of *S. spinulosa* biogenic reefs (EIAR Vol. 4, Appendix 11: Environmental Baseline Report - OWF).

In the offshore EICC, the presence of *S. spinulosa* was noted on five camera transects (ECC_40, 39, 03, 38 and 37) (Figure 10-7). An assessment of 'reefiness' (Gubbay, 2007) was performed assessing reef 'structure' and overall 'reefiness' (EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC). The first stage of the assessment indicated that *S. spinulosa* occurred exclusively in the western extent of the EICC route. As indicated in Table 10-6, out of the 403 images reviewed for *S. spinulosa*, the vast majority (79.9%, equivalent to 322 stills) did not show any evidence of *S. spinulosa* aggregations and are labelled as areas of 'No reef'. Of the images showing *S. spinulosa*, 60 (14.9%) are classed as 'Not a reef', 18 (4.5%) as 'Low reef', 2 (0.5%) as 'Medium reef' and one (0.2%) as 'High reef' in terms of percentage cover. A different pattern was evident for tube elevation with 25 images (6.2%) classed as 'Not a reef', 19 (4.7%) as 'Low reef', 30 (7.4%) as 'Medium reef', and six (1.5%) as 'High reef'. When both patchiness and elevation were considered, by examining reef 'structure', 61 (15.1%) are classed as 'Not a reef', 17 (4.2%) are classed as 'Low reef', one (0.3%) was classed as 'Medium reef' and one (0.3%) was classed as 'High reef'. The second stage of the analysis assessed the average reef structure for each delineated patch of *S. spinulosa* against the delineated patch area to assess the overall patch 'reefiness'. There are 15 areas delineated as 'Low reef' with the remaining delineated as 'Not a reef. The spatial extent of 'Low reef' ranged from 25.1 m^2 (ECC_38) to 305.1 m^2 (ECC_39) which are significantly below the 'Medium' extent threshold of 10,000 m^2 (EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC).

*Table 10-6 Summary of potential Saballaria spinulosa' reefiness' along EICC (**EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC**)*

'REEFINESS' OF VIDEO SCREEN GRABS	NO REEF		NOT A REEF		LOW		MEDIUM		HIGH	
	No.	%	No.	%	No.	%	No.	%	No.	%
Patchiness (% cover)	322	79.9	60	14.9	18	5.4	2	0.6	1	0.3
Elevation (tube height)			25	6.2	19	4.7	30	7.5	6	1.5
Reef Structure			61	15.1	17	4.2	1	0.3	1	0.3

The habitat assessment results have highlighted the presence of *S. spinulosa* in isolated patches in the western extent of the EICC (Figure 10-17). However, the ground-truthing data indicates that these *S. spinulosa* aggregations do not constitute Annex I reef habitat. While the presence of biogenic reefs within the area cannot be ruled out, the evidence suggests they are unlikely to be numerous or, of a significant size (EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC).

In the surveys carried out in 2018 in the inshore EICC, *S. spinulosa* was found at sampling station S02 in all three grab sample replicates (MMT, 2018). The tube structures are also seen in all four photos analysed at the sample location. On the hard surfaces seen in the images as well as on the cobbles in the grab sample, the tubes formed a thin crust draping the hard surface. The tube elevation was less than 1 cm. The assessed parameters at S02 sampling station do not fulfil the requirements for the area to be classified as an Annex I biogenic reef. The same conclusion was drawn regarding the habitat and the *S. spinulosa* tubes observed during transect T04 (MMT, 2018). At the outcropping bedrock surveyed at transect T05 the *S. spinulosa* tube aggregations had a different structure and elevation. On the slopes and on bedrock elevated from the surrounding sand and gravel, large reef structures are elevated > 10 cm from the underlying bedrock. No sampling was performed at the hard surfaces but the structures were clearly visible in the video data. Using the Gubbay (2007) definition for grading reefiness it is considered to fulfil the criteria of a high graded *S. spinulosa* reef. The extent of the area is hard to assess due to the mix of two different kinds of surfaces, one with and one without *S. spinulosa* present (MMT, 2018).

Assessments for the potential presence of *S. spinulosa* biogenic reefs in the inshore EICC were also carried for the data collected in surveys in 2024 (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC) (Figure 10-17). The reefiness was assessed following a two-stage analysis (Gubbay, 2007, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). In the first stage of analysis, a review of 10 high definition (HD) stills revealed one classed as 'Not a reef', two are classed as 'Medium reef' and the remaining seven stills (70%) are classed as 'High reef' in terms of percentage cover. A different pattern was evident for tube elevation with four images (40%) classed as 'Not a reef', three as 'Low reef' and three as 'Medium reef'. No instances of 'High reef' are evident when tube elevation was considered in isolation. When both patchiness and elevation were taken into account, by examining 'Reef structure', four stills were classed as 'Not a reef', three were classed as 'Low reef', three were classed as 'Medium reef'. No incidences of 'High reef' are observed across the Inshore IECC survey area. Aggregating the stills revealed the presence of two isolated patches of 'Low reef', based on the average *S. spinulosa* composition and tube height. In the second stage of the assessment, analysis of the spatial extent of each isolated patch of *S. spinulosa* revealed that only a single patch could be considered to reflect an area (>25 m^2) of 'Low reef'. In summary, the assessment of the inshore EICC highlighted the presence of *S. spinulosa* which formed two isolated patches across transect IECC_T05 (Figure 10-9. However, stills analysis indicated that only a single incidence of 'Low reef' was observed across the inshore EICC survey area and based on the size (69 m^2), was unlikely to constitute the presence of Annex I biogenic reef (EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC).

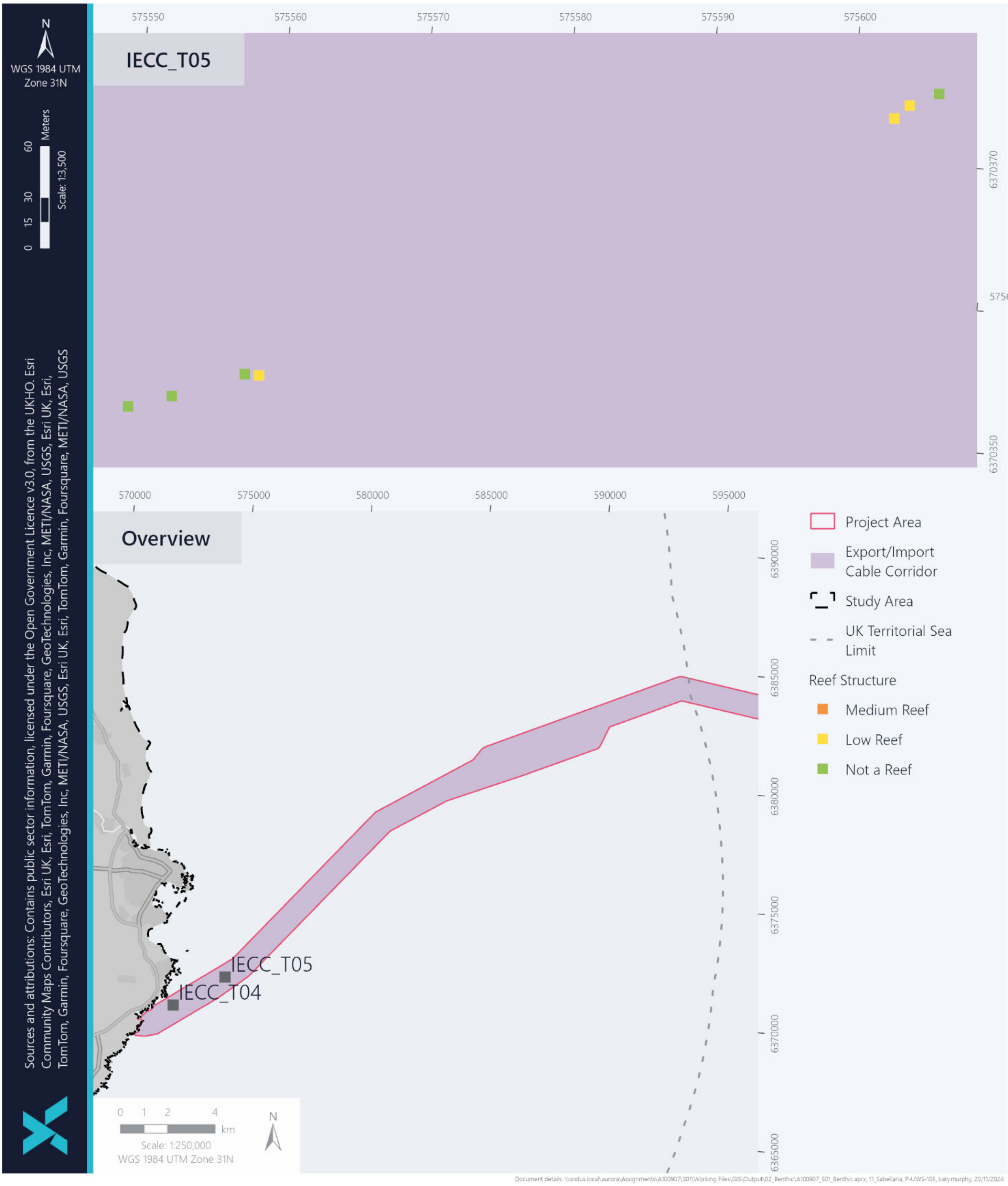

*Figure 10-17 Sabellaria spinulosa biogenic reef assessment based on the surveys carried out in 2024 (**EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC)***

10.4.4.4.8 Deep-sea sponge aggregations

The habitat "Deep-sea sponge aggregations" is listed in the OSPAR "List of Threatened and / or Declining Species and Habitats" and is currently considered under threat and / or decline in all OSPAR areas where it occurs (OSPAR, 2008). OSPAR (2010b) defines that any sponge aggregations with "more than 0.5 sponges per m^2" extending over an area of 25 m^2 should be defined as a potential deep-sea sponge aggregation.

In the Array Area, the assessment was applied to 539 stills images (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF). In order to verify the presence of deep-sea sponge aggregations, data were assessed against the OSPAR (2010b) and Henry and Roberts (2014) guidance; the latter takes into account the density, habitat, and ecological function of an area. For a 'High' confidence level to be assigned, an area must be compliant with all three criteria elements, while a 'Medium' confidence level requires two criteria to have been met. A 'Low' confidence level is assigned when only one criteria category can be met. In terms of density, the Array Area had an OSPAR sponge density of <0.5 m^2, so did not pass the minimum density criteria. None of the habitats (SS.SMu.OMu, SS.SMx.OMx) assigned in the Array Area corresponded to the sponge associated habitat classifications. The majority of erect epifauna associated with these habitats included branching porifera (*Axinella* sp.), encrusting porifera, occasional dead man's fingers (*A. digitatum*) and cup corals (*Caryophyllia* sp.).

Given no criteria were met, it is concluded that the OSPAR and PMF 'Deep-sea sponge aggregations' habitat is not present in the Array Area (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF).

Due to the lack of evidence of the presence of the habitat 'Deep-sea sponge aggregations' in the Project Area, this habitat has been scoped out from any further assessment.

10.4.4.4.9 Submarine structures made by leaking gases

This habitat is listed as an Annex I habitat under the EC Habitat Directive. These structures consist of Methane-derived authigenic carbonates (MDAC) structures which take the form of rocks, pavements, or pillars of carbonate cement (JNCC, 2014). While MDAC may form in isolation in sandy substrate, it is often found in association with seabed depressions, known as pockmarks, which can form in muddy seabed when shallow gas is unable to escape freely from the sediment into the water column. MDAC concretions function as habitat islands within otherwise soft sediment habitat and their rough, reef-like structures provide shelter for a variety of fauna (JNCC, 2014). In addition, should seepage of shallow gas continue then a number of chemosynthetic fauna may be supported which derive their nutrition fully or in part from methane or hydrogen sulphide in the sediment porewaters and / or seawater (Webb *et al.*, 2009).

In the EICC, the survey (EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC) showed a number of seabed depressions that resembled pockmarks. These pockmarks had central areas of high reflectivity which can be an indicator for the presence of MDAC. Three depressions were ground-truthed which revealed the sediment inside the pockmarks to be composed of mud with aggregations of relic shell fragments in the centre of the depression. There are no indicator species, such as the chemotrophic bivalve *Lucinoma borealis* often associated with active pockmarks (Dando *et al.*, 1986). In addition, there is no evidence of MDAC within either depression or other visible cues which might indicate active seepage of shallow gas, i.e. no gas bubbles, anoxic sediments, or bacterial mats (*Beggiatoa* sp.). Seabed depressions which were not ground-truthed were of a similar size, depth and sonar reflectivity to the aforementioned sites, and are likely to reflect the same muddy sediment composition with aggregations of relic shell fragments in the centre (EIAR Vol. 4, Appendix 9: Habitat Assessment Report - EICC). Given the lack of evidence of shallow gas in the vicinity of depressions and the absence of MDAC on camera ground-truthing data, there is no evidence to suggest that the EC Habitats Directive Annex I habitat 'Submarine structures caused by leaking gases' occurs within the Array Area (EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC).

Due to the lack of evidence of the presence of the habitat 'Submarine structures made by leaking gases' in the Project Area, this habitat has been scoped out from any further assessment.

10.4.4.5 Summary of key receptors

The key receptors including benthic species and habitats are detailed in Table 10-7, along with their key sensitivities and recoverability. The sensitivities used for this impact assessment have been largely drawn from the Marine Evidence based Sensitivity Assessment (MarESA) accessed via the MarLIN website and supplemented by the Feature Activity Sensitivity Tool (FeAST). MArESA sensitivity assessments are usually provided for biotopes, whereas FeAST focuses on features of NCMPAs.

Table 10-7 Key species / habitats and their associated sensitivity and recoverability

ASSOCIATED BIOTOPES	LOCATION	SENSITIVITY	RECOVERABILITY
Offshore deep-sea muds: a UK BAP Priority Habitat and a PMF			
• Offshore circalittoral mud (SS.SMu.OMu)	Array Area Offshore EICC	From FeAST (2024)[15] and MarESA (MarLIN, 2024)[16] • High sensitivity (FeAST, MarESA) to physical change (to another seabed type); • High sensitivity (FeAST) / Medium / (MarESA) to surface abrasion; • High (FeAST) / Medium (MarESA) sensitivity to sub-surface abrasion / penetration; • High (FeAST) / Medium (MarESA)sensitivity to siltation rate changes (heavy); • High (FeAST) / Not sensitive (MarESA) to siltation rate changes (light); • Not assessed (FeAST) / No evidence (MarESA) for sensitivity to Electromagnetic Fields (EMFs); • Medium (FeAST) / Not sensitive (MarESA) to temperature increase; • Not assessed (FeAST) / Not relevant (MarESA) for sensitivity to introduction of INNS.	• No specific data in FeAST (2024) about the tolerance and recovery of deep-sea muds to the pressures listed here. • No resistance and very low resilience to physical change (to another seabed type) (MarLIN, 2024); • Low resistance, medium resilience to surface abrasion (MarLIN, 2024); • Low resistance, medium resilience to sub-surface abrasion / penetration (MarLIN, 2024); • Low resistance and medium resilience to siltation rate changes (heavy) (MarLIN, 2024); • High resistance, high resilience to siltation rate changes (light) (MarLIN, 2024); • No evidence / Not relevant about resistance and resilience, respectively to EMFs generated by cables (MarLIN, 2024); • High resistance and high resilience to temperature increase generated by cables (MarLIN, 2024); • Not relevant for resistance and resilience to introduction of INNS (MarLIN, 2024).

[15] *Deep-sea muds*
[16] *Used the habitat 'Paramphinome jeffreysii, Thyasira spp. and Amphiura filiformis in offshore circalittoral sandy mud' as proxy for 'Offshore deep-sea muds' as this habitat is not listed in MarESA (2024)*

ASSOCIATED BIOTOPES	LOCATION	SENSITIVITY	RECOVERABILITY
Ocean quahog: on the OSPAR List of Threatened and / or Declining Species and a PMF			
• Offshore circalittoral mud (SS.SMu.OMu); • Offshore circalittoral sand (SS.SSa.Osa); and • Subtidal sands and gravels	Array Area; Offshore EICC	From FeAST (2024) and MarESA (MarLIN, 2024): • High (FeAST, MarESA) sensitivity to physical change (to another seabed type); • High (MarESA) sensitivity to physical change (to another sediment type) (this impact pathway is not included in FeAST); • Low (FeAST) / High (MarESA) sensitivity to abrasion / disturbance of the surface of the substratum or seabed; • High sensitivity (FeAST, MarESA) to penetration or disturbance of the substratum subsurface; • High (FeAST) / Not sensitive (MarESA) to smothering and siltation rate changes (heavy); • Not sensitive (FeAST, MarESA) to smothering and siltation rate changes (light); • Not assessed (FeAST) / No evidence (MarESA) for sensitivity to EMFs; • High (FeAST) / Medium (MarESA) sensitivity to temperature increase; • Not assessed (FeAST) / No evidence (MarESA) for sensitivity to introduction of INNS.	• Tolerance and recovery not assessed for physical change (to another seabed type) (FeAST, 2024); • No resistance and very low resilience to physical change (to another seabed type) (MarLIN, 2024) • Low resistance and very low resilience to physical change (to another sediment type) (MarLIN, 2024); • Tolerance and recovery not assessed for abrasion / disturbance of the surface of the substratum or seabed (FeAST, 2024); • Low resistance and very low resilience to abrasion / disturbance of the surface of the substratum or seabed (MarLIN, 2024); • Tolerance and recovery not assessed for penetration or disturbance of the substratum subsurface (FeAST, 2024); • Low resistance and very low resilience to penetration or disturbance of the substratum subsurface; • Tolerance and recovery not assessed for smothering and siltation rate changes (heavy) (FeAST, 2024); • High resistance and high resilience to smothering and siltation rate changes (heavy) (MarLIN, 2024); • Tolerance and recovery not assessed for smothering and siltation rate changes (light) (FeAST, 2024); • High resistance and high resilience to smothering and siltation rate changes (light) (MarLIN, 2024); • Tolerance and recovery not assessed for EMFs (FeAST, 2024) • No evidence and not relevant for resistance and resilience, respectively, for EMFs (MarLIN, 2024);

ASSOCIATED BIOTOPES	LOCATION	SENSITIVITY	RECOVERABILITY
			• Tolerance and recovery not assessed for temperature increase (FeAST, 2024); • Medium resistance and medium resilience to temperature increase (MarLIN, 2024); • Tolerance and recovery not assessed for introduction of INNS (FeAST, 2024); • No evidence and not relevant for resistance and resilience, respectively, for introduction of INNS (MarLIN, 2024).
Burrowed mud / Seapens and burrowing megafauna communities: a PMF and on the OSPAR List of Threatened and / or Declining Species and Habitats			
• Seapens and burrowing megafauna communities	Array Area	From FeAST (2024) and MarESA (MarLIN, 2024)[17]: • High (FeAST, MarESA) sensitivity to physical change (to another seabed type); • High (MarESA) sensitivity to physical change (to another sediment type) (this impact pathway is not included in FeAST); • Medium (FeAST, MarESA) / sensitivity to abrasion / disturbance of the surface of the substratum or seabed; • Medium (FeAST) / High (MarESA) sensitivity to penetration or disturbance of the substratum subsurface; • Medium (FeAST) / No sensitivity (MarESA) to smothering and siltation rate changes (heavy); • Low (FeAST) / No sensitivity (MarESA) to smothering and siltation rate changes (light); and	• Tolerance and recovery not assessed for physical changes (to another seabed type) (FeAST, 2024); • No resistance and very low resilience to physical change (to another seabed type) (MarLIN, 2024); • No resistance and very low resilience to physical change (to another sediment type) (MarLIN, 2024); • Tolerance and recovery not assessed for abrasion / disturbance of the surface of the substratum or seabed (FeAST, 2024); • Medium resistance and low resilience to abrasion / disturbance of the surface of the substratum or seabed (MarLIN, 2024); • Tolerance and recovery not assessed for penetration or disturbance of the substratum subsurface (FeAST, 2024); • Low resistance and low resilience to penetration or disturbance of the substratum subsurface (MarLIN, 2024); • Tolerance and recovery not assessed for smothering and siltation rate changes (heavy) (FeAST, 2024);

[17] *Seapens and burrowing megafauna in circalittoral fine mud*

ASSOCIATED BIOTOPES	LOCATION	SENSITIVITY	RECOVERABILITY
		• Not assessed (FeAST) / No evidence (MarESA) of sensitivity to EMFs; • Low (FeAST) / Medium (MarESA) sensitivity to temperature increase; • Not assessed (FeAST) / No evidence (MarESA) of Introduction of INNS.	• High resistance and high resilience to smothering and siltation rate changes (heavy) (MarLIN, 2024); • Tolerance and recovery not assessed for smothering and siltation rate changes (light) (FeAST, 2024); • High resistance and high resilience to smothering and siltation rate changes (light) (MArLIN, 2024); • Tolerance and recovery not assessed for EMFs (FeAST, 2024); • Not relevant for resistance and resilience for EMFs (MarLIN, 2024); • Tolerance and recovery not assessed for temperature increase (FeAST, 2024); • Medium resistance, low resilience to temperature increase (MarLIN, 2024).
Subtidal sands and gravels: a UK BAP Priority Habitat and a PMF			
• Offshore circalittoral sand (SS.SSa.Osa); • Offshore circalittoral mixed sediment (SS.SMx.OMx); • Offshore circalittoral coarse sediment; and	Array Area; Offshore EICC; Inshore EICC	From MarESA (MarLIN, 2024)[18,19] : • High sensitivity to physical change (to another seabed type or to another sediment type) • Low sensitivity to abrasion / disturbance of the surface of the substratum or seabed; • Low sensitivity to penetration or disturbance of the substratum subsurface; • Medium sensitivity to smothering and siltation rate changes (heavy); • Low sensitivity to smothering and siltation rate changes (light); • No evidence for sensitivity to EMFs;	From MarESA (MarLIN, 2024) • No resistance, very low resilience to physical change (to another seabed type or to another sediment type); • Low resistance, very low resilience to physical change (to another sediment type); • Medium resistance, high resilience to abrasion / disturbance of the surface of the substratum or seabed; • Medium resistance, high resilience to penetration or disturbance of the substratum subsurface; • Medium resistance, medium resilience to smothering and siltation rate changes (heavy);

[18] *Glycera lapidum, Thyasira spp. and Amythasides macroglossus in offshore gravelly sand*

[19] *For 'Subtidal sands and gravels' the assessment has taken into account only the information available in MarLIN (2024) as the habitat 'Subtidal sands and gravels' does not appear in FeAST (2024).*

ASSOCIATED BIOTOPES	LOCATION	SENSITIVITY	RECOVERABILITY
• Circalittoral muddy sand		• Low sensitivity to temperature increase; and • High sensitivity to introduction of INNS.	• Medium resistance, high resilience to smothering and siltation rate changes (light); • Not relevant for resistance and resilience to EMFs; • Medium resistance, low resilience to temperature increase; • Low resistance, very low resilience to introduction of INNS.
Geogenic (bedrock or stony) reef: Habitats Directive Annex I			
• Circalittoral mixed sediment (SS.SMx.CMx)	Array Area; Inshore EICC	From MarESA (MarLIN, 2024)[20,21] • High sensitivity to physical change (to another seabed type); • Low sensitivity to abrasion / disturbance of the surface of the substratum or seabed; • Not relevant for penetration or disturbance of the substratum subsurface; • Low sensitivity to smothering and siltation rate changes (heavy); • No sensitivity to smothering and siltation rate changes (light); • No evidence of sensitivity to EMFs; • Low sensitivity to temperature increase; • Insufficient evidence of sensitivity to introduction of INNS.	From MarESA (MarLIN, 2024) • No resistance, very low resilience to physical change (another seabed type); • Medium resistance and high resilience to abrasion / disturbance of the surface of the substratum or seabed; • Not relevant for resistance and resilience to penetration or disturbance of the substratum subsurface; • Medium resistance and high resilience to smothering and siltation rate changes (heavy) • High resistance, high resilience to smothering and siltation rate changes (light); • No evidence, not relevant for resistance and resilience, respectively, for EMFs; • Medium resistance, high resilience for temperature increase. • Insufficient evidence and not relevant for resistance and resilience, respectively, for introduction of INNS.

[20] *Alcyonium digitatum with Securiflustra securifrons on tide-swept moderately wave-exposed circalittoral rock*
[21] *For 'Geogenic (bedrock or stony) reef ' the assessment has taken into account only the information available in MarLIN (2024) as relevant habitat does not appear in FEAST (2024).*

ASSOCIATED BIOTOPES	LOCATION	SENSITIVITY	RECOVERABILITY
***S.spinulosa* biogenic reef Habitats Directive Annex I**			
S.spinulosa on stable circalittoral mixed sediment	• Offshore EICC; and • Inshore EICC	From MarESA (MarLIN, 2024)[22],[23] • High sensitivity to physical change (to another seabed type); • High sensitivity to physical change (to another sediment type); • Medium sensitivity to abrasion / disturbance of the surface of the substratum or seabed; • Medium sensitivity to penetration or disturbance of the substratum subsurface; • Medium sensitivity to smothering and siltation rate changes (heavy); • No sensitivity to smothering and siltation rate changes (light); • No evidence of sensitivity to EMFs; • Not sensitive to temperature increase ; • No evidence of sensitivity to introduction of INNS.	• No resistance and very low resilience to physical change (to another seabed type) (MarLIN, 2024); • No resistance and very low resilience to physical change (to another sediment type) (MarLIN, 2024); • Low resistance and medium resilience to abrasion / disturbance of the surface of the substratum or seabed (MarLIN, 2024); • No resistance and medium resilience to penetration or disturbance of the substratum subsurface (MarLIN, 2024); • No resistance and medium resilience to smothering and siltation rate changes (heavy) (MarLIN, 2024); • High resistance and high resilience to smothering and siltation rate changes (light) (MarLIN, 2024); • No evidence for resistance and resilience to EMFs (MarLIN, 2024); • High resistance and high resilience to temperature increase (MarLIN, 2024). • No evidence and not relevant for resistance and resilience, respectively, for temperature increase (MarLIN, 2024). • No evidence and not relevant for resistance and resilience, respectively, for introduction of INNS.

[22] *Sabellaria spinulosa on stable circalittoral mixed sediment*

[23] *For this habitat only information available in MarLIN (2024) has been used as this habitat does not appear in FeAST (2024).*

10.4.5 Future baseline

In the absence of the Project, the Benthic Ecology receptors within the Project Area are likely to experience future long-term changes as a result of a combination of climatic (e.g. rising sea temperatures) and non-climatic factors (e.g. fishing pressure), which may interact with and influence responses to climate change (Moore and Smale, 2020). As described in EIAR Vol.4, Chapter 20 Carbon and Greenhouse Gases, climate change is leading to increases in ocean temperature, changes to ocean chemistry, sea-level rise, changing salinities and oceanographic patterns and increased extreme events including storminess and marine heatwaves (Stocker, 2013; Hughes *et al*., 2018).

The predicted rise in sea temperatures may result in an increased abundance of warm-water species and a decline in cold-water species, with associated shifts in abundances and species composition (Moore and Smale, 2020). An example includes the increase in warmer-water kelp species *Laminaria ochroleuca* in the Western English Channel which now competes with *Laminaria hyperborea* (Smale *et al.*, 2015). Some species may be subject to warmer conditions if range shifts cannot keep pace with temperature changes or if food availability increases, resulting in physiological stress. For instance, a mean seabed temperature of 8.7°C is projected at the start of the operation and maintenance phase in 2035 and of 10.4°C by cessation of operations in 2070. These increase in temperature will also affect dissolved oxygen concentration and salinity which may impact the benthic community composition. An increase in sea temperature would decrease dissolved oxygen concentrations in the water column and in bottom waters, an effect which is exacerbated by changes in stratification in the North Sea, which may result from a more rapid rise in sea surface temperatures compared with near-bottom temperatures (Mahaffey *et al*., 2023). The increase in sea surface temperatures is likely to increase the risk of spread of INNS from warmer waters, particularly in shallower coastal waters where inherent risk of introductions is at its highest and where stratification may extend to the seabed.

An increase in the duration and strength of stratification could lead to dissolved oxygen deficiency in the summer months with consequences for ecosystems reliant on ocean mixing (Sharples *et al*., 2022; Mahaffey *et al*., 2023). This could in turn affect the productivity and nutrient cycles which are relied on by deposit and filter feeding benthos as well as have the potential disrupt the developmental planktonic life stages of certain benthic species. Ocean acidification may also affect subtidal calcifying benthic organisms such as crustaceans and bivalves (Mieszkowska *et al*., 2020; Moore and Smale, 2020; Grear *et al*., 2020).

The species and habitats in the Project Area are not at their northerly or southerly geographic distribution, which makes them less vulnerable to changing climatic conditions. Furthermore, many of the key benthic habits and species of conservation interest occur in the deeper waters of the Array Area which are expected to retain more stable environmental conditions than shallower areas closer to shore.

10.4.6 Summary and key sensitivities

A summary of sediment types and features of conservation significance in the Array Area, offshore EICC and inshore EICC is provided in Table 10-8. It should be clarified that the broad habitat 'Subtidal sands and gravels' is assumed to be present in those areas where the following habitats have been identified:

- Offshore circalittoral mixed sediment (MD4);
- Circalittoral mixed sediment (MC4);
- Offshore circalittoral coarse sediment (MD3); and
- Offshore circalittoral sand (MD5).

The PMF habitat 'Offshore deep-sea muds' has been assumed to be present in those areas where the habitat 'Offshore circalittoral mud / MD6' has been identified.

Table 10-8 Summary of sediment types and features of conservation significance for Benthic Ecology

SUMMARY AND KEY ISSUES

PROJECT AREA

Array Area

- The Array Area overlaps directly with the East of Gannet and Montrose Fields NCMPA which has qualifying seabed features.
- Two EUNIS sediments characterise the Array Area: A5.27 'Deep circalittoral sand' and A5.37 'Deep circalittoral mud'. This was generally in agreement with the site-specific habitat assessment results.
- Analysis of geophysical data, drop down camera and grab sampling identified the following UK and Ireland classification system habitats:
  - Offshore circalittoral mud (SS.SMu.Omu / MD6);
  - SS.SMu.Omu.PjefThyAfil '*Paramphinome jeffreysii*, *Thyasira sp*. and *Amphiura filiformis* in offshore circalittoral sandy mud;
  - Offshore circalittoral mixed sediment (SS.SMx.Omx / MD4); and
  - SS.SMx.OMx.PoVen 'Polychaete-rich deep Venus community'.
- Key conservation habitats and species found within the Array Area are as follows:
  - Offshore deep-sea muds (UK BAP, PMF);
  - Ocean quahog (OSPAR, PMF);
  - Burrowed mud / Seapens and burrowing megafauna communities (OSPAR, PMF);
  - Subtidal sands and gravels (UK BAP, PMF); and
  - Geogenic (stony) reef (Annex I).

Offshore EICC

- The Benthic Ecology Study Area overlaps with the Turbot Bank NCMPA (which is designated for sandeel).
- Along the EICC, EUNIS sediment types A5.27 'Deep circalittoral sand', A5.15 'Deep circalittoral coarse sediment' and A5.37 'Deep circalittoral mud' were prevalent. This was corroborated by the results of PSA.
- Analysis of geophysical data, drop down camera and grab sampling identified the following UK and Ireland classification system habitats:
  - Offshore circalittoral sand (SS.SSa.Osa / MD5);
  - SS.Ssa.Osa.OfusAfil '*Owenia fusiformis* and *Amphiura filiformis* in Offshore circalittoral sand or muddy sand;
  - Offshore Circalittoral Mud (SS.Smu.Omu / MD6);
  - SS.SMu.Omu.PjefThyAfil '*Paramphinome jeffreysii*, *Thyasira sp*. and *Amphiura filiformis* in Offshore circalittoral sandy mud'; and
  - Offshore circalittoral mixed sediment (SS.SMx.Omx / MD4).
  - SS.SMx.OMx.PoVen 'Polychaete-rich deep Venus community in offshore mixed sediments'.
- Key conservation habitats and species found within the offshore EICC are as follows:
  - Offshore deep-sea muds (UK BAP, PMF);
  - Subtidal sands and gravels (UK BAP, PMF);
  - *S. spinulosa* biogenic reef (Annex I); and
  - Ocean quahog (OSPAR, PMF).

Inshore EICC
• Within the inshore section of the EICC, EUNIS sediment types 'A5.27 - Deep circalittoral sand', 'A5.15 - Deep circalittoral coarse sediment' and 'A5.14 - Circalittoral coarse sediment' were characteristic. • Analysis of video and still data identified the following UK and Ireland classification system habitats: – Offshore circalittoral sand (SS.SSa.Osa / MD5); – Circalittoral muddy sand (SS.SSa.CmuSa / A5.26); – Offshore circalittoral coarse sediment (SS.SCS.OCS / MD3); – Circalittoral mixed sediment (SS.SMx.CMx / MC4); – Moderate energy circalittoral rock (CR.MCR / A4.2); – Mixed faunal turf communities (CR.HCR.Xfa); and – *S spinulosa* encrusted circalittoral rock (CR.MCR.Csab.Sspi). • Key conservation habitats and species found within the inshore EICC are as follows: – Subtidal sands and gravels (UK BAP, PMF); – Geogenic (bedrock) reef (Annex I); – Geogenic (stony) reef (Annex I); – *S. spinulosa* biogenic reef (Annex I); – Ocean quahog (OSPAR, PMF); and – Burrowed mud / Seapens and burrowing megafauna communities (OSPAR, PMF).

10.4.7 Data gaps and uncertainties

Rovco, Benthic Solutions Ltd, and SEP Hydrographic Ltd have undertaken comprehensive site specific environmental survey campaigns using a combination of geophysical data acquisition, ground-truthed with camera stills and transects and sediment grab sampling within the Array Area, offshore EICC and inshore EICC. As such, it is not considered that there are any major data limitations or uncertainties. However, surveys carried out do not cover 100% of the Project Area (Figure 10-4, Figure 10-7, Figure 10-9) so there is the potential that some benthic features (species, habitats) may have not been captured. The width of the EICC surveyed was 500 m while the total red line boundary of the EICC is 1 km across. In the inshore EICC, a corridor of 150 m was surveyed.

The scope of the Benthic Ecology assessment undertaken for the Project directly addresses and will provide useful data to inform some of the key research themes identified by the ScotMER benthic receptor group. These themes include:

- Species or feature distribution; data – extensive Project specific surveys and associated analysis have allowed detailed mapping of seabed features, habitats and species distribution;
- Impacts on ecosystem function – Potential ecosystem effects have been an integral aspect of the EIA; and
- Electromagnetic Field (EMF) impacts – EMF calculations undertaken for this Project have informed the assessment of EMF effects. Please see EIAR Vol. 4, Appendix 14A: EMF Assessment Report Vol. 1 and EIAR Vol. 4, Appendix 14B: EMF Assessment Report Vol. 2.

10.5 Impact assessment methodology

10.5.1 Impacts requiring assessment

The impacts identified as requiring consideration for Benthic Ecology are listed in Table 10-9. The potential impacts have been identified through scoping and discussion with regulators and stakeholders (Table 10-2). Information on the nature of impact (i.e. direct or indirect) is also described.

Table 10-9 Impacts requiring assessment for Benthic Ecology

POTENTIAL IMPACT	NATURE OF IMPACT
Construction	
Temporary impacts to the seabed and benthic habitats	Direct / indirect
Long-term impacts to the seabed and benthic habitats	Direct
Introduction of hard substrates in a predominantly sedimentary environment / Increased predation	Direct / Indirect
Potential changes to suspended sediment concentrations	Direct / indirect
Introduction of INNS	Direct / indirect
Operation and maintenance	
Temporary impacts to the seabed and benthic habitats	Temporary habitat loss or disturbance will also occur during the operation and maintenance phase as a result of seabed disturbance during major cable repair or replacement activities. This temporary disturbance would occur intermittently over the 35-year operation and maintenance phase.
Long-term impacts to the seabed and benthic habitats	Direct (please note that this impact is scoped in for the construction phase too, but it has been assessed under the operation and maintenance phase to avoid repetition).
Introduction of hard substrates in a predominantly sedimentary environment / Increased predation	Direct / indirect (It needs to be clarified that this impact is scoped in for the 'Construction' phase too, but it is assessed under the 'Operation and Maintenance' phase to avoid duplication.)
Potential changes to suspended sediment concentrations	Direct / indirect
Potential effects from EMF and heat generated by cables	Direct

POTENTIAL IMPACT	NATURE OF IMPACT
Introduction of INNS	Direct / indirect
Decommissioning	
Removal of hard structures during decommissioning resulting in loss of colonised surfaces	Direct

10.5.2 Impacts scoped out of the assessment

The impacts scoped out of the assessment during EIA Scoping, and the justification for this, are listed in Table 10-10.

Table 10-10 Impacts scoped out for Benthic Ecology

IMPACT SCOPED OUT	JUSTIFICATION
Construction	
Landfall works may disturb intertidal habitats and species	Impacts to intertidal habitats and species are scoped out because the landfall will be trenchless and tunnelled under the intertidal area. This means that no surface works will take place in the intertidal zone between MHWS and MLWS and no intertidal habitats will be disturbed. It should be clarified though that technically there is no intertidal area as the landfall is a vertical cliff where MLWS is directly beneath MHWS.
Accidental releases to the marine environment	Accidental releases to the marine environment will be limited to the chemical or hydrocarbon inventory on construction vessels. All vessels involved in the Project will be required to comply with best practice management. This includes the application of strict environmental controls through the implementation of the Environmental Management Plan (EMP), which will include a Marine Pollution Contingency Plan (MPCP), to be secured through Section 36 and Marine Licence conditions. These plans will detail procedures in the event of an accidental release, characterise all sources for potential contaminant releases and provide key emergency contact details for use in the event of a release. Measures detailed in the EMP and MPCP will be in accordance with OSPAR Convention and Marine Pollution (MARPOL) Convention guidelines for preventing pollution at sea. Individual vessels will also have a Ship Oil Pollution Emergency Plan (SOPEP) in place. For these reasons, the potential for accidental release of contaminants from vessels is extremely unlikely and any incidents would be responded to quickly, with strict controls to effectively minimise the scale and impact of any accidental release on the marine environment. As this embedded mitigation minimises the likelihood of a significant effect to negligible, accidental releases to the marine environment has been scoped out of the EIA as a potential impact pathway.
Operation and maintenance	
Accidental releases to the marine environment	Accidental releases to the marine environment will be limited to the chemical or hydrocarbon inventory on construction vessels. All vessels involved in the Project will be required to comply with best practice management. This includes the application of strict environmental controls through the implementation of the EMP, which will include a MPCP, to be secured through Section 36 and Marine Licence conditions. These plans will detail procedures in the event of an accidental release, characterise all sources for

IMPACT SCOPED OUT	JUSTIFICATION
	potential contaminant releases and provide key emergency contact details for use in the event of a release. Measures detailed in the EMP and MPCP will be in accordance with OSPAR Convention and MARPOL Convention guidelines for preventing pollution at sea. Individual vessels will also have a SOPEP in place. For these reasons, the potential for accidental release of contaminants from vessels is extremely unlikely and any incidents would be responded to quickly, with strict controls to effectively minimise the scale and impact of any accidental release on the marine environment. As this embedded mitigation minimises the likelihood of a significant effect to negligible, accidental releases to the marine environment has been scoped out of the EIA as a potential impact pathway.
Landfall works may disturb intertidal habitats and species	Impacts to intertidal habitats and species are scoped out because the landfall will be undertaken using HDD and therefore trenchless and tunnelled under the intertidal area. This means that no surface works will take place in the intertidal zone between MHWS and MLWS and no intertidal habitats will be disturbed. It should be clarified though that technically there is no intertidal area as the landfall is at the cliff and MHWS and MLWS are directly underneath each other.

10.5.3 Assessment methodology

An assessment of potential effects is provided separately for the construction, operation and maintenance, and decommissioning phases.

The assessment for Benthic Ecology is undertaken following the principles set out in EIAR Vol. 2, Chapter 7: EIA Methodology. The sensitivity of the receptor is combined with the magnitude to determine the impact significance. Topic-specific sensitivity and magnitude criteria are assigned based on professional judgement, as described in Table 10-11 and Table 10-12.

The process for defining sensitivity follows the MarESA and FeAST sensitivity assessments (summarised in Table 10-7), and where applicable, correlates resistance and recoverability to categorise sensitivity. The findings of the MarESA and FeAST sensitivity assessments are then considered alongside the value of the receptor for the judgement of overall sensitivity. In addition, the ScotMER evidence map was consulted which summarises and prioritises evidence gaps identified by the Benthic Species ScotMER Receptor Group in relation to the development of offshore wind and marine renewables (Scottish Government, 2023b).

Table 10-11 Sensitivity criteria

SENSITIVITY OF RECEPTOR	DEFINITION
High	• The receptor has a very low capacity to accommodate a particular effect with a low ability to recover or adapt; • The receptor has high vulnerability and low recoverability to accommodate a particular effect; • The receptor is of national importance and listed as a qualifying feature of a protected site, and or a primary reason for the selection of a protected site; • The species is listed on Annex IV of the European Union (EU) Habitats Directive as a European Protected Species and / or is a qualifying interest of a SAC and a significant proportion of the national population (>1%) is found within the Project; and • The receptor is of very high (International) importance or rarity, e.g. listed on Annex I (habitats) or Annex II (Species) of the EU Habitats Directive and / or those listed on the OSPAR Convention's List of Threatened and Declining Species and Habitats, International Union for Conservation of Nature (IUCN) Red List of Threatened Species (the 'Red List') including those listed as endangered or critically endangered and / or a significant proportion of the international population (> 1%) is found within the Project.
Medium	• High to Medium importance and rarity, a regional receptor with some capacity to absorb or accommodate change without significantly altering character. However, some damage to the receptor is anticipated to occur; and • The receptor may be of least concern on the IUCN Red List, listed in the post-2010 Biodiversity Framework (previously UK BAP), PMF, Scottish Biodiversity List (SBL), and / or a significant proportion of the regional population (> 1%) is found within the Project.
Low	• Low or medium importance and rarity and the receptor is considered tolerant to change without significant detriment to its character; some limited or minor change may occur; and/or • The receptor has some tolerance to accommodate a particular effect or will be able to recover or adapt.
Negligible	• Very low importance and rarity, local receptor and is tolerant to change with no effect on its fundamental character.

Table 10-12 Magnitude of effect criteria

MAGNITUDE CRITERIA	DEFINITION
High	• The effect occurs over a large spatial extent resulting in widespread, long-term, or permanent changes in baseline conditions or affecting a large proportion of receptor extent or population. The effect is very likely to occur and / or will occur at a high frequency or intensity.
Medium	• The effect occurs over a local to medium extent with a short- to medium-term change to baseline conditions or affects a moderate proportion of a receptor extent or population. The effect is likely to occur and / or will occur at a moderate frequency or intensity.
Low	• The effect is localised and temporary or short-term, leading to a detectable change in baseline conditions or a noticeable effect on a small proportion of a receptor extent or population. The effect is unlikely to occur or may occur but at low frequency or intensity.
Negligible	• The effect is highly localised and short-term, with full rapid recovery expected to result in very slight or imperceptible changes to baseline conditions or receptor population. The effect is very unlikely to occur; if it does, it will occur at a very low frequency or intensity.
No change	• No change from baseline condition.

The consequence and significance of effect is then determined using the matrix provided in EIAR Vol. 2, Chapter 7: EIA Methodology.

10.5.4 Embedded mitigation

As described in EIAR Vol. 2, Chapter 7: EIA Methodology, certain measures (primary and tertiary mitigation) have been adopted as part of the Project development process in order to reduce the potential for effects to the environment, as presented in Table 10-13. These have been accounted for in the assessment presented below. The requirement for additional mitigation measures (secondary mitigation) will be dependent on the significance of the effects on Benthic Ecology receptors.

Measures relevant to Benthic Ecology are listed in Table 10-13. General mitigation measures, which apply to all parts of the Project, are set out first. Thereafter mitigation measure that will apply specifically to the effects on Benthic Ecology receptors associated with the various phases of the Project are described separately.

Table 10-13 Embedded mitigation measures and management plans relevant to Benthic Ecology receptors

CODE	MITIGATION MEASURE	TYPE	DESCRIPTION	SECURED BY
MM-001	Use of horizontal directional drilling (HDD) as the landfall cable installation option.	Primary	Landfall installation methodology (HDD) will avoid direct impacts to the intertidal area.	Landfall installation methodology will be detailed within the Construction Method Statement (CMS), required under Section 36 Consent and/or Marine Licence conditions.
MM-002	Mooring and anchor design to ensure reduction of habitat loss and disturbance	Primary	FTU mooring designs considered for the project have excluded the catenary mooring which was identified as the design with the largest seabed footprint, therefore minimising footprint within the East of Gannet and Montrose field NCMPA. Semi-taut and taut mooring designs options for semi-submersible substructure and tendon mooring designs for TLP substructures have been retained as mooring design options for the Project because these design options produce the least disturbance and minimise potential for habitat loss. Additionally, anchor designs considered for the Project have excluded the drag embedment anchor, which was identified as the design with the greatest potential for seabed disturbance and habitat loss. Suction and driven pile anchor designs have been retained as anchor design options for the Project because they have the smallest footprint and minimise potential seabed disturbance during installation. Anchors will be installed through suction embedment or piling, rather than drilling, in order to minimise sediment disturbance. Novel anchor solutions with equivalent or similar seabed footprint have also been retained as options. Localised habitat loss during the installation phase is an unavoidable consequence of the Project. Best practices will be followed to ensure that potential habitat loss is reduced (e.g. micro-siting and reducing the benthic	Commitment made within Project design. The final design will be detailed within the CMS, required under Section 36 Consent and/or Marine Licence conditions.

CODE	MITIGATION MEASURE	TYPE	DESCRIPTION	SECURED BY
			footprint of the Project), including during the operational phase (e.g. from mobile mooring chains on the seabed). The amount of rock armour, grout bags, and concrete mattresses used to protect the Export/Import Cable and the IACs will be kept to a minimum where possible, especially in the NCMPAs.	
MM-003	Design of scour protection to minimise introduction of hard substrate	Primary	Rock placement will not be used for scour protection because it maximises the introduction of hard substrate and is difficult to remove. Alternative scour protection methods are being considered (e.g. scour reduction strakes and tubular sleeves) which would not increase the maximum footprint of the piles. The mean surface sediment thickness across the entire site is less than 0.5 m indicating scour protection requirements are likely to be negligible or not required within the Project Area.	Final scour requirements will be informed by the scour assessment and detailed within the CMS, required under Section 36 Consent and/or Marine Licence conditions.
MM-004	Micro-siting of FTUs and associated offshore infrastructure, including cable routes	Primary	Pre-construction cable route survey to confirm the condition of the seabed and that no significant changes have occurred from previous surveys, confirm the presence of morphological features and the requirement for micro-siting around these or completion of seabed preparation works. The final Array Area layout (including IACs) and Export / Import Cable Route will be presented within the Development Specification and Layout Plan (DSLP) and will include micro-siting of infrastructure to avoid sensitive habitats or features. Where possible, the Export/Import Cable Route will aim to avoid sensitive habitats and, where this is not practicable, the route will be designed to achieve the least impact to sensitive habitats or features.	Final layout will be captured in the DSLP, required under Section 36 Consent and/or Marine Licence conditions.
MM-005	Target DoL	Primary	Static cables will be trenched and buried to a minimum depth of 0.4 m. Where this cannot be achieved, remedial cable protection will be applied. The cable burial target depth is informed by a Cable Burial Risk Assessment (CBRA) and implemented through the Cable Plan (CaP), which will be produced post-consent.	Final cable design will be informed by the CBRA and detailed within the CaP, required under Section 36 Consent and/or Marine Licence conditions.

CODE	MITIGATION MEASURE	TYPE	DESCRIPTION	SECURED BY
			EMF emissions associated with the cabling will be reduced by burial of between 90-100% of the cables at the depth between 0.4 – 1.5 m.	
MM-006	EMP	Tertiary	The EMP will set out procedures to ensure all activities with the potential to affect the environment are appropriately managed and will include a description of planned activities and procedures, roles and responsibilities, pollution control and spillage response plans, incident reporting, chemical usage requirements, waste management plans, plant service procedures, communication and reporting structures, and programme of work. It will detail the final design selected and take into account Marine Licence conditions and commitments. The EMP will additionally include an INNS Management Plan (INNSMP) and a MPCP and will be developed in consultation with stakeholders.	The EMP, including the INNSMP and MPCP, will be required under Section 36 Consent and/or Marine Licence conditions. An outline EMP is provided as part of the application EIAR Vol. 4 Appendix 32: Outline EMP.
MM-008	Cable Plan (CaP)	Tertiary	The CaP will be provided post-consent and will detail the location / route and cable laying techniques of the IACs and Export / Import Cable and detail the methods for cable surveys during the operational life of the cables for the Project. This will be supported by survey results from the geotechnical, geophysical and benthic surveys. The CaP will also detail EMF of the cables deployed and methods to mitigate against any effects of EMF. A CBRA will also be undertaken and results included within the CaP which will detail cable specifications, cable installation, cable protection, target burial depths / depth of lowering and any hazards the cable will present during the lifespan of the cable. The CaP will also include methodologies of post construction and operational surveys and methodologies for cable inspection with measures to address and report any exposure of cables.	Final cable design will be informed by the CBRA and detailed within the CaP, required under Section 36 Consent and/or Marine Licence conditions.
MM-009	Decommissioning Programme	Tertiary	The development of, and adherence to, a Decommissioning Programme, approved by Scottish Ministers prior to construction and updated throughout the Project's operational life. This will be written in accordance	The Decommissioning Programme will be required under Section 105 of the Energy Act

CODE	MITIGATION MEASURE	TYPE	DESCRIPTION	SECURED BY
			with applicable guidance and will detail the required activities, programme and environmental management for decommissioning.	2004 (as amended) and a condition of the Section 36 Consent.
MM-010	MPCP	Tertiary	Accidental releases to the marine environment will be limited to the chemical or hydrocarbon inventory on construction vessels. All vessels involved in the Project will be required to comply with best practice management. This includes the application of strict environmental controls through the implementation of the EMP, which will include a MPCP, to be secured through Section 36 and Marine Licence conditions. These plans will detail procedures in the event of an accidental release, characterise all sources for potential contaminant releases and provide key emergency contact details for use in the event of a release. Measures detailed in the EMP and MPCP will be in accordance with OSPAR Convention and MARPOL Convention guidelines for preventing pollution at sea. Individual vessels will also have a SOPEP in place. For these reasons, the potential for accidental release of contaminants from vessels is extremely unlikely and any incidents would be responded to quickly, with strict controls to effectively minimise the scale and impact of any accidental release on the marine environment.	The MPCP will be required under Section 36 Consent and/or Marine Licence conditions as part of the EMP. An outline EMP is provided as part of the application EIAR Vol. 4 Appendix 32: Outline EMP.
MM-012	Removal of marine growth	Primary	Removal of marine growth contributes to the management of potential risks associated with INNS. The substructures, moorings and dynamic IACs will be designed to accommodate marine growth; however, to manage weight/drag-induced fatigue, growth levels will be inspected annually, and any required removal of marine growth will be completed using water jetting tools.	Details on removal of marine growth will be provided within the EMP and the Operations and Maintenance Programme (OMP).
MM-013	Operations and Maintenance Programme (OMP)	Tertiary	The OMP will set out the procedures and good practice measures for operation and maintenance of the Project Infrastructure. The OMP will include consideration for environmental sensitivities, to appropriately	Required under Section 36 Consent and/or Marine Licence conditions.

CODE	MITIGATION MEASURE	TYPE	DESCRIPTION	SECURED BY
			safeguard environmental receptors during the operation and maintenance phase of the Project.	
MM-014	Adherence to the International Convention for the Control and Management of Ships' Ballast Water and Sediments	Primary	The Project will adhere with the International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (UK Government, 2004). The Ballast Water Management Convention (BWM) aims to prevent the spread of harmful aquatic organisms, including invasive non-native species (INNS) from one region to another, by establishing standards and procedures for the management and control of ships' ballast water and sediments. Measures will be adopted to ensure that the risk of marine INNS introduction during construction, operation and maintenance, and decommissioning is reduced. An INNS Management Plan will be developed in consultation with stakeholders and will be included within the EMP.	The EMP, including the INNSMP and MPCP, will be required under Section 36 Consent and/or Marine Licence conditions.
MM-015	INNSMP	Tertiary	An INNSMP will be developed and adhered to by the Project. It will set out methods for minimising the potential for the introduction and spread of INNS. The plan will include, but may not be limited to, measures to facilitate vessel compliance with the International Maritime Organisation (IMO) ballast water management guidelines (UK Government, 2004) and adherence to the IMO guidelines for the control and management of ships' biofouling to minimise the transfer of invasive aquatic species (Biofouling Guidelines). Adopting these protocols will reduce risk in relation to the spread of INNS across all phases of the Project.	The EMP, including the INNSMP and MPCP, will be required under Section 36 Consent and/or Marine Licence conditions. An outline EMP is provided as part of the application EIAR Vol. 4 Appendix 32: Outline EMP.

10.5.5 Worst-case scenario

As detailed in EIAR Vol. 2, Chapter 7: EIA Methodology, this assessment considers the worst-case scenario for the Project parameters which are predicted to result in the greatest environmental impact, known as the 'realistic worst-case scenario'. The worst-case scenario represents, for any given receptor and potential effect, the scenario that would result in the greatest potential for change.

Given that the worst-case scenario is based on the design option (or combination of options) that represents the greatest potential for change, confidence can be held that development of any alternative options within the design parameters will give rise to no worse effects than assessed in this impact assessment. Table 10-14 presents the worst-case scenario for potential effects on Benthic Ecology receptors during construction, operation and maintenance, and decommissioning.

Table 10-14 Worst-case scenario specific to Benthic Ecology impact assessment

POTENTIAL IMPACT	WORST-CASE SCENARIO	JUSTIFICATION
Construction		
Temporary impacts to the seabed and benthic habitats	Up to 10.63 km^2 of temporary impacts to the seabed and benthic habitats associated with: • Pre-lay of full length of all FTU mooring lines on seabed (95 x 3,960 m) totalling 0.376 km^2 (based on 1 m disturbance width) • Disturbance over 10.25 km^2 from cable installation across 510 km of IACs and Export/Import Cable, including: - IACs installation: ▪ Maximum width of seabed disturbance from installation tool of 20 m: any disturbance from boulder clearance (grab and plough) and Pre-Lay Grapnel Run (PLGR) within this corridor; ▪ Disturbance over 5.6 km^2 from IACs installation (280 km cable length). - Temporary mattresses for IACs pre-lay: ▪ Disturbance of up to 0.054 km^2 for the installation of up to 3,000 temporary mattresses for IACs pre-lay (18 m^2 seabed footprint per mattress, up to 60 mattresses per cable installation for up to 50 IACs). - Export/Import Cable installation: ▪ Maximum width of seabed disturbance from installation tool of 20 m: any disturbance from boulder clearance (grab and plough) and PLGR within this corridor; ▪ Disturbance over 4.6 km^2 from Export/Import Cable installation including 0.56 km^2 within 12 NM (28 km cable length), 3.34 km^2 from 12 NM to the East of Gannet and Montrose Fields NCMPA boundary (167 km cable	Largest spatial area and duration of temporary impacts to the seabed and benthic habitats during construction. The total area of temporary impacts to the seabed and benthic habitats has been calculated based on the 0.02 km width of cable installation route, 510 km total length of IACs and Export/Import Cable used), deployment of up to 3,000 temporary mattresses for IACs pre-lay and the deployment of 10 temporary mattresses for one HDD exit point. Any seabed disturbance associated with the Pre-Lay Grapnel Run (PLGR) (10 m width) would be located within the 20 m corridor where the cable installation is taking place. It is expected that, where possible, all UXO clearance will be undertaken using low-noise clearance methods, such as deflagration, and all efforts will be made to avoid High Order Detonation (HOD), where possible. It has been assumed that high order UXO detonation will create a localised crater on the

POTENTIAL IMPACT	WORST-CASE SCENARIO	JUSTIFICATION
	length) and 0.7 km² from NCMPA boundary to OSCPs (35 km cable length). • Unexploded Ordnance (UXO) detonation - The maximum worst-case scenario assumes the clearance of 51 UXO's within the Project Area, with 50 cleared by Low Order Deflagration (LOD) with a donor charge of 0.08 kg and one HOD, with a charge weight of 227 kg and 5 kg donor charge. - Up to 706 m² temporary seabed disturbance (assuming a crater with 30 m diameter) due to one detonation. • Use of JUV in support of OSCPs commissioning that has three or more legs (spud cans) that can be mechanically extended from the seabed to lift the vessel above the sea surface: footprint of jack up spud cans will be encompassed within total temporary Project footprint within the East of Gannet and Montrose Fields NCMPA boundary. • HDD exit point - One HDD exit point with three boreholes at a water depth of approximately 26.5 m below MHWS, 190 m from cliffs. - Up to 0.0005 km² of temporary mattresses to be positioned in the HDD point (3 boreholes) (assuming 10 mattresses, 50 m2 seabed footprint for each mattress).	seabed and affect an area of up to 30m in diameter. The seabed area affected has been calculated at approximately 706 m². This conservative assumption is based on observations reported in Lepper *et al.*, (2024). It has been assumed that the Export/Import Cable and IACs will be trenched and buried along the majority of their length and will therefore incur a temporary disturbance. Sections of these cables that are proposed to be protected with rock material are considered under long-term impacts. A JUV will be used in support of OSCPs commissioning while DP vessels will be used in support of other activities e.g. IACs installation and FTU installation (mooring hook-up). Approximately 26.5 m water depth below MHWS of HDD exit point is assumed worst-case.
Potential changes to suspended sediment concentrations	Within the Array Area: • For up to 95 FTUs, construction of: - Moorings for semi-submersible only as this would interact with the seabed: ▪ Up to six per FTU, with a maximum semi-taut mooring length of 4,541 m per FTU; ▪ Mooring line pre-lay (worst-case area): 3,960 m of mooring line per FTU of 1 m disturbance width totalling 376,200 m²; ▪ Mooring installation to take one-week per FTU.	This covers the largest spatial area of impact associated with seabed preparation activities, OSCPs, and cable installation activities. Maximum volumes of sediment to be cleared and volumes of rock protection are also provided.

POTENTIAL IMPACT	WORST-CASE SCENARIO	JUSTIFICATION
	- Suction or driven pile anchors for semi-submersible and TLP: ▪ For semi-submersible, a total of six anchors per FTU, with a maximum seabed footprint of 198 m^2 per FTU and 15,840 m^2 for Array Area; and ▪ For TLP, a total of three clusters of piles, up to nine piles, with a maximum seabed footprint of 297 m^2 per FTU and 28,215 m^2 for Array Area. • For OSCPs, construction of: - Up to two OSCPs, with a seabed footprint per jacket foundation of 1,209 m^2, total seabed footprint of 2,418 m^2. • For IACs, construction of: - Up to 120 IACs with a total length of 280 km (on the seabed). Maximum trench width of 2 m and maximum trench depth of 1.8 m. Installation via jet trenching, mechanical trenching and/or ploughing; and - Maximum width of seabed disturbance for IACs installation tool of 20 m corridor: any disturbance from boulder clearance (grab and plough) and Pre-Lay Grapnel Run (PLGR) within this corridor. Total seabed disturbance area of 5.6 km^2 (20 m width x 280 km length) although little to no disturbance volume is anticipated associated with this width and only through the trenching process. Within the EICC: • For Export/Import Cable, construction of: - A bundle of two High Voltage Directional Current (HVDC) cables and one fibre-optic cable in a single trench with a total route length of 230 km; - Maximum trench width of up to 2 m and trench depth of 1.8 m. Exception is within 12 NM where maximum trench width of up to 3 m for pre-lay trenching via a plough. Installation via ploughing, trenching or jetting and assumes: ▪ 100% Export/Import Cable buried within the East of Gannet and Montrose Fields NCMPA (except for cable/pipeline crossings); and	

POTENTIAL IMPACT	WORST-CASE SCENARIO	JUSTIFICATION
	▪ 95% Export/Import Cable buried between 12 NM and East of Gannet and Montrose Fields NCMPA (except for cable/pipeline crossings). - Associated with the Export/Import Cable installation is a maximum 20 m corridor width of seabed disturbance from the installation tool, with any disturbance from PLGR and boulder clearance (grab and plough) also within this corridor. Total seabed disturbance area of 4.6 km^2, although little to no disturbance volume is anticipated associated with this width and only through the trenching process. • For landfall: - Maximum of one exit point with three boreholes, with a total maximum of 3,000 m^3 in fluid losses which will contain 18 m^3 in solid losses (most likely bentonite) to the sea at the HDD pop-out. The three boreholes will be drilled individually, not concurrently, and therefore there will be a maximum of 1,000m^3 of fluid loss (containing 6m^3 of drilling solids) discharged at any one time.	
Introduction of INNS	Up to 27 different vessels will be used across the construction period. The base case installation method is to tow WTGs (installed onto their floating substructures) to site. An alternative method is to tow substructures (with no WTG installed) to site with the WTGs installed offshore onto their floating substructures using crane vessels.	Maximum number of vessels transiting (potentially from waters outside of the UK) to and / or releasing ballast water within the Project Area during construction potentially introducing INNS. Other potential pathway for INNS is the towing of infrastructure to the Project Area.
Operation and maintenance		
Temporary impacts to the seabed and benthic habitats	The temporary impact during operation and maintenance will be less than construction as the footprint for all seabed preparatory work and infrastructure installation is captured under construction. However, the worst-case scenario has been assessed as the same impact as construction as the footprint of operation and maintenance activities has not been quantified.	See justification under construction phase.

POTENTIAL IMPACT	WORST-CASE SCENARIO	JUSTIFICATION
Long-term impacts to the seabed and benthic habitats	Up to 1.90 km² of long-term impacts to the seabed and benthic habitats associated with: • Mooring chains in the Array Area: – Disturbance over 1.44 km² from mooring chains of 95 FTUs in the Array Area (0.0025 km² of seabed disturbance by movement of each mooring chain, 6 mooring chains per FTU). This area includes the mooring chain seabed footprint i.e per FTU, a maximum proportion of 34% of the 3,960 m semi-taut mooring chain on the seabed. • OSCPs: – Up to 2 OSCPs with foundations of 0.0024 km² (incorporates footprints of mudmats and piles) • Piles for FTUs: – Up to 0.0282 km² for 95 FTUs piles (nine piles per FTU, 33 m² seabed footprint per pile). • Anchors for tethering IACs: – Up to 0.0023 km² (190 anchors, 12 m² per anchor). • Hubs – Up to 0.0017 km² (19 hubs, 90 m² per hub). • IACs protection: – Up to 0.0325 km² for IACs protection, including: ▪ Up to 0.0154 km² for IACs protection at the OSCPs base (22 cables, 0.1 km length of each IAC, 7 m width of cable protection); ▪ Up to 0.0171 km² of mattresses for IACs protection at the touchdown points (5 mattresses at each touchdown point, 18 m² seabed footprint of each mattress, 190 touchdown points). • Export/Import Cable protection: – Up to 0.1679 km² for Export/Import Cable protection, including: ▪ Up to 0.075 km² for cable protection within 12 NM;	Largest spatial area and duration of long-term impacts to the seabed and benthic habitats during operation and maintenance. Conservative assumptions have been made to estimate the cable protection requirements for the Project, as detailed in EIAR Vol. 2, Chapter 5: Project Description. This area differs from temporary impacts to the seabed and benthic habitats as it only considered areas where habitats and species will be impacted in the long-term through the installation of infrastructure. Therefore, the area considered is smaller than the area considered for temporary impacts to the seabed and benthic habitats. The semi-submersible option has been used as worst-case scenario for mooring chains as this option has the largest seabed footprint (in terms of moorings chains). The tension leg platform has been used as worst-case scenario for FTU piles as this option has the largest seabed footprint (in terms of FTU piles). No use of rock as scour protection for OSCPs foundations. Scour protection methods to include scour reduction strakes and tubular sleeves, with no additional seabed footprint to the existing seabed area of the OSCPs mudmats / piles. Also, no scour protection assumed for FTU foundations.

POTENTIAL IMPACT	WORST-CASE SCENARIO	JUSTIFICATION
	▪ Up to 0.0919 km^2 for cable protection from 12 NM to East of Gannet and Montrose Fields NCMPA boundary (assuming 8.35 km of cable length, 5% of cable needing protection, 11 m width of cable protection); ▪ Up to 0.0007 km^2 for cable protection inside the NCMPA at base of OSCPs (assuming 100 m length of cable needing protection and 7 m width of cable protection). ▪ Up to 0.000336 km^2 for rock placement at the HDD exit point • Cable/pipeline crossings: – Up to 0.2177 km^2 for protection at cable/pipeline crossings, including: ▪ Up to 0.0365 km^2 for protection of IACs crossings (assuming eight crossings and 0.0045 km^2 seabed footprint per crossing); ▪ Up to 0.0634 km^2 for protection of Export/Import Cable crossings within 12 NM (assuming seven crossings and 9,063 m^2 seabed footprint per crossing); ▪ Up to 0.0997 km^2 for protection of Export/Import Cable crossings from 12 NM to East of Gannett and Montrose Fields NCMPA (assuming 11 crossings and 9,063 m^2 seabed footprint per crossing); ▪ Up to 0.0181 km^2 for protection of Export/Import Cable crossings within the NCMPA of the CATS and Langeled Pipelines (assuming two crossings and 9,063 m^2 seabed footprint per crossing).	
Introduction of hard substrates in a predominantly sedimentary environment / Increased predation	Up to 0.58 km^2 of introduction of hard substrates to a predominantly sedimentary environment associated with: • OSCPs: – Up to two OSCPs with foundations of 0.0024 km^2 (incorporates footprints of mudmats and piles). • Piles for FTUs:	The maximum area of cable protection has the greatest potential to result in potential colonisation of benthic species. Congregation of fish around infrastructure / hard substrates may increase predation pressure on benthos. For example, cod are known to congregate

POTENTIAL IMPACT	WORST-CASE SCENARIO	JUSTIFICATION
	– Up to 0.0282 km^2 for 95 FTU piles (nine piles per FTU, 33m^2 seabed footprint per pile). • Mooring lines for FTUs – Long term deployment of mooring chains on seabed (128 km 34 % of length of lines) equating to 0.128 km^2. • Hubs: - Up to 0.0017 km^2 (19 hubs, 90 m^2 per hub). • Anchors for tethering IACs: – Up to 0.0023 km^2 (190 anchors, 12 m^2 per anchor). • IACs protection: – Up to 0.0325 km^2 for IACs protection, including: ▪ Up to 0.0154 km^2 for IACs protection at the OSCPs base (22 cables, 0.1 km length of each cable, 7 m width of cable protection); ▪ Up to 0.0171 km^2 of mattresses for IACs protection at the touchdown points (5 mattresses at each touchdown point, 18 m^2 seabed footprint of each mattress, 190 touchdown points). • Export/Import Cable protection: – Up to 0.1679 km^2 for Export/Import Cable protection, including: ▪ Up to 0.075 km^2 for cable protection within 12 NM; ▪ Up to 0.0919 km^2 for cable protection from 12 NM to East of Gannet and Montrose Fields NCMPA boundary (assuming 8.35 km of cable length, 5% of cable needing protection, 11 m width of cable protection); ▪ Up to 0.0007 km^2 for cable protection inside the NCMPA at base of OSCPs (assuming 100 m length of cable needing protection and 7 m width of cable protection). ▪ Up to 0.000336 km^2 for rock placement at the HDD exit point.	around offshore structures, and as demersal predators, may feed extensively on benthos. Long term deployment of mooring lines assumes that the ground chain that is contact with the seabed from mooring pre lay with the seabed during operation with a diameter of 1 m.

POTENTIAL IMPACT	WORST-CASE SCENARIO	JUSTIFICATION
	• Cable/pipeline crossings: – Up to 0.2177 km^2 for protection at cable/pipeline crossings, including: ▪ Up to 0.0365 km^2 for protection of IACs crossings (assuming eight crossings and 0.0045 km^2 seabed footprint per crossing); ▪ Up to 0.0634 km^2 for protection of Export/Import Cable crossings within 12 NM (assuming seven crossings and 9,063 m^2 seabed footprint per crossing); ▪ Up to 0.0997 km^2 for protection of Export/Import Cable crossings from 12 NM to East of Gannett and Montrose Fields NCMPA (assuming 11 crossings and 9,063 m^2 seabed footprint per crossing); ▪ Up to 0.0181 km^2 for protection of Export/Import Cable crossings within the NCMPA of the CATS and Langeled Pipelines (assuming two crossings and 9,063 m^2 seabed footprint per crossing).	
Potential changes to suspended sediment concentrations	Operation and maintenance activities including: • Up to 10% of IACs requiring repair (e.g. deburial and reburial) and up to 10% of IACs requiring replacement; and • Up to four Export / Import Cable repairs.	See justification under the construction phase. Construction activities regarded as being representative of max worst case with regarded to sediment resuspension.
Potential effects from EMF and heat generated by cables	• IACs: - Cable voltage up to 132 kV; - Up to 350 km of cables in total: ▪ Of which, 280 km are static, and 70 km are dynamic (have no contact with the seabed); ▪ Burial is the preferred protection method; ▪ Up to 0.0154 km^2 for IACs protection at the OSCPs bases (22 cables, 0.1 km length of each IAC);	The maximum length of IACs and the Export/Import Cable will result in the greatest potential for EMF effects. The minimum target burial depth represents the worst-case scenario as EMF exposure will be minimised by greater burial depths.

POTENTIAL IMPACT	WORST-CASE SCENARIO	JUSTIFICATION
	- Maximum target burial depth of 1.5 m; - Minimum target burial depth of 0.4 m; • Export/Import Cable: - Cable voltage up to 525 kV; - Cable route of up to 230 km length: ▪ Of which, 26.35 km will require cable protection within 12 NM out to a width of 7 m and height of 1 m (166,850 m^2); ▪ Of which 95% buried between 12 NM and East of Gannet and Montrose Fields NCMPA (except for cable/pipeline crossings); ▪ Of which 100% buried within East of Gannet and Montrose Fields NCMPA (except for cable/pipeline crossings); ▪ 0.0007 km protection at OSCPs bases at a height of 1 m (700 m^2). - Maximum target burial depth of 1.5 m; - Minimum target burial depth of 0.4 m; • Up to 20 crossings of the EICC associated with 181,260 m^2 of protection at a maximum height of 3.5 m; • Up to eight crossings within the Array Area associated with 36,480 m^2 of protection at a maximum height of 2.25 m; and • Operational life of 35 years.	The detailed presentation of the EMF modelling studies and their outputs can be seen in **EIAR Vol. 4, Appendix 14A: EMF Assessment Report Vol. 1** and in **EIAR Vol. 4, Appendix 14B: EMF Assessment Report Vol. 2**. Outputs of the EMF modelling studies related to Benthic Ecology can be seen in Section 10.6.2.5.
Introduction of INNS	• Operational life of 35 years; • Up to 10 vessels operating simultaneously during operation and maintenance phase; and • Up to 0.58 km^2 of introduction of hard substrates, as outlined under potential impact "Introduction of hard substrates in a predominantly sedimentary environment / Increased predation";	Maximum number of vessels transiting (potentially from waters outside of the UK) to and / or releasing ballast water within to the Project Area during operation and maintenance potentially introducing INNS. FTU piles and cable protection provide novel habitat that can be used as a stepping stone for INNS.

POTENTIAL IMPACT	WORST-CASE SCENARIO	JUSTIFICATION
Decommissioning		
In the absence of detailed decommissioning activities, the implications for Benthic Ecology receptors are similar, or likely less, to the worst-case scenarios for those outlined during the construction phase. Therefore, the worst-case parameters defined for the construction phase also apply to the decommissioning phase. More details are available on the decommissioning approach in EIAR Vol 2, Chapter 5: Project Description.		

10.5.6 Quantification of impacts

10.5.6.1 Direct temporary and long-term project footprint

The quantification of the worst-case direct project footprint on Benthic Ecology receptors is summarised in Table 10-15. This quantification broadly distinguishes between temporary footprint and long-term footprint, as was scoped into the impact assessment (Table 10-2).

The temporary impacts are considered to be related to direct short-term one-off disturbances which will mainly occur during pre-construction and construction activities that are not predicted to fundamentally change the substrate type in the long-term, and from which a level of recovery can be expected.

The long-term footprint is associated with the installed infrastructure itself, particularly where there is a fundamental change to the seabed substrate. In the case of long-term footprint, it is worth noting that this will occur within the boundary of the larger temporary footprint, so there will be physical overlap between the two. It should also be noted that the discussion of long-term impacts has been addressed in the Section 10.6.2 relating to the operation and maintenance phase of the Project as that is when the long-term impact of the infrastructure occurs, although it is recognised that direct loss of the existing seabed habitat will occur when the infrastructure is installed during construction as well as it may occur during decommissioning for any items left in situ (Table 10-9).

The worst-case Project direct footprint outlined in Section 10.5.5 used to quantify the impacts to Benthic Ecology receptors is summarised in Table 10-15. This quantification distinguishes between temporary and long-term impacts. The proportion of the Array Area, EICC, and overall Project Area that will be directly impacted are presented in Table 10-15.

Table 10-15 Overview of worst-case Project footprint

PROJECT AREA (ARRAY AREA, EICC)	INFRASTRUCTURE	TEMPORARY SEABED FOOTPRINT (km^2)	LONG-TERM SEABED FOOTPRINT (km^2)	WORKING ASSUMPTIONS
Array Area	• IACs • Temporary mattresses • Anchors for tethering cables • Protection for IACs at OSCPs • Mattresses for touch down points • Protection for IACs crossings • FTUs mooring chains • FTUs piles • OSCPs foundations	6.03	1.55	Temporary footprint • Cable installation seabed disturbance = 5.6 km^2 • Total footprint of temporary mattress for 50 cables = 0.054 km^2 • Temporary disturbance from the temporary lay-down of FTU moorings = 0.376 km^2 Long-term footprint • Total seabed footprint of anchors for tethering cables = 0.00228 km^2 • Total seabed footprint of hubs = 0.0017 km^2 • Total protection for IACs at OSCPs = 0.0154 km^2 • Total footprint of mattresses for 190 touch down points = 0.0171 km^2 • Total seabed footprint of protection at IACs crossings = 0.0365 km^2 • Seabed footprint of piles for 95 FTUs = 0.0282 km^2 • Seabed area disturbed by mooring chains of 95 FTU = 1.44 km^2 (*Note: Long term deployment of mooring chains remaining on seabed (34 % of length) = 0.128 km^2 (encompassed within 1.44 km^2 long term footprint*) • Total seabed footprint of up to two OSCPs Foundations = 0.0024 km^2

PROJECT AREA (ARRAY AREA, EICC)	INFRASTRUCTURE	TEMPORARY SEABED FOOTPRINT (km^2)	LONG-TERM SEABED FOOTPRINT (km^2)	WORKING ASSUMPTIONS
Offshore EICC	• Export/Import Cables • Protection for Export/Import Cable • Protection for cable/pipeline crossings	4.04	0.22	Temporary footprint • Seabed disturbance from Export/Import Cable installation between 12 NM and East of Gannet and Montrose Fields NCMPA = 3.34 km^2 • Seabed disturbance from Export/Import Cable installation from boundary of NCMPA to OSCPs = 0.7 km^2 Long-term footprint • Footprint of Export/Import Cable protection from 12 NM to East of Gannet and Montrose Fields NCMPA = 0.09 km^2 • Footprint of Export/Import Cable protection inside the NCMPA at base of OSCPs = 0.0007 km^2 • Footprint of rock protection of cable/pipeline crossings between 12 NM and East of Gannet and Montrose Fields NCMPA = 0.1 km^2 • Footprint of rock protection of cable/pipeline crossings within the NCMPA of the CATS and Langeled Pipelines = 0.02 km^2
Inshore EICC	• UXO Clearance	0.0007	-	High order UXO detonation affecting an area of seabed up to 30m in diameter.
Inshore EICC	• Export/Import Cable • Temporary mattresses for HDD exit points • Protection for cable/pipeline crossings • Protection for Export/Import Cable	0.5605	0.14	Temporary footprint • Seabed disturbance from Export/Import Cable installation within 12 NM = 0.56 km^2 • Seabed footprint of temporary mattresses positioned at HDD exit point = 0.0005 km^2

PROJECT AREA (ARRAY AREA, EICC)	INFRASTRUCTURE	TEMPORARY SEABED FOOTPRINT (km^2)	LONG-TERM SEABED FOOTPRINT (km^2)	WORKING ASSUMPTIONS
	• Protection for HDD exit point			Long-term footprint • Footprint of rock protection of cable/pipeline crossings within 12 NM = 0.063 km^2 • Footprint of rock protection for Export/Import Cable within 12 NM = 0.075 km^2 • Footprint of rock protection at the HDD exit point = 0.000336 km^2
Array Area total seabed footprint		6.03	1.55	It should be noted that 1.44 km^2 of the total 1.55 km^2 is due to impact from mooring chain contact in a semi-taut mooring for a semi-sub substructure. If a taut mooring is used for a semi-sub substructure, or a TLP with tendons is used, then the long-term impact from mooring line contact would reduce from 1.44 km^2 to zero.
EICC (offshore and inshore) total seabed footprint		4.60	0.35	
Total footprint of Project		10.63	1.90	

10.5.6.2 Indirect temporary footprint resulting from suspended sediment and redeposition

During construction, there will be activities (e.g., cable installation, PLGR) which will result in suspension and deposition of sediment on the seabed. The details of the modelling study (EIAR Vol. 4, Appendix 7: Marine & Physical Processes Modelling Report) on the suspension and deposition of sediment is outlined in EIAR Vol. 3, Chapter 8: Marine Geology, Oceanography, and Coastal Processes, which have been used to inform the assessment of impacts and effects on benthic habitats and species following sediment suspension and deposition. The overview of the activities resulting in sediment resuspension and deposition are outlined in Table 10-14.

A range of design details and tool options for cable burial and pre-lay bed preparation are listed in Table 10-14. The realistic worst-case for impacts caused by sediment disturbance is associated with the realistic combination of Project activities resulting in either the highest rate of sediment disturbance (for SSC), or the largest total volume of sediment locally or regionally disturbed (for deposition). This is calculated by considering the expected envelope of options for the designs and tools that might be realistically used for these activities. Details about the technical aspects of the worst-case scenarios are provided in EIAR Vol. 3, Chapter 8: Marine Geology, Oceanography, and Coastal Processes.

The deposition thicknesses and extents vary according to ejection height, flow speed and sediment size, and deposition thickness and area are inversely correlated. Below there is a summary of key information associated with suspended sediment concentration and thickness of sediment deposition associated with cable burial in a) 100% gravel habitats and b) 100% fine sand or coarse silt.

In the case of habitats composed 100% of gravel (theoretical output of model) the range of model outputs about the average thickness of sediment deposition (m) cover a relatively high range i.e., from 0.03 m to 1.125m. In the case of an average sediment deposition of 1.125 m (i.e., the highest values that may be encountered for cable burial in sediments composed 100% of gravel at an ejection height of 1 m and current speed 0.1 m / s), the seabed footprint is highly localised and limited in time. Specifically, the time for resettlement is approximately 2.0 seconds. The distance that the plume is advected by the current is 0.2 m. With regards to suspended sediments, the modelling shows that suspended sediments concentrations at low millions mg/l will be sustained for approximately 2 seconds and therefore extremely limited as coarse material typically will not enter suspension. In the case of a much lower average sediment deposition of 0.03 m (at an ejection height of 10 m and current speed 0.4 m / s), the seabed footprint of the disturbed gravels is also highly localised and limited in duration. In that case the model predicts that the time for resettlement is approximately 20 seconds. The distance that the plume is advected by the current is 8.0 m. The average SSC in the local area of effects is in the order of hundreds of thousands (mg / l) but this is highly localised and limited in duration. Specifically, the length of influence on SSC in downstream direction is approximately 5.8 m and the duration of influence in SSC locally is approximately 14.4 seconds.

In the case of habitats composed 100% of find sand or coarse silt the range of model's outputs about the average thickness of sediment deposition (m) cover a range from values below <0.005 m to approximately 0.06 m. In the case of an average sediment deposition of 0.06 m (i.e., the highest values that may be encountered for cable burial in sediments composed 100% of fine sand or coarse silt, at an ejection height of 1 m and at a current speed of 0.1 m / s) the seabed footprint is highly localised and limited in time. Specifically, the time for resettlement is approximately 16 minutes. The distance that the plume is advected by current is approximately 100 m. The average SSC in the local area of effect is in the order of low millions (mg / l) but this is highly localised and limited in duration. Specifically, the length of influence on SSC in downstream direction is 1.4 m and the duration of influence on SSC locally is approximately 14 seconds. The predicted maximum distance that fine sediment will be deposited at an average thickness of 0.01 m is 1000 m (1 km). It is noteworthy that in all cases the duration of influence of the increased SSC as a result of this disturbance locally is < 15 seconds.

Irrespective of sediment type, the volumes of sediment being displaced and deposited locally are relatively limited (up to 3.6 m^3 per metre of cable burial). The maximum distance from each metre of cable trench over which 3.6 m^3 of sediment can be spread to an average thickness of (for example) 0.05 m is 72 m; any larger distance would correspond to a smaller average thickness. The assessment suggests that the extent and so the area of deposition will normally be much smaller for sands and gravels (although leading to a greater average thickness of deposition in the order of tens of centimetres to a few metres) and that fine material will be distributed much more widely, becoming so dispersed that it is unlikely to settle in measurable thickness locally.

Finer material (fine sands, clays and muds, present as surficial sediment layers in high proportions in some locations) will be advected away from the release location by the prevailing tidal current. High initial concentrations (similar to sands and gravels) are to be expected but will be subject to rapid dispersion, both laterally and vertically, to near-background levels (tens of mg / l) within hundreds to a few thousands of metres of the point of release. In practice, only a small proportion of the material disturbed is expected to be fines, with a corresponding reduction in the expected levels of SSC.

The release of bentonite and drill cuttings in the form of drilling fluid from the planned HDD operations will result in a localised and temporary plume of elevated SSC specifically comprising bentonite clay. Where the plume has measurable SSC the duration and footprint of the plume will be small in absolute and relative terms (e.g. order of <10 mg / l over footprints larger than 500 m over a period of days; or, order of tens to low hundreds of mg / l over footprints less than 500 m over a period of minutes to one hour). It is expected that the plume would be dispersed to relatively low concentrations within hours of release and to background concentrations within a few tidal cycles (i.e. 1 day).

Based on the above it is concluded that the seabed footprint from sediments suspended or deposited on the seabed is highly localised and limited in duration. This is the case both for sediments composed mainly of gravels and for sediments composed of fine sand or coarse silt. Considering that the MarESA sensitivity assessment sets 30 cm of sediment deposition as the benchmark for heavy siltation / smothering (MarLIN, 2024), it is concluded that in those cases where > 30 cm deposition will take place this will be confined in a distance less than 1 m. In those cases where deposited sandy / silty sediments will have an average thickness of 0.05 m (i.e., the benchmark that MarESA sensitivity assessment sets for light siltation / smothering – MarLIN, 2024) the seabed footprint will be confined to a distance less than 2 m.

The detailed overview of the sediments disturbed and resuspended by the activities and their fate in the environment are detailed in EIAR Vol. 3, Chapter 8: Marine Geology, Oceanography and Coastal Processes. Some of the key considerations that are related to Benthic Ecology receptors are listed below:

10.5.6.3 Quantification of impact to protected sites

The boundary of the Array Area is situated within the eastern half of the East of Gannet and Montrose Field NCMPA on the habitat 'Offshore deep-sea muds', one of the key designated features of the site (Figure 10-14). The spatial extent of temporary habitat / loss disturbance associated with the Array Area is 6.03 km^2 and the temporary disturbance from the Export/Import Cable installation over the 'Offshore deep-sea muds' inside the NCMPA is approximately 0.35 km^2. It has been calculated that up to 6.38 km^2 of 'Offshore deep-sea muds' in the NCMPA will be temporarily disturbed in the East of Gannet and Montrose Fields NCMPA (i.e. 0.70 % of the total extent of the habitat 'Offshore deep-sea muds' in this NCMPA).

The long-term footprint in the habitat 'Offshore deep-sea muds' of the East of Gannet and Montrose Fields NCMPA will be 1.56 km^2. The spatial extent of the habitat 'Offshore deep-sea muds' in this NCMPA is approximately 900 km^2. Based on this it is concluded that approximately 0.17% of the habitat 'Offshore deep-sea muds' will be affected in the long-term (Table 10-16).

The spatial extent of the habitat 'Subtidal sands and gravels' that supports ocean quahog in the East of Gannet and Montrose Fields NCMPA is approximately 939 km^2 (JNCC, 2024) (Figure 10-14). Considering that the length of the Export / Import Cable in the NCMPA that intersects the habitat 'Subtidal sands and gravels' is approximately 17.5 km (20 m wide corridor) it is concluded that 0.35 km^2 of the habitat 'Subtidal sands and gravel' will be temporarily disturbed; this corresponds to approximately 0.04 % of the 'Subtidal sands and gravels' extent in the NCMPA (Table 10-16). (Note that the Array Area, is considered to be entirely encompassed within a broad region of circalittoral deep sea mud habitat).

The spatial extent of 'Subtidal sands and gravels' in the East of Gannet and Montrose Fields NCMPA is approximately 939 km^2 (i.e. approximately 51% of the total size of the NCMPA) (JNCC, 2024). The spatial extent of long-term impacts on 'Subtidal sands and gravels' in the East of Gannet and Montrose Fields NCMPA is 0.0095 km^2. Based on this it is concluded that 0.001% of the habitat will be affected in the long-term (Table 10-16).

The designated benthic feature in the Southern Trench NCMPA is 'Burrowed mud'. Site-specific surveys in the EICC mentioned that the habitat 'Burrowed mud' / 'Seapens and burrowing megafauna communities' have not been found in the part of the EICC that intersects this NCMPA (MMT, 2019, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). These findings are in line with publicly available data that mention that 'Burrowed mud' / 'Seapens and burrowing megafauna communities' are found in the central and northern parts of the Southern Trench NCMPA (Moore, 2017, NatureScot, 2024b).

The spatial extent of East of Gannet and Montrose Fields NCMPA and the Southern Trench NCMPA subject to smothering / siltation rate changes can be seen in Section 10.5.6.2.

The temporary and long-term seabed footprint in the Southern Trench NCMPA is 0.40 km^2 (0.02%) and 0.096 km^2 (0.004%), respectively (Table 10-16). The outputs are based on the length of the Export/Import Cable inside the Southern Trench NCMPA (i.e. 20 km), and the width of rock protection for the Export/Import Cable (i.e. 20 km and 3 m, respectively) and the presence of four cable/pipeline crossings inside this NCMPA (0.009 m^2 of rock protection per cable/pipeline crossing).

In terms of sediment deposition and associated smothering, the MarESA sensitivity assessment (MarLIN, 2024) mentions as the benchmark of light smothering / deposition thickness the value of 0.05 m. The modelling study for the suspension and deposition of sediments on the seabed mentions (assuming a total cable length of 280 km in the Array Area, 315 km in the East of Gannet and Montrose Fields NCMPA and 3.6 m^3 of sediment disturbed / m of cable installation) that the total volume of sediment disturbed in the East of Gannet and Montrose Fields NCMPA is 1,134,000 m^3 (EIAR Vol. 4, Appendix 7: Marine & Physical Processes Modelling Report), which will occur predominantly through cable burial activities. Considering the MarESA benchmark value of 0.05 m (light smothering) it is concluded that an area of 20,160,000 m^2 (20.16 km^2) in the Array Area and 22,680,000 m^2 (22.68 km^2) in the East of Gannet and Montrose Fields NCMPA will be subject to light smothering (Table 10-16). These values correspond to 6.05% of the Array Area and 1.23% of the East of Gannet and Montrose Fields NCMPA. Given that the large majority of the cable trenching activities in the NCMPA will occur within the Array area, which overlaps the offshore deep sea mud biotope, it can be expected that the majority of the associated deposition and smothering will occur to this habitat.

In the case of the Southern Trench NCMPA 69,120 m^3 of sediment are expected to be disturbed due to cable installation, which corresponds to 1,382,400 m^2 (1.38 km^2). This equates to approximately 0.06% of the Southern Trench NCMPA subjected to light smothering (Table 10-16). It should be mentioned that in case that the sediment deposition thickness taking place will be higher than 0.05 m, then the spatial extent of areas affected from siltation will be smaller (EIAR Vol. 4, Appendix 7: Marine & Physical Processes Modelling Report).

It should be noted that some minor sediment suspension may take place from the lateral dragging of the mooring chains on the seabed in the Array Area. However, the associated suspension is expected to be minor, highly localised, and not significant.

The potential impacts from suspended sediments from the Project on Turbot Bank NCMPA's sandeels are assessed in the EIAR Vol. 3, Chapter 13: Fish and Shellfish Ecology.

Table 10-16 Temporary, long-term and sediment deposition seabed footprint in the East of Gannet and Montrose and Southern Trench NCMPAs

	TOTAL AREA NCMPA (km²)	TOTAL AREA TEMPORARY IMPACTED (km²)	TOTAL AREA TEMPORARY IMPACTED (%)	TOTAL AREA LONG-TERM IMPACTED (km²)	TOTAL AREA LONG-TERM IMPACTCED (%)	SEDIMENT DEPOSITION TO 0.05 m (km²)	SEDIMENT DEPOSITION TO 0.05 m DEPTH (%)
East of Gannet and Montrose Fields NCMPA							
Offshore deep-sea muds	900	6.38	0.71	1.56	0.17	-	-
Subtidal sands and gravels	939	0.35	0.04	0.009	0.001	-	-
East of Gannet and Montrose Fields (Whole site)	1839	6.73	0.35	1.57	0.09	22.68	1.23
Southern Trench NCMPA							
Burrowed Mud	225	0	0	0	0	-	-
Southern Trench (Whole site)	2536	0.40	0.02	0.096	0.004	1.38	0.06

10.6 Assessment of potential effects

A summary of the benthic habitats and species that have been scoped in is given in Table 10-8.

10.6.1 Potential effects during construction

10.6.1.1 Temporary impacts to the seabed and benthic habitats

This Section focuses on the direct temporary habitat loss / disturbance resulting from the construction of the Project in the Array Area, and the EICC. The impacts discussed in this Section relate to the direct disturbances associated with pre-construction and construction activities which are expected to be transient and short-term, leaving behind seabed which is relatively unchanged in its composition and enable biological recovery to occur over time from following the temporary disturbance. Indirect effects associated with project activities, such as increases in suspended sediment concentrations, are covered in Section 10.6.1.2 and Section 10.5.6.2.

The construction phase will take place over a period of up to 6 years during which temporary impacts to the Benthic Ecology will occur. The worst-case quantification of temporary impacts takes account of the maximum areas affected by these activities but recognise that within the disturbance footprint, the same area may be subject to multiple disturbances over the construction period. For example, in year 1 of construction along the EICC there will be pre-lay grapnel runs and boulder clearance activities, followed by cable lay and burial that will extend into the second year of construction. Similarly, there will be overlap in the temporary footprints created in the Array Area where seabed is prepared prior to installing IACs. This is discussed further in Section 10.8.2.

Within the Array Area and EICC, seabed preparation activities such as PLGR will temporarily disturb existing seabed habitats and communities. In addition, the construction and installation of infrastructure such as the IACs as well as the installation of the Export/Import Cable will result in temporary habitat loss and disturbance. As per Table 10-14 and Table 10-15 the total combined temporary footprint from all activities in the Project Area is 10.63 km^2. This is split as follows: 6.03 km^2 in the Array Area, and 4.60 km^2 in the EICC (offshore and inshore).

Given that the area of the Array Area is 333 km^{2}and the EICC is 220 km^2 it is regarded that the total Project Area is 553 km^2. This means that the total temporary seabed footprint is approximately 1.92% of the total Project Area. The relevant temporary seabed footprint in each of the Project Areas is as follows: 1.81% in the Array Area, and 2.15% in the EICC.

The total spatial extent of the East of Gannet and Montrose Fields NCMPA is 1,839 km^2 (JNCC, 2024). The total temporary area of seabed affected in the East of Gannet and Montrose Fields NCMPA is 6.73 km^2. To put this into context, this represents only 0.37% of the NCMPA that will be temporarily disturbed.

The temporary seabed footprint inside the Southern Trench NCMPA is 0.40 km^2 (including 20 km of Export/Import Cable inside the NCMPA). The total spatial extent of the Southern Trench NCMPA is 2,536 km^2 (NatureScot, 2024b). Based on that it is concluded that 0.02% will be temporarily affected.

It should be noted that this disturbance area accounts for the area that will be directly disturbed temporarily but does not include the indirect seabed disturbance associated with deposited material from the excavation activities which is discussed further in Section 10.6.1.2 and Section 10.5.6.2. The potential effects are discussed below for each of the key habitat types and sensitive species within the temporary disturbance footprint.

When determining the significance of the temporary impact, it has been considered whether the impact is likely to result in a change in biological diversity or community composition that may impact ecosystem function and higher trophic levels including birds, fish, and mammals (Scottish Government, 2023b).

It should be mentioned that geotechnical survey investigations are planned which will involve some localised seabed disturbance including Cone Penetrating Testing (CPT), vibrocoring and borehole drilling. These will be undertaken prior to the construction phase and will be highly localised causing a temporary disturbance of very limited duration and extent. At the time of writing, details of these activities were not established and therefore the location and quantity of the sampling is not included within this EIAR. However, the footprint of these surveys will be restricted to discrete areas and expected to be within the temporary disturbance footprint assessed for the seabed and benthic habitats described below.

10.6.1.1.1 Offshore deep-sea muds

'Offshore deep-sea muds' are predominantly found in stable deeper / offshore areas where the reduced influence of wave action and / or tidal streams allow fine sediments to settle. These habitats are often dominated by polychaetes and echinoderms, such as *Amphiura* spp., seapens, such as the slender seapen (*V. mirabilis*), and burrowing megafauna, such as the Norway lobster (*N. norvegicus*) (Connor *et al.*, 2004), although polychaetes, sea spiders, molluscs, crustaceans and fish are also found. Bathymetry, current velocity, bottom water-mass distribution and particle size of the mud (clay, silty or sandy) have a significant influence on the distribution and composition of the seabed communities present (JNCC, 2024). The most common larger surface-dwelling animals are echinoderms, including sea cucumbers, brittlestars, and sea urchins.

'Offshore deep-sea muds' are listed as a Scottish PMF (Tyler-Walters *et al.*, 2016) and they are a designated habitat in the East of Gannet and Montrose Fields NCMPA (JNCC, 2024). Offshore deep-sea muds are one of the most common deep-water habitats in the UK offshore marine environment (Tyler-Walters *et al.*, 2016). The spatial extent of 'Offshore deep-sea muds' in the East of Gannet and Montrose Fields NCMPA is approximately 900 km^2 (i.e. approximately 49%) of the total NCMPA (JNCC, 2024).

In the Array Area and the EICC, one of the main habitats identified is 'Offshore circalittoral mud' (SS.Smu.Omu / MD6). In the Array Area, the habitat 'SS.Smu.Omu.PjefThyAfil '*Paramphinome jeffreysii*, *Thyasira* sp. And *Amphiura filiformis* in offshore circalittoral sandy mud' is likely to exist across the wider sand dominated survey area. In the EICC, analysis showed a conformance towards 'Atlantic offshore circalittoral mud' (SS.Smu.Omu / MD62) (**EIAR Vol. 4, Appendix 8: Habitat Assessment Report – OWF, EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 11: Environmental Baseline Report – OWF, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC**).

The sensitivity of the habitat 'Deep-sea muds' to 'Surface abrasion' and 'Subsurface abrasion / penetration' is high (De Bastos, 2016a, FeAST, 2024). It can therefore be expected that the sensitivity to temporary disturbance resulting from seabed preparation and installation activities will be high. The habitat is considered to have **high sensitivity** to temporary habitat loss / disturbance. While it is considered that mortality of species will occur within the footprint of the directly impacted area, (by the temporary disturbance), the characterising infaunal species such as polychaete (e.g. *P. jeffresii*) typically have short life spans and likely to have high recovery rates (De-Bastos, 2016b). It is acknowledged that many of the bivalve species associated with the mud habitats such as *Thyasira* sp. are vulnerable to such direct disturbances due to their fragile shells. However, many such species have a short pelagic larval phase and recruitment from adjacent area can be expected, as has been reported elsewhere where localised disturbance has reduced populations (De-Bastos, 2016b). The brittlestar *Amphiura filiformis* is a relatively long lived species, has reported low rates of recruitment and reaches sexual maturity after two years and therefore has a higher sensitivity with regard to recovery. Nonetheless, individual specimens that have been non fatally damaged are known to be able to grow back their arms and have a degree of resistance to the pressure. Overall while sensitivity is conservatively considered as high, the very close proximity to adjacent undamaged deep sea mud habitat is expected to ensure the localised recruitment of characteristic species and therefore no significant effects on the ecological functioning of the wider mud ecosystem are predicted.

Considering that the Array Area is found on the habitat 'Offshore deep-sea muds' (Figure 10-14), that the spatial extent of temporary habitat / loss disturbance associated with the 'Offshore deep-sea muds' in the Array Area is 6.03 km^2 and the temporary disturbance from the cable installation over the 'Offshore deep-sea muds' inside the NCMPA is 0.35 km^2 it is concluded that 6.38 km^2 of 'Offshore deep-sea muds' in the NCMPA will be temporarily disturbed (corresponding top 0.71% of the total extent of 'Offshore deep-sea muds' in the NCMPA) (Table 10-16). The proportion of the habitat temporarily affected is relatively low compared to the wider occurrence of this habitat and it is considered that the wider ecological function of the 'Offshore deep-sea muds' habitat will remain intact.

Based on localised spatial and temporal disturbance compared to their highly widespread distribution, and low frequency of construction / installation events, any effects are unlikely to affect the long-term functioning of the wider habitat and associated biotopes in the Array Area and the EICC. The effect is thus defined as being of low magnitude.

Furthermore, as indicated in Table 10-16, given the relatively low proportion (0.71%) of the protected deep-sea mud habitat within the East of Gannet and Montrose Fields NCMPA that would be temporarily affected it is not considered that the conservation objectives of the site would be hindered. Further details of the assessment on the NCMPA is provided within the MPA Assessment.

Evaluation of significance

Taking the high sensitivity of the receptor and the low magnitude of the effect, the overall effect of temporary habitat loss / disturbance to 'Offshore deep-sea muds' during construction is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance – NOT SIGNIFICANT

Based on the above it is also concluded that temporary impacts to the seabed and benthic habitats will not have a significant effect on blue carbon associated with 'Offshore deep-sea muds'. More information can be found in the EIAR Vol. 3, Chapter 20: Carbon and Greenhouse Gases.

10.6.1.1.2 Ocean quahog

Ocean quahog is predominately found on sublittoral firm sediments including level offshore areas, buried (or part buried) in sand and muddy sand that ranges from fine to coarse grains (MarLIN, 2024). The species is found around all British and Irish coasts, and offshore e.g., in the North Sea (MarLIN, 2024).

Ocean quahog aggregations (including sands and gravels as their supporting habitat) is a designated feature in the East of Gannet and Montrose Fields NCMPA (Figure 10-14) (JNCC, 2024) and are listed under the OSPAR List of Threatened and / or Declining Species and as a Scottish PMF (Tyler-Walters *et al.*, 2016).

As discussed in Section 10.4.4, no living adult specimens of ocean quahog and no evidence of their distinct siphons are observed on any of the video footage or still photographs across the Array Area and EICC. Analysis found 109 juveniles across 22 grab samples in the Array Area and 21 juveniles across 8 grab samples in the EICC (EIAR Vol. 4, Appendix 8: Habitat Assessment Report – OWF, EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC, EIAR Vol. 4, Appendix 11: Environmental Baseline Report – OWF, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC, EIAR Vol. 4, Appendix 13: Benthic eDNA Analysis Report). In addition, the compilation of publicly-available data (National Biodiversity Network (NBN) Atlas, 2024; GeMS, 2022, Scottish Government, 2024b) with data from site specific surveys (EIAR Vol. 4, Appendix 8: Habitat Assessment Report – OWF, EIAR Vol. 4, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC, EIAR Vol. 4, Appendix 11: Environmental Baseline Report – OWF, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC) show minimal overlap between the Array Area and EICC with ocean quahog inside the East of Gannet and Montrose Fields NCMPA (Figure 10-14). In addition, site specific surveys in the Array Area have shown that the main habitat type is 'Offshore circalittoral mud / MD6' and not 'Subtidal sands and gravels' that act as the supporting habitat for ocean quahog. The fact that the main type of habitat in the Array Area is 'Offshore circalittoral mud' is in line with publicly available data about distribution of designated benthic habitats and species in the East of Gannet and Montrose Fields NCMPA (Scottish Government, 2024a, JNCC, 2024). While it is acknowledged that the sand fraction within the 'offshore circalittoral mud' sediments is likely to be sufficient to support ocean quahog populations, it is not considered the optimum habitat for aggregations.

The spatial extent of the habitat 'Subtidal sands and gravels' that supports ocean quahog in the East of Gannet and Montrose Fields NCMPA is approximately 939 km^2 (JNCC, 2024) (Figure 10-14). Considering that the length of the EICC in the NCMPA that intersects the habitat 'Subtidal sands and gravels' is approximately 17.5 km (and that the Array Area occurs within a broad area of circalittoral mud), it is concluded that 0.35 km^2 of the ocean quahog supporting 'Subtidal sands and gravel' habitat will be temporarily disturbed; this corresponds to 0.04% of the 'Subtidal sands and gravels' extent in the NCMPA (Table 10-16).

Ocean quahog is considered to have high sensitivity to 'Abrasion / disturbance of the surface of the substratum or seabed', low resistance and very low resilience (Tyler-Walters and Sabatini, 2017). Similar findings about sensitivity, resistance and resilience apply also for 'Penetration or disturbance of the substratum subsurface' (Tyler-Walters and Sabatini, 2017). According to FeAST, ocean quahog has low sensitivity to surface abrasion and high sensitivity to subsurface abrasion / penetration (FeAST, 2024). It can therefore be expected that the sensitivity to temporary disturbance resulting from seabed preparation and installation activities will be high. The species is considered to have high sensitivity to temporary habitat loss / disturbance.

The habitat 'Subtidal sands and gravels' has low sensitivity to 'Abrasion / disturbance of the surface of the substratum or seabed' while resistance is medium, and resilience is high; similar findings are reported about the pressure 'Penetration or disturbance of the substratum subsurface' (Tyler-Walters and Sabatini, 2017). Considering its conservation value, the habitat is considered to have medium sensitivity to temporary habitat loss / disturbance.

Mortality of ocean quahog individuals and temporary disturbance of 'Offshore circalittoral mud / MD6' and 'Offshore circalittoral mixed sediments / MD4' in the immediate vicinity of the directly disturbed area can be expected. However, construction activities will be localised, and the spatial extent of 'Offshore circalittoral mud' and 'Offshore circalittoral mixed sediment / MD4' / subtidal sands and gravels that will be affected from the temporary habitat disturbance / loss will be small.

Although the eDNA analysis suggested the presence of ocean quahog throughout the Array Area and the EICC, it is noteworthy that the macrofaunal records across the Array Area and the EICC survey area were only juveniles (<1 cm in diameter) with no adults recorded and no visible siphons in video footage or stills. It is acknowledged that the presence of adult ocean quahog cannot be ruled out as the species are known to occur in a wide range of sediment types, including muddy biotopes. However, based on the survey evidence, it is expected that the areas of seabed affected by construction activities are not particularly important for established adult ocean quahog aggregations and that any individuals affected by the project will represent a very small proportion of the of the wider ocean quahog population.

Given, the low frequency of construction / installation events and the localised nature of temporary disturbance any effects are unlikely to affect the designated feature (ocean quahog and its supporting habitat) at a population level. Therefore, the effects on this receptor are considered to be of a low magnitude.

Furthermore, given the relatively low density of ocean quahog aggregations identified in the Array Area and the low proportion (0.04%) of their preferred sands and gravels habitat that will temporarily affected, within the East of Gannet and Montrose Fields NCMPA (Table 10-16), it is not considered that the abundance of ocean quahog across the wider area would be affected at a population level. In addition, it is assessed that the conservation objectives for ocean quahog aggregations across the site would not be hindered. Further details of the assessment on the NCMPA is provided within the MPA Assessment.

Evaluation of significance

Taking the high sensitivity of the receptor and the low magnitude of the effect, the overall effect of temporary habitat loss / disturbance to ocean quahog during construction is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.1.1.3 Burrowed mud / Seapens and burrowing megafauna communities

Scottish sea lochs and the northern North Sea support an estimated 95% of British records of burrowed mud habitat (Tyler-Walters *et al.*, 2016). Seapens and burrowing megafauna communities in Scotland are extensively distributed throughout sheltered sea lochs, voes, and other open coast muddy habitats on the west coast of Scotland, as well as the continental slope. There are scattered records on the east coast and notable records in offshore waters of the northern North Sea (Tyler-Walters *et al.*, 2016).

Burrowed mud is listed as Scottish PMF (Tyler-Walters *et al.*, 2016) while 'Seapens and burrowing megafauna communities' are listed as PMFs and in the OSPAR List of Threatened and / or Declining Species and Habitats (OSPAR, 2010a). Burrowed mud is a designated feature in the Southern Trench NCMPA (NatureScot, 2024b).

In the Array Area, the results of the burrows assessment indicated that 44 out of the 51 transects reviewed revealed the presence of burrows predominantly in the 'Offshore circalittoral mud / MD6' biotope (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF). Large burrows are observed across 42 stations and are categorised as 'Occasional' to 'Common' on the SACFOR scale, whereas small burrows are observed at just 21 stations varying in average density from 'Rare' to 'Frequent' (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF). The presence of 'Frequent' or above burrow densities, particularly in the case of large burrows (Figure 10-2), coupled with the presence of burrowing fauna (*N. norvegicus*) indicates a degree of conformity to the OSPAR 'Seapen and burrowing megafauna communities' and / or the 'Burrowed mud' Scottish PMF (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF). Despite the presence of muddy sand in the EICC (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC), the visual absence of seapens and burrows indicates that the OSPAR 'Seapen and burrowing megafauna communities' habitat is unlikely to exist across the EICC (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). As such, there was no burrowed mud habitat identified along the EICC that transacted the Southern Trench NCMPA.

The seapen species *V. mirabilis* and *P. phosphorea* can avoid abrasion by withdrawing into the sediment. However, *F. quadrangularis* cannot withdraw and is the tallest of all three of the seapens (up to 2 m) and is the most likely to be displaced or removed by surface abrasion and towed gear (Hill *et al.*, 2023). The sensitivity of CfiMU.SpnMeg ('Seapens and burrowing megafauna in circalittoral fine mud') is assessed as medium (for *P. phosphorea* and *V. mirabilis*) but the sensitivity of CfiMU.SpnMeg.Fun ('Seapens, including *F. quadrangularis*, and burrowing megafauna in undisturbed circalittoral fine mud') is regarded as being high (Hill *et al.*, 2023). Based on available evidence *V.*

mirabilis and *P. phosphorea* are likely to recover quickly from the effects of dragging and uprooting (Hill *et al.*, 2023) and the recovery of *F. quadrangularis* from abrasion or dislodgement may be slower (Hill *et al.*, 2023).

According to the MarESA and FeAST the sensitivity of the habitat 'Burrowed mud' / 'Seapens and burrowing megafauna in circalittoral fine mud' to 'Abrasion / disturbance of the surface of the substratum or seabed' is medium (Hill *et al.*, 2023, FeAST, 2024) while resistance is medium, and resilience is low (Hill *et al.*, 2023). Furthermore, according to FeAST (FeAST, 2024) the sensitivity of 'Burrowed mud' to sub-surface abrasion / penetration is medium and according to MarESA the sensitivity is high with low resistance and low resilience (Hill *et al.*, 2023). Considering, however, that 'Offshore deep-sea muds' and 'Burrowed mud' are closely related habitats, the sensitivity of 'Burrowed mud' has also been set to high, in line with 'Offshore deep-sea muds' (see Section 10.6.1.1.1).

Based on the above it can be expected that the sensitivity to temporary disturbance resulting from seabed preparation and installation activities will be high, therefore, the habitat is considered to have high sensitivity to temporary habitat loss / disturbance.

Based on the localised spatial and temporal disturbance compared to their highly widespread distribution, the low frequency of construction / installation events, any effects are unlikely to affect the long-term functioning of the wider habitat and associated biotopes. The effect is therefore defined as being of low magnitude.

Evaluation of significance

Taking the high sensitivity of the receptor and the low magnitude of the effect, the overall effect of temporary habitat loss / disturbance to 'Burrowed mud / Seapens and burrowing megafauna communities' during construction is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance – NOT SIGNIFICANT

Based on the above it is also concluded that temporary effects to the seabed and benthic habitats will not have a significant effect on blue carbon associated with 'Burrowed mud / seapens and burrowing megafauna communities'. More information can be found in the EIAR Vol. 3, Chapter 20: Carbon and Greenhouse Gases.

10.6.1.1.4 Subtidal sands and gravels

Sand and gravel sediments are one of the most common habitats in the UK and Scottish offshore waters (Tyler-Walters *et al.*, 2016). This habitat hosts diverse infaunal communities dominated by polychaetes, shells, and small bivalves. Offshore fine to muddy sands support a diversity of tube building polychaetes, burrowing brittlestars and bivalves, while the pea urchin (*Echinocyamus pusillus*) occurs in medium sands, and amphipods and *Athanas nitescens* (hooded shrimp) in fine sands. Mobile predators include flatfish, starfish, crabs and hermit crabs. The habitat subtidal sands and gravels is listed as a UK BAP Priority Habitat and Scottish PMF (Tyler-Walters *et al.*, 2016).

Site specific surveys have revealed the presence of subtidal sands and gravels in the Project Area. Specifically:

- Offshore circalittoral mixed sediment (MD4): Array Area, EICC;
- Offshore circalittoral sand (MD5): EICC;
- Offshore circalittoral coarse sediment (MD3): EICC; and
- Circalittoral muddy sand (MC5 / MC6): EICC.

The spatial extent of the habitat 'Subtidal sands and gravels' in the East of Gannet and Montrose Fields NCMPA is approximately 939 km^2 (JNCC, 2024) (Figure 10-14). Considering that the length of the Export/Import Cable in the NCMPA that intersects the habitat 'Subtidal sands and gravels' is approximately 17.5 km it is concluded that 0.35 km^2 of the habitat 'Subtidal sands and gravel' will be temporarily disturbed; this corresponds to 0.04% of the 'Subtidal sands and gravels' extent in the NCMPA.

The spatial extent of 'Subtidal sands and gravels' in the EICC is 88.46 km^2. Considering that the temporary seabed footprint in the EICC is 4.60 km^2 (Table 10-14, Table 10-15) it is concluded that 5.20% of 'Subtidal sands and gravels' along the EICC will be temporarily disturbed.

According to the MarESA sensitivity assessment subtidal sands and gravels and associated biotopes (e.g., the biotope 'Polychaete-rich deep *Venus* community in offshore mixed sediments' which has been recorded in the EICC) have low sensitivity to abrasion / disturbance of the surface of the substratum or seabed and also have medium resistance and high resilience (Tillin and Watson, 2023). It can therefore be expected that the sensitivity to temporary disturbance resulting from seabed preparation and installation activities will be low. However, as a PMF, the offshore subtidal sands and gravels habitat is a conservation priority and may have medium sensitivity to sediment surface disturbance while it does have some degree of resilience to temporary habitat loss (Tillin and Watson, 2023). The habitat is considered to have **medium sensitivity** to temporary habitat loss / disturbance.

Based on localised spatial and temporal disturbance compared to their highly widespread distribution, and low frequency of construction / installation events, any effects are unlikely to affect the long-term functioning of the wider habitat and associated biotopes. The effect is thus defined as being of **low magnitude**.

Evaluation of significance

Taking the medium sensitivity of the receptor and the low magnitude of the effect, the overall effect of temporary habitat loss / disturbance to 'Subtidal sands and gravels' during construction is considered to be **minor** and **not significant** in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Medium	Low	Minor

Impact significance – **NOT SIGNIFICANT**

Based on the above it is also concluded that temporary effects to the seabed and benthic habitats will not have a significant effect on blue carbon associated with 'Subtidal sands and gravels'. More information can be found in the EIAR Vol. 3, Chapter 20: Carbon and Greenhouse Gases.

10.6.1.1.5 Geogenic (bedrock and stony) reef

One of the habitats listed in Annex I of the Habitats Directive is 'Reefs'. This habitat category includes bedrock, stony and biogenic variants. Stony reefs may comprise areas of boulders or cobble which arise from the seafloor and provide a suitable substratum for the attachment of benthic species (Irving, 2009). Approximately 8,938 km^2 of Annex I reef is protected in Scottish waters within designated marine SACs.

In the EICC, due to the presence of cobbles / boulders and bedrock across transects a stony and rocky reef assessment following Irving (2009) and Golding *et al.* (2020) methodologies was undertaken (MMT, 2018, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). In the 2024 survey isolated incidences of 'Possible rocky reef with sand veneer' and 'Rocky reef with sand veneer', based on the occurrence of < 10% visible bedrock and visible epifauna, are identified across IECC_T04 (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). Whereas, incidences of 'Rocky reef with low biodiversity' and 'Rocky reef with high biodiversity', based on the occurrence of > 50% visible bedrock and > 40% epifaunal coverage of erect fauna, are identified across IECC_T05. Therefore, indicating the presence of Annex I bedrock reef in the EICC. (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC)The analysis of 2018 survey data also showed the presence of bedrock reef in the EICC (Section 10.4.4.4.4) (MMT, 2018). The analysis of the data collected in 2024 in the EICC shows the presence of two small (< 200 m^2) patches of 'Medium reef' that could be considered as an Annex I stony reef ; the analysis also shows the presence of three 'Low reef' patches that are unlikely to be considered as Annex I stony reef. The presence of stony reefs in the EICC is also shown from the analysis of the data collected in 2018 (Section 10.4.4.4.4) (MMT, 2018). In the Array Area, due to the presence of cobbles and boulders in the Array Area, a stony reef assessment following Irving (2009) methodology was undertaken. The analysis showed the presence of 'Low reef' areas but there is no strong evidence supporting the justification for Annex I protection.

The temporary disturbance to the bedrock / stony reef habitats will arise from pre-installation preparatory works such as boulder clearance which will essentially displace them making up rocky habitats in the adjacent areas. These geogenic reef habitats are considered to have low sensitivity, medium resistance and high resilience to temporary disturbance (Stamp *et al.*, 2023). The associated epifaunal communities are predicted to be suitably adapted to dynamic and energetic environmental conditions, especially in the EICC, and are therefore expected to be resilient to temporary disturbance. However, taking into account that some of the bedrock and stony reef patches identified in the EICC could be regarded as Annex I bedrock / stony reefs and thus have conservation value, it is concluded that these habitats have high sensitivity.

Whilst it is considered that boulder clearance is a temporary disturbance, mainly due to the associated boulders that make up the reef habitat being physically moved a short distance (out with a 20 m corridor), their integrity as reef features will remain intact. However, it is acknowledged that the relocation itself is permanent and not temporary. In relation to boulder clearance, preference will be given to micro-routeing to avoid boulders where possible. Further discussion on long-term effects on reef, including consideration of the permanent relocation of boulders making up this geogenic habitat is provided in Section 10.6.2.2.5.

Overall, the temporary effects will be localised and limited to the duration of the construction activities with an expected high recoverability following disturbance. With the implementation of embedded mitigation measures, such as micro-siting to avoid sensitive habitats wherever possible and reducing localised temporary habitat loss/ disturbance, the effect is defined as being of low magnitude.

Evaluation of significance

Taking the high sensitivity of the receptor and the low magnitude of the effect, the overall effect of temporary habitat loss / disturbance to 'Geogenic (bedrock and stony) reef' during construction is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance – NOT SIGNIFICANT

Based on the above it is also concluded that temporary effects to the seabed and benthic habitats will not have a significant effect on blue carbon associated with 'Geogenic (bedrock and stony) reefs'. More information can be found in the EIAR Vol. 3, Chapter 20: Carbon and Greenhouse Gases.

10.6.1.1.6 *S. spinulosa* biogenic reef

S. spinulosa is a tube-building polychaete worm and can occur as isolated individuals, small aggregations, thin crust-like veneers, or when in large numbers can form hard reef-like structures which can act to stabilise the surrounding seabed (Gibb *et al.*, 2014; Tillin *et al.*, 2023). As a result of the complex habitat created by *S. spinulosa* tubes there are a wealth of different species associated with the reefs it forms (Tillin *et al.*, 2023). *S. spinulosa* is known to occur on all UK coasts but there are many more records from English waters than there are from Scotland (Pearce and Kimber, 2020).

The high-definition video analysis in the EICC data from surveys carried out in 2024 revealed small aggregations of *S. spinulosa* (EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC). There are 15 areas delineated as 'Low reef' with the remaining delineated as 'Not a reef'. The spatial extent of the 'Low reef' area are significantly below the 'Medium' extent threshold of 10,000 m^2, indicating the isolated patches present do not constitute Annex I biogenic reef (EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC). The analysis of the data collected in 2024 in the EICC also showed that *S. spinulosa* formed two isolated patches; however, only a single incidence of 'Low reef' was observed and based on the size (69 m^2), is unlikely to constitute the presence of Annex I biogenic reef. The analysis of the data collected in 2018 in the EICC showed the presence of a *S. spinulosa* biogenic reef in transect T05 (MMT, 2018).

It is acknowledged that the use of the PLGR may lead to the relocation of boulders hosting *S. Spinulosa*. The boulders will be physically moved a short distance (out with a 20 m corridor) but their integrity supporting *S. spinulosa* will remain intact. The relocation itself is regarded as a permanent effect. The habitat assessment reports have shown that *S. spinulosa* biogenic reefs have a rather limited and patchy distribution in the EICC area (MMT, 2018, EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC). Any effects from boulder relocation will be highly localised and are considered temporary on the basis that any disturbed *S. Spinulosa* epifauna would be able to recolonise the relocated boulders.

S. spinulosa dominated biotopes typically occur in high energy marine environments that have plentiful supply of sand for the construction of their tubes. As such this, species is highly adapted to dynamic environments in which it occurs and as a result, it is considered that this species does have some inherent resilience to physical disturbance. For instance, areas where *S. spinulosa* had been lost due to winter storms appeared to recolonize up to a maximum thickness of 2.4 cm during the following summer (Tillin *et al.*, 2023). However, the extent of the physical damage is likely to be an important factor in the recoverability. If damage is limited to relatively small areas, full recovery through tube repair and may be relatively rapid (over a year or two). On the other hand, extensive damage or full removal resulting from surface abrasion may lead to low recovery rates. *S. spinulosa* reefs are often only approximately 10cm thick, and surface abrasion can, therefore, severely damage and / or remove a reef. No direct observations of reef recovery, through repair, from abrasion were found for *S. spinulosa (*Tillin *et al.*, 2023*)*.

According to the MarESA sensitivity assessment, the sensitivity of '*S. spinulosa* on stable circalittoral mixed sediment' to 'Abrasion / disturbance of the surface of the substratum or seabed' is medium while there is low resistance and medium resilience (Tillin *et al.*, 2023). Considering the MarESA sensitivity assessment the habitat is considered to have medium sensitivity to temporary habitat loss / disturbance (Tillin *et al.*, 2023). However, taking into account that some of the *S. spinulosa* reef patches identified in the EICC could be regarded as Annex I biogenic reef and thus have conservation value, it is concluded that these habitats have high sensitivity.

Overall, the temporary effects will be localised and limited to the duration of the construction activities. With the implementation of embedded mitigation measures, such as micro-siting to avoid sensitive habitats wherever possible and reducing localised temporary habitat loss / disturbance, the effect is defined as being of low magnitude.

Evaluation of significance

Taking the medium sensitivity of the receptor and the low magnitude of the effect, the overall effect of temporary habitat loss / disturbance to '*S. spinulosa* biogenic reef' during construction is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.1.2 Potential changes to suspended sediment concentrations and sediment deposition

Existing seabed habitats may be temporarily disturbed by the suspension of sediment and deposition during the installation of subsea infrastructure outlined in Table 10-14. These have been subject to modelling studies which are detailed in EIAR Vol. 3, Chapter 8: Marine Geology, Oceanography and Coastal Processes. The outputs of this modelling have been used to inform the effect to benthic receptors.

The seabed preparation (e.g., the use of the PLGR), construction and installation of infrastructure such as the IACs, Export/Import Cable, anchors and mooring lines on the seabed, and rock placement will disturb seabed sediments and result in a temporary increase in suspended sediment concentrations. The effect of suspended sediment and the deposition of the sediment within the Array Area, and EICC are considered here for each of the benthic receptors. The extent of the affected area and associated burial depth are dependent on numerous variables (e.g., type of sediment, current speed, height of sediment ejection) which were incorporated to model the potential suspended sediment concentrations, extent and duration of associated plumes and thickness of sediment deposits. A summary about the outputs of the modelling study on suspended and deposited sediments on the seabed is given in Section 10.5.6.2. Based on the outputs of the modelling study it is concluded that the seabed footprint from sediments suspended or deposited on the seabed is highly localised and limited in duration. This is the case both for sediments composed mainly of gravels and for sediments composed of fine sand or coarse silt. Considering that the MarESA sensitivity assessment sets 30 cm of sediment deposition as the benchmark for heavy siltation / smothering (MarLIN, 2024), it is concluded that in those cases where > 30 cm deposition will take place this will be confined in a distance less than 1 m. In those cases where deposited sandy / silty sediments will have an average thickness of 0.05 m (i.e., the benchmark that MarESA sensitivity assessment sets for light siltation / smothering – MarLIN, 2024) the seabed footprint will be confined to a distance less than 2 m.

As discussed in Section 10.5.6.3, the MarESA sensitivity assessment (MarLIN, 2024) mentions as the benchmark of light smothering / deposition thickness the value of 0.05 m. The modelling study for the suspension and deposition of sediments on the seabed mentions (assuming a total cable length of 280 km in the Array Area, 315 km in the East of Gannet and Montrose Fields NCMPA and 3.6 m^3 of sediment disturbed / m of cable installation) that the total volume of sediment disturbed in the Array Area will be 1,008,000 m^3 and 1,134,000 m^3 in the East of Gannet and Montrose Fields NCMPA (EIAR Vol. 4, Appendix 7: Marine & Physical Processes Modelling Report). Considering the MarESA benchmark value of 0.05 m (light smothering) it is concluded that an area of 20,160,000 m^2 (20.16 km^2) in the Array Area and 22,680,000 m^2 (22.68 km^2) in the East of Gannet and Montrose Fields NCMPA will be subject to light smothering (Table 10-16). These values correspond to 6.05% of the Array Area and 1.23% of the East of Gannet and Montrose Fields NCMPA. In the case of the Southern Trench NCMPA, 72,000 m^3 of sediment are expected to be disturbed due to Export/Import Cable installation, which corresponds to 1,440,000 m^2 (1.44 km^2). This means that 0.06% of the Southern Trench NCMPA can be subject to light smothering. If the sediment deposition thickness is higher than 0.05 m, then the spatial extent of areas affected from siltation will be smaller (EIAR Vol. 4, Appendix 7: Marine & Physical Processes Modelling Report

10.6.1.2.1 Offshore deep-sea muds

'Offshore deep-sea muds' are listed as a Scottish PMF (Tyler-Walters *et al.*, 2016) and are a designated habitat in the East of Gannet and Montrose Fields NCMPA (JNCC, 2024). 'Offshore deep-sea muds 'are one of the most common deep-water habitats in the UK offshore marine environment (Tyler-Walters *et al.*, 2016).

The spatial extent of 'Offshore deep-sea muds' in the Array Area is approximately 333 km^2 (JNCC, 2024; Figure 10-2; Figure 10-14). The spatial extent of 'Offshore deep-sea muds' in the East of Gannet and Montrose Fields NCMPA is approximately 900 km^2 (JNCC, 2024) and in the EICC it is 21.16 km^2.

According to the outputs of the modelling study, the seabed footprint associated with sediments suspended or deposited will be highly localised and limited in duration (EIAR Vol. 4, Appendix 7 – Marine & Physical Processes Modelling Report; see also Section 10.5.6.2). In those cases where deposited sandy / silty sediments will have an average thickness of 0.06 m (i.e., light siltation / smothering – MarLIN, 2024) the seabed footprint will be confined to a distance less than 2 m from the disturbance area, while in cases of higher sediment sedimentation, the seabed footprint will be even smaller. Assuming that the area of the East of Gannet and Montrose Fields that will be subject to light smothering / siltation rate changes due to cable installation will be approximately 22.68 km^2 (Section 10.5.6.2) and that the spatial extent of 'Offshore deep-sea muds' in the NCMPA is approximately 900 km^2 (JNCC, 2024) it is concluded that approximately 2.52% of 'Offshore deep-sea muds' will be subject to light smothering; in the case of smothering / siltation rate changes being higher than 0.05 m, then the spatial extent of 'Offshore deep-sea muds' affected will be even smaller.

According to the MarESA sensitivity assessment 'Offshore deep-sea muds' have medium sensitivity to heavy smothering and siltation rates changes while they are not sensitive light smothering and siltation rate changes; in heavy smothering they have low resistance and medium resilience while in light smothering they have high resistance and high resilience (Hill *et al.*, 2023). According to FeAST, the habitat 'Offshore deep-sea muds' has high sensitivity to both 'Siltation rate changes (heavy)' and 'Siltation rate changes (light)', although the rationale and evidence for this more conservative approach is not provided (FeAST, 2024). Considering the MarESA and FeAST sensitivity assessments, it is concluded that 'Offshore deep-sea muds' have **medium sensitivity** to potential changes to suspended sediment concentrations and sediment deposition that will occur during construction activities. Taking into account the findings of the sediment suspension modelling study (EIAR Vol. 4, Appendix 7 – Marine & Physical Processes Modelling Report; see also Section 10.5.6.2) it is concluded that the temporary effects will be localised and limited in time, taking place during the construction activities. High recoverability is expected following disturbance and the fine sediment that settles to the seabed can be expected to be reworked by the deposit feeding, infaunal burrowing organisms that characteristic of deep sea mud habitats without any significant change to the physical properties, community composition or ecological functioning of the habitat. it is not considered that the conservation objectives for offshore deep sea mud across the site would be hindered and the overall effect which is defined as being of **low magnitude.**

Evaluation of significance

Taking into account the medium sensitivity of the receptor and the low magnitude of the effect, the overall effect of potential changes to suspended sediment concentrations and sediment deposition during construction is considered to be **minor** and **not significant** in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Medium	Low	Minor

Impact significance – **NOT SIGNIFICANT**

10.6.1.2.2 Ocean quahog

Ocean quahog is a low-mobility species and there is a possibility for the species to be affected by suspended sediments, the associated deposition of fines, and the direct deposition of coarser material. The presence of ocean quahog across the whole Array Area was implied based on the eDNA analysis of sediment samples at all benthic stations sampled (EIAR Vol. 4, Appendix 13: Benthic eDNA Analysis Report). However, the site specific surveys did not record any adult specimens across the whole Project Area; analysis found 109 juveniles across 22 grab samples in the Array Area and 21 juveniles across 8 grab samples in the EICC (EIAR Vol. 4, Appendix 8: Habitat Assessment Report – OWF, EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC, EIAR Vol. 4, Appendix 11: Environmental Baseline Report – OWF, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC).

Ocean quahog (including sands and gravels as their supporting habitat) is a designated feature in the East of Gannet and Montrose Fields NCMPA (JNCC, 2024). Ocean quahog is listed under the OSPAR List of Threatened and / or Declining Species while both ocean quahog and subtidal sands and gravels are listed as Scottish PMFs (Tyler-Walters *et al.*, 2016).

According to the outputs of the modelling study, the seabed footprint associated with sediments suspended or deposited will be highly localised and limited in duration (EIAR Vol. 4, Appendix 7 – Marine & Physical Processes Modelling Report; see also Section 10.5.6.2). According to the MarESA sensitivity assessment, the species ocean quahog is not sensitive to both light or heavy smothering and siltation rate changes; in addition, the species has high resistance and high resilience to these impact pathways (Tyler-Walters and Sabatini, 2017). According to FeAST, the species is not sensitive to 'Siltation rate changes (light)' while it has high sensitivity to 'Siltation rate changes (heavy)' (FeAST, 2024). Considering both the MarESA and FeAST sensitivity assessments and that it will be predominantly light smothering that is experienced by the receptor, it is considered that ocean quahog has medium sensitivity to potential changes to suspended sediment concentrations and sediment deposition.

Taking into account the findings of the sediment suspension modelling study (EIAR Vol. 4, Appendix 7 – Marine & Physical Processes Modelling Report see also Section 10.5.6.2) it is concluded that the temporary effects will be localised and limited in time taking place during the construction activities. High recoverability is expected following disturbance. Considering the lack of adult specimens in the Array Area and the EICC as well as the low density of ocean quahog in the area of proposed operations (Figure 10-14), the effect is defined as being of low magnitude.

Furthermore, given the given the relatively low density of ocean quahog aggregations identified in the array area and the lower proportion of the supporting sands and gravels habitat likely to be affected by cable trenching activities in the East of Gannet and Montrose Fields NCMPA (most will occur in mud habitat), it is not considered that the conservation objectives for ocean quahog aggregations across the site would be hindered. Further details of the assessment on the NCMPA is provided within the MPA Assessment.

Evaluation of significance

Taking into account the low magnitude of the effect and the fact that the receptor has medium sensitivity to this effect, the overall effect of potential changes to suspended sediment concentrations and sediment deposition during construction is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Medium	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.1.2.3 Burrowed mud / Seapens and burrowing megafauna communities

In the Array Area, the results of the burrows assessment indicated that 44 out of the 51 transects reviewed revealed the presence of burrows predominantly in the 'Offshore circalittoral mud / MD6' biotope (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF). Large burrows are observed across 42 stations and are categorised as 'Occasional' to 'Common' on the SACFOR scale, whereas small burrows are observed at just 21 stations varying in average density from 'Rare' to 'Frequent' (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF). The presence of 'Frequent' or above burrow densities, particularly in the case of large burrows (Figure 10-2), coupled with the presence of burrowing fauna (*N. norvegicus*) indicates a degree of conformity to the OSPAR 'Seapen and burrowing megafauna communities' and / or the 'Burrowed mud' Scottish PMF (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF). Despite the presence of muddy sand across the eastern end of the EICC , the visual absence of seapens and burrows indicates that the OSPAR 'Seapen and burrowing megafauna communities' habitat is unlikely to exist in the EICC (MMT, 2018, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC).

Studies have shown that *P. phosphorea* and *F. quadrangularis* recovered within 72-96 hours after experimental smothering by pots or creels for 24 hours and after 96-144 hours after 48 hours of smothering by pots or creels (Kinnear *et al.*, 1996; Eno *et al.*, 2001). However, smothering by a pot or creel differs significantly from 30 cm of fine sediment, which could clog feeding apparatus and exclude oxygen. Kinnear *et al.* (1996) noted that *F. quadrangularis* was quick to remove any adhering mud particles by producing copious quantities of mucus, once the source of smothering (in this case potting) was removed. Similarly, Hiscock (1983) observed *V. mirabilis* secretes copious amounts of mucus, which could keep the polyps clear of silt and is also likely to be able to self-clean.

Where present, the characteristic burrowing megafauna (mud-shrimp and *N. norvegicus*) are unlikely to be affected adversely as they are active burrowers and *N. norvegicus*, *Calocaris macandreae* and *Callianassa ornicatean* were reported within the Garroch Head (Firth of Clyde) sludge dumping ground (Smith, 1988; accessed in Hughes, 1998). In addition, if the deposited sediment occludes burrow openings, then they would be reopened quickly. Observations from Loch Sween suggest that they are re-established soon after experimental disturbance (Hughes, 1998).

The above burrowing species often occur in deep, sheltered muddy habitats where the accretion rates are potentially high. Both *P. phosphorea* and *V. mirabilis* can burrow and move into and out of their own burrows (Hill *et al.*, 2023 and references therein). It is probable therefore that deposition of 30 cm of fine sediment will have little effect other than to temporarily suspend feeding and the energetic cost of burrowing. *F. quadrangularis* cannot withdraw into a burrow but can stand up to two metres above the substratum and so will probably not be affected adversely (Hill *et al.*, 2023 and references therein).

According to the outputs of the modelling study, the seabed footprint associated with sediments suspended or deposited will be highly localised and limited in duration (EIAR Vol. 4, Appendix 7 – Marine & Physical Processes Modelling Report; see also Section 10.5.6.2). In those cases where deposited sandy / silty sediments will have an average thickness of 0.06 m (i.e., light siltation / smothering – MarLIN, 2024) the seabed footprint will be confined to a distance less than 2 m while in cases of higher sedimentation than 0.05 (i.e. heavy siltation / smothering) the seabed footprint will be even smaller. Based on that it is likely that 'Burrowed mud / Seapens and burrowing megafauna communities' will mainly be exposed to 'light smothering'. According to the MarESA sensitivity assessment 'Seapens and burrowing megafauna communities' are not sensitive to light or heavy smothering and siltation rate changes; in addition, they have high resistance and high resilience (Hill *et al.*, 2023). According to FeAST, the habitat 'Burrowed mud' has low sensitivity to 'Siltation rate changes (light)'. Considering the MarESA and FeAST sensitivity assessments it is concluded that 'Burrowed mud / Seapens and burrowing megafauna communities' have low sensitivity to potential changes to suspended sediment concentrations and sediment deposition.

Taking into account the findings of the sediment suspension modelling study (EIAR Vol. 4, Appendix 7 – Marine & Physical Processes Modelling Report; see also Section 10.5.6.2) it is concluded that the temporary effects will be localised and limited in time, taking place during the construction activities. High recoverability is expected following disturbance. The effect is defined as being of low magnitude.

Evaluation of significance

Taking into account the low sensitivity of the receptor and the low magnitude of the effect, the overall effect of potential changes to suspended sediment concentrations and sediment deposition during construction is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Low	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.1.2.4 Subtidal sands and gravels

Sand and gravel sediments are one of the most common habitats in the UK and Scottish offshore waters (Tyler-Walters *et al.*, 2016). This habitat hosts diverse infaunal communities dominated by polychaetes, shells and small bivalves. Offshore fine to muddy sands support a diversity of tube building polychaetes, burrowing brittlestars and bivalves while the pea urchin (*E. pusillus*) occurs in medium sands and amphipods and hooded shrimp in fine sands. Mobile predators include flatfish, starfish, crabs and hermit crabs.

The habitat subtidal sands and gravels is listed as a UK BAP Priority Habitat and Scottish PMF (Tyler-Walters *et al.*, 2016).

Site specific surveys have revealed the presence of subtidal sands and gravels in the Project Area. Specifically:

- Offshore circalittoral mixed sediment (MD4): Array Area, EICC;
- Offshore circalittoral sand (MD5): EICC;
- Offshore circalittoral coarse sediment (MD3): EICC;
- Circalittoral muddy sand (MC5 / MC6):EICC.

Addition of fine material may alter the character of habitats containing gravels, mixed / coarse sediments by covering them with a layer of sediment and may reduce suitability for the species associated with this feature. The mobile infaunal communities which dominate these habitats can be expected to be able to burrow through light smothering caused by the settled re-suspended material. There are expected to be energetic costs associated with the re-opening of burrows. In addition, there is potential that smothering will cause mortality of some organisms through burial, particularly sessile species with no means to migrate through the sediment such as bryozoans and anthozoans. Nonetheless, the extensive undisturbed adjacent areas close by are expected to be able to support recruitment and allow faunal recovery of these sediments. Whilst there is the possibility that the sediment type shifts from what was previously present, and there could be some local change to the benthic composition, particularly during recovery phase, it is not expected that the level of disturbance in the long-term will incur a fundamental shift in the benthic habitat. Given the relatively localised areas affected compared with the extensive adjacent undisturbed areas, the resulting increased sediment suspension and siltation on subtidal sands and gravels in the Array Area, and the EICC is not expected to significantly impact the overall ecological functioning of the affected seabed habitats.

According to the MarESA sensitivity assessment the habitat '*Glycera lapidum*, *Thyasira* spp., and *Amythasides macroglossus* in offshore gravelly sand' has **medium sensitivity**, medium resistance and medium resilience to the pressure 'Smothering and siltation rate changes (both light and heavy)' (Tillin and Watson, 2023). It is explained by Tillin and Watson that the addition of fine material will alter the character of this habitat by covering it with a layer of dissimilar sediment and will reduce suitability for the species associated with this feature and that recovery will depend on the rate of sediment mixing or removal of the overburden. However, it is considered that the resettlement of sediment in sand and gravel areas that are subjected to trenching will largely be localised and of a similar composition therefore not significantly altering the physical characteristics of the habitat or the species present , and therefore there is anticipated to be a good potential for full recovery following disturbance.

According to the outputs of the modelling study, the seabed footprint associated with sediments suspended or deposited will be highly localised and limited in duration (**EIAR Vol. 4, Appendix 7 – Marine & Physical Processes Modelling Report**; see also Section 10.5.6.2). In those cases where deposited sandy / silty sediments will have an average thickness of 0.06 m (i.e., light siltation / smothering – MarLIN, 2024) the seabed footprint will be confined to a distance less than 2 m while in cases of higher sedimentation (up to and above 0.3 m (i.e. heavy siltation / smothering) the seabed footprint will be even smaller and limited to sediments disturbed with a high gravel content (outwith the East of Gannet and Montrose Field NCMPA). Assuming that the size of the East of Gannet and Montrose Fields NCMPA that will be subject to light smothering / siltation rate changes due to cable installation will be approximately 22.68 km^2 (Section 10.5.6.2) and that the spatial extent of 'Subtidal sands and gravels' in the NCMPA is approximately 939 km^2 (JNCC, 2024), assuming worst case that 100 % of all deposition was to take place on sands and gravel, approximately 2.42% of 'Subtidal sands and gravels' will be subject to light smothering; in the case of smothering / siltation rate changes being higher than 0.05 m, then the spatial extent of 'Offshore deep-sea muds' affected will be much smaller. Overall, the temporary effects will be localised and limited in time (**EIAR Vol. 4, Appendix**

7 – Marine & Physical Processes Modelling Report; see also Section 10.5.6.2) taking place during the construction activities. The effect is defined as being of low magnitude.

Evaluation of significance

Taking into account the medium sensitivity of the receptor and the low magnitude of the effect, the overall effect of potential changes to suspended sediment concentrations and sediment deposition during construction is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Medium	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.1.2.5 Geogenic (bedrock / stony) reef

In the Array Area and the EICC, due to the presence of cobbles / boulders and bedrock, a stony and rocky reef assessment following Irving (2009) and Golding *et al*. (2020) methodologies was undertaken. The analysis indicated the presence of Annex I bedrock reef and Annex I stony reef in the EICC (MMT, 2018, EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC) while there is no strong evidence supporting the justification for Annex I stony reef in the Array Area.

The mode of affecting benthic species from suspended sediment comes from potential clogging of feeding and respiratory structures of benthic invertebrates, especially effect filter feeding species as suspended sediments re-settle to the seabed.

The outputs of the modelling study on suspended and deposited sediments have shown that the effects from disturbed sediment will be highly localised and limited in time (EIAR Vol. 4, Appendix 7 – Marine & Physical Processes Modelling Report; see also Section 10.5.6.2). In those cases where deposited sandy / silty sediments will have an average thickness of 0.05 m (i.e., light siltation / smothering – MarLIN, 2024) the seabed footprint will be confined to a distance less than 2 m while in cases of sedimentation higher than 0.05 (i.e. heavy siltation / smothering) the seabed footprint will be even smaller. Based on that it is likely that 'Geogenic reefs (bedrock / stony)' will mainly be exposed to 'light smothering'.

In the Array Area, the epifaunal species recorded on stony reef habitats are suspected branching Porifera (*Axinella* sp.), the cnidarian *A. digitatum*, bryozoan turf and cup corals (*Caryophyllia*). In the EICC the main epifaunal species recorded on bedrock and stony reef habitats are the sea star *Asterias rubens*, the bryozoan *Flustra foliacea* and the cnidarian *A. digitatum* (MMT, 2018, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). According to the MarESA sensitivity assessment there is some variability to sensitivity, resistance and resilience of these benthic species to smothering. For example, in terms of increase in suspended sediment, *A. digitatum* has very low sensitivity, low intolerance and very high recoverability. *A. digitatum* is tolerant to high levels of suspended sediment (Budd, 2008). Hill *et al.* (1997) demonstrated that *A. digitatum* sloughed off settled particles with a large amount of mucous. In terms of smothering *A. digitatum* has low sensitivity, intermediate intolerance and high recoverability (Budd, 2008). Some colonies of *A. digitatum* can attain a height of up to 20 cm (i.e. a level of sedimentation much higher than the worst-case scenario predicted from the modelling study – see Section 10.6.1.2 and Section 10.5.6.2) so would still be able to expand tentacles and columns of the polyps to filer feed, and materials may be sloughed off with a large amount of mucus. Smaller / younger colonies that initially form encrustations between 5 and 10 mm thick are likely to be killed by smothering as respiration is likely to be hindered (Budd, 2008).

The bryozoan *F. foliacea* is not sensitive to increase in suspended sediments (Tyler-Walters and Ballerstedt, 2007). *F. foliacea* dominated communities have been reported from areas subject to sediment abrasion due to strong tidal streams either by mainly sand (Holme and Wilson, 1985) or by gravel (Hartnoll, 1983). Bryozoan larvae are reported to avoid areas affected by siltation (Eggleston, 1972, Ryland, 1976), however, the abundance of *F. foliacea* in areas subject to sediment abrasion and suspended sediment loads subjects that the some of its larvae are also able to settle and survive. *F. foliacea* is not sensitive and has tolerance to smothering (Tyler-Walters and Ballerstedt, 2007). *F. foliacea* dominated communities were reported to form in, and hence tolerate, areas subject to sediment transport (mainly sand) and periodic, temporary, submergence by thin layers of sand (ca <5 cm) (Holme and Wilson, 1985). The seastar *A. rubens* has low sensitivity, low intolerance and high recoverability to increase in suspended sediment (Budd, 2008). *A. rubens* appears able to flourish in naturally turbid conditions such as the north-east coast of England (Budd, 2008).It is noted that *A. rubens* would cleanse itself of adhering mud particles by secreting mucus (Moore, 1977). The species *A. rubens* has very low sensitivity to smothering, low intolerance and very high recoverability (Budd, 2008). It is likely that *A. rubens* would have little difficulty in crawling out from beneath 5 cm of sediment (Budd, 2008).

Based on the above it is concluded that the benthic species in bedrock / stony reef habitats in the Array Area / EICC in terms of low smothering have low sensitivity.

It is recognised that increased suspended sediments and associated siltation can impair filter feeding efficiency in some species including bryozoans, sponges and cnidarians (Tyler-Walters and Ballerstedt, 2007, Budd, 2008). Considering the short distance that sediment plumes will expand, the limited duration of sediments kept in suspension and the very low sedimentation thickness (EIAR Vol. 4, Appendix 7 – Marine & Physical Processes Modelling Report; see also Section 10.5.6.2), it is concluded that the disturbance from suspended sediments will be highly localised, short-term and it is not likely to disturb the ecological functioning of the reef habitats. Overall, the temporary effects will be localised and limited to the duration of the construction activities. The effect is defined as being of low magnitude.

Evaluation of significance

Taking into account the low sensitivity of the receptor and the low magnitude of the effect, the overall effect of potential changes to suspended sediment concentrations and sediment deposition during construction is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Low	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.1.2.6 *S. spinulosa* biogenic reef

The high-definition video analysis in the EICC data from surveys carried out in 2023 revealed small aggregations of *S. spinulosa* (EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC). There are 15 areas delineated as 'Low reef' with the remaining delineated as 'Not a reef'. The spatial extent of the 'Low reef' area are significantly below the 'Medium' extent threshold of 10,000 m^2, indicating the isolated patches present do not constitute Annex I biogenic reef (EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC). The analysis of the data collected in 2023 in the EICC also showed that *S. spinulosa* formed two isolated patches; however, only a single incidence of 'Low reef' was observed and based on the size (69 m^2), is unlikely to constitute the presence of Annex I biogenic reef. The analysis of the data collected in 2018 in the EICC showed the presence of a *S. spinulosa* biogenic reef in transect T05 (MMT, 2018).

S. spinulosa reefs adjacent to aggregate dredging areas appear unimpacted by dredging operations (Pearce et *al.*, 2007; Pearce *et al.*, 2011). Evidence suggests that given the dynamic sedimentary environments in which sabellariids live, their populations can certainly persevere in turbid conditions in spite of 'typical' natural levels of burial (Last *et al.*, 2011) and that recovery from burial events is high.

Direct evidence for the effects of siltation on *S. spinulosa* is limited to the experiments undertaken by Last *et al.* (2011). The experimental conditions do not, however, relate to the pressure benchmark (30 cm of siltation in a single event) given in the MarESA sensitivity assessment (Tillin *et al.*, 2023). Last *et al.* (2011) buried *S. spinulosa* worms (isolated into artificial tubes), under three different depths of sediment – shallow (2 cm), medium (5 cm) and deep (7 cm). The results indicate that *S. spinulosa* can survive short-term (32 days), periodic sand burial of up to 7 cm. Last *et al.* (2011) suggested that the formation of 'emergence tubes' (newly created tubes extending to the surface) under sediment burial allowed *S. spinulosa* to tolerate gradual burial and that perhaps this mechanism allows for continued adult dispersal. This mechanism occurred most rapidly throughout the 8-day burial at ~1 mm per day (Last *et al.*, 2011) but even though tube-growth still seems possible under burial, it is likely that a dumping of fine and coarse material will block feeding apparatus and therefore worm development will be curtailed.

A *S. spinulosa* reef off the coast of Dorset has shown periodic burial from large sandwaves (Collins, 2003). The displacement of some colonies that had established themselves on a gas pipeline 1 km off the coast of Aberdeen was also associated with burial (Mistakidis, 1956; accessed by Holt *et al.*, 1998). Furthermore, the loss of a 2 km^2 area of *S.*

spinulosa reef in Jade Bay, North Sea was attributed to burial as a consequence of mud deposition, although fishing activity may have contributed to the decline (Dörjes, 1992, accessed from Hendrick *et al.*, 2011).

The outputs of the modelling study on suspended and deposited sediments have shown that the effects from disturbed sediment will be highly localised and limited in time (EIAR Vol. 4, Appendix 7 – Marine & Physical Processes Modelling Reports see also Section 10.5.6.2). In those cases where deposited sandy / silty sediments will have an average thickness of 0.05 m (i.e., light siltation / smothering – MarLIN, 2024) the seabed footprint will be confined to a distance less than 2 m while in cases of sedimentation higher than 0.05 (i.e. heavy siltation / smothering) the seabed footprint will be even smaller. Based on that it is likely that 'Geogenic reefs (bedrock / stony)' will mainly be exposed to 'light smothering'. According to the MarESA sensitivity assessment the habitat '*S. spinulosa* on stable circalittoral mixed sediment' is not sensitive to 'Smothering and siltation rate changes (light)' and also has high resistance and high resilience (Tillin *et al.*, 2023). Considering though the potential that Annex I *S. spinulosa* biogenic reef have been identified, the receptor is considered to have low sensitivity.

Based on the outcomes of the sediment suspension modelling study (EIAR Vol. 4, Appendix 7 – Marine & Physical Processes Modelling Report; see also Section 10.5.6.2) it is concluded that the temporary effects will be highly localised and limited in time taking place during the construction activities. The effect is defined as being of low magnitude.

Evaluation of significance

Taking into account the low sensitivity and the low magnitude of the effect, the overall effect of potential changes to suspended sediment concentrations and sediment deposition during construction is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Low	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.1.3 Introduction of INNS

There is potential for marine INNS to be introduced or transferred by construction vessels, particularly for vessels working within an international market. This can happen through biofouling (e.g. attachment of organisms to boat hulls) or discharge of ballast water as well as through towing of floating infrastructures and pre-lay of infrastructure prior to being installed. In addition, introduction of hard substrate in the Array Area and EICC (as a result of cable protection) may create 'stepping stones' for INNS dispersal.

INNS can have a detrimental effect on Benthic Ecology through predation on existing wildlife or outcompeting for prey and habitat. This can result in biodiversity changes in the existing habitats present in the Benthic Ecology Study Area. Depending on the INNS species introduced, this could potentially lead to complete loss of certain species and may result in new habitats forming (e.g., reef-forming species). It is worth noting that site specific surveys did not identify any INNS species (EIAR Vol. 4, Appendix 8: Habitat Assessment Report – OWF, EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report

- Inshore EICC, EIAR Vol. 4, Appendix 11: Environmental Baseline Report – OWF, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC, EIAR Vol. 4, Appendix 13: Benthic eDNA Analysis Report).

Up to 27 different vessels will be used across the construction period. The vessels likely to be used, but not limited to, include construction support vessels, rock dump vessels, heavy lift vessels, cable laying vessels, and supply vessels.

10.6.1.3.1 Offshore deep-sea muds

In the Array Area and the EICC, one of the main habitats identified is 'Offshore circalittoral mud' (SS.Smu.Omu / MD6). In the Array Area, the habitat 'SS.Smu.Omu.PjefThyAfil '*Paramphinome jeffreysii*, *Thyasira* sp. And *Amphiura filiformis* in offshore circalittoral sandy mud' is likely to exist across the wider sand dominated survey area. In the EICC analysis showed a conformance towards 'Atlantic offshore circalittoral mud' (SS.Smu.Omu / MD62) (EIAR Vol. 4, Appendix 8: Habitat Assessment Report – OWF, EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 11: Environmental Baseline Report – OWF, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC).

'Offshore deep-sea muds' are listed as Scottish PMF (Tyler-Walters *et al.*, 2016). In the case of FeAST (2024) sensitivity assessment it is mentioned that introduction of INNS is not assessed for deep-sea muds while in MarESA (De-Bastos, 2016a) it is mentioned that introduction of INNS is not relevant for this habitat. On a pre-cautionary basis, it is concluded that 'Offshore deep-sea muds' have medium sensitivity to INNS.

Any introduction of INNS could affect the long-term functioning of habitat and associated biotopes and therefore it is acknowledged that there is a potential risk from non-native species. Nonetheless, based on the localised workings of the vessels and the temporary nature of the activities and embedded mitigation for INNS effects, such as the INNSMP and the routine removal of marine growth, the effect is defined as being of low magnitude. The INNSMP will follow the guidance of NatureScot's 'Marine Biosecurity Planning Guidance for Producing Site and Operation-Based Plans for Preventing the Introduction of Non-Native Species'. The INNSMP will be submitted and agreed with MD-LOT.

Evaluation of significance

Taking the medium sensitivity of the receptor and the low magnitude of the effect, the overall effect of introduction and spread of INNS to 'Offshore deep-sea muds' during construction is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Medium	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.1.3.2 Ocean quahog

The presence of ocean quahog across the whole Array Area was implied based on the eDNA analysis of sediment samples at all benthic stations sampled. However, the site specific surveys did not record any adult specimens across the whole Project Area; Analysis found 109 juveniles across 22 grab samples in the Array Area and 21 juveniles across 8 grab samples in the EICC (EIAR Vol. 4, Appendix 8: Habitat Assessment Report – OWF, EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC, EIAR Vol. 4, Appendix 11: Environmental Baseline Report – OWF, EIAR Vol. 4, Appendix 12: Environmental Baseline Report – EICC, EIAR Vol. 4, Appendix 13: Benthic eDNA Analysis Report).

Ocean quahog are listed in the OSPAR Convention's List of Threatened and Declining Species (OSPAR, 2008) and are Scottish PMFs (Tyler-Walters *et al.*, 2016). In FeAST (2024) sensitivity assessment it is mentioned that introduction of INNS is not assessed while in MarESA (Tyler-Walters and Sabatini, 2017) it is mentioned that there is no evidence. However, the ocean quahog supporting habitat is considered to be sensitive to the introduction and spread of INNS (JNCC, 2024b). Therefore, on a precautionary basis, it is concluded that ocean quahog has **medium sensitivity** to INNS.

Any introduction of INNS could affect the long-term functioning of ocean quahog populations; therefore, it is acknowledged that there is a potential risk from non-native species. Nonetheless, based on the localised workings of the vessels and the temporary nature of the activities and embedded mitigation for INNS effects, such as the INNSMP, and the routine removal of marine growth, the effect is defined as being of **low magnitude**. The INNSMP will follow the guidance of NatureScot's 'Marine Biosecurity Planning Guidance for Producing Site and Operation-Based Plans for Preventing the Introduction of Non-Native Species'. The INNSMP will be submitted and agreed with MD-LOT.

Evaluation of significance

Taking the medium sensitivity of the receptor and the low magnitude of the effect, the overall effect of introduction and spread of INNS to ocean quahog during construction is considered to be **minor** and **not significant** in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Medium	Low	Minor

Impact significance – **NOT SIGNIFICANT**

10.6.1.3.3 Burrowed mud / Seapens and burrowing megafauna communities

In the Array Area, the presence of 'Frequent' or above burrow densities, particularly in the case of large burrows, coupled with the presence of burrowing fauna (*N. norvegicus*) indicates a degree of conformity to the OSPAR 'Seapen and burrowing megafauna communities' and / or the 'Burrowed mud' Scottish PMF (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF). In the EICC, despite the presence of muddy sand across the southern extent of the survey area, the visual absence of seapens and burrows indicates that the OSPAR 'Seapen and burrowing megafauna communities' habitat is unlikely to exist across the EICC (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC).

Burrowed mud is listed as Scottish PMF (Tyler-Walters *et al.*, 2016) while 'Seapens and burrowing megafauna communities' are listed in Scottish PMFs and in the OSPAR List of Threatened and / or Declining Species and Habitats (OSPAR, 2010a).

In FeAST (2024) assessment it is mentioned that the sensitivity of the habitat to the introduction of INNS is not assessed while in MarESA (Hill *et al.*, 2023) it is mentioned that there is no evidence. On a pre-cautionary basis, it is concluded that 'Burrowed mud' / 'Seapens and burrowing megafauna communities' have medium sensitivity to INNS.

Any introduction of INNS could affect the long-term functioning of 'Burrowed mud' / 'Seapens and burrowing megafauna communities', therefore it is acknowledged that there is a potential risk from non-native species. Nonetheless, based on the localised workings of the vessels and the temporary nature of the activities and embedded mitigation for INNS effects, such as the INNSMP and the routine removal of marine growth, the effect is defined as being of low magnitude. The INNSMP will follow the guidance of NatureScot's 'Marine Biosecurity Planning Guidance for Producing Site and Operation-Based Plans for Preventing the Introduction of Non-Native Species'. The INNSMP will be submitted and agreed with MD-LOT.

Evaluation of significance

Taking the medium sensitivity of the receptor and the low magnitude of the effect, the overall effect of introduction and spread of INNS to 'Burrowed mud / Seapens and burrowing megafauna communities' during construction is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Medium	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.1.3.4 Subtidal sands and gravels

The habitat subtidal sands and gravels is listed as a UK BAP Priority Habitat and Scottish PMF (Tyler-Walters *et al.*, 2016).

Site specific surveys have revealed the presence of subtidal sands and gravels in the Project Area. Specifically:

- Offshore circalittoral mixed sediment (MD4): Array Area, EICC;
- Offshore circalittoral sand (MD5): EICC;
- Offshore circalittoral coarse sediment (MD3):EICC; and
- Circalittoral Muddy Sand: EICC

The sediments characterising this biotope are likely to be too mobile or otherwise unsuitable for most of the recorded INNS currently recorded in the UK. However, colonisation or establishment of INNS would likely change the biotope classification(s) and characterising species may be prey items for invasive mobile species. As such, the biotopes associated with this benthic habitat, such as 'Polychaete-rich deep *Venus* community in offshore mixed sediments' are considered to have a high sensitivity to INNS. In particular, two species may be of concern including the slipper limpet *Crepidula fornicate* which has been recorded to smother bivalves and alter seabed habitat and the colonial ascidian *Didemnum vexillum* which may have the potential to colonize and smother offshore gravel habitat, alter habitat, and outcompete other species for space. Therefore, the introduction and establishment of INNS to the Array Area and EICC could result in long-term changes to the native biotopes.

It is acknowledged that there is a potential risk from non-native species to offshore sands and gravels habitats. Nonetheless, based on the localised workings of the vessels and the temporary nature of the activities and embedded mitigation for INNS effects, such as the INNSMP and the routine removal of marine growth, the effect is defined as being of low magnitude. The INNSMP will follow the guidance of NatureScot's 'Marine Biosecurity Planning Guidance for Producing Site and Operation-Based Plans for Preventing the Introduction of Non-Native Species'. The INNSMP will be submitted and agreed with MD-LOT.

Evaluation of significance

Taking the high sensitivity of the receptor and the low magnitude of the effect, the overall effect of introduction and spread of INNS to 'Subtidal sands and gravels' during construction is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.1.3.5 Geogenic (bedrock and stony) reef

In the EICC, due to the presence of cobbles / boulders and bedrock across transects a stony and rocky reef assessment following Irving (2009) and Golding *et al.* (2020) methodologies was undertaken (MMT, 2018, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). In the 2024 survey isolated incidences of 'Possible rocky reef with sand veneer' and 'Rocky reef with sand veneer', based on the occurrence of < 10% visible bedrock and visible epifauna, are identified across IECC_T04 (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). Whereas, incidences of 'Rocky reef with low biodiversity' and 'Rocky reef with high biodiversity', based on the occurrence of > 50% visible bedrock and > 40% epifaunal coverage of erect fauna, are identified across IECC_T05, indicating the presence of Annex I bedrock reef in the EICC. (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). The analysis of 2018 survey data also showed the presence of bedrock reef in the EICC (Section 10.4.4.4.4) (MMT, 2018).

In the Array Area, due to the presence of cobbles and boulders, a stony reef assessment following Irving (2009) methodology was undertaken. The analysis showed the presence of 'Low reef' areas but there is no strong evidence supporting the justification for Annex I protection. The analysis of the data collected in 2024 in the EICC showed the presence of two small (< 200 m^2) patches of 'Medium reef' that could be considered as an Annex I stony reef; the analysis also showed the presence of three 'Low reef' patches that are unlikely to be considered as Annex I stony reef. The presence of stony reefs in the EICC is also shown from the analysis of the data collected in 2018 in the EICC (Section 10.4.4.4.4) (MMT, 2018).

The species of colonial sea squirt known as the carpet sea squirt (*Didemnum vexillum*) is native to Asia, is invasive in the UK, and can outcompete and smother native biological communities on rocky substrates. This species can form extensive mats over the substrata it colonises, binding boulders and cobbles, and altering the host habitat (Griffith *et al.*, 2009). While this invasive species is limited to sheltered rocky locations in the UK, based on some reports from the United States of America (USA) where this species has been recorded in more exposed offshore locations (Lengyel *et al.*, 2009), it is deemed possible that the carpet sea squirt could colonize more exposed locations within the UK such as that in the Array Area. Other notable medium / low or unknown impact INNS include Japanese kelp (*Undaria pinnatifida*), bryozoan *Schzoporella japonica* and Japanese wireweed (*Sargassum muticum*) (Marine Scotland, 2023). Overall, the carpet sea squirt is expected to pose the greatest threat to reef biodiversity.

When considering that the stony reef is possibly vulnerable to such an invasive species, this receptor is considered to have high sensitivity.

Furthermore, the UK reports of this carpet sea squirt are restricted to sheltered rocky shore areas where there is continuously high vessel traffic in confined areas such as in marinas. The Array Area and the EICC will be subject to vessel activity for a temporary period only, during construction over a large area of open water and as such the threat is expected to be restricted.

The main risk identified is the invasive sea squirt species mentioned above, which has been recorded in Scottish waters. Once details are known post consent and following contractor procurement, an INNS risk assessment will be undertaken which will allow for finalisation of the outline INNSMP that has been submitted with the application and for the Project to understand any INNS monitoring requirements. With the implementation of embedded mitigation measures for INNS effects through the INNSMP, the effect is assessed as being of low magnitude. The INNSMP will follow the guidance of NatureScot's 'Marine Biosecurity Planning Guidance for Producing Site and Operation-Based Plans for Preventing the Introduction of Non-Native Species'. The INNSMP will be submitted and agreed with MD-LOT.

Evaluation of significance

Taking the high sensitivity of the receptor and the low magnitude of the effect, the overall effect of introduction and spread of INNS to 'Geogenic (bedrock and stony) reef' during construction is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.1.3.6 *S. spinulosa* biogenic reef

The high-definition video analysis in the EICC revealed small aggregations of *S. spinulosa*. There are 15 areas delineated as 'Low reef' with the remaining delineated as 'Not a reef' The aerial extent of 'Low reef' are significantly below the 'Medium' extent threshold of 10,000 m^2, indicating the isolated patches present do not constitute Annex I biogenic reef. In the EICC, the analysis showed that *S. spinulosa* formed two isolated patches; however, only a single incidence of 'Low reef' was observed and, based on the size (69 m^2), is unlikely to constitute the presence of Annex I biogenic reef (EIAR Vol. 4, Appendix 8: Habitat Assessment Report – OWF, EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC, EIAR Vol. 4, Appendix 11: Environmental Baseline Report – OWF, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC).

Direct evidence relating to the effects of the introduction of non-indigenous species on *S. spinulosa* reefs is very limited (MarLIN, 2024). Two species that potentially pose a threat to *S. spinulosa* reefs are the Pacific oyster *Magallana gigas* and the slipper limpet *Crepidula fornicata*. Reefs in the bay of Mont Saint Michel, France were increasingly colonized by the Pacific oyster *Magallana gigas* (Dubois *et al.*, 2006). Given the high filtration rates of *Magallana gigas*, it is believed that they can out-compete *S. spinulosa* for feeding resources (Dubois *et al.*, 2006; MarLIN, 2024). In the Wadden Sea, *Magallana gigas* have replaced blue mussels (Diederich, 2005, 2006) suggesting that *Magallana gigas* may affect filter feeding, reef-forming organisms in general. The species *C. fornicata* has been recorded in association with *S. spinulosa* reefs at Hastings Shingle Bank (up to 66 individuals per grab, Pearce *et al.*, 2007) and in lower numbers in the East Coast REC area (maximum 4 per grab, Pearce *et al.*, 2011). The relationship between *C. fornicata* and *S. spinulosa* has not been investigated. However, potential effects on *S. spinulosa* reefs could occur through changes to substratum suitability or other interactions (MarLIN, 2024 and references there in).

When considering that the *S. spinulosa* biogenic reef is possibly vulnerable to such an invasive species, this receptor is considered to have high sensitivity.

Once details are known post consent and following contractor procurement, an INNS risk assessment will be undertaken which will allow for finalisation of the outline INNSMP that has been submitted with the application and for the Project to understand any INNS monitoring requirements. The INNSMP will follow the guidance of NatureScot's 'Marine Biosecurity Planning Guidance for Producing Site and Operation-Based Plans for Preventing the Introduction of Non-Native Species'. The INNSMP will be submitted and agreed with MD-LOT. With the implementation of embedded mitigation measures for INNS effects through the INNSMP, the effect is assessed as being of low magnitude.

Evaluation of significance

Taking the high sensitivity of the receptor and the low magnitude of the effect, the overall effect of introduction and spread of INNS to '*S. spinulosa* biogenic reef' during construction is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.2 Potential effects during operation and maintenance

10.6.2.1 Temporary impacts to the benthic habitats and species (all receptors)

Temporary habitat loss and disturbance will also occur during the operation and maintenance phase as a result of seabed disturbance during major cable repair or replacement activities. This temporary disturbance would occur intermittently over the 35-year operation and maintenance phase. However, the spatial extent would be highly localised and is not expected to exceed the effects assessed for the construction phase. Therefore, the sensitivity and magnitude ratings for temporary habitat loss and disturbance during the construction phase is also considered applicable to the operation and maintenance phase.

Overall, the temporary disturbance in the Array Area and the EICC during operations is considered to be of low magnitude and not significant.

Evaluation of significance

Taking the high sensitivity of the receptor and the low magnitude of the effect, the overall effect of temporary habitat loss / disturbance to benthic habitats and species (all receptors) during operation is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.2.2 Long-term impacts to the seabed and benthic habitats

Existing seabed habitats and communities may be changed in the long-term due to the introduction of the infrastructure outlined in Table 10-14 and Table 10-15. Within the Array Area and EICC the presence of the installed infrastructure on the seabed will represent a long-term / permanent introduction of additional hard substrate and the long-term loss of the natural sediment beneath. As per Table 10-14 and Table 10-15, the total combined long-term footprint from all activities in the Project Area is 1.90 km^2. This is split as follows: 1.55 km^2 in the Array Area and 0.35 km^2 in the EICC.

Given the combined area of the Project is approximately 553 km^2, the long-term footprint will only disturb approximately 0.37% of the Project Area. The long-term footprint in each of the Project Area (as % of the total surface of each area) is this: 0.5 % in the Array Area and 0.16 % in the EICC.

The total long-term footprint in the East of Gannet and Montrose Fields NCMPA is 1.57 km^2. Considering that the total spatial extent of this NCMPA is 1,839 km^2 it is considered that approximately 0.09% of the NCMPA seabed will be affected long-term.

The temporary and long-term seabed footprint in the Southern Trench NCMPA is 0.40 km^2 (0.02%) and 0.096 km^2 (0.004%), respectively (Table 10-16).

An important aspect of determining the significance of long-term effects is whether the effect is likely to incur a change in biological diversity or community composition that may affect ecosystem function to other receptors such as birds, fish, and marine mammals (Scottish Government, 2023b).

10.6.2.2.1 Offshore deep-sea muds

Offshore deep-sea muds are listed as a Scottish PMF (Tyler-Walters *et al.*, 2016) and they are a designated habitat in the East of Gannet and Montrose Fields NCMPA (JNCC, 2024). Offshore deep-sea muds are one of the most common deep-water habitats in the UK offshore marine environment (Tyler-Walters *et al.*, 2016).

In the Array Area and the EICC, one of the main habitats identified is 'Offshore circalittoral mud' (SS.Smu.Omu / MD6). In the Array Area, the habitat 'SS.Smu.Omu.PjefThyAfil '*Paramphinome jeffreysii*, *Thyasira* sp. And *Amphiura filiformis* in offshore circalittoral sandy mud' is likely to exist across the wider sand dominated survey area. In the EICC analysis showed a conformance towards 'Atlantic offshore circalittoral mud' (SS.Smu.Omu / MD62) (**EIAR Vol. 4, Appendix 8: Habitat Assessment Report – OWF, EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 11: Environmental Baseline Report – OWF, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC**).

The spatial extent of 'Offshore deep-sea muds' in the Array Area is approximately 333 km^2 (JNCC, 2024), in the EICC is 21.16 km^2 and in the East of Gannet and Montrose Fields NCMPA is approximately 900 km^2 (JNCC, 2024).

There are primarily two long term impact pathways that will affect the 'Offshore deep-sea muds' habitat:

- The direct installation of infrastructure resulting in a fundamental change from a sediment substrate to hard substrata which will essentially result in long-term loss of the deep-sea muds habitat; and
- The continuous movement of mooring chains in contact with the seabed which will result in surface abrasion for the duration of the development.

These two impact pathways are considered here, particularly in the context of the habitat as a designated feature of the East of Gannet and Montrose Fields NCMPA.

The long-term footprint in the 'Offshore deep-sea muds' of the East of Gannet and Montrose Fields NCMPA will be 1.56 km^2. The spatial extent of 'Offshore deep-sea muds' in this NCMPA is approximately 900 km^2. Based on this it is concluded that approximately 0.17% of the designated offshore deep-sea muds will be affected in the long-term.

The sensitivity of the habitat 'Deep-sea muds' to 'Physical change (to another seabed type)' is high (De-Bastos, 2016a, FeAST, 2024). In addition, the sensitivity of 'Deep-sea muds' to 'Surface abrasion' is high based on FeAST (2024) and medium according to De-Bastos (2016a). It can therefore be expected that the sensitivity to long-term disturbance resulting from the installation of hard substrates will be high. The habitat is considered to have **high sensitivity** to long-term loss from the installation of infrastructure and disturbance from surface abrasion of the mooring lines.

The proportion of long-term loss of this habitat is small, especially when considering that the majority (~90%) of the long term disturbance area of 1.56 km^2 relates to abrasion from the mooring lines. It is estimated that only 0.24 km^2 of the long term footprint will actually result in long term direct habitat loss from the placement of infrastructure on the seabed. For the purposes of considering the worst-case magnitude, the footprint of the mooring lines is also considered, as recovery will be limited throughout the operation and maintenance phase. However, even when this is taken into account, the total long term footprint to 'Offshore deep-sea muds' is small (0.17% in the East of Gannet and Montrose Fields NCMPA) compared to the amount of 'Offshore deep-sea muds' not directly affected. Based on localised spatial disturbance compared to the highly widespread distribution of 'Offshore deep-sea muds', any effects are unlikely to affect the long-term functioning of the wider habitat and associated biotopes in the Array Area, East of Gannet and Montrose Fields NCMPA and the EICC. The effect is thus defined as being of low magnitude.

As indicated in Table 10-16, given the relatively low proportion (0.17%) of the 'Offshore deep-sea muds' habitat affected within the East of Gannet and Montrose Fields NCMPA that would be affected long term, it is not considered that the conservation objectives of the site would be hindered. Further details of the assessment on the NCMPA is provided within the MPA Assessment.

Evaluation of significance

Taking the high sensitivity of the receptor and the low magnitude of the effect, the overall effect of long-term loss or disturbance to 'Offshore deep-sea muds' during the operation is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.2.2.2 Ocean quahog

Ocean quahog aggregations (including sands and gravels as their supporting habitat) is a designated feature in the East of Gannet and Montrose Fields NCMPA (Figure 10-14) (JNCC, 2024). Ocean quahog is listed under the OSPAR List of Threatened and / or Declining Species and is also listed as a Scottish PMF (Tyler-Walters *et al.*, 2016).

As discussed in Section 10.4.4, the presence of ocean quahog across the whole Array Area was implied based on the eDNA analysis of sediment samples at all benthic stations sampled (EIAR Vol. 4, Appendix 13: Benthic eDNA Analysis Report). However, the site specific surveys did not record any adult specimens across the whole Project Area; Analysis found 109 juveniles across 22 grab samples in the Array Area and 21 juveniles across 8 grab samples in the EICC (EIAR Vol. 4, Appendix 8: Habitat Assessment Report – OWF, EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC, EIAR Vol. 4, Appendix 11: Environmental Baseline Report – OWF, EIAR Vol. 4, Appendix 12: Environmental Baseline Report – EICC).

In addition, the compilation of publicly-available data (NBN Atlas, 2024; GeMS, 2022, Scottish Government, 2024b) with data from site specific surveys (EIAR Vol. 4, Appendix 8: Habitat Assessment Report – OWF, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC, EIAR Vol. 4, Appendix 11: Environmental Baseline Report – OWF, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC) show minimal overlap between the Array Area and EICC with ocean quahog inside the East of Gannet and Montrose Fields NCMPA (Figure 10-14). Site-specific surveys and publicly available data have also shown that the area where EICC overlaps with the habitat 'Subtidal sands and gravels' in the East of Gannet and Montrose Fields NCMPA is an area of relatively low ocean quahog abundance compared to other areas (Figure 10-14). The Array Area is found on the habitat 'Offshore deep-sea muds' i.e. a type of habitat that is less important for ocean quahog aggregations compared to the habitat 'Subtidal sands and gravels' (Figure 10-14) (JNCC, 2024).

The spatial extent of 'Subtidal sands and gravels' in the East of Gannet and Montrose Fields NCMPA is approximately 939 km^2 (i.e. approximately 51% of the total size of the NCMPA) (JNCC, 2024). The spatial extent of long-term effects on 'Subtidal sands and gravels' in the East of Gannet and Montrose Fields NCMPA is 0.009 km^2. Based on this it is concluded that 0.001% of the habitat will be affected in the long-term.

The spatial extent of 'Subtidal sands and gravels' in the EICC is approximately 88.46km^2. The spatial extent of long-term effects in the EICC is 0.35 km^2. Based on this it is concluded that 0.40% of this habitat in the EICC will be affected in the long-term.

Ocean quahog has high sensitivity to 'Physical change (to another sediment type)', (Tyler-Walters and Sabatini, 2017, FeAST, 2024) as well as low resistance and very low resilience (Tyler-Walters and Sabatini, 2017). The species has low resistance and very low resilience and high sensitivity to 'Abrasion / disturbance of the surface of the substratum or seabed' that will be caused by mooring chains that makes up a considerable proportion (0.85%) of the overall long term project footprint in the East of Gannet and Montrose Fields NCMPA) (Tyler-Walters and Sabatini, 2017). According to FeAST (2024), ocean quahog has low sensitivity to surface abrasion. Mortality of individuals in the immediate vicinity of the directly disturbed area can be expected. The stressor specific effect on the life stages of this species of conservation importance comes from the long-term placement of infrastructure that will ultimately remove the available seabed sediments available for larval settlement and any potential recovery within the directly affected areas for this species (Scottish Government, 2023b). The stressor specific effect on this species also comes from long-term surface abrasion that will be caused from the mooring chains on the seabed. It can therefore be expected that the sensitivity to long-term loss or disturbance resulting from the installation of infrastructure / hard substrates will be high. The species is considered to have high sensitivity to long-term loss or disturbance.

The habitat subtidal sands and gravels has high sensitivity to 'Physical change (to another seabed type') while it has no resistance and very low resilience (Tyler-Walters and Sabatini, 2017). It is therefore expected that the habitat subtidal sands and gravels has high sensitivity to long-term loss or disturbance.

The long-term effects of infrastructure installation on ocean quahog and its supporting habitat subtidal sands and gravels will be localised. The spatial extent and the proportion of subtidal sands and gravels habitat affected in the long-term will be small (0.001% of the habitat in the East of Gannet and Montrose Fields NCMPA and 0.40% of the habitat in the EICC). It is also considered that all the recorded specimens of ocean quahog across the Array Area and the EICC are juveniles. Given that there are predictions about the availability of suitable habitat for ocean quahog (i.e. subtidal sands and gravels) in the vicinity of the proposed operations as well as in the wider area beyond what is potentially lost (Figure 10-2, Figure 10-3), it is not predicted that the ocean quahog will be affected at a population level. Therefore, any potential long-term effects on ocean quahog and subtidal sands and gravels are considered to be of a low magnitude.

Furthermore, as indicated in Table 10-16, given the relatively low density of ocean quahog aggregations identified in the Array Area and the low proportion (0.001%) of the supporting sands and gravels habitat affected long term within the East of Gannet and Montrose Fields NCMPA, it is not considered that the conservation objectives for ocean quahog aggregations across the site would be hindered. Further details of the assessment on the NCMPA is provided within the MPA Assessment.

Evaluation of significance

Taking the high sensitivity of the receptor and the low magnitude of the effect, the overall effect of long-term loss or disturbance to ocean quahog during the operation is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.2.2.3 Burrowed mud / Seapens and burrowing megafauna communities

Burrowed mud is listed as Scottish PMF (Tyler-Walters *et al.*, 2016) while 'Seapens and burrowing megafauna communities' are list in PMFs and in the OSPAR List of Threatened and / or Declining Species and Habitats (OSPAR, 2010a). Burrowed mud is a designated feature in the Southern Trench NCMPA (NatureScot, 2024b).

In the Array Area, the results of the burrows assessment indicated that 44 out of the 51 transects reviewed revealed the presence of burrows predominantly in the 'Offshore circalittoral mud' biotope (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF). Large burrows are observed across 42 stations and are categorised as 'Occasional' to 'Common' on the SACFOR scale, whereas small burrows are observed at just 21 stations varying in average density from 'Rare' to 'Frequent' (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF). The presence of 'Frequent' or above burrow densities, particularly in the case of large burrows (Figure 10-2), coupled with the presence of burrowing fauna (*N. norvegicus*) indicates a degree of conformity to the OSPAR 'Seapen and burrowing megafauna communities' and / or the 'Burrowed mud' Scottish PMF (EIAR Vol. 4, Appendix 8: Habitat Assessment Report - OWF). Despite the presence of muddy sand across the southern extent of the EICC, the visual absence of seapens and burrows indicates that the OSPAR 'Seapen and burrowing megafauna communities' habitat is unlikely to exist across the EICC (MMT, 2018, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC).

A change in sediment type is likely to adversely affect the seapens (Hill *et al.*, 2023). A change from 'mud and sandy mud' to 'sand and muddy sand' or 'mixed' would probably exclude *P. phosphorea* and *F. quadrangularis* (except where *F. quadrangularis* occurs in deep basins) but not adversely affect *V. mirabilis*, based on their reported distribution. In all cases, a change in the sediment type is likely to change the associated community and result in loss of the seapen population. Long-term disturbance to the habitat is also expected to be caused from the placement of mooring chains on the seabed.

According to Hill *et al.* (2023) the sensitivity of 'Seapens and burrowing megafauna in circalittoral fine mud' to 'Physical change (to another seabed type)' and 'Physical change (to another sediment type)' is high while there is no resistance and resilience is very low. Furthermore, the sensitivity of the habitat to 'Abrasion / disturbance of the surface of the substratum or seabed' is medium while there is medium resistance and low resilience (Hill *et al.*, 2023). According to

FeAST (2024) the sensitivity of 'Burrowed mud' to 'Physical change (to another seabed type)' is high. Based on the above it can be expected that the habitat has high sensitivity to long-term loss or disturbance resulting from the installation of infrastructure / hard substrates will be high. The habitat is considered to have high sensitivity to long-term loss or disturbance.

Based on localised spatial long-term loss or disturbance compared to their highly widespread distribution, any effects are unlikely to affect the long-term functioning of the wider habitat and associated biotopes. The effect is thus defined as being of low magnitude.

Evaluation of significance

Taking the high sensitivity of the receptor and the low magnitude of the effect, the overall effect of long-term loss or disturbance to 'Burrowed mud / Seapens and burrowing megafauna communities' during the operation is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.2.2.4 Subtidal sands and gravels

Sand and gravel sediments are one of the most common habitats in the UK and Scottish offshore waters (Tyler-Walters *et al.*, 2016). This habitat hosts diverse infaunal communities dominated by polychaetes, shells and small bivalves. Offshore fine to muddy sands support a diversity of tube building polychaetes, burrowing brittlestars and bivalves while the pea urchin occurs in medium sands and amphipods and hooded shrimp in fine sands. Mobile predators include flatfish, starfish, crabs and hermit crabs.

The habitat subtidal sands and gravels is listed as a UK BAP Priority Habitat and Scottish PMF (Tyler-Walters *et al.*, 2016). Site specific surveys have revealed the presence of subtidal sands and gravels in the Project Area. Specifically:

- Offshore circalittoral mixed sediment (MD4): Array Area, EICC;
- Offshore circalittoral sand (MD5): EICC;
- Offshore circalittoral coarse sediment (MD3): EICC; and
- Circalittoral muddy sand (MC5 / MC6):EICC.

The spatial extent of 'Subtidal sands and gravels' in the East of Gannet and Montrose Fields NCMPA is approximately 939 km^2 (i.e. approximately 51% of the total size of the NCMPA) (JNCC, 2024). The spatial extent of long-term effects on 'Subtidal sands and gravels' in the East of Gannet and Montrose Fields NCMPA is 0.0095 km^2. Based on this it is concluded that 0.001% of the habitat will be affected in the long-term.

The spatial extent of 'Subtidal sands and gravels' in the EICC is approximately 88.46km^2. The spatial extent of long-term effects in the EICC is 0.35 km^2. Based on this it is concluded that 0.40% of this habitat in the EICC will be affected in the long-term.

The habitat subtidal sands and gravels has high sensitivity to 'Physical change (to another seabed type') while it has no resistance and very low resilience (Tillin and Watson, 2023). Furthermore, the habitat has low sensitivity to 'Abrasion / disturbance of the surface of the substratum or seabed' (that will be caused by mooring chains on seabed) while it has medium resistance and high resilience (Tillin and Watson, 2023).

The introduction of infrastructure / hard substrates in the East of Gannet and Montrose Fields NCMPA, and the EICC will essentially result in the long-term loss or disturbance of subtidal sands and gravels in the immediate vicinity with no possibility of future recovery. These sediment habitats will essentially be lost or disturbed in the long-term (i.e. in the case of long-term disturbance caused by mooring chains in the Array Area). It is therefore expected that the habitat subtidal sands and gravels have high sensitivity to long-term loss or disturbance.

Considering that subtidal sands and gravels are one of the most common habitats in Scottish offshore waters and that the proportion of long-term loss or disturbance of this habitat is small compared to the extent of subtidal sands and gravels not directly affected, it is concluded that any effects are unlikely to affect the long-term functioning of the wider habitat and associated biotopes. The effect is thus defined as being of low magnitude.

Evaluation of significance

Taking the high sensitivity of the receptor and the low magnitude of the effect, the overall effect of long-term loss or disturbance to 'Subtidal sands and gravels' during the operation is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.2.2.5 Geogenic (bedrock and stony) reef

In the EICC, due to the presence of cobbles / boulders and bedrock across transects a stony and rocky reef assessment following Irving (2009) and Golding *et al.* (2020) methodologies was undertaken (MMT, 2018, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). In the 2024 survey isolated incidences of 'Possible rocky reef with sand veneer' and 'Rocky reef with sand veneer', based on the occurrence of < 10% visible bedrock and visible epifauna, are identified across IECC_T04 (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). Whereas, incidences of 'Rocky reef with low biodiversity' and 'Rocky reef with high biodiversity', based on the occurrence of > 50% visible bedrock and > 40% epifaunal coverage of erect fauna, are identified across IECC_T05. Therefore, indicating the presence of Annex I bedrock reef in the EICC (EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). The analysis of the 2018 survey data also showed the presence of bedrock reef in the EICC (Section 10.4.4.4.4) (MMT, 2018).

The analysis of the data collected in 2024 in the EICC showed the presence of two small (< 200 m^2) patches of 'Medium reef' that could be considered as an Annex I stony reef; the analysis also showed the presence of three 'Low reef' patches that are unlikely to be considered as Annex I stony reef. The presence of stony reefs in the EICC is also shown from the analysis of the data collected in 2018 in the EICC (Section 10.4.4.4.4) (MMT, 2018).In the Array Area, due to the presence of cobbles and boulders, a stony reef assessment following Irving (2009) methodology was undertaken. The analysis showed the presence of 'Low reef' areas which are not considered representative of potential Annex I reef. The long-term habitat loss in the Array Area and EICC affecting bedrock / stony reef habitat will arise from the installation of cables (Export/Import Cable, IACs), moorings associated with the FTUs, OSCPs and rock placement. The placement of infrastructure and protective material on the rocky habitats will replace the existing habitat in the immediate vicinity with direct mortality of all affected surfaces and replace the existing boulders and cobble substrate with anthropogenic artificial substrate. However, it is acknowledged that the presence of reef across the Project Area is highly patchy and mostly restricted to the EICC, particularly the inshore section.

It is acknowledged that the use of PLGR may lead to the relocation of boulders. The boulders will be physically moved a short distance (out with a 20 m corridor) but their integrity as reef features will remain intact. The relocation itself is regarded as a permanent effect. In terms of boulder clearance, it should be mentioned that preference will be given to micro-routeing to avoid boulders where possible. The habitat assessments reports have shown that geogenic reefs have a rather limited and patchy distribution in the EICC (MMT, 2018, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC). Any effects from boulder relocation will be highly localised and are considered temporary on the basis that any disturbed epifauna would be able to recolonise the relocated boulders. Specifically, epifauna found on rock habitats e.g., the bryozoan *Flustra foliacea* has high resilience and low sensitivity to temporary physical disturbance (Readman *et al.*, 2023). The soft coral *A. digitatum* has low sensitivity to abrasion and physical disturbance on account of its high recoverability owing, in part to its high fecundity (Budd, 2008). It is expected that these species will still be able to recolonise the coarse material that is redistributed from boulder clearance activities as boulders are expected to be relocated at a short distance.

It is recognised that one of the aspects influencing the benthic biodiversity across the stony reef areas is the heterogenous nature of the seabed habitats that range from cobble and pebbles interspersed with sands and gravels. However, it is also worth noting that the high level of patchiness of the stony reef / sediment areas and high proportion of other types of sediments (mud, sand gravel) reduces the overall 'reefiness' of the seabed. The stony reef present across the Array Area and the EICC are relatively low lying and are therefore expected to be subjected to natural seabed scouring which can limit the suitability of the substrate for less tolerant benthos. It is considered that bedrock / stony reefs in the Array Area and EICC will be directly lost in the long-term or be subject to long-term disturbance (e.g., in the case of mooring chains on the seabed). It is considered that bedrock / stony reef has high sensitivity to long-term loss or disturbance.

When the subsea infrastructure / hard substrates are installed, the small-scale patchy variation of seabed habitats present will be reduced in the immediate vicinity and replaced in the long-term. Natural rocky substrates will be lost and will recover to pre disturbance levels. However, the infrastructure / hard substrates may create new habitat for colonisation by benthic species (this is discussed in Section 10.6.2.3).

Given the relatively limited distribution of rocky habitats within the Array Area, and EICC, as well as the low proportion of reef habitat to be affected compared with unaffected rocky habitat, it is predicted that there would be no significant effect to the ecological function of these reef habitats as a result of long-term disturbance. Overall, the long-term effects will be localised and limited in spatial extent. Furthermore, there will be new habitat created by the new infrastructure and introduced rock which is discussed in Section 10.6.2.3. With the implementation of embedded mitigation measures, such as micro-siting to avoid sensitive habitats wherever possible and reducing localised long-term habitat loss, the effect is defined as being of low magnitude.

Evaluation of significance

Taking the high sensitivity of the receptor and the low magnitude of the effect, the overall effect of long-term loss or disturbance to 'Geogenic (bedrock and stony) reef' during the operation is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.2.2.6 *S. spinulosa* biogenic reef

The high-definition video analysis in the EICC data from the surveys in 2024 revealed small aggregations of *S. spinulosa* (EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC). There are 15 areas delineated as 'Low reef' with the remaining delineated as 'Not a reef' The spatial extent of 'Low reef' are significantly below the 'Medium' extent threshold of 10,000 m^2, indicating the isolated patches present do not constitute Annex I biogenic reef (EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC). The analysis of the data collected in 2024 in the EICC also showed that *S. spinulosa* formed two isolated patches; however, only a single incidence of 'Low reef' was observed and based on the size (69 m^2), is unlikely to constitute the presence of Annex I biogenic reef. The analysis of the data collected in 2018 in the EICC showed the presence of *S. spinulosa* in transect T05 (MMT, 2018).

It is noted that *S. spinulosa* can colonise bedrock and artificial structures (Mistakidis, 1956, MarESA, 2024). An increase in the availability of hard substratum may, therefore, be beneficial in areas where sedimentary habitats were previously less suitable for colonisation (Tillin *et al.,* 2023).

It is acknowledged that the use of the PLGR may lead to the relocation of boulders hosting *S. spinulosa*. The boulders will be physically moved a short distance (out with a 20 m corridor) but their integrity supporting *S. spinulosa* will remain intact. The relocation itself is regarded as a permanent effect. The habitat assessment reports have shown that *S. spinulosa* biogenic reefs have a rather limited and patch distribution in the EICC area (MMT, 2018, EIAR Vol. 4, Appendix 9: Habitat Assessment Report – EICC, EIAR Vol. 4, Appendix 10: Environmental Baseline and Habitat Assessment Report - Inshore EICC, EIAR Vol. 4, Appendix 12: Environmental Baseline Report - EICC). Any effects from boulder relocation will be highly localised and are considered temporary on the basis that any disturbed *S. Spinulosa* epifauna would be able to recolonise the relocated boulders. *S. spinulosa* reef dominated biotopes typically occur in high energy marine environments that have plentiful supply of sand for the construction of their tubes. As such this species is highly adapted to dynamic environments in which it occurs and as a result it is considered that this species does have some inherent resilience to physical disturbance However, the extent of the physical damage is likely to be an important factor in the recoverability (see Section 10.6.1.1.6).

According to the MarESA sensitivity assessment, the habitat '*S. spinulosa* on stable circalittoral mixed sediment' has high sensitivity to 'Physical change (to another seabed type)' while it is not resistant and has very low resilience (Tillin *et al.*, 2023). Likewise, the habitat has high sensitivity, no resistance and very low resilience to 'Physical change (to another sediment type) (Tillin *et al.*, 2023). The habitat is considered to have high sensitivity to long-term loss / disturbance.

Overall, the long-term effects will be localised while the introduction of hard substrates may provide colonisation surfaces to *S. spinulosa* enhancing the recovery of the habitat (Tillin *et al.*, 2023 and references there in). With the implementation of embedded mitigation measures, such as micro-siting to avoid the most sensitive habitats wherever possible and reducing localised long-term loss or disturbance, the effect is defined as being of low magnitude.

Evaluation of significance

Taking the high sensitivity of the receptor and the low magnitude of the effect, the overall effect of long-term loss or disturbance to '*S. spinulosa* biogenic reef' during the operation is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance – NOT SIGNIFICANT

10.6.2.3 Introduction of hard substrates in a predominantly sedimentary environment / Increased predation

Subsea infrastructure from OWFs can provide potential new novel hard structures that can provide hard substrate for colonisation by epilithic species. The introduction of hard infrastructure may alter previously soft sediment habitat areas which can attract new species with a preference for hard substrates are expected to colonise the installed structures, typically increasing the habitat complexity biodiversity of the area.

As per Section 10.6.2.2, the long-term footprint of the Project is 1.90 km^2 of which only 0.58 km^2 is introduced hard substrate (1.44 km^2 of the long term footprint is a swept area by mooring lines). The introduced hard substrate covering 0.58 km^2 will be present for the duration of the operation and maintenance phase (35 years). The presence of up to 95 FTUs, up to two OSCPs foundations, mooring chains, and rock protection material will introduce new hard structures, with the potential for encrusting epifauna typical of local bedrock and cobbles including bryozoans, and anthozoans to colonise as well as communities which resemble those of exposed intertidal rock that may colonise infrastructure such as moorings near the sea surface. The lack of high structural complexity on the FTUs and OSCPs structures makes it unlikely that highly diverse communities will develop, however, biofouling communities will become part of the local food-web system. Scientific evidence about the role of offshore windfarms in inducing aggregations of higher trophic levels around them in the North Sea is relatively limited so far (e.g., Hermans *et al.*,

2020) while there is no consensus across the findings from studies carried out in different places of the world; in some cases, the effects of wind farms on fish distribution was limited (e.g., Jech *et al.*, 2023) while modelling studies have shown that piscivorous fish responded positively to the aggregation of biomass on piles and turbine scour protection (Raoux *et al.*, 2017). Although scientific evidence is limited, it is not anticipated that the effect of long-term provision of novel hard substrate will propagate up the food chain.

To reduce the footprint of the cable protection, the Export/Import Cable and IACs associated with the Project will be buried where possible and cable protection will only be required where sufficient burial depth is not achieved or where there are cable/pipeline crossings. The sediments in the Array Area and EICC are mainly muddy and sandy sediments (including a rather minor contribution of mixed sediments, Figure 10-2, Figure 10-3) while sediments in the EICC are more heterogeneous (sandy, muddy coarse / mixed sediments and rocky habitats, Figure 10-12). As shown in Section 10.6.2.2 the spatial extent of the sandy and muddy habitats that will be affected from the installation of infrastructure and rock protection across the Project Area is small. Therefore, a substantial change in the benthic community is not expected.

It is acknowledged that the introduction of infrastructure and hard substrates may also increase predation due to the congregation of fish. For example, cod are known to congregate around offshore structures, and as demersal predators they may increase predation on benthos (e.g., Wright *et al.*, 2020). However, evidence about the role of anthropogenic infrastructures in increasing predation on benthos e.g., through attracting fish predators is very limited (Dannheim *et al.*, 2019).

Langhamer (2012) explained that the new benthic habitats resulting from the introduction of renewable structures, can compensate for habitat loss. It can be expected that introduced protective rock will be colonised with similar species associated with the existing bedrock / stony reef habitats (see Figure 10-2 for the Array Area; Figure 10-15 and Figure 10-16 for EICC) with recruitment from nearby unaffected sites. Therefore, the introduced rock could therefore be considered to provide surrogate substrate and ecosystem complexity that could possibly even have positive effects on productivity and diversity through colonising organisms. It is recognised that there is some uncertainty about how much of a positive effect on biodiversity there may be. The ScotMER working group considered that new infrastructure such as WTG may be associated with increased biodiversity (Scottish Government, 2023b). Bearing in mind that that the infrastructure will provide a higher relief substrate with potentially lowered sediment scouring a, there may be potentially a net increase in faunal biodiversity and biomass in the vicinity of the installed infrastructure. It should also be mentioned that enrichment of organic material in the surrounding seabed sediments may also play a part in ecological effects of the increase in marine growth on the structures which may have a localised effect on the infauna communities present. However, this effect is expected to be very localised with low consequence to the overall ecological function of the surrounding habitat. The introduction of infrastructure / rock protection material may also serve as a shelter to various organisms (Dannheim *et al.*, 2019). The effect and spatial extent of this shelter service is currently unknown.

The benthic receptors across the Project Area are broadly considered to be of high sensitivity. The introduction of hard structures in a predominantly sedimentary environment / increased predation represents a minor shift away from the existing baseline conditions. Based on this, the effect is defined as being of low magnitude. Any effects are unlikely to affect the long-term functioning of the baseline benthic receptors.

Evaluation of significance

Taking the high sensitivity of the receptor and the low magnitude of the effect, the overall effect of long-term disturbance or loss to benthic habitats and species during the operation is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance - NOT SIGNIFICANT

10.6.2.4 Potential changes to suspended sediment concentrations and deposition

The increase in suspended sediment concentrations during operation and maintenance will be lower to that during construction, although it is acknowledged, that there will be to some extent, a continuous sediment disturbance from the mooring lines on the seabed which can resuspend sediments locally. In addition, where the target cable burial depth is not achieved, or in areas where cables are exposed, further cable protection may be required as part of maintenance activities during operation. Cable repair, reburial or replacement activities (in addition to other major maintenance activities) may also result in increases in suspended sediment concentrations. The installation of this additional protection is likely to incur a further temporary increase in suspended sediment concentrations, although this will not exceed what is already discussed as a worst-case in Section 10.6.1.2 and Section 10.5.6.2.

Evaluation of significance

Taking the medium sensitivity of the receptor and the low magnitude of the effect, the overall effect of suspended sediment and deposition during operations is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Medium	Low	Minor

Impact significance - NOT SIGNIFICANT

10.6.2.5 Potential effects from EMF and heat generated by cables

10.6.2.5.1 EMF

EMFs have the potential to alter the behaviour of marine organisms that are able to detect electric (E-fields, measured in volts per metre (V / m)) or magnetic (B-field, measured in micro Tesla (μT)) components of the fields. The B-field penetrates most materials, and therefore, is emitted into the marine environment, thus resulting in an associated induced Electric (iE)-field. The direct E-fields are blocked by the use of conductive sheathing within the cable and hence are not considered further. When relative motion is present between B-fields and a conductive medium (e.g. sea water), iE-fields are produced. Earth has its own natural Geomagnetic Field (GMF) with associated B and iE-fields which species rely on for navigation (Gill and Desender, 2020, Winklhofer, 2009). The natural iE-fields result from sea water interacting with the natural GMF, due to relative motion caused by the Earth's rotation, and tidal currents (Gill and Desender, 2020).

Up to 120 (66kV or 132kV) HVAC IACs (280 km on seabed), and one bundle of two Export/Import Cable (320kV or 525 kV HVDC) (230 km) will be installed as part of the Project. All cables will either be buried to a target depth of 0.4 – 1.5 m or covered by cable protection. Although the burial of cables and other protective measures such as cable protection are not considered to be effective ways to mitigate the extent of magnetic fields in the marine environment, it does separate the most sensitive species from the source of the emissions, thereby reducing the maximum field strength likely to be encountered (e.g., at the seabed) (Copping and Hemery, 2020). In addition, design parameters and installation methods are expected to conform to industry standard specifications which includes shielding technology to reduce the direct emission to EMFs.

EMF modelling studies were carried out for IACs and Export/Import Cable and results are presented in Sections below.

10.6.2.5.1.1 IACs

In the case of IACs, a 66 kV static cable was identified for the base case where a string will comprise five, 18 Megawatts (MW) WTGs at an estimated power factor of 0.9. The EMF was calculated for increasing heights above the seabed, based on the shallowest and deepest lowering depths of 0.4 and 1.5 m, respectively to top of the cable (EIAR Vol. 4, Appendix 14B – EMF Assessment Report Vol. 2). The peak EMF is approximately 15 μT above the background, static geomagnetic field, when calculated directly above the cable. The EMF attenuates rapidly when moving away from the cable. When the cable burial depth is increased to 1.5 m, the EMF at the seabed level is decreased significantly, with a peak of approximately 6 μT calculated directly above the cable. Intensities of EMFs from the buried IACs sections at burial depths of 0.4 m and 1.5 m are summarised in Table 10-17 for increasing heights above the seabed. Based on the outputs of the modelling study it can be said that the EMF intensity reduces rapidly when the horizontal position is beyond a metre or so (EIAR Vol. 4, Appendix 14B – EMF Assessment Report Vol. 2).

Table 10-17 Maximum EMF intensities for the 66 kV static cable build

HEIGHT ABOVE SEABED (m)	MAXIMUM EMF (μT)	
	Depth of Lowering = 0.4 m	Depth of Lowering = 1.5 m
0.0	66.23	6.05
1.0	6.90	2.26
5.0	0.50	0.35
10.0	0.14	0.11

The 132 kV IAC design was assumed for the base case scenario that a string will comprise five, 18 MW WTGs at an estimated power factor of 0.9. The EMF was calculated for increasing heights above the seabed, based on the shallowest and deepest lowering depths of 0.4 and 1.5 m, respectively to the top of the cable. The peak EMF is below the background, static geomagnetic field, when calculated directly above the cable. The EMF attenuates rapidly when moving away from the cable. When the lowering depth is increased to 1.5 m, the EMF at the seabed level is decreased significantly, with a peak of approximately 6.66 µT calculated directly above the cable. Intensities of EMFs from the buried IACs sections at burial depths of 0.4 m and 1.5 m are summarised in Table 10-18.

Table 10-18 Maximum EMF intensities for 132 kV static cable build

HEIGHT ABOVE SEABED (m)	MAXIMUM EMF (µT)	
	Depth of lowering = 0.4 m	Depth of lowering = 1.5 m
0.0	70.37	6.66
1.0	7.57	2.50
5.0	0.56	0.39
10.0	0.15	0.12

From the outputs of the modelling study, it can be said that the EMF intensity reduces rapidly when the horizontal position is beyond a meter or so (EIAR Vol.4, Appendix 14B – EMF Assessment Report Vol. 2).

10.6.2.5.1.2 Export/Import Cable

For the Export/Import Cable (320 kV HVDC and 525 kV HVDC options), calculations of EMF intensities are based on DoL of 0.4 m and 1.5 m. Plots from EMF modelling for the 320 kV cable at KP118.426 at a DoL of 0.4 m are provided (Figure 10-18). This KP was selected as it represents a worst-case where the cable installed angle is estimated as 86^0 to magnetic north, allowing the cable field to align closest to Earth's geomagnetic field (EIAR Vol.4, Appendix 14A – EMF Assessment Report Vol.1). The EMF attenuated rapidly when moving away from the cable (Figure 10-18). When the lowering depth increases from 0.4 to 1.5 m, the EMF at the seabed level is decreased significantly from approximately 451 µT to 79 µT (EIAR Vol.4, Appendix 14A – EMF Assessment Report Vol.1).

For the 525 kV HVDC Export/Import Cable option, calculations of EMF intensities were based on DoL of 0.4 m and 1.5 m on top of the cable. The EMF attenuates rapidly when moving away from the cable. When the lowering depth increases from 0.4 to 1.5 m, the EMF at the seabed level is decreased significantly from approximately 363 µT to 73 µT (EIAR Vol.4, Appendix 14A – EMF Assessment Report Vol.1).

The EMF modelling study has shown that beyond approximately 10 m from the cable, calculated EMF intensities tend towards the background geomagnetic field levels.

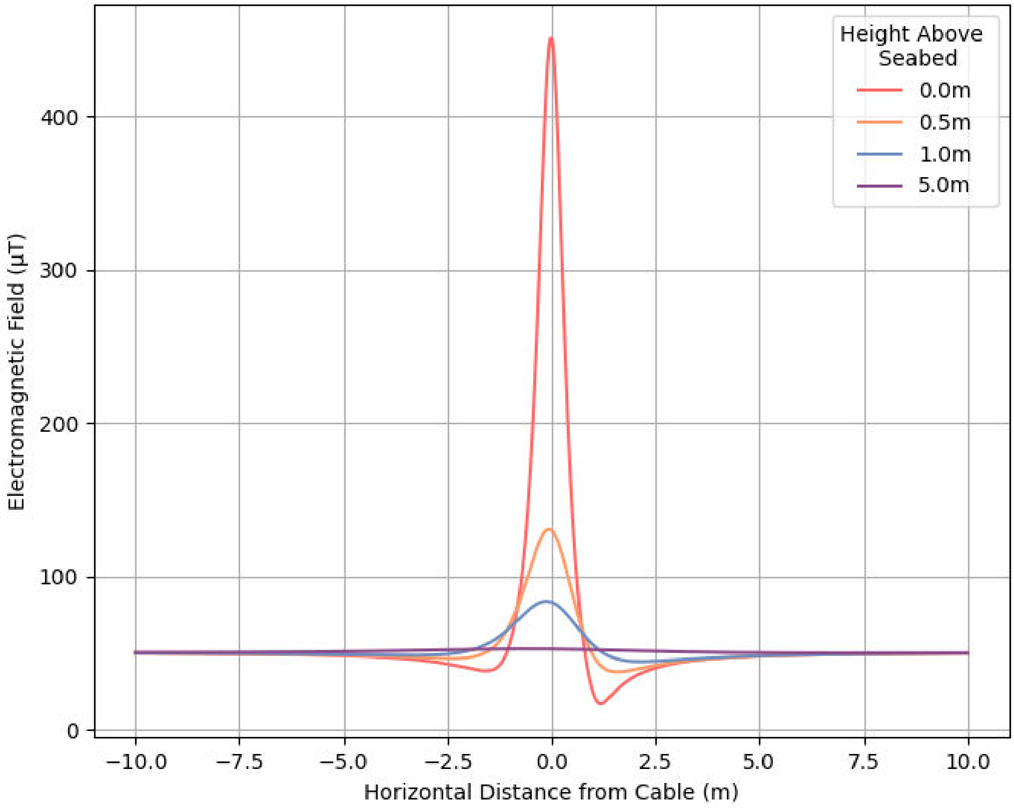

Figure 10-18 Cable EMF intensities along the seabed and at increasing heights above the seabed as a function of horizontal distance from the cable for a DoB of 0.4 m

Although the effects of EMFs on benthic communities are not well understood, recent studies suggest that benthic communities growing along cables routes are similar to those in nearby baseline areas, and where species are not found this is likely due to the physical presence of the cable and surface properties, rather than an EMF effect (Copping and Hemery, 2020). Information on the effects of EMF on fish and shellfish species is presented within EIAR Vol. 3, Chapter 13: Fish and Shellfish Ecology.

The burrowing activity of the polychaete *Hediste diversicolor* was enhanced in the presence of EMF up to 1 mT, although no avoidance or attraction behaviour to EMF was shown (Jakubowska *et al.*, 2019). Enhanced sediment reworking activity observed in response to exposure to EMF might be profitable for the ecosystem in terms of sediment oxygenation and stimulation of cycling of nutrients. A recent work studied the effects of EMF of 500 µT, on the behaviour (righting reflex) and physiology (refractive index of haemolymph / coelomic fluid, and total haemocyte / coelomocyte counts) of marine invertebrates encountered in Scottish waters i.e. the gastropod *Littorina littorea*, the sea star *Asterias rubens*, the sea urchin *Echinus esculentus*, and the commercially important velvet crab (*Necora puber*); the analysis showed no significant differences either in behaviour or physiology of the species (Chapman *et al.*, 2023).

Benthic receptors are considered to have a moderate vulnerability to EMF effects. Therefore, the receptors are assessed to have medium sensitivity. EMF will be continuous and emitted throughout the life cycle of the Project (i.e.

long-term). However, based on the local spatial extent of this effect, and the widespread distribution of the benthic communities, it is defined as being of low magnitude.

Evaluation of significance

Taking the medium sensitivity of the receptor and the low magnitude of the effect, the overall effect of EMF to benthic habitats and species during operation is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
Medium	Low	Minor

Impact significance - NOT SIGNIFICANT

10.6.2.5.2 Heat load

Cables have the potential to emit heat into the surrounding environment as when electric energy is transported, a certain amount dissipates as heat energy (OSPAR Commission, 2009b). Therefore, there is the potential that the buried IACs within the Array Area and the Export/Import Cable within the EICC have the potential to emit heat energy (or thermal emissions) into the surrounding sediment.

A substantial increase in sediment temperature can potentially alter the physical and chemical properties of the substratum such as the oxygen concentration. These changes can have knock on effects (or indirect effects) that lead to alterations in the microorganism communities (Rhoads and Boyer, 1982; OSPAR Commission, 2008). A detailed presentation of habitats and species sensitivities to temperature increase is given in Table 10-7. For example, ocean quahog has high (FeAST, 2024) or medium sensitivity (Tyler-Walters and Sabatini, 2017) to temperature increase. The habitat 'Burrowed mud / Seapens and burrowing megafauna communities' have low (FeAST, 2024) or medium sensitivity (Hill *et al.*, 2023). Although there has been limited research on the effects of thermal loading as it related to subsea cables, based on available evidence, the benthic receptors are considered to be of high sensitivity, based on the value of the presence of ocean quahog and the habitat 'Burrowed mud' / 'Seapen and burrowing megafauna communities. Within the sediments, thermal emissions are highly localised to the immediate surroundings of the cable. Taormina *et al*. (2018) found that a maximum increase of 2.5°C occurs 50 cm directly below the cable. Sediment temperature increases above the cables are reduced, due to the influence of the seawater interacting with the seabed. Additionally, Emeana *et al.* (2016) determined that heat transfer is dependent on sediment type, with coarse silts experiencing the greatest temperature change. Coarser sediments had a lower temperature change but are affected over a greater distance. As sediment types change throughout the Project Area, it is possible that the extent of thermal emissions within the sediments will vary across the Project Area. However, as cable thermal emissions are relatively low, the degree of heating is not likely to change perceptibly throughout the Array Area and along the EICC. Based on the above the effect is defined as being of low magnitude. Any effects are therefore unlikely to affect the long-term functioning of the other benthic receptors within the Benthic Ecology Study Area.

Evaluation of significance

Taking the high sensitivity of the receptor and the low magnitude of the effect, the overall effect of heat load to benthic habitats and species during operation is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance - NOT SIGNIFICANT

10.6.2.6 Introduction of INNS

The risk of potential introduction of INNS from vessels and installed infrastructure acting as stepping stones for the introduction and dispersal of INNS during the operation and maintenance are expected to be lower than that during construction. As such these effects are assessed as a worst-case in Section 10.6.1.3. This Section focuses on the potential stepping stone effect of the installed infrastructure present within the Project Area during the operation and maintenance phase as highlighted by the ScotMER Receptor group (Scottish Government, 2023b).

As per Section 10.5.5, the long-term footprint of the Project is 1.90 km^2, present for the duration of the project (35 years). In addition, the presence of up to 95 FTUs (including moorings) and up to two foundation structures (Jacket and legs) for the OSCPs could act as a stepping stone for INNS with pelagic larvae that move passively under the influence of currents, such as barnacles, bivalves and algae. There is some evidence that introduced structures in UK offshore waters provide new or unique opportunities for INNS which could facilitate their introduction (De Mesel *et al.*, 2015; Kerckhof *et al.*, 2010).

As described previously in Section 10.6.1.3, INNS can have a detrimental effect on the Benthic Ecology of an area through predation on existing wildlife or outcompeting for prey and habitat, with resultant changes to localised biodiversity (Inger *et al.*, 2009). Based on that it is regarded that benthic habitats and species have high sensitivity to INNS.

The Project will develop and adhere to an INNSMP that will set out methods for minimising the potential for the introduction and spread of INNS. The Project will periodically inspect and clear marine growth from infrastructure. The potential effect is therefore considered to be of low magnitude. The INNSMP will follow the guidance of NatureScot's 'Marine Biosecurity Planning Guidance for Producing Site and Operation-Based Plans for Preventing the Introduction of Non-Native Species'. The INNSMP will be submitted and agreed with MD-LOT.

Evaluation of significance

Taking the high sensitivity of the receptor and the low magnitude of the effect, the overall effect of introduction of INNS to benthic habitats and species during operation is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance - NOT SIGNIFICANT

10.6.3 Potential effects during decommissioning

In the absence of detailed information regarding decommissioning works, the effects during the decommissioning of the Project are considered analogous with, or likely less than, those of the construction phase.

10.6.3.1 Removal of hard structures during decommissioning resulting in loss of colonised surfaces

The worst-case scenario for decommissioning will be a clear seabed. Fixed structures (including FTU piles and OSCP jacket foundations) will be fully removed where possible, otherwise cut 3 m below mudline and removed to shore for recycling. The mooring chains will be removed for recycling. The IACs and Export/Import Cable will be fully removed where appropriate, otherwise ends will be cut and buried.

A Decommissioning Programme will be developed and approved pre-construction to address the principal decommissioning measures for the Project. This will be written in accordance with applicable guidance and will detail the management, environmental management and schedule for decommissioning. Prior to the commencement of any decommissioning works, the Decommissioning Programme will be reviewed and revised as required in accordance with the industry practice and legislation at that time. The expected durations of decommissioning activities are 1-5 years.

Given the nature of the decommissioning activities and the worst-case being full removal of the offshore infrastructure (Table 10-14), which will largely be a reversal of the installation process, the effects during decommissioning are expected to be similar in extent or less than those assessed for the construction phase. The removal of the hard structures will also result in the reduction in the long-term footprint calculated for the operation and maintenance phase, although it is likely that the majority of rock protection will remain *in situ*.

The removal of the infrastructure will essentially result in loss of the artificial hard structures such as the OSCPs foundations, anchors, and mattresses, which will have been colonised by sessile epifauna which themselves will have provided an ecological function, providing food and shelter to other species such as fish. The removal of these three-dimensional structures and associated colonised surfaces will be replaced with a return to a more open expanse of soft sediments similar to those that have been reported from the site specific surveys in the Array Area (Figure 10-2), and the EICC (Figure 10-3, Figure 10-12) The removal of infrastructure / hard substrates will contribute to an extent to the achievement of pre-construction seabed conditions. In addition, the removal of infrastructure / hard substrates will promote re-establishment of the soft or mixed substrate sediments characteristic of the area (e.g., 'Offshore circalittoral mud (MD6)', 'Offshore circalittoral mixed sediment (MD4)') that support notable habitats and species such as 'Seapens and burrowing megafauna communities' and ocean quahog. As there is expected to be little or no effects to the physical processes at the seabed from the Project Area (see EIAR Vol. 3, Chapter 8: Marine Geology, Oceanography and Coastal Processes) the surrounding seabed out-with the immediate long-term project footprint is expected to remain relatively intact, allowing for the potential of recruitment and recolonisation of the seabed left behind from the undisturbed areas. It is noted that this recovery period will follow the temporary disturbance associated with the physical removal of the infrastructure.

Therefore, the magnitude of effects assigned to Benthic Ecology receptors during the construction phase is also applicable to the decommissioning phase. It is also assumed that the receptor sensitivities will not materially change over the lifetime of the Project. Therefore, the temporary decommissioning effects are not expected to exceed those assessed for construction. Based on the information presented in Section 10.6.1 about the assessment of effects during the construction phase the benthic receptors are considered, in overall, to have high sensitivity and the effect is defined as being of low magnitude.

Evaluation of significance

Taking the high sensitivity of the receptors and the low magnitude of the effect, the overall effect of decommissioning operations on benthic habitats and species is considered to be minor and not significant in EIA terms.

Sensitivity	Magnitude of effect	Consequence
High	Low	Minor

Impact significance - NOT SIGNIFICANT

10.6.4 Summary of potential effects

A summary of the outcomes of the assessment of potential effects from the construction, operation and maintenance and decommissioning of the Project is provided in Table 10-19.

No significant effects on Benthic Ecology receptors are identified. Therefore, mitigation measures in addition to the embedded mitigation measures listed in Section 10.5.4 are not considered necessary.

Table 10-19 Summary of potential effects

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF EFFECT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Construction						
Temporary impacts to the seabed and benthic habitats	Offshore deep-sea muds	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
	Ocean quahog	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
	Burrowed mud / Seapens and burrowing megafauna communities	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
	Subtidal sands and gravels	Medium	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF EFFECT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
	Geogenic (bedrock / stony) reef	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
	S. spinulosa biogenic reef	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
Potential changes to suspended sediment concentrations and sediment deposition	Offshore deep-sea muds	Medium	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant
	Ocean quahog	Medium	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant
	Burrowed mud / Seapens and burrowing megafauna communities	Low	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF EFFECT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
	Subtidal sands and gravels	Medium	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
	Geogenic (bedrock / stony) reef	Low	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
	S. spinulosa biogenic reef	Medium	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
Introduction of INNS	Offshore deep-sea muds	Medium	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
	Ocean quahog	Medium	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF EFFECT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
	Burrowed mud / Seapens and burrowing megafauna communities	Medium	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
	Subtidal sands and gravels	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
	Geogenic (bedrock / stony) reef	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
	S. spinulosa biogenic reef	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
Operation and maintenance						

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF EFFECT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Temporary impacts to the seabed and benthic habitats	All benthic receptors discussed collectively	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
Long-term impacts to the seabed and benthic habitats	Offshore deep-sea muds	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
	Ocean quahog	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
	Burrowed mud / Seapens and burrowing megafauna communities	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
	Subtidal sands and gravels	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF EFFECT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
	Geogenic (bedrock /stony)reef	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
	S. spinulosa biogenic reef	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
Introduction of hard substrates in a predominantly sedimentary environment / increased predation	All benthic receptors discussed collectively	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
Potential changes to suspended sediment concentrations	All benthic receptors discussed collectively	Medium	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)

POTENTIAL EFFECT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF EFFECT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Potential effects from EMF and heat generated by cables	All benthic receptors discussed collectively	Medium	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
Introduction of INNS	All benthic receptors discussed collectively	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)
Decommissioning						
Removal of hard structures during decommissioning resulting in loss of colonised surfaces	All benthic receptors discussed collectively	High	Low	Minor (not significant)	None required above existing embedded mitigation measures.	Minor (not significant)

10.7 Assessment of cumulative effects

10.7.1 Introduction

Potential impacts from the Project have the potential to interact with those from other projects (developments), plans and activities, resulting in cumulative effects on Benthic Ecology receptors. The general approach to the cumulative effects assessment is described in EIAR Vol. 2, Chapter 7: EIA Methodology and in EIAR Vol. 4, Appendix 31: Cumulative Effects Assessment Methodology and further detail is provided below.

As part of the cumulative process, a long list of plans, activities and projects (developments) is first defined. Upon review of this long list, the construction period of some of the identified developments did not overlap with the construction phase of the Project, so these plans, activities and projects (developments) will not be considered further in this cumulative assessment. The long list was centred around the proposed Project construction timeline (from 2030 to 2035), ±1 year either side to capture any uncertainty in other project (development) schedules. This long list was then reduced to a 'short list' by taking receptor-specific potential pathways of effect (e.g. temporal and spatial overlap of effects) into account. The short list has been defined using topic-specific ZoIs. For Benthic Ecology, the ZoI used for the identification of projects was 20 km. The 20 km ZoI around the Project Area was selected in order to conservatively account for suspended sediments (Table 10-2; Section 10.4.1).

The list of relevant projects (developments) for inclusion within the cumulative effects assessment is outlined in Table 10-20 and an overview of their location is provided in Figure 10-19.

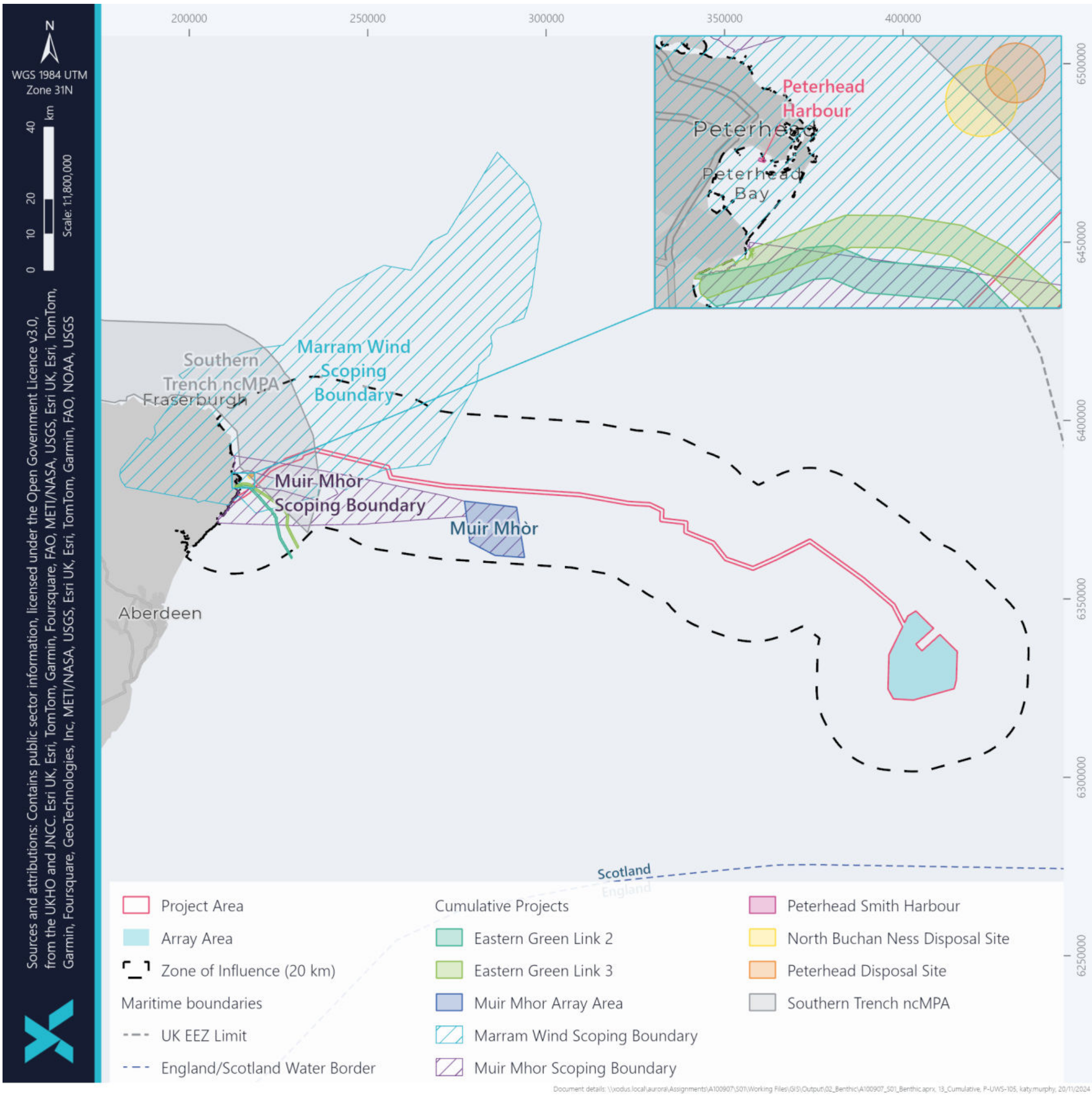

Figure 10-19 Cumulative projects (developments) within a Zone of Influence of 20 km

Table 10-20 List of developments considered for the Benthic Ecology assessment of cumulative effects

LOCATION	PROJECT TYPE	PROJECT NAME	DISTANCE TO PROJECT (km)	STATUS	CONFIDENCE[24]
United Kingdom	Disposal	North Buchan Ness	1.56	Operational	Low
United Kingdom	Disposal	Peterhead	1.57	Operational	Low
United Kingdom	Disposal	Peterhead Harbour	4.06	Operational	Low
United Kingdom	Cable	Eastern Green Link 3	0	Pre-Application (Scoping)	Low
United Kingdom	Offshore Wind	Muir Mhòr Offshore Wind Farm	0	Application	Low
United Kingdom	Offshore Wind	MarramWind	0	Pre-Application (Scoping)	Low

[24] Confidence ratings have been applied to each cumulative project where: 'Low' = pre-application or application, 'Medium' = consented and 'High' = under construction or operational. Disposal sites are an exception to this; despite being operational, they are marked as 'Low' owing to uncertainty over frequency of use.

The following impacts have been taken forward for the cumulative assessment:

- Construction:
  - Temporary impacts to the seabed and benthic habitats;
  - Long-term impacts to the seabed and benthic habitats;
  - Introduction of hard substrates in a predominantly sedimentary environment / Increased predation;
  - Potential changes to suspended sediment concentrations; and
  - Introduction of INNS.
- Operation and maintenance:
  - Temporary impacts to the seabed and benthic habitats;
  - Long-term impacts to the seabed and benthic habitats;
  - Introduction of hard substrates in a predominantly sedimentary environment / Increased predation;
  - Potential changes to suspended sediment concentrations;
  - Potential effects from EMFs and heat generated by cables; and
  - Introduction of INNS.
- Decommissioning:

Removal of hard structures during decommissioning resulting in loss of colonised surfaces.

Impacts scoped out of the cumulative assessment:

- Construction:

Landfall works may disturb intertidal habitats and species; and
Accidental releases to the marine environment.

- Operation and maintenance:

Accidental releases to the marine environment; and
Landfall works may disturb intertidal habitats and species.

10.7.2 Cumulative construction effects

The projects (developments) considered within the cumulative effects assessment for Benthic Ecology are those within 20 km of the Project (Figure 10-19 and Table 10-20) and include: the Eastern Green Link 3 (EGL3; which overlaps the EICC), Muir Mhòr Offshore Wind Farm (the Muir Mhòr Offshore Wind Farm array is located 3.30 km south of the EICC, and the Muir Mhòr Offshore Wind Farm export cable corridor directly overlaps the EICC) and the export cable associated with MarramWind (which overlaps the EICC). There will be potentially overlapping seabed disturbance during the construction of these projects until 2035.

In addition to the wind farms / cables mentioned above within the ZoI of 20 km there are also three disposal sites (Figure 10-19): North Buchan Ness disposal site (located 1.56 km northwest from the EICC), Peterhead disposal site (located 1.57 km northwest from the EICC), and the Peterhead Harbour disposal site (located 4.06 km north from the EICC). There will be potential changes in SSC associated with activities within these three disposal sites.

10.7.2.1 Temporary impacts to the seabed and benthic habitats

As described above for the Project alone, the most sensitive benthic habitats and species to temporary habitat loss has high sensitivity.

EGL3 comprises a two gigawatt HVDC system linking Aberdeenshire and Lincolnshire in England. EGL3 would include the construction of new infrastructure consisting of the English Onshore Scheme, the Scottish Onshore Scheme, and the Marine Scheme (i.e the offshore section of cables; Collaborative Environmental Advisers, 2023). The EGL3 Marine Scheme includes approximately 575 km of subsea HVDC cable from a proposed landfall at either Anderby Creek or Theddlethorpe, Lincolnshire, to a proposed landfall at Sandford Bay, Peterhead. The submarine cable system will consist of two HVDC cables and a fibre optic cable (Collaborative Environmental Advisers, 2023). The expected start date of the construction phase for the EGL3 is in 2029.

The Muir Mhòr Offshore Wind Farm (APEM, 2023) will include up to 67 floating offshore WTGs and associated infrastructure, up to three offshore electrical platforms, scour protection for WTGs and offshore electrical platforms, inter-array cables, offshore export cables, cable protection and onshore transmission infrastructure (APEM, 2023). The expected start date for construction of the Muir Mhòr Offshore Wind Farm is in 2027.

The MarramWind Offshore Wind Farm will be located 75 – 110 km offshore of the northeast Aberdeenshire coast. The proposed project will consist of 126 to 225 WTGs, anticipated to be connected at or near Peterhead or New Deer (MarramWind, 2023). The offshore elements of the project will incorporate WTGs with floating units and mooring system within the Option Agreement Area, as well as offshore transmission infrastructure including array export cables between the Option Agreement Area and landfall location(s). The project will also include onshore transmission infrastructure to facilitate connection of the MarramWind Offshore Wind Farm to the National Electricity Transmission System (MarramWind, 2023). The earliest start date for construction of the MarramWind Offshore Wind Farm is 2025.

It is expected that for the mentioned above arrays and cable developments, any temporary disturbance will be highly localised with good recovery potential of the seabed benthos once the installation activities are completed. It is also noteworthy that the overlap or proximity with these developments with the Project are within predominantly inshore areas which are typically shallower, dynamic habitats within which the benthic ecology receptors can be expected to have a degree of natural resilience to physical disturbance. Furthermore, it is likely that the temporal overlap in the construction activities of these projects and the Project will be rather limited considering that the installation of infrastructure for the Project will commence in 2030; the construction for the EGL3 is expected over 2028 – 2033, and for the MarramWind Offshore Wind Farm export cable the construction period is expected over 2029 – 2034.

Overall, the temporary effects to the seabed and benthic habitats of the cumulative projects will not substantially increase those temporary effects to the seabed associated with the Project. Therefore, the effect remains as being at a low magnitude for all receptors. Therefore, the overall effect is assessed to be minor and not significant in EIA terms.

10.7.2.2 Long-term impacts to the seabed and benthic habitats

The cumulative effects for 'Long-term effects to the seabed and benthic habitats' have been scoped in and assessed for the construction and for the operation and maintenance phases. It is acknowledged that although the introduction of hard substrates can take place during the construction phase it is during the operation and maintenance phase that any potential long-term environmental effects will take place (and potentially during / after decommissioning for any infrastructure that may be left *in situ*). Since it is a single effect occurring across different phases, with the majority occurring during operation and maintenance phase, it is assessed once in that phase to avoid duplication (see Section 10.7.3.2).

10.7.2.3 Introduction of hard substrates in a predominantly sedimentary environment / Increased predation

The cumulative effects for 'Introduction of hard substrates in a predominantly sedimentary environment' have been scoped in and assessed for the construction and for the operation and maintenance phases. It is acknowledged that although the introduction of hard substrates can take place during the construction phase it is during the operation and maintenance phase that any potential long-term environmental effects will take place (and potentially during / after decommissioning for any infrastructure that may be left in situ). Since it is a single effect occurring across different phases, with the majority occurring during operation and maintenance phase, it is assessed once in that phase to avoid duplication (Section 10.7.3.3).

10.7.2.4 Potential changes to suspended sediment concentrations

As described above for the Project alone, the most sensitive benthic habitats and species to increased suspended sediment concentration and sediment deposition has medium sensitivity.

All the projects listed in Table 10-20 (disposal sites, cables, arrays) have the potential to cause a localised increase in suspended sediment concentration and sediment deposition. The output of the sediment suspension and sedimentation modelling study (Section 10.5.6.2 and Section 10.6.1.2) have shown highly localised effects with limited duration in time and (very) low sediment deposition thickness. The three disposal sites are operational, so there is the potential for plume development during disposal operations within the disposal sites. As the three disposal sites are at appreciable distances (ranging from 1.56 km for the North Buchan Ness to 4.06 km for the Peterhead harbour) from the Export/Import Cable, the potential for the coalescence of sediment plumes from the disposal site and the Project is relatively low, but it would be primarily dependent on the deposited material and disposal operations at the disposal sites. Should the Project construction activities coincide with disposal Activities rapid dilution of suspended sediment concentrations can be expected (Section 10.6.1.2 and Section 10.5.6.2) to reduce the potential for the coalescence of sediment plumes from each independent activity. The expected construction period onset for the Project's transmission assets is in 2030 while the construction period for EGL3 over 2029 – 2032, for Muir Mhòr Offshore Wind Farm over 2029 – 2030 and for MarramWind over 2029 – 2033. Thus, there is potential for plume development during the construction phases of all these projects.

Should the plume development during the Project's construction activities coincide with plume development from construction activities of EGL3, Muir Mhòr Offshore Wind Farm and MarramWind, rapid dilution of suspended sediment concentrations can be expected (see Section 10.5.6.2) to reduce the potential for the coalescence of sediment plumes from each independent activity. Based on the outputs of the Project's modelling studies about sediment suspension and deposition (EIAR Vol. 4, Appendix 7: Marine & Physical Processes Modelling Report) it is regarded that plumes generated from disposal sites, EGL3, Muir Mhòr Offshore Wind Farm and MarramWind will also be highly localised, limited in duration and the sediment deposition thickness will be low. Therefore, the effects associated with the other developments are not likely to add considerably to the effect of the Project alone. The cumulative effect remains with the assessment for the Project alone. Therefore, the effect remains as being at a low magnitude for all receptors and the overall effect is assessed to be minor for all receptors and not significant in EIA terms.

10.7.2.5 Introduction of INNS

As described for the Project alone, the most sensitive benthic habitats and species from the introduction of INNS have high sensitivity.

As there is potential for the construction periods of the projects mentioned above (Table 10-20; Section 10.7.2.4) to overlap with the Project's construction period, there is the potential for a temporary increase in the number of vessels in the area that have the potential to introduce INNS. It is, however, assumed that all vessels will adhere to regulation and industry standards, including the Ballast Water Management Convention (2004). The Project will develop and adhere to an INNSMP that will set out methods for minimising the potential for the introduction and spread of INNS. Therefore, the risks are expected to be effectively managed with potential effects remaining as low magnitude. As such, the overall cumulative effects are assessed to be minor and not significant in EIA terms.

10.7.3 Cumulative operation and maintenance effects

10.7.3.1 Temporary impacts to the seabed and benthic habitats

As described above for the Project alone, the most sensitive benthic habitats and species to temporary effects to the seabed and benthic habitats have high sensitivity.

The projects considered within the cumulative assessment are those within the 20 km of the Project (Table 10-20). The start date for the operation of EGL3 is 2033, for Muir Mhòr Offshore Wind Farm in 2030 and for MarramWind in 2034. There will be temporary seabed disturbance during any maintenance work undertaken at the projects associated with wind farms and cables during their operational lifetimes. However, it is anticipated that any temporary habitat loss will be significantly less than that occurring during construction. It is also unlikely that all cumulative projects will require maintenance works simultaneously.

Overall, the temporary habitat loss of the cumulative projects will not substantially increase that which is associated with the Project. Therefore, the effect remains as being at a low magnitude for all receptors. Therefore, the overall effect is assessed to be minor for all receptors and not significant in EIA terms.

10.7.3.2 Long-term impacts to the seabed and benthic habitats

As described above for the Project alone, the most sensitive benthic habitats and species to long-term habitat loss have high sensitivity.

The projects considered within the cumulative assessment are those within the 20 km of the Project (Table 10-20). There will be long-term habitat loss associated with the introduction of hard substrate associated with wind farm and cable projects which will have a cumulative effect.

For the projects EGL3, Muir Mhòr Offshore Wind Farm and MarramWind the Scoping Reports are publicly available; a high high-level description of the infrastructures / hard substrates associated with these projects is given in Section 10.7.2.1. Overall, the cumulative long-term habitat loss and disturbance, including localised redistribution of stony reef through boulder clearance is not predicted to substantially increase that which is associated with the Project. Therefore, the effect remains as being at a low magnitude for all receptors. Therefore, the overall effect is assessed to be minor for all receptors and not significant in EIA terms.

10.7.3.3 Introduction of hard substrates in a predominantly sedimentary environment / Increased predation

As described above for the Project alone, the most sensitive benthic habitats and species to introduction of hard substrates in a predominantly sedimentary environment / increased predation have high sensitivity.

The potential areas for the colonisation of hard structures will be localised to discrete areas around the FTUs, OSCPs, scour protection and cable protection associated with the IACs and Export/Import Cable. The EGL3, Muir Mhòr Offshore Wind Farm and MarramWind projects are considered as having the potential to act cumulatively with the Project.

The areas of the cable installation corridor for the EGL3 (Collaborative Environmental Advisers, 2023) are located in areas which contain to some extent rocky substrates, and thus, any potential reef effect would be minimal. It would be expected that some hard substrate may be required for cable protection for EGL3, Muir Mhòr Offshore Wind Farm and MarramWind projects, which could result in the colonisation of these structures and cause increased predation. Where there is direct overlap between the prospective projects, any cable/pipeline crossings will necessitate the further requirement for rock protection to be deployed. Nonetheless, this introduced rock will be localised and not expected to significantly alter the character or ecological functioning of the sediments habitats across the wider area.

Overall, the potential colonisation of hard substructures and increased predation effects of the cumulative projects will be highly localised and are not expected to substantially increase that which is associated with the Project. Therefore, the effect remains as being at a low magnitude for all receptors. Therefore, the overall effect is assessed to be minor for all Benthic Ecology receptors and not significant in EIA terms.

10.7.3.4 Potential changes to suspended sediment concentrations

As described above for the Project alone, the most sensitive benthic habitats and species to increase in suspended sediment concentration and sediment deposition has medium sensitivity.

All the projects listed in Table 10-20 (disposal sites, cables, wind farms) have the potential to cause a localised increase in suspended sediment concentration and sediment deposition during operation and maintenance activities. However, it is anticipated that any potential changes to suspended sediment concentrations will be significantly less than construction. It is also unlikely that cumulative projects associated with cables and wind farms (EGL3, Muir Mhòr Offshore Wind Farm and MarramWind) will require maintenance works simultaneously.

The scale of the cable and wind farm projects (EGL3, Muir Mhòr Offshore Wind Farm and MarramWind) is comparable to the Project. Therefore, the effects associated with the other projects are not likely to add considerably to the effect of the Project alone. Therefore, the cumulative effect remains consistent with the assessment for the Project alone. Therefore, the effect remains as being at a low magnitude for all receptors and the overall effect is assessed to be minor for all receptors and not significant in EIA terms.

10.7.3.5 Potential effects from EMFs and heat generated by cables

As described above for the Project alone, the most sensitive benthic habitats and species to EMFs and heat generated by cables have medium sensitivity.

The range of thermal load and EMF from subsea cables is very localised. The projects EGL3, Muir Mhòr Offshore Wind Farm and MarramWind have been considered as having the potential to act cumulatively with the Project.

In the Scoping Reports of the projects EGL3 (Collaborative Environmental Advisers, 2023), Muir Mhòr Offshore Wind Farm (APEM, 2023) and MarramWind (MarramWind, 2023) it is mentioned that the projects aim for cable burial to a sufficient depth where possible or, where burial is not possible, cable protection measures will be applied reducing the effects of EMF. The Muir Mhòr Offshore Wind Farm array area will also include suspended cables in the water column, the EMF effects of which are also anticipated to remain highly localised and therefore limited in any potential cumulative effect.

The Project may have to cross EGL3, Muir Mhòr Offshore Wind Farm and MarramWind cables (Figure 10-19). The crossing will be in line with industry best practice to reduce any potential damage and in accordance with a crossing agreement sought between the projects. Proximity agreements will also be developed, if required, and these will seek agreement on how close construction activities can occur to existing infrastructure. Any cumulative thermal load or EMF levels are anticipated to remain highly localised, although it is recognised that the cumulative potential affects incurred where cables overlap may be amplified to a greater extent than would be the case for the project on its own, these crossing areas will have additional protection which will reduce the potential for exposure to marine fauna. Out-with crossing areas, proximity agreements will be in place, and therefore, ensuring the cables will not be close enough to cause cumulative thermal load or EMF effects, Therefore, the cumulative effect is still considered to be low magnitude, making the overall effect minor for all Benthic Ecology receptors and not significant in EIA terms.

10.7.3.6 Introduction of INNS

As described for the Project alone, the most sensitive benthic habitats and species from the introduction of INNS have high sensitivity.

The types of projects considered within the cumulative effects assessment are those within 20 km of the Project (Table 10-20; Figure 10-19). There is potential for the maintenance periods of the projects to overlap with maintenance activities for the Project, which will result in a temporary increase in vessels in the area. However, the number of vessels will be significantly less than those during construction. It is, however, assumed that all vessels will adhere to regulation and industry standards, including the Ballast Water Management Convention (2004). The Project will develop and adhere to an INNSMP that will set out methods for minimising the potential for the introduction and spread of INNS. Therefore, the effect remains as being of low magnitude. As such, the overall cumulative effects are assessed to be minor and not significant in EIA terms.

10.7.4 Cumulative decommissioning effects

10.7.4.1 Removal of hard structures during decommissioning resulting in loss of colonised surfaces

The decommissioning of the Project intends to complete the full removal of offshore infrastructure to below the mudline (where safe/practicable to do so). The majority of decommissioning works are likely to be undertaken in reverse to the sequence of construction works. However, there is limited information on the details around decommissioning of the Project and around the lifecycle of other developments. Considering this, it is assumed that decommissioning involves similar or lesser levels of effects to construction.

A Decommissioning Programme will be prepared prior to construction, in line with the requirements of Section 105 of the Energy Act 2004 (as amended) and any applicable guidance available at the time.

10.7.5 Summary of cumulative effects

A summary of the outcomes of the assessment of cumulative effects for the construction, operation and maintenance and decommissioning phases of the Project is provided in Table 10-21.

Table 10-21 Summary of assessment of cumulative effects

POTENTIAL IMPACT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF EFFECT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Construction and decommissioning						
Temporary impacts to the seabed and benthic habitats	All receptors	High	Low	Minor (not significant)	None required above embedded mitigation measures	Minor (not significant)
Potential changes to suspended sediment concentrations	All receptors	Medium	Low	Minor (not significant)	None required above embedded mitigation measures	Minor (not significant)
Introduction of INNS	All receptors	High	Low	Minor (not significant)	None required above embedded mitigation measures	Minor (not significant)
Operation and maintenance						

POTENTIAL IMPACT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF EFFECT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Temporary impacts to the seabed and benthic habitats	All receptors	High	Low	Minor (not significant)	None required above embedded mitigation measures	Minor (not significant)
Long-term impacts to the seabed and benthic habitats	All receptors	High	Low	Minor (not significant)	None required above embedded mitigation measures	Minor (not significant)
Introduction of hard substrates in a predominantly sedimentary environment / Increased predation	All receptors	High	Low	Minor (not significant)	None required above embedded mitigation measures	Minor (not significant)
Potential changes to suspended sediment concentrations	All receptors	Medium	Low	Minor (not significant)	None required above embedded mitigation measures	Minor (not significant)

POTENTIAL IMPACT	RECEPTOR	SENSITIVITY OF RECEPTOR	MAGNITUDE OF EFFECT	CONSEQUENCE (SIGNIFICANCE OF EFFECT)	SECONDARY MITIGATION REQUIREMENTS	RESIDUAL CONSEQUENCE (SIGNIFICANT OF EFFECT)
Potential effects from EMFs and heat generated by cables	All receptors	Medium	Low	Minor (not significant)	None required above embedded mitigation measures	Minor (not significant)
Introduction of INNS	All receptors	High	Low	Minor (not significant)	None required above embedded mitigation measures	Minor (not significant)
Decommissioning						
Removal of hard substrates during decommissioning resulting in loss of colonised surfaces	All receptors	High	Low	Minor (not significant)	None required above embedded mitigation measures	Minor (not significant)

10.8 Inter-related effects

Inter-related effects are the potential effects of multiple effects, effecting one receptor or a group of receptors. Inter-related effects include interactions between the effects of the different phases of the Project (i.e. interaction of effects across construction, operation and maintenance, and decommissioning), as well as the interaction between effects on a receptor within a Project phase. The potential inter-related effects for Benthic Ecology receptors are described below.

10.8.1 Inter-related effects between Project phases

There are inter-related affects between the construction phase and the operation and maintenance phase, particularly where the installation of infrastructure has an immediate effect on the seabed benthic environment and is then prolonged for the duration of the development throughout the operation and maintenance phases. This includes the areas affected by Export/Import Cable and IACs trenching which overlap with the long-term footprint of the mooring chains as well as with the long-term footprint of the installed protective material at cable/pipeline crossings. Similarly, there will be long-term effects of sediment resuspension resulting from the movement of mooring chains following their installation. The direct effects of such seabed disturbances throughout the life of the field have already been incorporated in this assessment and these inter-related effects between construction and operation are not considered to increase that which has already been assessed.

Inter-related effects between construction and decommissioning are expected to be minimal given the long delay between these phases.

At the end of the operation and maintenance phase, following the removal of structures there will be an impoverished bare seabed left behind in areas where infrastructure was located. In addition, the operational effects of mooring scars, occurring as a result of long-term operational effects, may potentially persist beyond the decommissioning phase. Nonetheless, while physical scarring may take some time to dissipate, the recovery of the seabed benthic communities is anticipated to be rapid via recruitment from nearby unaffected areas.

10.8.2 Inter-related effects within a Project phase

The greatest potential for spatial and temporal interactions is likely to occur with the installation activities during the construction phase which will take place over a six year period with the first two years targeting the pre-lay activities and installation of the Export/Import Cable, the subsequent two years in the array area installing the IACs and pre-lay of moorings. The final two years will focus on completing the WTG installation and hook up.

In particular the PLGR clearance areas will incur a temporary disturbance, however there will also be subsequent trenching and cable lay activities which will incur within the PLGR corridor, further increasing the persistence of the temporary disturbance. This is also the case with the placement of temporary mattresses which may persist for up to three years. Sediment suspension and deposition is expected to occur during PLGR use; sediment suspension and deposition is also expected to occur during Export/Import Cable and IACs lay activities. The seabed footprint assessed accounts for the maximum case footprint and these interrelated effects occurring throughout the construction phase have been considered. It is therefore not anticipated that any inter-related effects will be produced that are of greater significance than the assessments presented for each individual phase.

10.8.3 Inter-relationships

Inter-relationships are defined as the interaction between the impacts assessed within different topic assessment chapters on a receptor. The other chapters and impacts related to the assessment of potential effects on Benthic Ecology are provided in Table 10-22.

Table 10-22 Benthic Ecology inter-relationships

CHAPTER	IMPACT	DESCRIPTION
EIAR Vol. 3, Chapter 8: Marine Geology, Oceanography and Coastal Process	Direct and indirect impacts on benthic habitats and benthic species from suspended sediments and sediment deposition.	Changes in marine physical processes could lead to the suspension of sediments which may indirectly result in the smothering of benthic habitats and benthic species which depend on these habitats.
	Indirect impacts on benthic habitats and benthic species from changes to hydrodynamics.	Changes in hydrodynamics could lead to increased scour and abrasion which may indirectly result in the loss or disturbance of benthic habitats and benthic species.
EIAR Vol. 3, Chapter 9 Water and Sediment Quality	Indirect impacts on benthic habitats and benthic species from changes in water and sediment quality.	Changes in water and sediment quality can result in indirect impacts to benthic habitats and benthic species which are sensitive to contaminants and toxins.
EIAR Vol. 3, Chapter 13 Fish and Shellfish Ecology	Temporary and long-term habitat disturbance or loss.	Change in benthic habitats can lead to an indirect impact on fish spawning and nursery grounds which rely on these habitats. Direct impacts to benthic habitats from the Project are assessed within this chapter and may also extend to important fishery species including *Nephrops*. Temporary fish habitat disturbance or loss due to the presence of the Project Area infrastructure are assessed within EIAR Vol. 3, Chapter 13: Fish and Shellfish Ecology.
	Indirect effects related to changes in availability or distribution of prey species.	Colonisation of benthic habitats and species may occur as a result of the Project Area infrastructure.
EIAR Vol. 3, Chapter 11: Marine Mammal Ecology	Indirect impacts to marine mammals through long-term benthic habitat change, including	Changes in benthic habitats can lead to an indirect impact on marine mammals due to changes in prey availability of fish,

CHAPTER	IMPACT	DESCRIPTION
	the potential for changes to habitat quality.	which may be impacted due to changes to benthic habitat on which they rely. Direct impacts to benthic habitats from the Project are assessed within this chapter. Impacts on marine mammals from long-term habitat changes are assessed within EIAR Vol. 3, Chapter 11: Marine Mammal Ecology.
EIAR Vol. 3, Chapter 12: Ornithology	Indirect impacts to Ornithology from potential changes in benthic habitat and prey availability.	Changes in benthic habitats can lead to an indirect impact on ornithology due to changes in prey availability of fish, which may be impacted due to changes to benthic habitat on which they rely. Direct impacts to benthic habitats from the Project are assessed within this chapter. Impacts on ornithology from potential change in benthic habitat and prey availability are assessed within EIAR Vol. 3, Chapter 12: Ornithology.

10.8.4 Onward Development Connections

The Onward Development Connections for oil and gas electrification will be finalised and brought forward by 3rd party oil and gas operators, subject to separate marine licensing and permitting requirements (including separate EIA, as appropriate). At this very early stage in the process, the information available about these connections is limited and cannot be confirmed by the Project. In accordance with standard practice and relevant industry guidance, the level of information available means there is insufficient detail to enable full inclusion within a cumulative effects assessment. However, recognising industry feedback and a keen interest in this topic from stakeholders, the Applicant has voluntarily provided a qualitative assessment of the combined impact of the Project and Onward Development Connections, to the extent it can with the limited details on possible Onward Development. Please refer to EIAR Vol 3, Chapter 22: Statement of Combined Effect for further details.

With regards to interactions with the East of Gannet and Montrose Fields NCMPA, it has been concluded – based on the level of information currently available - that installation of the Onward Development Connections does not have the potential to change the conclusions of the MPA Assessment stated for the Project alone.

10.9 Ecosystem assessment

Benthic habitats and species play an important role within the food chain, largely occupying the lower trophic levels of primary producers and primary consumers and form prey or feeding habitats for higher trophic levels such as fish and shellfish species. As such, benthic habitats also influence the abundance and distribution of key commercial species, of fish and shellfish species, with species such as sandeel having close association with specific substrates and herring utilising specific habitats (i.e. sands and gravels) for spawning. A holistic approach has been undertaken in the identification of impacts to consider any potential impacts that may occur at an ecosystem scale and particularly across trophic levels (e.g., impacts on prey species affecting their availability for predators). Changes in the availability or distribution of benthic habitats and species could have cascading effects on other species within the ecosystem and may indirectly affect those species that feed on them (predator species including piscivorous fish, marine mammals and birds).

The impacts discussed in this chapter may indirectly affect fish and shellfish receptors, which may in turn indirectly affect high trophic levels such as marine mammals and seabirds. As assessed in Section 10.6, no significant impact on Benthic Ecology receptors have been concluded. Indirect effects to fish and shellfish species related to changes in availability or distribution of prey has been assessed within EIAR, Vol. 3, Chapter 13: Fish and Shellfish Ecology and subsequently the effect of changes on fish prey for marine mammals and offshore ornithology is assessed in EIAR Vol. 3, Chapter 11: Marine Mammal Ecology and EIAR Vol. 3, Chapter 12: Ornithology, respectively.

10.10 Whole Project assessment

Please refer to EIAR Vol. 2, Chapter 7: EIA Methodology for the full description of the Whole Project assessment. The onshore aspects of the Project (i.e., those landwards of MLWS), including the onshore HDD entry point and the Export/Import Cable pull through, have been consented through the NorthConnect HVDC Cable Planning Consent. Details of the onshore Project infrastructure which has been acquired through NorthConnect is presented within EIAR Vol. 2, Chapter 5: Project Description.

The impacts from the HDD exit point on Benthic Ecology receptors have been assessed in Section 10.5.6.2 and Section 10.6. It is not anticipated that there will be any additional effects from the onshore Project on Benthic Ecology receptors.

10.11 Transboundary effects

Transboundary effects arise when impacts from a development within one EEA state's territory affects the environment of another EEA state(s).

There is no potential for transboundary impacts upon Benthic Ecology receptors due to construction, operation and maintenance and decommissioning of the Project. The potential impacts are localised and are not expected to affect other EEA states. This is primarily due to the fact that the Project is entirely within the UKCS with a localised footprint. Therefore, transboundary effects for Benthic Ecology receptors do not need to be considered further. The ZoI of 20 km was based on the approximate extent of two mean tidal excursions and also does not extend beyond the nearest international boundary (the UK/Norway boundary (Table 10-2; Section 10.4.1).

10.12 Summary of mitigation and monitoring

No secondary mitigation, over and above the embedded mitigation measures proposed in Section 10.5.4, is either required or proposed in relation to the potential effects of the Project on Benthic Ecology receptors as no adverse significant impacts are predicted.

10.13 References

APEM (2023). Muir Mhòr Offshore Wind Farm. Offshore Environmental Impact Assessment (EIA) Scoping Report. Available online at: https://marine.gov.scot/sites/default/files/scoping_report_6.pdf [Accessed on 21/10/2024].

Budd, G.C. (2008). *Asterias rubens* Common starfish. In Tyler-Walters H. Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 09-09-2024]. Available from: https://www.marlin.ac.uk/species/detail/1194. [Accessed on 25/10/2024].

Bunker, F.StP.d., Maggs, C.A., Brodie, J.A. & Bunker, A.R. (2010). Seasearch guide to British seaweeds of Britain and Ireland. Marine Conservation Society, Ross-on-Wye.

Burrows M.T., Kamenos N.A., Hughes D.J., Stahl H., Howe J.A. & Tett P. (2014). Assessment of carbon budgets and potential blue carbon stores in Scotland's coastal and marine environment. Scottish Natural Heritage Commissioned Report No. 761.

Burrows, M.T., Hughes, D.J., Austin, W.E.N., Smeaton, C., Hicks, N., Howe, J.A., Allen, C., Taylor, P. & Vare, L.L. (2017). Assessment of Blue Carbon Resources in Scotland's Inshore Marine Protected Area Network. Scottish Natural Heritage Commissioned Report No. 957.

Chapman, E.C.N., Rochas, C.M.V., Piper, A.J.R., Vad, J. & Kazanidis, G. (2023). Effect of electromagnetic fields from renewable energy subsea power cables on righting reflex and physiological response on coastal invertebrates. Marine Pollution Bulletin. 193, 115250.

CIEEM (2018). Guidelines for ecological impact assessment (EcIA). Available online at: https://cieem.net/resource/guidelines-for-ecological-impact-assessment-ecia/ [Accessed on 16/09/2024].

Collaborative Environmental Advisers (2023). Eastern Green Link 3. Marine Environmental Appraisal Non-Statutory Scoping Report. Available online at: https://marine.gov.scot/node/25025 [Accessed on 21/10/2024].

Collins, K. (2003). Dorset marine habitat surveys: maerl, worms reefs, bream nests, sea fans and brittlestars. 2003 survey results. Report to Dorset Wildlife Trust and English Nature from the School of Ocean and Earth Science. University of Southampton.

Connor, D.W., Allen, J.H., Golding, N., Howell, K.L., Lieberknecht, L.M., Northen, K.O. & Reker, J.B. (2004). The Marine Habitat Classification for Britain and Ireland, Version 04.05. Available online at: https://data.jncc.gov.uk/data/d216bdbd-503b-4fc4-a9d8-69ea8266e03d/mhc-v04-05-web.pdf [Accessed on 05/09/2024].

Copping, A. E. & Hemery, L. G. (2020). State of the Science Report: Environmental Effects of Marine Renewable Energy Development Around the World. Report for Ocean Energy Systems (OES). Available online at: https://tethys.pnnl.gov/publications/state-of-the-science-2020 [Accessed on 10/09/2024].

Cornes, R.C., Tinker, J., Hermanson, L., Oltmanns, M., Hunter, W.R., Hartley-Lloyd, H., Kent, E.C., Rabe, B. & Renshaw, R. (2023). The impacts of climate change on sea temperature around the UK and Ireland. MCCIP Science Review. Available online at: https://www.mccip.org.uk/sites/default/files/2024-04/The%20Impacts%20of%20Climate%20Change%20on%20Sea%20Temperature%20around%20the%20UK%20and%20Ireland_1.pdf [Accessed on 08/10/2024].

Cunningham, C., Hunt, C. (2023). Scottish Blue Carbon - a literature review of the current evidence for Scotland's blue carbon habitats. NatureScot Research Report 1326.

Dando, P.R., Southward, A.J. & Southward, E.C. (1986). Chemoautotrophic symbionts in the gills of the bivalve mollusc Lucinoma borealis and the sediment chemistry of its habitat. Proceedings of the Royal Society of London B. 227, 227 – 247.

Dannheim, J., Bergstrom, L., Birchenough, S.N.R., Brzana, R., Boon, A.R., Coolen, J.W.P., Dauvin, J-C., Mesel, I.D., Derweduwen, J., Gill, A.B., Hutchison, Z.L., Jackson, A.C., Janas, U., Martin, G., Raoux, A., Reubens, J., Rostin, L., Vanaverbeke, J., Wilding, T.A., Wilhelmsson, D. & Degraer, S. (2019). Benthic effects of offshore renewables: identification of knowledge gaps and urgently needed research. ICES Journal of Marine Science. 77, 1092 - 1108.

De-Bastos, E. (2016a). Paramphinome jeffreysii, Thyasira spp. and Amphiura filiformis in offshore circalittoral sandy mud. In Tyler-Walters H. and Hiscock K. Marine Life Information Network: Biology and Sensitivity Key Information Reviews. Plymouth: Marine Biological Association of the United Kingdom. Available from: https://www.marlin.ac.uk/habitat/detail/1109 [Accessed on 25/10/2024].

De-Bastos, E. (2016b). [Owenia fusiformis] and [Amphiura filiformis] in offshore circalittoral sand or muddy sand. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews. Plymouth: Marine Biological Association of the United Kingdom. Available online at: https://dx.doi.org/10.17031/marlinhab.381.1 [Accessed on 21/10/2024].

De Mesel, I., Kerckhof, F., Norro, A., Rumes, B. & Degraer, S. (2015). Succession and seasonal dynamics of the epifauna community on offshore wind farm foundations and their role as stepping stones for non-indigenous species. Hydrobiologia. 756, 37 - 50.

Diederich, S. (2005). Differential recruitment of introduced Pacific oysters and native mussels at the North Sea coast: coexistence possible? Journal of Sea Research. 53, 269 - 281.

Diederich, S. (2006). High survival and growth rates of introduced Pacific oysters may cause restrictions on habitat use by native mussels in the Wadden Sea. Journal of Experimental Marine Biology and Ecology. 328, 211 - 227.

Dörjes, J. (1992). Langzeitentwicklung makrobenthischer Tierarten im Jadebussen (Nordsee) während der Jahre 1974 bis 1987. Senckenbergiana maritima. 22, 37 - 57.

Dubois, S., Commito, J.A., Olivier, F. & Retière, C. (2006). Effects of epibionts on *Sabellaria alveolata* (L.) biogenic reefs and their associated fauna in the Bay of Mont Saint-Michel. Estuarine, Coastal and Shelf Science. 68, 635 - 646.

Eggleston, D. (1972). Factors influencing the distribution of sub-littoral ectoprocts off the south of the Isle of Man (Irish Sea). Journal of Natural History, 6, 247-260.

Emeana, C. J., Hughes, T. J., Dix, J. K., Gernon, T. M., Henstock, T. J., Thompson, C. E. & Pilgrim, J. A. (2016). The thermal regime around buried submarine high-voltage cables. Geophysical Journal International. 206, 1051-1064.

Eno, N.C., MacDonald, D.S., Kinnear, J.A.M., Amos, C.S., Chapman, C.J., Clark, R.A., Bunker, F.S.P.D. & Munro, C. (2001). Effects of crustacean traps on benthic fauna ICES Journal of Marine Science. 58, 11-20.

Earll R. & Erwin, D.G. (1983). Sublittoral ecology: the ecology of the shallow sublittoral benthos. Oxford University Press, USA.

FeAST (2024). Feature Activity Sensitivity Tool. Available on line at: https://feature-activity-sensitivity-tool.scot/ [Accessed on 05/09/2024].

GeMS (2022). Available online at: https://opendata.nature.scot/maps/snh::gems-species-point-dataset/about [Accessed on 10/09/2024].

Gibb, N., Tillin, H.M., Pearce, B. & Tyler-Walters, H. (2014). Assessing the sensitivity of Sabellaria spinulosa reef biotopes to pressures associated with marine activities. Joint Nature Conservation Committee, Peterborough, JNCC report No. 504, 67 pp. Available online at https://data.jncc.gov.uk/data/126dba2e-e3cc-472a-9a29-adde6752d0d0/JNCC-Report-504-FINAL-WEB.pdf. [Accessed on 31/10/2024].

Gill, A.B. & Desender, M. (2020). State of the Science Report, Chapter 5: Risk to Animals from Electromagnetic Fields Emitted by Electric Cables and Marine Renewable Energy Devices. Available online at: https://www.osti.gov/servlets/purl/1633088 [Accessed on 05/09/2024].

Golding, N., Albrecht, J. & McBreen, F. (2020). Refining the criteria for defining areas with a 'low resemblance' to Annex I stony reef; Workshop Report. JNCC Report No. 656. JNCC, Peterborough, ISSN 0963-8091. Griffith, K., Mowat, S., Holt, R.H., Ramsay, K., Bishop, J.D., Lambert, G. & Jenkins, S.R., (2009). First records in Great Britain of the invasive colonial ascidian *Didemnum vexillum* Kott, 2002. Aquatic Invasions. 4, 581 - 590.

Gubbay, S. (2007). Defining and managing *Sabellaria spinulosa* reefs: Report of an inter-agency workshop 1-2 May, 2007. JNCC Report No. 405. Harrower, C., Rorke, S. & Roy, H. (2023). English Biodiversity Indicators 2023; technical background document. Available online at: https://assets.publishing.service.gov.uk/media/6550a2c96a650f0012bf4841/15_TB_Funding_for_biodiversity_2023_final.pdf [Accessed on 05/09/2024].

Grear, J.S., Leary, C.A., Nye, J.A., Tettelback, S.T., and Gobler, C.J. (2020). Effects of coastal acidification on North Atlantic bivalves: interpreting laboratory responses in the context of in situ populations. Marine Ecological Progress Series. Vol: 633 89-104. Available at: https://www.int-res.com/articles/meps2019/633/m633p089.pdf [Accessed on 11/11/2024]

Hartnoll, R.G. (1983). Substratum. In Sublittoral ecology. The ecology of the shallow sublittoral benthos (ed. R. Earll & D.G. Erwin), pp. 97-124. Oxford: Clarendon Press.

Hendrick, V., Foster-Smith, R., Davies, A. & Newell, R. (2011). Biogenic Reefs and the Marine Aggregate Industry. Marine ALSF Science Monograph Series, Cefas.

Henry, L. A. & Roberts, J. M. (2014). Applying the OSPAR habitat definition of deep-sea sponge aggregations to verify suspected records of the habitat in UK waters. JNCC Report No. 508.

Hermans, A., Bos, O.G., & Prusina, I. (2020). Nature-Inclusive Design: a catalogue for offshore wind infrastructure. Available online at: https://research.wur.nl/en/publications/nature-inclusive-design-a-catalogue-for-offshore-wind-infrastruct. [Accessed on 15/10/2024].

Hill, A.S., Brand, A.R., Veale, L.O. & Hawkins, S.J. (1997). Assessment of the effects of scallop dredging on benthic communities. Final Report to MAFF, Contract CSA 2332, Liverpool: University of Liverpool.

Hill, J.M., Tyler-Walters, H.,, Garrard, S.L., & Watson, A. (2023). Seapens and burrowing megafauna in circalittoral fine mud. In Tyler-Walters H. Marine Life Information Network: Biology and Sensitivity Key Information Reviews, Plymouth: Marine Biological Association of the United Kingdom. Available online at: https://www.marlin.ac.uk/habitat/detail/131 [Accessed on 10/09/2024].

Hiscock, K. (1983). Water movement. In Sublittoral ecology. The ecology of shallow sublittoral benthos (ed. R. Earll & D.G. Erwin), pp. 58-96. Oxford: Clarendon Press.

Holme, N.A. & Wilson, J.B. (1985). Faunas associated with longitudinal furrows and sand ribbons in a tide-swept area in the English Channel. Journal of the Marine Biological Association of the United Kingdom. 65, 1051-1072.

Holt, T.J., Rees, E.I., Hawkins, S.J. & Seed, R. (1998). Biogenic reefs (Volume IX). An overview of dynamic and sensitivity characteristics for conservation management of marine SACs. Scottish Association for Marine Science (UK Marine SACs Project), 174 pp. Available online at: http://ukmpa.marinebiodiversity.org/uk_sacs/pdfs/biogreef.pdf. [Accessed on 05/09/2024].

Hughes, D.J. (1998). Seapens & burrowing megafauna (volume III). An overview of dynamics and sensitivity characteristics for conservation management of marine SACs. Natura 2000 report prepared for Scottish Association of Marine Science (SAMS) for the UK Marine SACs Project., Scottish Association for Marine Science. (UK Marine SACs Project). Available online at: http://ukmpa.marinebiodiversity.org/uk_sacs/pdfs/seapens.pdf. [Accessed on 05/09/2024]

Hughes, S.L., Hindson, J., Berx, B., Gallego, A. & Turrell, W.R. (2018). Scottish Ocean Climate Status Report 2016. Scottish Marine and Freshwater Science Vol 9 No 4, 167pp. Available online at: https://data.marine.gov.scot/dataset/scottish-ocean-climate-status-report-2016 [Accessed on 10/09/2024].

Inger, R., Attrill, M.J., Bearhop, S., Broderick, A.C., James Grecian, W., Hodgson, D.J., Mills, C., Sheehan, E., Votier, S.C., Witt, M.J. & Godley, B.J. (2009). Marine renewable energy: potential benefits to biodiversity? An urgent call for research. Journal of applied ecology. 46, 1145 - 1153.

Irving, R. (2009). The identification of the main characteristics of stony reef habitats under the Habitats Directive: Summary report of an inter-agency workshop 26–27 March 2008, JNCC Report No. 432.

Jakubowska, M., Urban-Malinga, B., Otremba, Z. & Andrulewicz, E. (2019). Effect of low frequency electromagnetic field on the behaviour and bioenergetics of the polychaete *Hediste diversicolor*. Marine Environmental Research. 150, 104766.

Jech, J.M., Lipsky, A., Moran, P., Matte, G., Diaz, G. (2023). Fish distribution in three dimensions around the Block Island Wind Farm as observed with conventional and volumetric echosounders. Marine and Coastal Fisheries. 15, e10265.

JNCC (2014). JNCC clarifications on the habitat definitions of two habitat Features of Conservation Importance: Mud habitats in deep water, and; Seapen and burrowing megafauna communities. Available online at: http://data.jncc.gov.uk/data/91e7f80a-5693-4b8c-8901-11f16e663a12/3-AdviceDocument-MudHabitats-Seapen-definitions-v1.0.pdf [Accessed on 10/09/2024].

JNCC (2018). Supplementary advice on conservation objectives for Turbot Bank Nature Conservation Marine Protected Area. Available online at: https://data.jncc.gov.uk/data/63f05a50-a78b-4a58-9bde-d78261780729/TurbotBank-3-SACO-V1.0.pdf [Accessed on 05/09/2024].

JNCC (2024a). Supplementary Advice on Conservation Objectives for East of Gannet and Montrose Fields Nature Conservation MPA. Available online at: https://data.jncc.gov.uk/data/7d1e751a-e082-405b-aad9-51eeaf53dd67/egmf-saco-v2-0.pdf [Accessed on 07/10/2024].

JNCC (2024b) East of Gannet and Montrose Fields Advice on Operations. Excel spreadsheet Available at : https://hub.jncc.gov.uk/assets/7d1e751a-e082-405b-aad9-51eeaf53dd67

JNCC & DEFRA (2012). UK Post-2010 Biodiversity Framework. Available online at: https://data.jncc.gov.uk/data/587024ff-864f-4d1d-a669-f38cb448abdc/UK-Post2010-Biodiversity-Framework-2012.pdf [Accessed on 31/10/2024].

International Convention for the Control and Management of Ships' Ballast Water and Sediments (2004). Available online at: https://www.imo.org/en/About/Conventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships%27-Ballast-Water-and-Sediments-(BWM).aspx [Accessed on 10/09/2024].

Kerckhof, F., Rumes, B., Jacques, T.J., Degraer, S. & Norro, A. (2010). Early development of the subtidal marine biofouling on a concrete offshore windmill foundation on the Thornton Bank (Southern North Sea): first monitoring results. International Journal of the Society for Underwater Technology. 29, 137 - 149.

Kinnear, J.A.M., Barkel, P.J., Mojseiwicz, W.R., Chapman, C.J., Holbrow, A.J., Barnes, C. & Greathead, C.F.F. (1996). Effects of Nephrops creels on the environment. Fisheries Research Services Report No. 2/96, 24 pp.

Langhamer, O. (2012). Artificial reef effect in relation to offshore renewable energy conversion: state of the art (review article). The Scientific World Journal. Available online at: https://pubmed.ncbi.nlm.nih.gov/23326215/ [Accessed on 31/10/2024].

Last, K.S., Hendrick V. J, Beveridge C. M & Davies, A. J. (2011). Measuring the effects of suspended particulate matter and smothering on the behaviour, growth and survival of key species found in areas associated with aggregate dredging. Report for the Marine Aggregate Levy Sustainability Fund, Project MEPF 08/P76.

Lengyel, N. L., Collie, J. S. & Valentine, P. C. (2009). The invasive colonial ascidian *Didemnum vexillum* on Georges Bank–ecological effects and genetic identification. Aquatic Invasions 4, 143-152.

Lepper, P.A., Cheong, S-H., Robinson, S.P., Wang, L., Tougaard, J., Griffiths, E.T. and Hartley, J.P. (2024). In-situ comparison of high-order detonations and low-order deflagration methodologies for underwater unexploded ordnance (UXO) disposal. Marine Pollution Bulletin 199.

Mahaffey, C., Hull, T., Hunter, W., Greenwood, N., Palmer, M., Sharples, J., Wakelin, S. and Williams, C. (2023). Climate change impacts on dissolved oxygen concentration in marine and coastal waters around the UK and Ireland. Marine Climate Change Impacts Partnership Science Review, 31pp. Available online at: https://www.mccip.org.uk/sites/default/files/2023-02/Climate%20Change%20Impacts%20on%20Dissolved%20Oxygen%20Concentration%20in%20Marine%20and%20Coastal%20Waters%20around%20the%20UK%20and%20Ireland%20.pdf [Accessed on 03/10/2024].

Marine Scotland (2023). The Marine Scotland Assessment of Non Native Species. Available online at: https://marine.gov.scot/sma/assessment/non-native-species [Accessed on 31/10/2024] MarLIN (2024). The Marine Life Information Network. Available online at: https://www.marlin.ac.uk/ [Accessed on 05/09/2024].

MarramWind (2023). MarramWind Offshore Wind Farm. Environmental Impact Assessment. Scoping Report. Available online at: https://marine.gov.scot/node/23530 [Accessed on 21/10/2024].

McCabe, C., McBreen, F. & O'Connor, J. (2020). East of Gannet and Montrose Fields MPA Monitoring Report 2015 (Version 2). Available online at: https://data.jncc.gov.uk/data/78cb6096-16a3-4904-9014-f17fc56d402a/jncc-mss-report-1-v2.pdf [Accessed on 10/09/2024].

Mieszkowska, N., Burrows, M. and Sugden, H. (2020) Impacts of climate change on intertidal habitats relevant to the coastal and marine environment around the UK. MCCIP Science Review 2020, 256–271.

Mistakidis, M.N. (1956). Survey of the pink shrimp fishery in Morecambe Bay, Lancashire and Western Sea Fisheries Joint Committee.

Marine Management Organisation (MMO) (2013). Guidance on MCZ Assessments. MMO Report, No. 2013-01.

MMT (2018). NorthConnect – UK Nearshore, North Sea and Norwegian Fjord Survey. Geophysical, Benthic, and Geotechnical Route Survey: Benthic Survey Report. Doc: 102273-NOC-MMT-SUR-REP-ENUKNSNF (Rev A).

Moore, P.G. (1977). Inorganic particulate suspensions in the sea and their effects on marine animals. Oceanography and Marine Biology: An Annual Review. 15, 225-363.

Moore, C.G (2017). Biological analyses of underwater video from ongoing monitoring and research cruises in Lochs Sunart, Etive and Alsh, sea lochs off South Skye, the Sounds of Barra and Arisaig and around the Southern Trench. Scottish Natural Heritage Commissioned Report No. 959.

Moore, P.J. and Smale, D.A. (2020) Impacts of climate change on shallow and shelf subtidal habitats relevant to the coastal and marine environment around the UK. MCCIP Science Review 2020, 272–292.

Natural England & JNCC (2019). Natural England and JNCC advice on key sensitivities of habitats and Marine Protected Areas in English Waters to offshore wind farm cabling within Proposed Round 4 leasing areas. Available online at: https://data.jncc.gov.uk/data/3c9f030c-5fa0-4ee4-9868-1debedb4b47f/NE-JNCC-advice-key-sensitivities-habitats-MPAs-offshore-windfarm-cabling.pdf [Accessed on 31/10/2024].

NatureScot (2019). Buchan Ness to Collieston Special Area of Conservation. Conservation advice package. Available online at: https://apps.snh.gov.uk/sitelink-api/v1/sites/8214/documents/66 [Accessed on10/09/2024].

NatureScot (2024). Guidance on marine non-native species. Available online at: https://www.nature.scot/professional-advice/land-and-sea-management/managing-coasts-and-seas/marine-non-native-species [Accessed on 07/10/2024].

NatureScot (2024). Southern Trench NCMPA. Conservation and Management Advice. Available online at: https://sitelink.nature.scot/site/10477 [Accessed on 07/10/2024].

NBN atlas (2024). Available online at: https://nbnatlas.org/ [Accessed on 05/09/2024].

NorthConnect (2018). NorthConnect HVDC Cable - Environmental Impact Assessment Report. Available online at: https://marine.gov.scot/data/northconnect-hvdc-cable-environmental-impact-assessment-report-volume-3 [Accessed on 10/09/2024].

OSPAR (2008-07). Descriptions of habitats on the OSPAR list of threatened and/or declining species and habitats. Available online at: https://www.ospar.org/work-areas/bdc/species-habitats/list-of-threatened-declining-species-habitats [Accessed on 10/09/2024].

OSPAR (2009a) Background Document for Ocean quahog (*Arctica islandica), Available online at: https://www.ospar.org/documents?v=7171* [Accessed on 11/11/2024].

OSPAR (2009b). Assessment of the environmental impacts of cables. Available online at: https://qsr2010.ospar.org/media/assessments/p00437_Cables.pdf [Accessed on 10/09/2024].

OSPAR (2010). Background document for Seapen and Burrowing megafauna communities. Available online at: https://qsr2010.ospar.org/media/assessments/Species/P00481_Seapen_and_burrowing_megafauna.pdf [Accessed on 05/09/2024].

OSPAR. (2023). The 2023 Quality Status Report for the Northeast Atlantic. OSPAR Commission, London. Available online at: https://oap.ospar.org/en/ospar-assessments/quality-status-reports/qsr-2023/ [Accessed on 10/09/2024).

Pearce, B., Taylor, J. & Seiderer, L.J. (2007). Recoverability of *Sabellaria spinulosa* following aggregate extraction: Marine Ecological Surveys Limited.

Pearce, B., Hill, J.M., Grubb, L. & Harper, G. (2011). Impacts of marine aggregate extraction on adjacent *Sabellaria spinulosa* aggregations and other benthic fauna. Rep. MEPF 08/P39, The Crown Estate. Available online at: https://www.researchgate.net/publication/323855265_MEPF_09P39_Impacts_of_Marine_Aggregate_Extraction_on_Adjacent_Sabellaria_spinulosa_aggregations_and_Other_Benthic_Fauna?channel=doi&linkId=5aafbed1aca2721710fcda0a&showFulltext=true [Accessed on 05/09/2024].

Pearce, B. & Kimber, J. (2020). 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: SMFS Vol 11 No 17. Available on line at: https://data.marine.gov.scot/sites/default/files//Scottish%20Marine%20and%20Freshwater%20Science%20%28SMFS%29%20Vol%2011%20No%2017_%20The%20Status%20of%20Sabellaria%20spinulosa%20Reef%20%281%29.pdf [Accessed on 10/09/2024].

Porter, J.S., Austin, W.E.N., Burrows, M.T., Clarke, D., Davies, G., Kamenos, N., Riegel, S., Smeaton,C., Page, C. & Want, A. (2020). Blue carbon audit of Orkney waters. Scottish Marine and Freshwater Science 11 (3).

Raoux, A., Tecchio, S, Pezy, J-P., Lassalle, G., Degraer, S., Wilhelmsson, D., Cachera, M., Ernande, B., Le Guen, C., Haraldsson, M., Grangere, K., Le Loc'h, F., Dauvin, J-C. & Niquil. N. (2017). Benthic and fish aggregation inside an offshore wind farm: Which effects on the trophic web functioning. Ecological Indicators. 72, 33-46.

Readman, J.A.J., Lloyd, K.A., and Watson, A. (2023). Flustra foliacea on slightly scoured silty circalittoral rock. In Tyler-Walters H. Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available online at: https://www.marlin.ac.uk/habitats/detail/24 [Accessed on 15/10/2024].

Rhoads, D.C. & Boyer, L.F. (1982). The Effects of Marine Benthos on Physical Properties of Sediments. A Successional Perspective. In: McCall PL, Tevesz MJS, editors. Anim. Relations Biog. Alter. Sediments, Springer US; 1982, p. 3–43.

Rovco (2024a). Geophysical Results Report, CENOS OWF Geoenvironmental Survey.

Rovco (2024b). Cenos ECC Geoenvironmental Survey.

Ryland, J.S. (1976). Physiology and ecology of marine bryozoans. Advances in Marine Biology. 14, 285-443.

Scottish Government (2015a). Scotland's National Marine Plan. Available online at: https://www.gov.scot/publications/scotlands-national-marine-plan/ [Accessed on 07/10/2024].

Scottish Government (2015b). Scotland's Biodiversity: a Route Map to 2020. Available online at: https://www.gov.scot/publications/scotlands-biodiversity-route-map-2020/ [Accessed on 07/10/2024].

Scottish Government (2023a). National Planning Framework 4. Available online at: https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2023/02/national-planning-framework-4/documents/national-planning-framework-4-revised-draft/national-planning-framework-4-revised-draft/govscot%3Adocument/national-planning-framework-4.pdf [Accessed on 13/11/2024].

Scottish Government (2023b). Benthic Species ScotMER Receptor Group - Evidence map (updated January 2023). Available online at: https://www.gov.scot/publications/benthic-species-specialist-receptor-group/ [Accessed on 05/09/2024].

Scottish Government (2024a). Drafty fisheries assessment – Turbot Bank NCMPA. Available online at: https://www.gov.scot/binaries/content/documents/govscot/publications/research-and-analysis/2024/08/draft-fisheries-assessment-turbot-bank-NCMPA-fisheries-management-measures-within-scottish-offshore-marine-protected-areas-mpas/documents/draft-fisheries-assessment-turbot-bank-NCMPA-fisheries-management-measures-within-scottish-offshore-marine-protected-areas-mpas/draft-fisheries-assessment-turbot-bank-NCMPA-fisheries-management-measures-within-scottish-offshore-marine-protected-areas-mpas/govscot%3Adocument/draft-fisheries-assessment-turbot-bank-NCMPA-fisheries-management-measures-within-scottish-offshore-marine-protected-areas-mpas.pdf [Accessed on 07/10/2024].

Scottish Government (2024b). Draft fisheries assessment – East of Gannet and Montrose Fields NCMPA. Available online at: https://www.gov.scot/binaries/content/documents/govscot/publications/research-and-analysis/2024/08/draft-fisheries-assessment-east-gannet-montrose-fields-NCMPA-fisheries-management-measures-within-scottish-offshore-marine-protected-areas-mpas/documents/draft-fisheries-assessment-east-gannet-montrose-fields-NCMPA/draft-fisheries-assessment-east-gannet-montrose-fields-NCMPA/govscot%3Adocument/draft-fisheries-assessment-east-gannet-montrose-fields-NCMPA.pdf [Accessed on 05/09/2024].

Sharples, J., Holt, J., Wakelin, S. and Palmer, M.R. (2022) Climate change impacts on stratification relevant to the UK and Ireland. MCCIP Science Review 2022, 11pp

Smale D.A., Wernberg T., Yunnie A.L.E. & Vance T. (2015). The rise of *Laminaria ochroleuca* in the Western English Channel (UK) and preliminary comparisons with its competitor and assemblage dominant *Laminaria hyperborea*. Marine Ecology. 36, 1033 - 1044.

Smeaton, C., Austin, W., Turrell, W.R. (2020). Re-evaluating Scotland's sedimentary carbon stocks. Marine Scotland Science. Scottish Marine and Freshwater Science Vol 11 No 2. Available online at : https://data.marine.gov.scot/sites/default/files/SMFS%201102.pdf [Accessed on 23/10/2024].

Stamp, T.E., Williams, E., Lloyd, K.A., & Watson, A. (2023). *Alcyonium digitatum* with *Securiflustra securifrons* on tide-swept moderately wave-exposed circalittoral rock. In Tyler-Walters H. Marine Life Information Network: Biology and Sensitivity Key Information Reviews. Plymouth: Marine Biological Association of the United Kingdom. Available online at: https://www.marlin.ac.uk/habitat/detail/15 [Accessed on 10/09/2024].

Stocker, T., Dahe, Q., Plattner, G-K. et al. (eds). (2013) Climate Change 2013: Working Group 1 (WG1) Contribution to the Intergovernmental Panel on Climate Change (IPCC) 5th Assessment Report (AR5), Cambridge University Press.

Taormina, B., Bald, J., Want, A., Thouzeua, G., Lejart, M., Desroy, N., and Carlier A. (2018). A review of potential impacts of submarine power cables on the marine environment: Knowledge gaps, recommendations and future directions. Renewable and Sustainable Energy Reviews, 96, pp. 380–391. Available online at: https://doi.org/10.1016/j.rser.2018.07.026 [Accessed on 10/09/2024].

Tillin, H.M. & Watson, A. (2023). Glycera lapidum, Thyasira spp. and Amythasides macroglossus in offshore gravelly sand. In Tyler-Walters H. Marine Life Information Network: Biology and Sensitivity Key Information Reviews. Plymouth: Marine Biological Association of the United Kingdom. Available online at: https://www.marlin.ac.uk/habitat/detail/1136 [Accessed on 10/09/2024].

Tillin, H.M., Marshall, C.E., Garrard, S.L., & Gibb, N., (2023). Sabellaria spinulosa on stable circalittoral mixed sediment. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews. Plymouth: Marine Biological Association of the United Kingdom. Available online at: https://www.marlin.ac.uk/habitat/detail/377 [Accessed on 10/09/2024].

Tyler-Walters, H., & Ballerstedt, S. (2007). Flustra foliacea Hornwrack. In Tyler-Walters H. Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 09-09-2024]. Available online at: https://www.marlin.ac.uk/species/detail/1609 [Accessed on 10/09/2024].

Tyler-Walters, H., James, B., Carruthers, M. (eds.), Wilding, C., Durkin, O., Lacey, C., Philpott, E., Adams, L., Chaniotis, P.D., Wilkes, P.T.V., Seeley, R., Neilly, M., Dargie, J. & Crawford-Avis, O.T. (2016). Descriptions of Scottish Priority Marine Features (PMFs). Scottish Natural Heritage Commissioned Report No. 406.

Tyler-Walters, H., & Sabatini, M. (2017). Arctica islandica Icelandic cyprine. In Tyler-Walters H. Marine Life Information Network: Biology and Sensitivity Key Information Reviews. Plymouth: Marine Biological Association of the United Kingdom. Available online at: https://www.marlin.ac.uk/species/detail/1519. [Accessed on 19/09/2024].

UK Government (2004). International treaty - International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (as amended) [MS No.6/2021] Available online at: https://www.gov.uk/government/publications/international-convention-for-the-control-and-management-of-ships-ballast-water-and-sediments-2004-as-amended-ms-no62021 [Accessed on 10/12/2024].

UK Government (2011). UK Marine Policy Statement. Available online at: https://assets.publishing.service.gov.uk/media/5a795700ed915d042206795b/pb3654-marine-policy-statement-110316.pdf [Accessed on 13/11/2024].

UKOOA (2001, 2002). An analysis of U.K Offshore Oil & gas Environmental Surveys 1975-95.

Van Daele, M., Van Bastelaere, B., De Clercq, J., Meyer, I., Vercauteren, M. & Asselman, J. (2024). Mud and organic content are strongly correlated with microplastic contamination in a meandering riverbed. Communications Earth & Environment. 5. Available online at: https://www.nature.com/articles/s43247-024-01613-2 [Accessed on 13/11/2024].

Vorberg, R. (2000). Effects of shrimp fisheries on reefs of *Sabellaria spinulosa* (Polychaeta). ICES Journal of Marine Science. 57, 1416 - 1420.

Webb, K.E., Barnes, D.K.A. & Planke, S. (2009). Pockmarks: Refuges for marine benthic biodiversity. Limnology and Oceanography. 54, 1776 - 1788.

Winklhofer, M. (2009). The physics of geomagnetic-field transduction in animals. IEEE Transactions on magnetics. 45, 5259 - 5265.

Wright, S.R., Lynam, C.P., Righton, D.A., Metcalfe, J., Hunter, E., Riley, A., Garcia, L., Posen, P. & Hyder, K. (2020). Structure in a sea of sand: fish abundance in relation to man-made structures in the North Sea. ICES Journal of Marine Science. 77, 1206-1218. Zhang, C., Yu, Z-g., Zeng, G-m., Jiang, M., Yang, Z-z., Cui, F., Zhu, M-y., Shen, L-q. & Hu, L. (2014). Effects of sediment geochemical properties on heavy metal bioavailability. Environmental International. 73, 270-281.