XLINKS MOROCCO-UK POWER PROJECT

Preliminary Environmental Information Report

Volume 3, Chapter 1: Benthic Ecology

FOR ISSUE
April 2024

xlinks.co

Contents

Tables

Figures (See Volume 3, Figures)

Appendices (See Volume 3, Appendices)

Glossary

Term	Meaning
Landfall	The proposed area in which the offshore cables make landfall in the United Kingdom (come on shore) and the transitional area between the offshore cabling and the onshore cabling. This term applies to the entire landfall area at Cornborough Range, Devon, between Mean Low Water Springs and the Transition Joint Bay inclusive of all construction works, including the offshore and onshore cable routes, and landfall compound(s).
Offshore Cable Corridor	The proposed corridor within which the offshore cables are proposed to be located, which is situated within the United Kingdom Exclusive Economic Zone.
Onshore HVAC Cable Corridor	The proposed corridor within which the onshore High Voltage Alternating Current cables would be located.
Onshore HVDC Cable Corridor	The proposed corridor within which the onshore High Voltage Direct Current cables will be located.
Proposed Development	The element of the Xlinks Morocco-UK Power Project within the UK, which includes the offshore cables (from the UK Exclusive Economic Zone to landfall), landfall site, onshore Direct Current and Alternating Current cables, converter stations, road upgrade works and, based on current assumptions, the Alverdiscott Substation Connection Development.
Xlinks Morocco-UK Power Project	The overall scheme from Morocco to the national grid, including all onshore and offshore elements of the transmission network and the generation site in Morocco. (referred to as the 'Project')
Further Terminology	
Beam trawl	A method of bottom trawling with a net that is held open by a beam, which is generally a heavy steel tube supported by steel trawl heads at each end. Tickler chains or chain mats, attached between the beam and the ground rope of the net, are used to disturb fish and crustaceans that rise up and fall back into the attached net.
Benthic	Associated with or occurring on the bottom of the seabed.
Demersal	Living on or near the seabed.
Electromagnetic Fields (EMF)	EMFs are part of the natural world, and are produced wherever electricity is generated, transmitted, or used.
Habitat Regulations Assessment	An assessment of the likely significant effects on a European site protected by the Conservation of Habitats and Species Regulations 2017.
ICES statistical rectangles	ICES standardise the division of sea areas to enable statistical analysis of data. Each ICES statistical rectangle is '30 min latitude by 1 degree longitude' in size (approximately 30 x 30 nautical miles). A number of rectangles are amalgamated to create ICES statistical areas.
Intertidal area	The area between Mean High Water Springs and Mean Low Water Springs.
Kyoto Protocol	The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its parties to reducing greenhouse gas emissions by setting internationally binding emission reduction targets, implemented primarily through national measures but also via wider market-based mechanism
Maximum Design Scenario	The realistic worst-case scenario, selected on a topic-specific and impact specific basis, from a range of potential parameters for the Proposed Development.
Mean High Water Springs	The height of mean high water during spring tides in a year.
Mean Low Water Springs	The height of mean low water during spring tides in a year.

Term	Meaning
Marine Net Gain	Marine Net Gain builds on the Government's progress with Biodiversity Net Gain (BNG), which applies to terrestrial areas and down to the mean low water mark. Marine Net Gain (MNG) will only be applicable to developments below the Low Water Mark and is intended to cover most new marine developments in English waters.
Marine Conservation Zone(s)	Marine Conservation Zone(s) are marine nature reserves and are areas that protect a range of nationally important, rare or threatened habitats and species.
National Policy Statement(s)	The current national policy statements published by the Department for Energy Security and Net Zero in 2023.
Protected species	A species of animal or plant which it is forbidden by law to harm or destroy.
Ramsar Site	Wetlands of international importance that have been designated under the criteria of the Ramsar Convention. In combination with Special Protection Areas and Special Areas of Conservation, these sites contribute to the national site network.
Special Areas of Conservation (SAC)	A site designation specified in the Conservation of Habitats and Species Regulations 2017. Each site is designated for one or more of the habitats and species listed in the Regulations. The legislation requires a management plan to be prepared and implemented for each Special Area of Conservation to ensure the favourable conservation status of the habitats or species for which it was designated. In combination with Special Protection Areas and Ramsar sites, these sites contribute to the national site network.

Acronyms

Acronym	Meaning
BGS	British Geological Survey
BNG	Biodiversity Net Gain
CBRA	Cable Burial Risk Assessment
CEA	Cumulative Effects Assessment
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CEMP	Construction Environmental Management Plan
CIEEM	Chartered Institute of Ecology and Environmental Management
cSAC	Candidate Special Area of Conservation
DC	Direct Current
DCO	Development Consent Order
DDV	Drop Down Video
Defra	Department for Environment, Food & Rural Affairs
DESNZ	The Department for Energy Security and Net Zero
EA	Environment Agency
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMF	Electromagnetic Fields
EMODnet	European Marine Observation and Data Network
EPUK	Environmental Protection UK
ES	Environmental Statement
ESCA	European Subsea Cables Association

Acronym	Meaning
EU	European Union
FSA	Formal Safety Assessment
GIS	Geographic Information System
GT	Gross Tonnage
HDD	Horizontal Directional Drilling
HOCI	Habitat of Conservation Interest
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
ICES	International Council for the Exploration of the Sea
IEMA	Institute for Environmental Management and Assessment
IMO	International Maritime Organization
INNS	Invasive Non-native Species
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
LAT	Lowest Astronomical Tide
MARPOL	International Convention for the Prevention of Pollution from Ships
MCA	Maritime and Coastguard Agency
MCZs	Marine Conservation Zones
MGN	Marine Guidance Note
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MPA	Marine Protected Area
MPCP	Marine Pollution Contingency Plan
MPS	Marine Policy Statement
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NSIP	Nationally Significant Infrastructure Project
OMU	Other Marine Users
OREI	Offshore Renewable Energy Installation
OS	Ordnance Survey
PDA	Project Development Area
PDE	Project Design Envelope
PEIR	Preliminary Environmental Information Report
pSAC	Possible Special Area of Conservation
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SBP	Sub-bottom Profiler
SOCI	Species of Conservation Interest
SPAs	Special Protection Areas
SSC	Suspended Sediment Concentration
TCE	The Crown Estate

Acronym	Meaning
TSS	Traffic Separation Scheme
TTS	Temporary Threshold Shift
UK	United Kingdom
UKCP18	United Kingdom Climate Projections (2018)
UKHO	United Kingdom Hydrographic Office
UXO	Unexploded Ordnance
WFD	Water Framework Directive
ZOI	Zone of Influence

Units

Units	Meaning
GW	Gigawatt
km	Kilometre
km^2	Square Kilometre
m	Metre
AOD	Above ordnance datum
m/s	Metres Per Second (Speed)
mm	Millimetre
mph	Miles per hour
t	Tonnes
°C	Degrees Celsius

1 BENTHIC ECOLOGY

1.1 Introduction

1.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents the preliminary findings of the Environmental Impact Assessment (EIA) work undertaken to date for the United Kingdom (UK) elements of the Xlinks Morocco-UK Power Project. For ease of reference, the UK elements of the Xlinks Morocco-UK Power Project are referred to in this chapter as the 'Proposed Development'.

1.1.2 This chapter considers the potential impacts and effects of the Proposed Development on benthic ecology during the construction, operation and maintenance and decommissioning phases. Specifically, it relates to the offshore elements of the Proposed Development seaward of Mean High Water Springs (MHWS).

1.1.3 In particular, this PEIR chapter:

- sets out the existing and future environmental baseline conditions, established from desk studies, surveys and consultation undertaken to date;
- presents the potential environmental impacts and effects on all aspects of benthic ecology arising from the Proposed Development, based on the information gathered and the analysis and assessments undertaken to date;
- identifies any assumptions and limitations encountered in compiling the environmental information; and
- highlights any necessary monitoring and/or mitigation measures that could prevent, minimise, reduce or offset the possible environmental effects identified in the EIA process.

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

- Volume 3, Chapter 5: Shipping and Navigation
- Volume 3, Chapter 8: Physical Processes

1.1.5 This chapter also draws upon information contained within Volume 3, Appendix 4.1: Underwater Noise Assessment, of the PEIR, and the Electromagnetic Field (EMF) and Thermal Study (Amplitude Consultants, 2021)

1.1.6 The PEIR will inform pre-application consultation. Following consultation, comments on the PEIR and any refinements in design will be reviewed and taken into account, where appropriate, in preparation of the Environmental Statement that will accompany the application to the Planning Inspectorate for development consent.

1.2 Legislative and Policy Context

Legislation

1.2.1 The following section provides information regarding key legislation that applies to benthic ecology, and which has been considered within the assessment process in this chapter of the PEIR.

International

- Convention on the Conservation of Migratory Species of Wild Animals (the 'Bonn Convention');
- Convention on the Conservation of European Wildlife and Natural Habitats (the 'Bern Convention');
- Marine Strategy Framework Directive 2008 (EU Directive 2008/56/EC).
- Ramsar Convention (1976);
- OSPAR Convention (1992);
- Convention on Biological Diversity (1993);
- Espoo Convention (1997);
- EU Invasive Alien Species Regulation (Regulation No 1143/2014); and
- International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM).

National

- The Conservation of Habitats and Species Regulations 2017 (as amended by the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019);
- Conservation of Offshore Marine Habitats and Species Regulations 2017 (as amended);
- Marine Strategy Regulations 2010
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017;
- Planning Act 2008 (as amended);
- Marine and Coastal Access Act 2009;
- Infrastructure Planning (EIA) Regulations 2017 (as amended);
- Marine Works (EIA) Regulations 2007 (as amended);
- Environment Act 2021;
- Natural Environment and Rural Communities (NERC) Act 2006 (England); and
- Wildlife and Countryside Act (1981 as amended).

Planning Policy Context

1.2.2 The Proposed Development will be located within UK inshore waters and the UK EEZ offshore waters - beyond 12 nautical miles (nm) from the English coast (with the onshore infrastructure located wholly within Devon, England). As set out in Volume 1, Chapter 1: Introduction, of the PEIR, the Secretary of State for the Department for Energy Security and Net Zero (DESNZ) has directed that elements of the Proposed Development are to be treated as development for which development consent is required under the Planning Act 2008, as amended.

National Policy Statements

1.2.3 There are currently six energy National Policy Statements (NPSs), three of which contain policy relevant to the Proposed Development, specifically:

- Overarching NPS for Energy (NPS EN-1) which sets out the UK Government's policy for the delivery of major energy infrastructure (Department for Energy Security & Net Zero 2023a);
- NPS for Renewable Energy Infrastructure (NPS EN-3) (Department for Energy Security & Net Zero 2023b); and
- NPS for Electricity Networks Infrastructure (NPS EN-5) (Department for Energy Security & Net Zero 2023c).

1.2.4 **Table 1.1** sets out key aspects from the NPSs relevant to the Proposed Development, with particular reference to the need for and approach to consenting such infrastructure.

Table 1.1: Summary of relevant NPS policy

Summary of NPS requirement	How and where considered in the PEIR
NPS EN-1	
Para 5.4.17: Where the development is subject to EIA the applicant should ensure that the ES clearly sets out any effects on internationally, nationally, and locally designated sites of ecological or geological conservation importance (including those outside England), on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity, including irreplaceable habitats	The designated sites considered in the assessment are indicated in **Table 1.16**, and key receptors of conservation importance are indicated in **Table 1.17**. Effects of the Proposed Development are considered in **sections 1.8** (construction)**, 1.9** (operation and maintenance) and **1.10** (decommissioning). A HRA Screening Report has been submitted with this PEIR. An MCZ assessment will also be prepared for submission with the ES.
Para 5.16.7: The ES should in particular describe any impacts of the proposed project on water bodies or protected areas (including shellfish protected areas) under the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017	Effects on water bodies or protected areas under the WFD will be considered within a supporting WFD assessment (WFD assessment has been

Summary of NPS requirement	How and where considered in the PEIR
	submitted with this PEIR, see Volume 3, Appendix 1.1).
Para 5.4.23: Energy projects will need to ensure vessels used by the project follow existing regulations and guidelines to manage ballast water	Management of ballast water has been considered in **section 1.6** and **section 1.7**.
Para 5.4.19: The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests	Burial will be the preferred option for the cable protection, and only when full target burial depth is not possible will additional protection be installed. Where additional rock protection is necessitated, this will be placed within the trench wherever possible i.e. above seabed level rock placement is deemed the final option (**Table 1.20)**. Installation of cable protection has the potential to promote local biodiversity if it is colonised by a range of epifaunal organisms. It should be noted, however, that where such change in habitat differs notably from the surrounding habitat, such increases in biodiversity may not be perceived as being beneficial (**section 1.9**).
NPS EN-3	
Para 3.11.32: Applicants should assess the potential of their proposed development to have net positive effects on marine ecology and biodiversity, as well as negative effects.	Burial will be the preferred option for the cable protection, and only when full target depth burial is not possible will additional protection be installed. Where additional rock protection is necessitated, this will be placed within the trench wherever possible i.e. above seabed level rock placement is deemed the final option (**Table 1.20**). Installation of cable protection has the potential to promote local biodiversity if it is colonised by a range of epifaunal organisms. It should be noted, however, that where such change in habitat differs notably from the surrounding habitat, such increases in biodiversity may not be

Summary of NPS requirement	How and where considered in the PEIR
	perceived as being beneficial (**section 1.9**).
Para 3.8.118: Applicants should consult at an early stage of pre-application with relevant statutory consultees, as appropriate, on the assessment methodologies, baseline data collection, and potential avoidance, mitigation and compensation options should be undertaken.	Consultation has been considered in **section 1.3 1.3**.
Para 3.11.27: Applicants should have regard to the specific ecological and biodiversity considerations that pertain to proposed offshore renewable energy infrastructure developments, namely intertidal and subtidal seabed habitats and species.	Key benthic ecology receptors have been considered in **section 1.5**.
Para 3.8.127: Assessments should also include effects such as the scouring that may result from the proposed development and how that might impact sensitive species and habitats.	Scouring has been considered in **section 1.6** and **section 1.9**.
Para 3.8.138: Applicant assessment of the effects of installing cable across the intertidal/coastal zone should demonstrate compliance with mitigation measures identified by The Crown Estate in any plan-level HRA produced as part of its leasing round and include information, where relevant, about: *• any alternative landfall sites that have been considered by the applicant during the design phase and an explanation for the final choice;* *• any alternative cable installation methods that have been considered by the applicant during the design phase and an explanation for the final choice;* *• potential loss of habitat;* *• disturbance during cable installation, maintenance/repairs and removal (decommissioning);* *• increased suspended sediment loads in the intertidal zone during installation and maintenance/repairs;* *• predicted rates at which the intertidal zone might recover from temporary effects, based on existing monitoring data; and* *• Protected sites.*	Effects considered in the PEIR encompass those listed. Effects of the Proposed Development on benthic ecology during construction (installation) have been considered in **section 1.8**, effects during operation have been assessed in **section 1.9**, and effects during decommissioning have been considered in **section 1.10**.
Para 3.8.166: Applicant assessment of the effects on the subtidal environment should include: *• loss of habitat due to foundation type including associated seabed preparation, predicted scour, scour protection and altered sedimentary processes, e.g. sandwave/boulder/UXO clearance;* *• environmental appraisal of inter-array and export cable routes and installation/maintenance methods, including predicted loss of habitat due to predicted scour and scour/cable protection and sandwave/boulder/UXO clearance;* *• habitat disturbance from construction and maintenance/repair vessels' extendable legs and anchors;* *• increased suspended sediment loads during construction and from maintenance/repairs;* *• predicted rates at which the subtidal zone might recover from temporary effects;* *• potential impacts from EMF on benthic fauna;* *• protected sites; and* *• potential for invasive/non-native species introduction*	Effects considered in the PEIR encompass those listed. Effects of the Proposed Development on benthic ecology during construction (installation) have been considered in **section 1.8**, effects during operation have been assessed in **section 1.9**, and effects during decommissioning have been considered in **section 1.10**.

Summary of NPS requirement	How and where considered in the PEIR
NPS EN-5	
Para 2.14.2: In the assessments of their designs, applicants should demonstrate: *• how environmental, community and other impacts have been considered and how adverse impacts have followed the mitigation hierarchy i.e. avoidance, reduction and mitigation of adverse impacts through good design; and* *• how enhancements to the environment post construction will be achieved including demonstrating consideration of how proposals can contribute towards biodiversity net gain (as set out in Section 4.5 of EN-1 and the Environment Act 2021), as well as wider environmental improvements in line with the Environmental Improvement Plan and environmental targets (paragraph 4.2.29 of EN-1).In addition, all applicants are encouraged to demonstrate how the construction planning for the proposals has been coordinated with that for other similar projects in the area on a similar timeline.*	Proposed mitigation measures adopted as part of the Proposed Development are indicated in **section 1.7** Environmental, community and other impacts from the Proposed Development on benthic ecology have been considered in **section 1.8, section 1.9 and section 1.10.** Cumulative impacts with other plans and projects have been considered in **section 1.11**.

Marine Policy

UK Marine Policy Statement

1.2.5 The UK Marine Policy Statement was adopted in 2011 and provides the policy framework for the preparation of marine plans and establishes how decisions affecting the marine area should be made (HM Government, 2011).

1.2.6 The high-level marine objective "Living within environmental limits" includes the following requirements which are relevant to benthic ecology:

- Biodiversity is protected, conserved and where appropriate recovered and loss has been halted;
- Healthy marine and coastal habitats occur across their natural range and are able to support strong, biodiverse biological communities and the functioning of healthy, resilient and adaptable marine ecosystems;
- Our oceans support viable populations of representative, rare, vulnerable, and valued species.

South West Inshore and South West Offshore Marine Plans

1.2.7 **Table 1.2** sets out a summary of the specific policies set out in the South West Inshore and South West Offshore Marine Plans (MMO, 2021) relevant to this chapter.

Table 1.2: Summary of inshore and offshore marine plan policies relevant to this chapter

Policy	Key provisions	How and where considered in the PEIR
SW-MPA-1	Proposals that may have adverse impacts on the objectives of marine protected areas must demonstrate that they will, in order of preference: a) avoid b) minimise c) mitigate - adverse impacts, with due regard given to statutory advice on an ecologically coherent network.	The designated sites considered in the assessment are indicated in **Table 1.16**, and key receptors of conservation importance are indicated in **Table 1.17**. Effects of the Proposed Development are considered in **sections 1.8, 1.9 and 1.10.** A HRA Screening Report has been submitted with this PEIR. An MCZ assessment will also be prepared for submission with the ES.
SW-BIO-1	Proposals that may have significant adverse impacts on the distribution of priority habitats and priority species must demonstrate that they will, in order of preference: a) avoid b) minimise c) mitigate - adverse impacts so they are no longer significant d) compensate for significant adverse impacts that cannot be mitigated.	Key receptors of conservation importance are indicated in **Table 1.17** and **section 1.5**. Impacts from the Proposed Development on priority habitats and species have been considered in **section 1.8**, **section 1.9** and **section 1.10**.
SW-BIO-2	Proposals that enhance or facilitate native species or habitat adaptation or connectivity, or native species migration, will be supported. Proposals that may cause significant adverse impacts on native species or habitat adaptation or connectivity, or native species migration, must demonstrate that they will, in order of preference: a) avoid b) minimise c) mitigate - adverse impacts so they are no longer significant d) compensate for significant adverse impacts that cannot be mitigated.	The proposed cable route has avoided interaction with protected sites as far as possible, and none of the footprint of the Offshore Cable Corridor is within a protected site (**section 1.5**). Any areas of Annex I habitat (outside protected sites) will be avoided via micro-routing of the cable corridor as far as possible (**section 1.7**). The potential for introduction of Invasive Non-Native Species (INNS) has been assessed in **sections 1.8**, **1.9** and **1.10**.
SW-BIO-3	Proposals must take account of the space required for coastal habitats, where important in their own right and/or for ecosystem functioning and provision of ecosystem services, and demonstrate that they will, in order of preference: a) avoid b) minimise c) mitigate	Effects on coastal habitats due to the Proposed Development have been considered in **section 1.8**.

Policy	Key provisions	How and where considered in the PEIR
	d) compensate for - net habitat loss.	
SW-HAB-1	Proposals that may have direct adverse impacts on deep sea habitats must demonstrate that they will, in order of preference: a) avoid b) minimise c) mitigate - direct adverse impacts on deep sea habitats.	Effects on deep sea habitats due to the Proposed Development have been considered in **sections 1.8**, **1.9** and **1.10**.
SW-INNS-1	Proposals must put in place appropriate measures to avoid or minimise significant adverse impacts that would arise through the introduction and transport of invasive non-native species, particularly when: 1) moving equipment, boats or livestock (for example fish or shellfish) from one water body to another 2) introducing structures suitable for settlement of invasive non-native species, or the spread of invasive non-native species known to exist in the area.	The potential effects of INNS on benthic ecology receptors due to the Proposed Development have been assessed in **sections 1.8**, **1.9** and **1.10**. Proposed mitigation measures adopted as part of the Proposed Development to reduce the risk of introduction and spread of INNS are indicated in **section 1.7**
SW-UWN-2	Proposals that result in the generation of impulsive or non-impulsive noise must demonstrate that they will, in order of preference: a) avoid b) minimise c) mitigate - adverse impacts on highly mobile species so they are no longer significant. If it is not possible to mitigate significant adverse impacts, proposals must state the case for proceeding.	The potential effects of underwater noise and vibration on benthic ecology receptors due to the Proposed Development have been assessed in **section 1.8.**

Local Planning Policy

1.2.8 The onshore elements of the Proposed Development are located within the administrative area of Torridge District Council. The relevant local planning policies applicable to benthic ecology based on the extent of the study areas for this assessment are summarised in **Table 1.3**.

Table 1.3: Summary of local planning policy relevant to this chapter

Policy	Key provisions	How and where considered in the PEIR
North Devon and Torridge Local Plan 2011-2031		
ST09: Coast and Estuary strategy	The integrity of the coast and estuary as an important wildlife corridor will be protected and enhanced. The importance of the undeveloped coastal, estuarine and marine environments, including the North Devon Coast Areas of Outstanding Natural Beauty, will be recognised through supporting designations, plans and policies. The undeveloped character of the Heritage Coasts will be protected	Effects on benthic ecology receptors due to the Proposed Development have been assessed in **sections 1.8, 1.9, and 1.10**.
ST14: Enhancing Environmental Assets	The quality of northern Devon's natural environment will be protected and enhanced by ensuring that development contributes to: (a) providing a net gain in northern Devon's biodiversity where possible, through positive management of an enhanced and expanded network of designated sites and green infrastructure, including retention and enhancement of critical environmental capital; (b) protecting the hierarchy of designated sites in accordance with their status; (c) conserving European protected species and the habitats on which they depend; … (h) recognising the importance of the undeveloped coastal, estuarine and marine environments through supporting designations, plans and policies that aim to protect and enhance northern Devon's coastline; (i) conserving and enhancing the robustness of northern Devon's ecosystems and the range of ecosystem services they provide.	Effects on benthic ecology receptors due to the Proposed Development have been assessed in **sections 1.8, 1.9, and 1.10**.

North Devon Biosphere Reserve

1.2.9 The Proposed Development is located within the North Devon Biosphere Reserve, which is recognised under UNESCO's Man and the Biosphere (MAB) Programme and designated as an area for testing and demonstrating sustainable development on a sub-regional scale.

1.2.10 The North Devon Biosphere Reserve consists of three zones; a core zone centred around Braunton Burrows SAC / SSSI, a buffer zone consisting of the Taw Torridge Estuary (as far as Barnstaple and Bideford), and a transition zone formed by the catchment area of the rivers and streams that drain to the North Coast of Devon in addition to an area of sea as far out as Lundy.

1.2.11 The Biosphere Reserve is overseen by the North Devon Biosphere Reserve Partnership, which is a collaboration of 26 partnership organisations who work to deliver sustainable development through direct action, through advocacy and providing advice. The non-statutory 'North Devon Biosphere Reserve Strategy for Sustainable Development 2014 to 2024' (NDB undated) provides a context for stakeholders to deliver programmes and plans in support of the sustainable development of the Biosphere Reserve.

1.2.12 Within the North Devon Biosphere Reserve, non-statutory programmes and plans relevant to benthic ecology include:

- North Devon Marine Natural Capital Plan
- North Devon Marine Nature Recovery Plan 2022-2027

1.2.13 The extent to which the Proposed Development impacts on the North Devon Biosphere Reserve and its relevant programmes / plans has been considered in this benthic ecology chapter, and consultation will take place with the North Devon Biosphere Reserve Partnership ahead of ES stage to further characterise any potential impacts. **Table 1.4** presents a summary of the provisions set out in the North Devon Marine Natural Capital plan (North Devon Biosphere Reserve, 2020) relevant to this chapter.

Table 1.4: Summary of North Devon UNESCO Biosphere marine policies relevant to this chapter

Policy	Key provisions / Description	How and where considered in the PEIR
North Devon Marine Nature Recovery Plan 2022-2027		
North Devon Marine Nature Recovery Plan	This Marine Nature Recovery Plan covers the biodiversity found in the coastal, estuarine and marine areas of the North Devon Biosphere Reserve and has been developed in order to deliver against relevant international, national and local policies and initiatives. The plan highlights habitats of importance which includes coastal and estuarine rocky intertidal habitats, coastal and estuarine sediment intertidal habitats, saltmarsh and saline reedbeds, subtidal rocky habitats, subtidal vegetated habitats, and transitional and coastal waters. Benthic species of importance indicated include the Celtic sea slug, gold star coral, sunset cup coral and pink sea fan, with the plan recommending actions that need to be taken forward to support their recovery.	A range of species and habitats of conservation importance have been identified in **section 1.5** and are indicated in **Table 1.17.** Effects on benthic ecology receptors due to the Proposed Development have been assessed in **sections 1.8, 1.9,** and **1.10**.
Marine Natural Capital Plan		
Marine Natural Capital Plan PL07: *Support proposals that identify habitat extents outside MPAs that enhance ecological connectivity and seek*	*Identifying habitat extents outside MPAs that enhance ecological connectivity would benefit site level management approaches to underpin flows of ecosystem benefits. PL07 supports ongoing research and monitoring of natural capital assets in North Devon*	The baseline benthic ecology characterisation of the Offshore Cable Corridor will contribute to the ongoing understanding of the wider biosphere area. A range of species and habitats of conservation importance have been identified in **section 1.5** and are indicated in **Table 1.17.**

Policy	Key provisions / Description	How and where considered in the PEIR
to increase extent and / or condition of these assets where it has been identified as 'at risk'.	*to improve understanding of the flow of ecosystem services for enhancement of marine natural capital.*	Effects on benthic ecology receptors due to the Proposed Development have been assessed in **sections 1.8, 1.9,** and **1.10**.
Marine Natural Capital Plan PL08: *Set management priorities that will rapidly enable 'recovery' of estuarine and coastal intertidal habitats within MPAs, where this conservation objective exists.*	*In the North Devon Marine Natural Capital Plan area these habitats, particularly saltmarsh as well as shallow subtidal reefs and sediments, support multiple ecosystem benefits including food provision, sea defence, healthy climate, and, tourism and recreation. PL08 recognises the importance of these habitats and focuses management measures towards delivering multiple ecosystem service benefits.*	A range of species and habitats of conservation importance have been identified in **section 1.5** and are indicated in **Table 1.17.** Effects on benthic ecology receptors due to the Proposed Development have been assessed in **sections 1.8, 1.9,** and **1.10**.
Marine Natural Capital Plan PL09: *Support MPA management priorities that consider the wider ecological structures and processes that have the potential for 'recovery' and 'renewal' beyond the delineated boundaries of features of conservation interest within an MPA.*	*Environmental net gain for natural capital may be achieved via MPA management though a more ambitious approach to marine biodiversity conservation. PL09 supports proposals that seek a reduction in pressure across the whole site instead of considering only the designated features, along with the identification of thresholds for sustainable use.*	A range of species and habitats of conservation importance have been identified in **section 1.5** – across the entire Offshore Cable Corridor (not limited to MPAs - and are indicated in **Table 1.17.** Effects on benthic ecology receptors due to the Proposed Development have been assessed in **sections 1.8, 1.9,** and **1.10**.
Marine Natural Capital Plan PL10: *Support the implementation of management measures that reduce pressure across subtidal sediments*	*Deeper subtidal habitats provide multiple ecosystem service benefits including food provision and water quality. These habitat assets make up a significant proportion of the plan area but very large extents of these deeper offshore habitats are in an impactedcondition, both within and outside MPAs, due to previous interactions with abrasive pressure from demersal fishing activities. PL10 recognises that management must consider improving the condition of this habitat.*	A range of species and habitats of conservation importance have been identified in **section 1.5** and are indicated in **Table 1.17.** Effects on benthic ecology receptors due to the Proposed Development have been assessed in **sections 1.8, 1.9,** and **1.10**. Commercial fisheries activities are described and assessed in Volume 3, Chapter 3: Commercial Fisheries, of this PEIR.

1.3 Consultation and Engagement

1.3.1 In January 2024, the Applicant submitted a Scoping Report to the Planning Inspectorate, which described the scope and methodology for the technical studies being undertaken to provide an assessment of any likely significant effects for the construction, operational and decommissioning phases of the Proposed Development. It also described those topics or sub-topics which are proposed to be scoped out of the EIA process and provided justification as to why the Proposed Development would not have the potential to give rise to significant environmental effects in these areas.

1.3.2 Following consultation with the appropriate statutory bodies, the Planning Inspectorate (on behalf of the Secretary of State) provided a Scoping Opinion on 07 March 2024. Key issues raised during the scoping process which are specific to benthic ecology are listed in

1.3.3 **Table 1.5**, together with details of how these issues have been addressed within the PEIR.

Table 1.5: Summary of Scoping Responses

Comment	How and where considered in the PEIR
Planning Inspectorate	
Several aspect chapters in the Scoping Report refer to fixed distance study areas with no explanation as to why these have been selected. The ES should ensure the study area for each aspect reflects the Proposed Development's ZoI and the impact assessment should be based on the ZoI from the Proposed Development with reference to potential effect pathways. Clear justification should be provided to support any distances applied.	The Study Area is presented in paragraph 1.4.6 and Volume 3, Figure 1.1, of the PEIR. A fixed distance study area of 5 km has been used for the full length of the cable route. This is a precautionary distance fully encompassing the ZoI for suspended sediment dispersion (maximum distance of 3.9 km determined across all locations) which is the impact with the greatest zone of influence (ZoI) (Volume 3, Appendix 8.1, High Level Assessment of Sediment Dispersion).
The Inspectorate acknowledges that data and knowledge regarding the baseline environment exists for the offshore area in which the Proposed Development would be located. The Inspectorate understands the benefits of utilising this information to supplement site-specific survey data but advises that suitable care should be taken to ensure that the information in the ES remains representative and fit for purpose. The Applicant should make effort to agree the suitability of information used for the assessments in the ES with relevant consultation bodies.	Data and information from desk-based review was used to supplement data from site-specific surveys when describing the baseline environment in the Scoping Report. These data were reviewed again to ensure suitability of the information to inform the assessment in the PEIR, with information updated in the PEIR where appropriate. It will also be reviewed for the ES to ensure that the most up to date information available is taken into account, with baseline data sources to be agreed with relevant consultation bodies prior to the ES.
It is noted that the Scoping Report includes consideration of potential transboundary effects in relation to benthic ecology. The Inspectorate recommends that the ES should identify whether the Proposed Development has the potential for significant transboundary effects, and if so, what these are, and which EEA States would be affected. The Inspectorate will undertake a transboundary screening on behalf of the SoS in due course.	Transboundary impacts in relation to Benthic Ecology are considered in **section 1.12**.
The Inspectorate notes that no justification is presented in the Scoping Report for the proposal to scope direct habitat loss out during operation (repair) and decommissioning (in situ). It is also noted that the potential for a change in	In this PEIR the assessment for the impact 'Temporary habitat loss/disturbance' considers any direct habitat loss during operation (repair) as a result of any de-burial and re-burial of cable failure points (**Table 1.19**, **section 1.9**).

Comment	How and where considered in the PEIR
hydrodynamic regime from localised areas of scour is scoped into the assessment.	The assessment for the impact 'Long-term habitat loss/change' considers any direct habitat loss during decommissioning if the cable was left in situ (Table 1.19, **section 1.10**). Effects of changes in hydrodynamic regime are assessed in **section 1.9.**
The Inspectorate considers that there is a possibility for localised scour due to the presence of the offshore cable and cable protection (if required), which could also result in direct habitat loss. This matter should be considered in the assessment, where likely significant effects could occur, or provide evidence demonstrating agreement with the relevant consultation bodies that significant effects are not likely to occur.	The assessment for the impact 'Change in hydrodynamic regime (scour & accretion)' considers the potential for scour due to the presence of the offshore cable and cable protection (if required) (**Table 1.19**, **section 1.9**).
The Inspectorate notes that no justification is presented in the Scoping Report for the proposal to scope physical habitat change during decommissioning (if the cable is removed) out and that paragraphs 4.12.11 to 4.12.14 of the Scoping Report provide limited information about the proposed approach to decommissioning if the cable is removed, beyond it being similar to installation. It is unclear whether the armour protection would be fully removed and any works that might be required to reinstate habitat affected during operation. The Inspectorate does not have sufficient evidence to exclude the possibility of likely significant effects and this matter should be scoped into the assessment, where likely significant effects could occur.	In this PEIR the assessment for the impact 'Temporary habitat loss/disturbance' considers any habitat loss during decommissioning if the cable is removed (**section 1.10**) which is primarily based on the assessment for the construction phase (**section 1.8**). The decommissioning project description has been updated in this PEIR, containing further detail compared to the Scoping Report (Volume 1, Chapter 3 of this PEIR). It is anticipated the effects of any decommissioning activities would be less than for the construction phase, with e.g. footprint of disturbance less than construction (as removal of e.g. a section of cable is anticipated to result in less disturbance than methods such as seabed clearance or trenching used to install it).
The Inspectorate notes that no justification is presented in the Scoping Report to scope out physical disturbance and displacement (disturbance of bottom sediments) and changes to water quality (resuspension of sediments and increased sediment loading) during operation (excluding operational repair) and decommissioning (if the cable is left in situ). However, it considers that a pathway for effect from these matters is unlikely to arise during operation and decommissioning from the presence of the offshore cable, the majority of which is predicted to be buried as described at paragraph 4.7.38 of the Scoping Report, and on the basis that there would be no physical works or significant vessel movements. The Inspectorate agrees that these matters can be scoped out of the assessment on that basis.	'Temporary habitat loss/disturbance' and 'Temporary increase in suspended sediments and sediment deposition' have been scoped out of assessment for operation (excluding operational repair) and decommissioning (if cable is left in situ), (**Table 1.19**).
The Inspectorate notes that no justification is presented in the Scoping Report for the proposal to scope out changes to water quality (release of hazardous substances) during operation (excluding operational repair) and	'Changes to water quality (release of hazardous substances from sediments)' has been scoped out of assessment for operation (excluding operational repair) and decommissioning (if cable is left in situ), (**Table 1.19**).

Comment	How and where considered in the PEIR
decommissioning (if the cable is left in situ). However, it considers that a pathway for effect from these matters is unlikely to arise during operation (excluding repair) and decommissioning (in situ) given the limited activities involved and the infrequent vessel movements along the offshore cable corridor, as described in Chapter 4 of the Scoping Report respectively. The Inspectorate agrees that these matters can be scoped out of the assessment on that basis.	
The Inspectorate agrees that the introduction and spread of INNS during operation (excluding operational repair) and decommissioning (if the cable is left in situ) can be scoped out of the ES on the basis that the Applicant has committed to embedded mitigation measures including the production and implementation of a biosecurity plan with incorporation of biosecurity risk assessment during all phases of the Proposed Development (Table 4.8.2 of the Scoping Report). The Scoping Report also indicates that vessel movements during operation (excluding repair) would be minimal with a single vessel per year for the first five years, and five yearly thereafter (Paragraph 4.11.11).	'Introduction and spread of INNS' has been scoped out of assessment for operation (excluding operational repair), and decommissioning (if the cable is left in situ), (**Table 1.19**). Embedded mitigation measures including the production and implementation of a biosecurity plan with incorporation of biosecurity risk assessment are presented in **Table 1.20**.
An outline of the biosecurity plan and risk assessment should be submitted with the DCO application. It should describe how available best industry practice would be incorporated into the plan. The ES should also explain the proposed measures and how these are secured through DCO requirements (or other suitably robust methods). Effort should be made to agree such measures with relevant consultation bodies.	An outline biosecurity plan will be included as part of the DCO application which will describe how available industry best practice would be incorporated into the plan. A standalone outline offshore biosecurity plan is intended to be submitted as an ES appendix; which will be finalised by the Principal Contractor alongside the final CEMP). Consultation will be held with relevant consultation bodies in advance of ES submission to discuss proposed measures.
The Scoping Report states that changes could occur from presence of rock berms, which may be required for cable protection at crossings or in isolated hard seabed areas during operation. The Inspectorate notes the predicted construction timetable and two offshore cable laying phases as described at Paragraphs 4.7.10 to 4.7.12 of the Scoping Report. It appears possible that rock berms would be in place for extended periods of construction activity in advance of the cable becoming operational and that mitigation may also be required during this period. The Inspectorate advises that the potential for change to the hydrodynamic regime due to the presence of cable protection should be assessed for the phases during which it is likely to give rise to significant effects and that the ES should describe any mitigation required and explain how this would be secured in the DCO.	Acknowledging that the separate bipoles / cable bundles may be installed in separate construction years, there is potential for hydrodynamic and scour effects to commence prior to completion of the 'construction phase'. However, consistent with the further PINS comment below (*The Inspectorate is content for the effect of the introduction of hard substrate to be considered during the operational phase and therefore agrees this matter can be scoped out of the construction stage assessment*) the impact 'Change in hydrodynamic regime (scour & accretion)' on benthic ecology receptors has been assessed for the operational phase but not the construction phase. Effects during the operation phase will effectively be worst case with all seabed rock protection and crossings in place.

Comment	How and where considered in the PEIR
The Inspectorate agrees that there is unlikely to be an effect pathway from change in hydrodynamic regime (scour and accretion) during operational repair and this matter can be scoped out of assessment.	‘Change in hydrodynamic regime (scour & accretion)’ has been scoped out of assessment for operation (repair), (**Table 1.19**).
The Inspectorate does not have sufficient evidence to exclude the possibility of likely significant effects from change in hydrodynamic regime (scour and accretion) during decommissioning (if the cable is removed) and this matter should be scoped into the assessment, where likely significant effects could occur.	‘Change in hydrodynamic regime (scour & accretion)’ has been scoped in to assessment for decommissioning (if the cable is removed), (**Table 1.18**).
The Inspectorate does not agree to scope out underwater noise and vibration during operation (including repair) and decommissioning (both options) as no supporting evidence has been provided in the Scoping Report. It is unclear whether underwater noise and vibration could be generated during these phases of the Proposed Development for example from vessel movements, cable repair and/ or reburial, and cable removal activity and whether there are noise and/ or vibration sensitive benthic receptors that could be affected by these works. The ES should include an assessment of underwater noise, where likely significant effects could occur, or provide evidence demonstrating agreement with the relevant consultation bodies that significant effects are not likely to occur.	For benthic ecology, underwater noise and vibration has only been assessed for the HDD aspects of construction with justification provided in **section 1.8**. The noise levels that would be generated by construction vessels, by cable laying equipment and during boulder clearance would be very low compared to e.g. much louder sources of noise such as pile driving (an impact which is not associated with the Proposed Development), and any effects on benthic invertebrates are anticipated to be minimal. NE and JNCC have not raised any concerns about underwater noise and vibration in relation to benthic ecology in either their Scoping opinion or in their meetings with the Applicant at PEIR stage.
The Inspectorate notes that no justification is presented in the Scoping Report for the proposal to scope out sediment heating and electromagnetic fields (EMFs) from the cable during construction and decommissioning (both options). However, the Inspectorate considers that a pathway for effect from these matters would only arise when the cable is operational and live, and as such significant effects are not likely to occur during construction and decommissioning. The Inspectorate agrees that these matters can be scoped out of the assessment.	Consideration of sediment heating and EMFs has been scoped out of assessment for construction and both decommissioning options (**Table 1.18**).
The CIEEM guidelines for Ecological Impact Assessment for Terrestrial, Freshwater and Coastal Environments (2018) was updated in April 2022 as version 1.2. The assessment should refer to the most recent iteration of the guidelines as relevant.	The updated CIEEM guidelines have been referred to within the PEIR but they are still referenced as 2018 (as specified in the 2022 update). This has been referenced as ‘CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (version 1.2 – Updated April 2022)’ within the reference list in **section 1.15**.
Whilst the Inspectorate agrees that suspended sediment carried in plumes is likely to be pathway resulting in the greater spatial extent, it is noted that no survey or modelling evidence has been presented in the Scoping Report to explain how the proposed 15km buffer relates to the potential extent of suspended sediment plumes and/ or	The Study Area is presented in paragraph 1.4.6 and Volume 3, Figure 1.1, of the PEIR. A fixed distance study area of 5 km has been used for the full length of the cable route. This is a precautionary distance fully encompassing the ZoI for suspended sediment dispersion (maximum distance of 3.9 km across all locations) which is the impact with the greatest ZoI

Comment	How and where considered in the PEIR
whether there is potential for effects to extend beyond this including to designated sites with benthic features located outside of the 15km buffer. Section 8.9 of the Scoping Report proposes a 30km buffer for physical processes. The ES should clearly identify and justify the final study area applied to the assessment of effects on benthic ecology, based on the ZoI and considering relevant guidance.	(Volume 3, Appendix 8.1, High Level Assessment of Sediment Dispersion).
Effort should be made to agree whether modelling is required to identify the ZoI, together with scope and extent of any modelling, with relevant consultation bodies.	The methods for the semi-empirical approach used to estimate the ZoI for suspended sediment dispersion have been provided to NE, the MMO and JNCC for comment (methods and results are in Volume 3, Appendix 8.1, High Level Assessment of Sediment Dispersion).
The Scoping Report describes site-specific benthic surveys that have been carried out to inform the baseline. In the absence of information on the rationale behind the approach to sampling and the area covered by the survey, it is difficult for the Inspectorate to understand if the baseline data is likely to be adequate. The ES should either demonstrate that the adequacy of the baseline data has been agreed through consultation with relevant consultation bodies (with supporting information eg meeting minutes) or present a detailed justification as to why it is considered adequate.	Site-specific subtidal benthic surveys were conducted by GEOxyz between August and October 2023. The survey design consisted of a total of 61 camera transects and 51 grab sample stations covering the length of the Offshore Cable Corridor. Sampling locations were informed by geophysical survey. Data was obtained for the distribution of seabed habitats and associated fauna within the survey area, including assessment of the presence or absence of potential habitats/species of conservation importance including Annex I habitats. Additionally, water profiling was also conducted at each target location. Reports outlining methods and survey results have been provided to NE, the MMO and JNCC for information ahead of PEIR consultation. An intertidal survey will be conducted to provide additional data for the intertidal environment in the vicinity of the HDD works to inform the assessment in the ES.
In relation to site-specific survey data, the Applicant should ensure the baseline is adequately understood for the purposes of impact assessment and to inform preparation of the cable burial risk assessment, and development of any necessary mitigation measures thereafter.	See response to comment directly above. Site-specific survey data has been collected to inform the assessment and to inform preparation of the cable burial risk assessment, and development of any necessary mitigation measures.
Section 8.2 of the Scoping Report identifies several SACs and MCZs within the study area, but these are not referred to as receptors for consideration in the assessment in Table 8.2.5. For the avoidance of doubt, the potential for likely significant effects to designated MCZ and SAC, and relevant benthic ecology features, should be considered in the impact assessment.	Features of SACs and MCZs identified within the study area (Table 1.17) have been considered as key receptors for consideration within the assessment (**Table 1.18**). A HRA Screening Report will be submitted with the PEIR. An MCZ assessment will also be prepared for submission with the ES.

Comment	How and where considered in the PEIR
The assessment should include reference to, and consideration of, the conservation objectives for the MCZ. The Applicant's attention is drawn to the comments of NE and the JNCC (Appendix 2 of this Scoping Opinion), which highlight the availability of further information about MCZ.	Benthic ecology features of MCZs within the ZoI of the Proposed Development are outlined in **Table 1.17**. An indication of potential effects on MCZ features is provided in the PEIR and an MCZ assessment will also be prepared for submission with the ES.
For the SACs, cross-reference can be made to information within a HRA Report(s) to avoid duplication.	The PEIR indicates that potential effects on SAC features are indicated in the HRA Screening report accompanying the PEIR (**section 1.8)**.
Where cable protection is required, the Inspectorate advises that the ES should identify the options available and provide an assessment of the likely significant effects that would arise from installation of the selected option (or options if flexibility is sought), including impacts from secondary scouring. The ES should clearly describe any mitigation measures relied on to avoid significant effects on benthic receptors including SACs and MCZs and explain how the measures would be secured.	The impact 'Temporary habitat loss/disturbance' has been considered for installation of cable protection (**section 1.8**). For the assessment of effects of cable protection during operation the impact 'Long-term habitat loss/change' has been considered (**section 1.9)**. Mitigation measures to avoid significant effects on benthic ecology receptors are described in Table 1.20. A high level scour assessment has been provided in this PEIR and a scour assessment will be presented in the ES which will build on the recent estimates of bed current velocities and the calculations of sediment mobilisation potential.
The Inspectorate is content for the effect of the introduction of hard substrate to be considered during operational phase and therefore agrees this matter can be scoped out of the construction stage assessment. The ES should however consider the removal of subsequent hard substate in the decommissioning (removal) phase, where likely significant effects could occur, or provide evidence demonstrating agreement with the relevant consultation bodies that significant effects are not likely to occur.	The impacts 'Long-term habitat loss/change' and 'Change in hydrodynamic regime (scour & accretion)' associated with the introduction of hard substrata have been scoped out of the construction phase. However, they have been assessed for the operational phase in **section 1.9**. For this PEIR, a precautionary approach to decommissioning (removal) impacts has been adopted where it is assumed impacts will be equivalent to those associated with the construction phase (despite likely reduced magnitude of impact in many instances); c.f. Volume 1, Chapter 3 for project description.
The impact assessment should be informed by plume modelling. The ES should clearly describe the modelling undertaken to inform the impact assessment and seek to agree the scope of the physical process modelling with relevant consultation bodies, such as JNCC, NE and the MMO.	A semi-empirical approach has been used to estimate the ZoI for suspended sediment dispersion. The methods have been provided to NE, the MMO and JNCC for comment. At time of PEIR finalisation Natural England have confirmed scope of sediment dispersion modelling as appropriate.
The ES should assess impacts from climate change, including extreme weather events over the construction and decommissioning periods, where significant effects are likely to occur and describe and secure any relevant mitigation measures.	The impacts of climate change have been considered within the future baseline conditions section (**section 1.5**).
The ES should set out the methodologies used to explain any departure from the proposed approach where professional judgement is applied. Outputs from other assessments should	The impact assessment methodology is presented in **section 1.4**. Criteria for sensitivity and magnitude have been informed by previous assessments.

Comment	How and where considered in the PEIR
be clearly explained where these have been applied.	
Where significance criteria are not explicitly defined within the guidance, the ES should clearly set out where deviation from guidance has occurred and professional judgement has been applied.	The impact assessment methodology is presented in **section 1.4**. Criteria for sensitivity and magnitude have been informed by previous assessments.
The Inspectorate agrees that likely significant effects arising from residues and emissions (eg dust, pollutants, light, noise, vibration) are to be assessed in the relevant aspect chapters of the ES and a standalone aspect chapter for residues and emissions is not required.	This benthic ecology chapter includes consideration of construction phase 'emissions' of noise and vibration and suspended sediments (**section 1.8**) and operational phase 'emissions' of EMF and sediment heating (**section 1.9**).
The Inspectorate notes that various aspect chapters in the Scoping Report do not clearly identify those impacts scoped-in to the assessment that include an assessment of major accidents and disasters. The Inspectorate advises that the ES ensures clarity on what has been considered within the technical assessments. The Inspectorate would expect an overarching section in the ES which explains how potential impacts have been identified and where in the ES the assessment of their effects is presented.	In terms of potential major accidents, this PEIR chapter includes consideration of 'Accidental pollution' (**sections 1.8, 1.9 and 1.10**).
The Scoping Report confirms that heat generated during the operation and maintenance of the Proposed Development (eg heat generated by offshore and onshore cables) will be considered within the relevant aspect chapters, including Benthic Ecology, Fish and Shellfish Ecology; and Commercial Fisheries. However, activities during construction and decommissioning of the Proposed Development are unlikely to generate significant levels of heat. The Inspectorate agrees that activities during construction and decommissioning are unlikely to result in significant environmental effects and can be scoped out of the assessment.	'Sediment heating' has been scoped in to assessment of the operation and maintenance phase only (**section 1.9**).
The Scoping Report confirms that EMFs generated during the operation of the Proposed Development will be considered in the relevant aspect chapters, including benthic ecology, and would not be included in a standalone ES chapter in respect of heat and radiation. The Inspectorate is content with this approach.	EMF effects have been scoped in to assessment of the operation and maintenance phase only (**section 1.9**).
Site-specific survey data: The Inspectorate advises that effort should be made to agree the scope and method of any future survey work with relevant consultation bodies, including the JNCC, NE and the Marine Management Organisation (MMO).	The Proposed Development benefits from extensive benthic survey data which is deemed sufficient to inform the PEIR (c.f. 'Site-Specific Surveys' section of this PEIR chapter). Additional geophysical survey data may be collected as part of UXO identification and characterisation surveys; the scope of these surveys would be agreed with the MMO (and other relevant bodies). Any such surveys

Comment	How and where considered in the PEIR
	would be undertaken prior to construction and under separate marine licence (approach confirmed by recent MMO consultation discussions); c.f. Volume 3, Chapter 4: Marine Mammals and Sea Turtles. Similarly, any additional geophysical surveys required for additional characterisation of unknown archaeological features (following Wessex Archaeology review of existing data), would be designed in consultation with statutory bodies, including Historic England (c.f. Volume 3, Appendix 7.2 of this PEIR: Outline Offshore Archaeological Written Scheme of Investigation).
Joint Nature Conservation Committee (JNCC)	
We note that the project passes through the following sites designated for nature conservation: • East of Haig Fras Marine Conservation Zone (MCZ); • South-West Approaches to Bristol Channel MCZ; • Lundy Sand Special Area of Conservation (SAC); • Lundy MCZ; • Bristol Channel Approaches SAC; • North West of Lundy MCZ; and • Bideford to Foreland Point MCZ. The East of Haig Fras MCZ is an offshore site and so JNCC is the responsible agency for this site. The South West Approaches to the Bristol Channel MCZ and Bristol Channel Approaches SAC are jointly managed sites between Natural England, Natural Resources Wales (in the case of Bristol Channel Approaches SAC) and JNCC. JNCC defer to Natural England for comments on the remaining sites as they are the responsible agency.	Designated sites with benthic ecology features which overlap with the Benthic Ecology Study Area are presented in **Table 1.17** and are: • Taw-Torridge Estuary SSSI; • Lundy SAC; • Bideford to Foreland Point MCZ; • South West Approaches to Bristol Channel MCZ; and • East of Haig Fras MCZ The only feature of Lundy MCZ is spiny lobster which is mentioned in **Table 1.16**, but a footnote has been added to indicate it is covered by the Fish and Shellfish PEIR chapter (**Table 1.16**).
Whilst reviewing the Scoping Report we found some of the figures in chapters difficult to understand as the text was too small. For example, the legend on Figure 8.2.3 cannot be read as the text is too small.	Noted. Figures have been provided separately to the main document for the PEIR (see Appendix 3) which means they can be more readily enlarged making text easier to read.
We note that the Applicant has allowed for a 500m corridor within which they aim to microroute the cable following interpretation of geophysical and geotechnical survey results. We would encourage the Applicant to consider surveying and potentially micro-routing outside of this 500m corridor if sensitive habitat is found to cover the width of this 500m corridor. In some situations, the habitat extent may only extend to just outside the cable corridor and so microrouting just outside of the corridor could be plausible.	The potential presence of sensitive habitats including potential Annex I geogenic reefs (i.e. bedrock reefs and stony reef) and biogenic reef (*Sabellaria spinulosa* reef) was determined across the proposed cable route based on outputs of geophysical surveys and DDV surveys. Results found that where these habitats were identified, they did not span the 500 m width of the Offshore Cable Corridor. Therefore, it is anticipated that micro-routing around these sensitive habitats will be possible within the cable corridor.
JNCC agree with the Applicant using CIEEM Guidelines for Ecological Impact Assessment for	The updated CIEEM (2018) guidelines have been referred to within the PEIR. This has been referenced

Comment	How and where considered in the PEIR
Terrestrial, Freshwater and Coastal Environments (2018) for the benthic ecology assessment. We would also recommend that the Applicant uses 'Nature conservation considerations and environmental best practice for subsea cables for English inshore and UK offshore waters' (Natural England and JNCC, 2022).	as 'CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (version 1.2 – Updated April 2022)' within the reference list in **section 1.15**. The guidance 'Nature conservation considerations and environmental best practice for subsea cables for English inshore and UK offshore waters' (Natural England and JNCC, 2022) has been used to inform the assessment of potential impacts.
JNCC agrees with the proposed study area for benthic ecology being determined based on the pathway for effect that is likely to have the greatest spatial extent, which will be suspended sediment carried in plumes as a result of cable burial activities. We also agree with this being based on physical processes understanding and would recommend sediment plume modelling be undertaken as a basis for the study area taken forward in the assessment.	The Study Area is presented in paragraph 1.4.6 and Volume 3, Figure 1.1, of the PEIR. A fixed distance study area of 5 km has been used for the full length of the cable route. This is a precautionary distance fully encompassing the ZoI for suspended sediment dispersion (maximum distance of 3.9 km) which is the impact with the greatest ZoI (Volume 3, Appendix 8.1, High Level Assessment of Sediment Dispersion). The methods for the semi-empirical approach used to estimate the ZoI for suspended sediment dispersion have been provided to NE, the MMO and JNCC for comment (methods and results are in Volume 3, Appendix 8.1, High Level Assessment of Sediment Dispersion).
We note that the applicant has not included the Cefas OneBenthic Baseline Tool within the desk-based data sources to be used in the assessment, but this source is used to describe the benthic baseline within the chapter. We would recommend the Applicant includes all desk-based data sources to be used to inform the assessment be included here.	The Cefas OneBenthic Baseline Tool has been used to inform the baseline in **section 1.5** and results from the OneBenthic Baseline Tool are presented in **Table 1.15**. The OneBenthic Tool has been referenced as a data source in Table 1.8 of this PEIR Chapter.
JNCC are grateful for this early information provided by site-specific surveys of the cable corridor. We would like to highlight that sampling effort should be thorough enough so as to adequately characterise the benthic environment and understand all potential impact pathways that may present themselves throughout the whole cable corridor.	Site-specific subtidal benthic surveys were conducted by GEOxyz between August and October 2023. The survey design consisted of a total of 61 camera transects and 51 grab sample stations covering the length of the Offshore Cable Corridor. Sampling locations were informed by geophysical survey. Data was obtained for the distribution of seabed habitats and associated fauna within the survey area, including assessment of the presence or absence of potential habitats/species of conservation importance including Annex I habitats. Additionally, water profiling was also conducted at each target location. Reports outlining methods and survey results have been provided to NE and JNCC for information ahead of PEIR consultation. An intertidal survey will be conducted to provide additional data for the intertidal environment in the vicinity of the HDD works to inform the assessment in the ES.

Comment	How and where considered in the PEIR
JNCC agrees with the designated sites for benthic features that have been scoped into the assessment. We defer to Natural England in regard to comments on Lundy Sand Special Area of Conservation (SAC), Braunton Burrows SAC, Hartland Point to Tintagel Marine Conservation Zone (MCZ) as they are these sites' responsible agency. For the East of Haig Fras MCZ, JNCC is the responsible agency for this site and the South West Approaches to the Bristol Channel MCZ is jointly managed by JNCC and Natural England. We have therefore focused our comments on these two sites. The applicant has highlighted the designated features for these sites which are benthic species and habitats. We would recommend that the Applicant reviews the site information and Conservation Objectives available on JNCC's website in order to assess the impact the project might have on these sites. Whilst the cable corridor does not directly cross either of these sites there is potential for activities to affect designated features through impact pathways such as sediment plumes caused during construction and operation and maintenance. JNCC would therefore expect these impacts to be assessed during the subsequent EIA stages.	Noted. Consideration of protected sites for assessment for benthic ecology has been based on a distance of 5 km, which is a precautionary distance fully encompassing the ZoI for suspended sediment dispersion which is the impact with the greatest ZoI (Volume 3, Appendix 8.1, High Level Assessment of Sediment Dispersion). A HRA Screening Report will be submitted with the PEIR. An MCZ assessment will also be prepared for submission with the ES.
JNCC agrees with the applicant's proposed approach of determining the full extent of the areas showing characteristics of Annex I reefs during the subsequent EIA process by undertaking further assessments. We wish to clarify if these assessments at the EIA stage will involve further sampling of the area to determine the extent of these habitats as this may provide options for micro-routing around the habitat. If so, we would recommend survey effort is not restricted to the cable corridor as it may be that the habitat extent does not extend far outside of the corridor boundaries and could present opportunities for cable micro-routing and reduced rock dump for cable protection.	The potential presence of sensitive habitats including potential Annex I geogenic reefs (i.e. bedrock reefs and stony reef) and biogenic reef (*Sabellaria spinulosa* reef) was determined across the proposed cable route based on outputs of geophysical surveys and DDV surveys. Results found that where these habitats were identified, they did not span the 500 m width of the Offshore Cable Corridor. Therefore, it is anticipated that micro-routing around these sensitive habitats will be possible within the Offshore Cable Corridor. It is considered that data available are sufficient to inform micro-routing.
JNCC agree with the applicant scoping all benthic impacts listed in Table 8.2.5 into the assessment and acknowledge that effects related to UXO clearance works will be covered in a separate licence application if necessary. In regard to the impact 'direct habitat loss', if the cable is buried then we agree that direct habitat loss will not occur during the operational phase of work. However, if the cable cannot be buried and cable protection measures are needed then permanent direct habitat loss will still occur during the operational phase. If the cable cannot be buried,	The effect of 'Long term habitat loss/change' has been assessed for the operational phase in **section 1.9**. This represents a worst case scenario with all cable protection measures in place and any effects during construction would be reduced in comparison.

Comment	How and where considered in the PEIR
cable protection material would be present and will permanently reduce the area of natural habitat that is available for colonisation.	
JNCC agrees with the applicant's proposed approach to assessing the impact of works on benthic ecology. We would recommend that the applicant uses the Marine Evidence based Sensitivity Assessment (MarESA) on the Marine Life Information Network website to help with understanding of the sensitivity of receptors identified during desk-based reviews and site-specific surveys to the impact pathways identified in Table 8.2.5.	The assessment in **sections 1.8** and **1.9** has used the MarESA on the Marine Life Information Network website to identify the sensitivity of key receptors to various impacts (pressures).
The applicant includes mitigation measures as one of the iterative steps involved in the assessment approach. We would recommend the applicant applies the mitigation hierarchy to their assessment approach (avoid, minimise, rectify, reduce, offset). For example, JNCC would recommend micro-routing a cable around Annex I stony habitat in the first instance in order to avoid additional rock dump and would expect survey evidence as justification as to why this isn't being proposed before any measures to offset significant impacts are considered.	Mitigation measures are presented in **Table 1.20** and the mitigation hierarchy has been applied to the assessment approach, Where Annex I habitats are present the first option to be considered will be micro-routing of the cable.
Natural England	
Natural England would like to sign post the applicant to our joint advice with JNCC on subsea cable projects for high level advice for environmental considerations that are essential for cable operations across English inshore waters and UK offshore waters: Environmental considerations for offshore wind and cable projects - Nature conservation considerations and environmental best practice for subsea cables for English Inshore and UK offshore waters, Sept 22.pdf - All Documents (sharepoint.com)	This guidance has been used to inform the assessment of potential impacts.
The development site is within or may impact on the following Habitats/internationally designated nature conservation sites: Marine sites: • Bristol Channel Approaches Special Area of Conservation (SAC) • Lundy SAC • Isles of Scilly Complex SAC • Severn Estuary SAC/Ramsar Terrestrial sites: • Braunton Burrows SAC Based on the information provided, Natural England's advice is that the proposed cable route is unlikely to have a significant effect on terrestrial European sites and can therefore be screened	Of these sites listed, the only site with benthic ecology features within the Benthic Ecology Study Area (5 km either side of the Offshore Cable Corridor) is Lundy SAC. Braunton Burrows is outside this area (5.5 km from the cable route). Conservation objective 3 for the Bristol Channel Approaches SAC (i.e. 'The condition of supporting habitats and processes, and the availability of prey is maintained') is considered in **section 1.8** (and the HRA Screening report that accompanies the PEIR). The Annex I habitat which is the primary reason for site selection for Lundy SAC is 'Reefs' (1170) Annex I habitats present as qualifying features, but not a primary reason for site selection are: 'Sandbanks which are slightly covered by sea water all of the time' (1110), and 'Submerged or partly submerged sea caves' (833).

Comment	How and where considered in the PEIR
out from requiring further assessment. (Discretionary Advice Service 17671-358612 dated 03/08/2021).	Potential effects on Lundy SAC are covered in **section 1.8** and a HRA Screening Report will be submitted with the PEIR.
The development site is within or may impact on the following Sites of Special Scientific Interest: • Mermaid's Pool to Rowden Gut Site of Special Scientific Interest (SSSI) • Taw Torridge Estuary SSSI • Lundy SSSI The Environmental Statement should include a full assessment of the direct and indirect effects of the development on the features of special interest within the SSSI and identify appropriate mitigation measures to avoid, minimise or reduce any adverse significant effects.	The Taw-Torridge Estuary SSSI has been included as it has some intertidal and subtidal benthic habitat features. The Lundy SSSI encompasses terrestrial areas and the intertidal zone only, so has not been included in the assessment for benthic ecology. Mermaid's Pool to Rowden Gut SSSI is designated for its geological interest. Therefore, it has not been included in the assessment for benthic ecology.
You will need to consider Marine Conservation Zones (MCZs) where appropriate. The ES should include a full assessment of the direct and indirect effects of the development on the site and identify appropriate mitigation measures to avoid, minimise or reduce any adverse significant effects. The proposal may affect the following Marine Conservation Zones: • Bideford to Foreland Point MCZ • South West Approaches to Bristol Channel MCZ • East of Haig Fras MCZ • Lundy MCZ • Hartland Point to Tintagel MCZ • North West of Lundy MCZ • Morte Platform MCZ	The MCZs to be considered have been screened in based on the modelled maximum distance for dispersal of suspended sediments due to the works (using semi-empirical methods). Based on this distance (5 km which is maximum dispersal distance of 3.9 km and an extra 1.1 km applied to be precautionary) only three MCZs have been considered in the assessment: - Bideford to Foreland Point MCZ - South West Approaches to Bristol Channel MCZ - East of Haig Fras MCZ Potential effects on these MCZs are covered in **section 1.8, 1.9** and **1.10** and an MCZ assessment will also be prepared for submission with the ES.
Cable protection within marine protected areas should be avoided and where that is possible every effort should be made to mitigate the impacts. In order to achieve this, we advise that a cable burial risk assessment is undertaken as part of the application process informed by comprehensive geotechnical and geophysical surveys. If cable protection is required options that have the greatest success of removal with least impact to interest features should be taken forward. A site integrity plan could then be used to determine the risk to the conservation objectives for the site and determine the requirements for any compensation measures.	A Cable Burial Risk Assessment will be provided with the ES (it is provisional at the time of PEIR). Burial will be the preferred option for the cable protection, and only when full target burial depth is not possible will additional protection be installed. It should be noted that the cable route will not pass through any protected sites other than the Bristol Channel Approaches SAC which is only designated for Harbour Porpoise. Therefore, direct loss of habitat is not an impact for any designated sites with benthic habitat features.

Comment	How and where considered in the PEIR
Please note that impacts from secondary scouring around cable protection should also be factored into both marine processes and benthic assessment.	The impact 'Changes in hydrodynamic regime (scour & accretion)' has been scoped in to assessment for the operation and maintenance phase (**section 1.9**). Scour has currently been assessed in a qualitative way indicating that it is anticipated to be localised around any cable protection structures. The MarESA pressure that has been used for the 'Change in hydrodynamic regime (scour and accretion)' assessment is 'Water flow (tidal current) changes (local)' as there is no MarESA pressure for scour as such. A more detailed scour assessment will be presented in the ES (Physical Processes chapter) which will build on the recent estimates of bed current velocities and the calculations of sediment mobilisation potential.
For priority habitats within the cable corridor, Natural England advises that the mitigation hierarchy is used. Avoidance techniques can include micro-routing the cable around Annex I habitats that fall within the cable corridor. Where the cable corridor is too narrow to allow micro-routing around priority habitats, micro-routing outside of the cable corridor may need to be used to avoid Annex I habitats. If this is the case for the stony reef habitat as shown on slide 16 of the meeting between Natural England and Xlinks 22/02/2024, Natural England would like to see the habitat mapping surveys for the area outside of this section of the cable corridor, to understand the viability of cable routing outside of the cable corridor.	The potential presence of sensitive habitats including potential Annex I geogenic reefs (i.e. bedrock reefs and stony reef) and biogenic reef (*Sabellaria spinulosa* reef) was determined across the proposed cable route based on outputs of geophysical surveys and DDV surveys. Results found that where these habitats were identified, they did not span the 500 m width of the Offshore Cable Corridor. Therefore, it is anticipated that micro-routing around these sensitive habitats will be possible within the Offshore Cable Corridor.

1.3.4 Following scoping, consultation and engagement with interested parties specific to benthic ecology has continued.

1.3.5 A summary of the key issues raised during consultation activities undertaken to date is presented in **Table 1.6**, together with how these issues have been considered in the production of this PEIR chapter.

Table 1.6: Summary of consultation relevant to this chapter

Date	Consultee and type of response	Issues raised	How and where considered in the PEIR
January 2024	JNCC consultation meeting	This was a meeting to introduce the offshore aspects of the project to JNCC. JNCC indicated that the proximity of the Offshore Cable Corridor to the South-West approaches to Bristol Channel MCZ was to be considered in terms of potential effects on the MCZ. It was seen as a positive that the cable route did not run through the site. It was suggested the key information required would be the potential distance that suspended sediments released into suspension during the works could be transported beyond the MCZ boundary and any the effects of any subsequent smothering. It was indicated where Annex I stony or bedrock reef was present the cable should be micro-routed to avoid them, and the boulder plough should not be used in those habitats. Key considerations for JNCC were associated with the requirements for any cable protection measures and long-term habitat change. It was clarified that the term habitat creation should be avoided in relation to the use of cable protection measures, and habitat change should be used instead. There was discussion around linking the use of rock for cable protection with changes to	The proposed cable route has avoided interaction with protected sites as far as possible, and none of the footprint of the Offshore Cable Corridor is within a protected site (**section 1.5**). Annex I habitat (outside protected sites) will be avoided via micro-routing of the Offshore Cable Corridor where possible (**section 1.7**). Cable protection (rock placement) would be kept level with the seabed where possible, and if above the seabed they would be kept to a minimum of 1 m above seabed level (**section 1.7).** Specific options for cable protection will be considered in more detail in the ES.

Date	Consultee and type of response	Issues raised	How and where considered in the PEIR
		habitat, so determining where rock would be used and selecting options most appropriate to the habitat in which the cable protection would be installed.	
January 2024	Environment Agency consultation meeting	Introduction to project, non-technical discussion	Not applicable
February 2024	Natural England consultation meeting	This was a meeting to introduce the offshore aspects of the project to NE, with focus on areas within the 12 nm limit. It was confirmed to NE that ground investigations had been completed to determine the suitability of use of HDD at landfall so that there would be no interaction with the intertidal zone. NE confirmed that although there was slightly overlap of the 12 nm boundary with the South-West approaches to Bristol Channel MCZ, consideration of the potential effects on this MCZ would be the responsibility of JNCC. Potential presence of stony and bedrock reef in some areas was discussed. It was indicated the preference would be to micro-route the cable around these areas. It was discussed that guidance in Irving (2009) and Golding *et al*. (2020) would be used to determine if areas of stony reef constituted Annex I habitat.	Details for HDD are provided in **section 1.6** and in Volume 1, Chapter 3: Project Description. Potential effects of vibration from the HDD on benthic invertebrates is consider in **section 1.8** (Impact 5 – Underwater noise and vibration). Potential effects of break out are assessed in **section 1.8** (Impact 6 – Accidental Pollution). Potential presence of Annex I reef habitat was determined via use of best practice guidance including Irving (2009) and Golding *et al*. (2020), (see GEOxyz, 2024). Any areas of Annex I habitat (outside protected sites) will be avoided via micro-routing of the Offshore Cable Corridor as far as possible (**section 1.7**).

Date	Consultee and type of response	Issues raised	How and where considered in the PEIR
March 2024	Natural England consultation meeting	Discussion of Natural England Scoping Opinion responses – as per responses in **Table 1.5**. Following issue of sediment dispersion Technical Note ahead of meeting (presented within the PEIR as Volume 3, Appendix 8.1 High Level Assessment of Sediment Dispersion), the methods were presented and discussed. Natural England confirmed review by NE Physical Processes experts and acceptance of methods.	Discussions confirmed approach to address Scoping Opinion responses – as per **Table 1.5**. Sediment dispersion technical note (as circulated to Natural England) presented as PEIR Volume 3, Appendix 8.1.
April 2024	JNCC meeting – Scoping Opinion and methods discussions	Discussed all JNCC scoping opinion responses. JNCC welcomed the presentation of the sediment dispersion calculation methods which underpin and justify the benthic ecology study area. JNCC confirmed that any impact assessment on the Bristol Channel Approaches SAC should include consideration of conservation objective 3.	The 'study area' discussions within **section 1.4** of this PEIR chapter provide justification for the ZoI and the benthic ecology study area. Conservation objective 3 for the Bristol Channel Approaches SAC (i.e. 'The condition of supporting habitats and processes, and the availability of prey is maintained') is considered in **section 1.8** (and the HRA Screening report that accompanies the PEIR).

1.4 Methodology

Relevant Guidance

1.4.1 The benthic ecology assessment referred to the CIEEM guidelines for Ecological Impact Assessment for Terrestrial, Freshwater and Coastal Environments (2018).

1.4.2 Marine Evidence-based Sensitivity Assessment (MarESA) information hosted by the Marine Life Information Network (MarLIN) was consulted to determine sensitivity of different benthic habitats to a range of anthropogenic pressures.

Scope of the Assessment

1.4.3 The scope of this PEIR has been developed in consultation with relevant statutory and non-statutory consultees as detailed in **Table 1.5** and **Table 1.6**.

1.4.4 Taking into account the scoping and consultation process, **Table 1.7** summarises the issues considered as part of this assessment.

Table 1.7: Potential impacts considered within this assessment

Activity	Potential impacts scoped into the assessment
Construction Phase	
Seabed preparation, route clearance, cable laying, HDD and burial activities.	Temporary habitat loss/disturbance
	Temporary increase in suspended sediments and sediment deposition
	Changes to water quality (release of hazardous substances from sediments)
	Introduction and spread of invasive non-native species (INNS)
	Underwater noise and vibration
	Accidental pollution
Operational phase	
Cable operation and presence of rock protection	Change in hydrodynamic regime (scour and accretion)
	Sediment heating
	Electromagnetic field (EMF) effects
	Long-term habitat loss/change
Operational phase repair activities	
Cable repairs	Temporary habitat loss/disturbance
	Temporary increase in suspended sediments and sediment deposition
	Changes to water quality (release of hazardous substances from sediments)
	Introduction and spread of INNS
	Accidental pollution
Decommissioning phase – cable left *in-situ*	
Repair works (cable cut, recover, and burial activities)	Introduction of invasive non-native species
	Long-term habitat loss/change

Activity	Potential impacts scoped into the assessment
	Accidental pollution
Decommissioning phase – cable removal	
Decommissioning activities	Temporary habitat loss/disturbance
	Temporary increase in suspended sediments and sediment deposition
	Changes to water quality (release of hazardous substances from sediments)
	Introduction and spread of INNS
	Change in hydrodynamic regime (scour and accretion)
	Accidental pollution

1.4.5 Effects which are not considered likely to be significant have been scoped out of the assessment. A summary of the effects scoped out is presented in **Table 1.8**.

Table 1.8: Issues scoped out of the assessment

Activity	Potential effects scoped out of the assessment
Construction Phase	
UXO clearance	Effects related to any potential UXO clearance works have been excluded, and if required would be subject to a separate licence application

Study Area

1.4.6 The benthic ecology study area comprises the Offshore Cable Corridor with a 5 km buffer area either side (Volume 3, Figure 1.1). The extent of the study area was informed by consideration of the extent of the potential effect with the greatest ZoI for benthic ecology which was distribution of resuspended sediment during construction works (anticipated to be 0.1 to 3.9 km from the corridor depending on location) (Volume 3, Chapter 8: Physical processes; Volume 3, Appendix 8.1). The only locations along the cable route where sediment was found to not fall out of suspension in the immediate vicinity of the cable route were between Stations 61 to 56 (from just beyond the intertidal zone moving approximately 8 km seawards) and Station 19 to 09 (towards the end of the cable route in UK waters) (see Volume 3, Figure 1.6 for indication of station locations). Consequently, the approach which has been taken (adding an extra 1.1 km to the maximum 3.9 km calculated (maximum across all sites and across all directions) to create an anticipated potential ZoI of 5 km either side of the Offshore Cable Corridor, and then applying that to the whole of the Offshore Cable Corridor), is extremely precautionary. It is anticipated that this study area will allow for robust characterisation of the benthic habitats and species within the ZoI of the works.

Methodology for Baseline Studies

Desk Studies

1.4.7 A high-level desk-based assessment has been conducted for benthic ecology receptors using a range of existing ecological data (**Table 1.9**).

1.4.8 The DEFRA Magic Map site was used to determine designated sites with benthic ecology qualifying features in the vicinity of the Proposed Development.

Table 1.9: Summary of desk study sources used

Title	Source	Year	Author
Benthic habitat classification mapping	European Marine Observation and Data Network (EMODnet)	2023	European Commission
Occurrence data for benthic species (excluding entries not licensed for commercial use)	National Biodiversity Network (NBN) Atlas	2024	NBN
OneBenthic portal	Cefas	2023	Cefas
Marine environments across Great Britain	DEFRA Magic Map	2024	DEFRA

1.4.9 The desk-based study information was supplemented by project-specific surveys which are outlined in the following section and have provided the main source of site-specific information relating to benthic species and habitats to inform the impact assessment.

Site-Specific Surveys

1.4.10 Site-specific surveys have been conducted to obtain data for benthic habitats and species with a brief summary provided in **Table 1.10**, and the survey methods and results detailed in GEOxyz (2023 and 2024). A summary of baseline data obtained from the surveys is provided in **section 1.5**.

Table 1.10: Site-specific surveys – Benthic Ecology

Surveys	Summary
Geophysical surveys	Geophysical surveys included acquisition of seabed data using a MBES, SSS, magnetometer and Sub-bottom Profiler (SBP) Shallow and Deep SBP Dura Spark 400 for seismic data. The SSS and bathymetry from the MBES were interpreted to inform the survey plan for Drop Down Video (DDV) and grab surveys.
Subtidal DDV surveys	Seabed video footage was acquired to ground-truth all grab locations, features of interest and to facilitate a habitat assessment. A total of 61 camera transects were acquired across the survey area using a STR Seabug system mounted on a camera sled or a Freshwater Lens system.
Subtidal Grab surveys	51 grab stations were surveyed along the UK section of the Offshore Cable Corridor (with samples successfully collected at 48 of the stations). The majority of stations were sampled with a Dual Van Veen (DVV) grab (2 x 0.1 m^2) with stations with coarser sediments sampled with a 0.01 m^2 mini-Hamon grab. Samples were acquired to provide data on physico-chemistry and macrofauna at sampling stations.

Surveys	Summary
	Water sampling using a multi-parameter Conductivity Temperature Depth (CTD) sensor was conducted at every third station in the deeper offshore sections of the cable route, increasing to every station in water depths of less than 50 m.
Intertidal Phase I and Phase II Rocky Shore surveys	It is proposed that Phase I biotope mapping and Phase II quadrat surveys are undertaken at the landfall in the area the HDD will be conducted. These would be conducted using standard approaches as set out in Wyn *et al.* (2006); Davies *et al.* (2001); and JNCC (2004). These surveys have not yet been conducted, but it is intended that results from these surveys will be available to be considered in the Benthic Ecology chapter of the Environmental Statement for the Proposed Development.

Impact Assessment Methodology

Overview

1.4.11 The approach to determining the significance of effects is a two-stage process that involves defining the sensitivity of the receptor and magnitude of the impact. This section describes the criteria applied in this chapter to assign values to the magnitude of potential impacts and the sensitivity of the receptors. The terms used to define magnitude and sensitivity are based on those which are described in further detail in Volume 1, Chapter 5: EIA methodology, of the PEIR.

1.4.12 The assessment approach will be based on the conceptual ‘source-pathway-receptor’ model. This model identifies likely environmental effects resulting from the construction, operation, maintenance and decommissioning of the Proposed Development. This process provides an easy to follow assessment route between effect sources and potentially sensitive receptors ensuring a transparent impact assessment. The parameters of this model are defined as follows:

- source: the origin of a potential effect (noting that one source may have several impact pathways and associated receptors); e.g. a construction activity;
- pathway: the link or interaction ‘pathway’ by which the effect of the activity could influence a receptor; and
- receptor: the element of the receiving environment that is affected.

1.4.13 Iterative steps involved in the assessment approach included:

- determination of potential interactions between the Proposed Development and ecological receptors (for construction and operation and maintenance phases);
- definition of benthic ecology environment within the influence of the Proposed Development;
- assessment of the sensitivity of benthic ecological receptors;
- assessment of the magnitude of impact;
- assessment of the significance of effects;
- proposal of mitigation measures to reduce, prevent or where these are not possible, to offset, any adverse significant effects;

- assessment of the residual effects after any mitigation measures have been considered; and
- assessment of cumulative effects

1.4.14 In some instances, the Proposed Development will retain flexibility in terms of the options for methods and approaches to be applied during the construction phase. Where this is the case, for each combination of effect and receptor, the assessment will be based on the Maximum Design Scenario (MDS) for the specific assessment (as outlined in **Section 1.6**).

Receptor Sensitivity/Value

1.4.15 The criteria for defining value in this chapter are outlined in **Table 1.11** below. To incorporate value into the assessment it has been included as part of the sensitivity criteria outlined in **Table 1.12**. It should be noted, however, that conservation value and high sensitivity are not necessarily linked for a particular effect. For example, a receptor could be of international or national importance (e.g. an interest feature of a protected site) but have a low or negligible physical/ecological sensitivity to an impact and vice versa. Consequently, when determining the sensitivity level taken forward to assessment this has taken into account habitat and species-specific considerations and professional judgement.

Table 1.11: Value criteria for benthic ecology receptors

Value	Definition
International	• An internationally designated site or candidate site (SPA, pSPA, SAC, cSAC, pSAC, Ramsar site etc.) or an area which the country agency has determined meets the published selection criteria for such designation, irrespective of whether or not it has yet been notified. • Internationally significant and viable areas of a habitat type listed in Annex I of the Habitats Directive (implemented in the UK via the Habitats Regulations) which are qualifying interests of an SAC in the Study Area. • Globally threatened species (i.e. Critically endangered or endangered on IUCN Red list) or species listed on Annex 1 of the Berne Convention. • Regularly occurring populations of internationally important species that are rare or threatened in the UK or of uncertain conservation status. • A regularly occurring, nationally significant population/number of any internationally important species. • Habitat/species are highly regarded for their important biodiversity, social/community value and / or economic value.
National	• A nationally designated site (SSSI, NNR, MNR, MCZ) or a discrete area, which the country conservation agency has determined meets the published selection criteria for national designation (e.g. SSSI selection guidelines) irrespective of whether or not it has yet been notified. • Annex I habitat that is not a qualifying interest of an SAC in the Study Area. • Regularly occurring, globally threatened species (i.e. Vulnerable or lower on IUCN Red list) or species listed on Annex 1 of the Berne Convention. • S41 species/habitats list of NERC Act (Previously UKBAP habitats/species) – whether National or Regional importance requires consideration of the species/habitat being considered, its abundance/extent within the Proposed Development area, and its abundance/extent in the wider area. • Habitat/species possess important biodiversity, social/community value and / or economic value.

Value	Definition
Regional	• S41 species/habitats list of NERC Act (Previously UKBAP habitats/species) – whether National or Regional importance requires consideration of the species/habitat being considered, its abundance/extent within the Proposed Development area, and its abundance/extent in the wider area. • WFD biological element. • Any regularly occurring significant population that is listed in a Local Red Data Book. • Significant populations of a regionally/county important species. • Habitat/species possess moderate biodiversity, social / community value and / or economic value.
Local	• Areas of habitat identified in a sub-County (District/Borough) BAP or in the relevant Natural Area profile. • District sites that the designating authority has determined meet the published ecological selection criteria for designation, including Local Nature Reserves selected on District/Borough ecological criteria (District sites, where they exist, will often have been identified in local plans). • Sites/features that are scarce within the District/Borough or which appreciably enrich the District/Borough habitat resource. • Species are abundant, common or widely distributed. • Habitat/species possess low biodiversity, social/community value and / or economic value.

1.4.16 The criteria for defining sensitivity in this chapter are outlined in **Table 1.12** below. Sensitivity has been considered as required when assessing effects, and information relating to sensitivity of receptors to impacts has been clearly indicated in the assessment narrative where appropriate.

Table 1.12: Sensitivity criteria for benthic ecology receptors

Sensitivity	Definition
Very High	**Vulnerability**: The receptor cannot avoid, adapt or tolerate the impact. **Recoverability**: The effect on the receptor is anticipated to be permanent. **Value**: The receptor is of international value.
High	**Vulnerability**: The receptor cannot or has very low capacity to avoid, adapt or tolerate the impact. **Recoverability**: Partial recovery is only likely to occur after about 10 years and full recovery may take over 25 years. **Value**: The receptor is of international or national value.
Medium	**Vulnerability**: The receptor has limited capacity to avoid, adapt or tolerate the impact. **Recoverability**: Only partial recovery is likely within 5 years and full recovery is likely to take up to 10 years. **Value**: The receptor is of national or regional value.
Low	**Vulnerability**: The receptor has a reasonable capacity to avoid, adapt or tolerate the impact. **Recoverability**: Full recovery will occur but will take many months (or more likely years) but should be complete within about five years. **Value**: The receptor is of regional or local value.
Negligible	**Vulnerability**: The receptor has a high capacity to avoid, adapt or tolerate the impact. **Recoverability**: The receptor is anticipated to recover immediately (seconds to days). **Value**: The receptor is of regional or local value.

Magnitude of Impact

1.4.17 The criteria for defining magnitude in this chapter are outlined in **Table 1.13** below. Magnitude of impact has been assessed taking into account property/aspect/features designed into the Proposed Development to avoid or minimise environmental effects (i.e. embedded mitigation). Where an impact could reasonably be assigned to more than one level of magnitude, professional judgement has been used to determine which level is applicable.

Table 1.13: Impact magnitude criteria for benthic ecology receptors

Magnitude of impact	Definition
High	**Extent**: Impact across the near-field and far-field areas beyond the Study Area. **Duration**: The impact is anticipated to be permanent or long-term (>5 years). **Frequency**: The impact will occur constantly throughout the relevant project phase.
Medium	**Extent**: Impact across the near-field (0 to 2 km from Offshore Cable Corridor) and far-field areas (2 to 5 km from Offshore Cable Corridor), but not beyond the Study Area. **Duration**: The impact is anticipated to be medium term (1-5 years) or long-term (>5 years). **Frequency**: The impact will occur constantly throughout a relevant project phase.
Low	**Extent**: Impact mainly in the near-field (0 to 2 km from Offshore Cable Corridor). **Duration**: The impact is anticipated to be short term (<1 year). **Frequency**: The impact will occur frequently throughout a relevant project phase.
Negligible	**Extent**: Impact immediately adjacent to the source. **Duration**: The impact is anticipated to be momentary (seconds to minutes) to brief (lasting less than one day). **Frequency**: The impact will occur once or infrequently throughout a relevant project phase.
No change	Impact is expected to result in no change.

Significance of Effect

1.4.18 The significance of the effect upon benthic ecology receptors has been determined by taking into account the sensitivity of the receptor and the magnitude of the impact. The method employed for this assessment is presented in **Table 1.14.**

1.4.19 Where a range of significance levels is presented, the final assessment for each effect is based upon expert judgement.

1.4.20 In all cases, the evaluation of receptor sensitivity, impact magnitude and significance of effect has been informed by professional judgement and is underpinned by narrative to explain the conclusions reached.

1.4.21 For the purpose of this assessment, any effects with a significance level of minor or less are not considered to be significant in terms of the EIA Regulations.

Table 1.14: Assessment Matrix

Sensitivity of Receptor	Magnitude of Impact				
	No Change	**Negligible**	**Low**	**Medium**	**High**
Negligible	No Change	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	No Change	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate
Medium	No Change	Negligible or Minor	Minor	Moderate	Moderate or Major
High	No Change	Minor	Minor or Moderate	Moderate or Major	Major
Very High	No Change	Minor	Moderate or Major	Major	Major

1.4.22 Where the magnitude of impact is 'no change', no effect would arise.

1.4.23 The definitions for significance of effect levels are described as follows:

- **Major**: These effects are considered to be very important considerations and are likely to be material in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category.
- **Moderate**: These effects have the potential to be important and may influence the key decision-making process.
- **Minor**: These effects are generally, but not exclusively, raised as local factors. They are unlikely to be critical in the decision-making process.
- **Negligible**: No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.
- **No change**: No loss or alteration of characteristics, features or elements; no observable impact in either direction.

Assumptions and Limitations of the Assessment

1.4.24 The assessment is based on the information that has been provided to date in relation to methods for construction, operation, and decommissioning detail. In some cases, the information provided has been high level and numerous details have not yet been finalised including e.g. the expected months of work and duration for different aspects of the construction phase; the exact methods that will be used for seabed preparation and cable installation; the exact locations at which cable protection measures will be applied; the nature of the cable protection measures applied (e.g. rock placement, concrete mattresses); the requirements for cable maintenance; the options to be taken at decommissioning (leaving *in-situ* or removal). Where this is the case, a precautionary MDS approach to the assessment has been undertaken where appropriate, with various associated parameters clearly laid out in **Table 1.19**. As the Proposed Development moves towards the DCO application, these details will be finalised and the assessment contained within the ES will take the additional information into account.

1.4.25 Marine environmental and ecological conditions in the Benthic Study Area are subject to change over time, e.g. due to habitat changes across spatial and temporal scales, which can be influenced by a range of factors. The assessment of effects on benthic ecology has been largely informed by the results of surveys conducted for the Proposed Development with a geophysical survey conducted in July-September 2023 and a subsequent ground truthing survey deploying underwater video and benthic grabs, which was conducted in August-October 2023. The results of surveys can be influenced by specific conditions at the time of sampling including tidal state, weather conditions and seasonal trends, however, these surveys are considered sufficiently recent to provide a robust baseline data set for assessment.

1.5 Baseline Environment

Desk Study

1.5.1 Information on benthic ecology within the study area was collected through a detailed review of existing studies and datasets. These are summarised in **Table 1.9**.

1.5.2 The EUSeaMap (2023) habitat types (Marine Strategy Framework Directive (MSFD) benthic broad habitats) mapped by EMODnet indicates the subtidal habitat is likely to be 'Circalittoral sand' up to 18 km from the landfall (Volume 3, Figure 1.2). Beyond this point the EMODnet data indicate subtidal habitats may include:

- Circalittoral coarse sediment;
- Circalittoral rock and biogenic reef;
- Offshore circalittoral coarse sediment;
- Offshore circalittoral mixed sediment;
- Offshore circalittoral sand; and
- Offshore circalittoral mud.

1.5.3 Records from the NBN Atlas from within the study area collected between 2013 and 2023 indicated a total of 1,643 individuals across 469 taxa within the study area (which includes intertidal and subtidal species) (NBN Trust, 2023). Records indicated a faunal community rich in molluscs and arthropods, with three arthropods and five mollusc taxa within the top 10 recorded species (**Table 1.15**).

Table 1.15: Top 10 Benthic Species by number (n), from NBN Atlas Species Occurrence Data

Taxa	Taxonomic Group	Count, n
Chaetognatha	Chaetognatha	35
Trivia monacha	Mollusca	31
Doris pseudoargus	Mollusca	30
Cancer pagarus	Arthropoda	29
Goniodoris nodosa	Mollusca	27
Echinodermata	Echinodermata	26
Necora puber	Arthropoda	23
Berthella plumula	Mollusca	22
Trivia arctica	Mollusca	22
Decapoda	Arthropoda	21

1.5.4 The OneBenthic portal from Cefas provides predictive maps of subtidal assemblages based on random forest modelling of point source data. OneBenthic indicated that faunal cluster groups (biotopes) were mainly characterised by cluster group D2c for the first 15 km of the cable route (OneBenthic, 2023; **Table 1.16**). There is a section of C1b between the ~15-25 km section and then the remainder of the route is mainly indicated as being represented by D2a, apart from the section from ~210km to 300 km which was characterised as D2b. Other cluster groups within the benthic ecology study area are listed in **Table 1.16** and indicated in Volume 3, Figure 1.3.

Table 1.16: Characterising Taxa for Faunal Cluster Groups Identified Within the Benthic Subtidal and Intertidal Study Area and Surrounding area (Cooper and Barry, 2017). (A) = Amphipod crustacean, (AT) = Ascidian tunicate, (B) = Bryozoan, (BC) = Barnacle crustacean, (BM) = Bivalve mollusc, (DC) = Decapod crustacean, (E) = Echinoderm, (NE) = Nematoda, (P) = Polychaete

Cluster	Taxa
A2a	*Sabellariidae* (P)
A2b	*Sabellariidae* (P), *Serpulidae* (P), *Syllidae* (P), *Terebellidae* (P), *Spionidae* (P), *Capitellidae* (P), *Polynoidae* (P), *Styelidae* (AT), *Lumbrineridae* (P), *Porcellanidae* (DC), *Amphiuridae* (E), *Cirratulidae* (P), *Verrucidae* (BC)
B1b	*Spionidae* (P), *Serpulidae* (P), *Syllidae* (P), *Galatheidae* (DC), *Glyceridae* (P), *Terebellidae* (P), *Phyllodocidae* (P), *Amphiuridae* (E), *Polynoidae* (P), *Capitellidae* (P), *Nemertea* (NE), *Scalibregmatidae* (P), *Fibulariiidae* (E), *Eunicidae* (P), *Lumbrineridae* (P), *Cirratulidae* (P)
C1a	*Spionidae* (P), *Terebellidae* (P), *Serpulidae* (P), *Syllidae* (P), *Capitellidae* (P), *Lumbrineridae* (P), *Sabellariidae* (P), *Nemertea* (NE), *Polynoidae* (P), *Phyllodocidae* (P), *Glyceridae* (P), *Maldanidae* (P)
C1b	*Spionidae* (P), *Capitellidae* (P), *Terebellidae* (P), *Lumbrineridae* (P), *Ampeliscidae* (A), *Nemertea* (NE), *Cirratulidae* (P), *Semelidae* (BM), *Ampharetidae* (P), *Phyllodocidae* (P), *Pholoidae* (P)
D2a	*Spionidae* (P), *Glyceridae* (P), *Nemertea* (NE), *Terebellidae* (P), *Capitellidae* (P), *Fibulariidae* (E), *Syllidae* (P), *Phyllodocidae* (P), *Cirratulidae* (P), *Opheliidae* (P), *Lumbrineridae* (P), *Goniadidae* (P), *Polynoidae* (P), *Nephtyidae* (P), *Dorvilleidae* (P)

Cluster	Taxa
D2b	*Oweniidae* (P), *Spionidae* (P), *Amphiuridae* (E), *Capitellidae* (P), *Ampharetidae* (P), *thyasiridae* (BM), *lumbrineridae* (P), *Nemertea* (NE), *Nephytidae* (P), *Cirraatulidae* (P)
D2c	*Nephytidae* (P), *Spionidae* (P), *Opheliidae* (P), *Glyceridae* (P), *Bathyporeiidae* (A), *Nemertea* (NE), *Terebellidae* (P), *Orbiniidae* (P), *Electridae* (B), *Urothoidae* (A), *Semelidae* (BM), *Capitellidae* (P) *Ophiuridae* (E), *Cirratulidae* (P), *Mysidae* (DC), *Mactridae* (BM), *Phyllodocidae* (P), *Magelonidae* (P), *Lumbrineridae* (P), *Tellinidae* (BM)
D2d	*Bathyporeiidae* (A), *Spionidae* (P), *Magelonidae* (P), *Nephytidae* (P), *Tellinidae* (BM), *Cirratulidae* (P), *Semelidae* (BM), *Nemertea* (NE)

Identification of designated sites

1.5.5 There are several SSSIs, SACs and MCZs in the vicinity of the Offshore Cable Corridor, but the majority are outside the benthic ecology study area (Volume 3, Figure 1.4).

1.5.6 All designated sites within the study area with benthic ecology features are set out in **Table 1.17** and only the interest features of relevance to this chapter are listed.

Table 1.17: Designated sites and relevant qualifying interests

Designated Site	Distance to the Proposed Development Site	Relevant Qualifying Interest Feature
Sites of Special Scientific Interest		
Taw-Torridge Estuary SSSI	5 km	It is designated for its populations of overwintering and migratory populations of wading birds and its wide tidal range and intertidal habitats, with large areas of mudflats and sandbanks. Together with beaches and saltmarsh, these provide a rich and varied source of food for many birds and animals.
Special Areas of Conservation		
Bristol Channel Approaches / Dynesfeydd Môr Hafren SAC	0 km	Although the only feature of this site is harbour porpoise, conservation objective 3 states 'The condition of supporting habitats and processes, and the availability of prey is maintained'
Lundy SAC	3.5 km	The primary reason for site selection is the Annex I habitat 'Reefs' (1170) Annex I habitats present as qualifying features, but not a primary reason for site selection are: 'Sandbanks which are slightly covered by sea water all of the time' (1110), and 'Submerged or partly submerged sea caves' (833)
Marine Conservation Zones		
South West Approaches to Bristol Channel MCZ	0 km	Features of Conservation Interest (FOCI): • Subtidal coarse sediment; • Subtidal sand.
Bideford to Foreland Point MCZ	0.5 km	Features of Conservation Interest (FOCI): • Honeycomb worm, *Sabellaria alveolata* reefs; • Intertidal under boulder communities;

Designated Site	Distance to the Proposed Development Site	Relevant Qualifying Interest Feature
		• Fragile sponge and anthozoan communities on subtidal rocky habitats; • Pink sea fan, *Eunicella verrucosa*; • Spiny lobster, *Palinurus elephas*[1]; • Low energy intertidal rock; • Moderate energy intertidal rock; • High energy intertidal rock; • Intertidal coarse sediment; • Intertidal mixed sediments; • Intertidal sand and muddy sand; • Littoral chalk communities; • Low energy infralittoral rock. • Moderate energy infralittoral rock; • High energy infralittoral rock; • Moderate energy circalittoral rock; • High energy circalittoral rock; • Subtidal coarse sediment; • Subtidal mixed sediments; • Subtidal sand.
East of Haig Fras MCZ	0.65 km	Features of Conservation Interest (FOCI): • Sea-pen and burrowing megafauna communities; • Fan mussel, *Atrina fragilis*; • High energy circalittoral rock; • Moderate energy circalittoral rock; • Subtidal coarse sediment / subtidal mixed sediments mosaic; • Subtidal sand; • Subtidal mud.
Lundy MCZ	3.5 km	Features of Conservation Interest (FOCI): • Spiny lobster (*Palinurus elephas*)[1]

Site-Specific Surveys

Intertidal Benthic Ecology

1.5.7 The Bideford to Foreland Point Marine Conservation Zone (MCZ) 500 m to the north of the landfall was surveyed in 2013 when intertidal rocky shore surveys were conducted (Natural England, 2014). The area closest to the landfall location was recorded to have '*Fucus vesiculosus* on full salinity moderately exposed to sheltered mid eulittoral rock' (JNCC: LR.LLR.F.Fves.FS, EUNIS: A1.3131) and *Chthamalus spp*. on exposed eulittoral rock (JNCC: LR.HLR.MusB.Cht, EUNIS:

[1] This feature (relevant to Bideford and Foreland Point MCZ and Lundy MCZ) is covered by the Fish and Shellfish chapter.

A1.112) rocky shore biotopes backed by ‘*Fucus spiralis* on full salinity sheltered upper eulittoral rock’ (JNCC: LR.LLR.F.Fspi.FS, EUNIS: A1.3121).

1.5.8 The foreshore location at the landfall is backed by cliffs. Notably HDD will be deployed to allow the cables to be installed beneath the intertidal zone, thus there are no works planned in the intertidal zone. The HDD will be physically separated from the intertidal zone (HDD boreholes will be c.20 m below seabed level) with the only pathway for impact (**Section 1.8**) considered to be escape of drill fluids via accidental 'frack out’.

1.5.9 Despite the lack of works across the foreshore, an intertidal survey will be conducted to characterise the intertidal zone in the HDD works area and results from this survey are anticipated to be available to inform the Benthic Ecology ES Chapter for the EIA for the Proposed Development. The intertidal survey will consist of Phase I mapping of habitats in the HDD works area, and Phase II survey to gather quantitative data for benthic communities present.

Subtidal Benthic Ecology

1.5.10 Extensive project-specific benthic characterisation surveys have been conducted of the subtidal environment from the landfall to the EEZ boundary. These have included subtidal grab surveys using a Dual Van Veen grab and a mini-Hamon grab, water quality sampling and Drop Down Video surveys (**Table 1.10**), (see GEOxyz (2023 and 2024), for more details).

Sediment type along the Offshore Cable Corridor

1.5.11 Particle size interpretation of sediments was based on the analytical results of surface sediments acquired at sampling stations along the survey cable route. A detailed analysis of sediment distribution along the Offshore Cable Corridor is provided in GEOxyz (2024).

1.5.12 Grab samples were represented by eight BSG modified folk classifications (Volume 3, Figure 1.5). Results indicate that sediments were primarily characterised by sand within the nearshore section of the Offshore Cable Corridor (i.e. 0 – 15 km), shifting to gravelly sand up to 50 km along the Offshore Cable Corridor (Volume 3, Figure 1.5). Between 50 and 200 km along the Offshore Cable Corridor, sediment was primarily slightly gravelly sand and gravelly sand with some instances of sand and sandy gravel sediments (Volume 3, Figure 1.5). From approximately 210 to 250 km, the Offshore Cable Corridor consisted of a range of sediment types including slightly gravelly sand, gravelly muddy sand, gravelly mud, and sand. Between 250 and 300 km, sediments were primarily characterised by muddy sand and slightly gravelly muddy sand. The final section of the Offshore Cable Corridor (300 to 373 km) was characterised by gravelly sand, gravelly muddy sand, and slightly gravelly sand and slightly gravelly muddy sand (Volume 3, Figure 1.5).

Habitat assignment at grab/DDV stations

1.5.13 A habitat assessment survey was carried out along the UK section of the proposed Offshore Cable Corridor (GEOxyz 2024). Seabed habitats were identified primarily using a combination of benthic grab data and Particle Size Analysis (PSA) data from 48 stations (there were 51 target stations), additional video assessment ground-truthing from a number of stations and geophysical data for the cable route.

1.5.14 Biotope classifications within the Offshore Cable Corridor were as follows:

- Close to the coast (0 to 6 km along the Offshore Cable Corridor), stations were assigned the EUNIS habitat 'Abra alba and Nucula nitidosa in circalittoral muddy sand or slightly mixed sediment' (EUNIS: MC5215 / JNCC: SS.SSa.CMuSa.AalbNuc) (Volume 3, Figure 1.6).
- From approximately 6 to 15 km along the Offshore Cable Corridor, the predominant recorded habitat was 'Sparse fauna in Atlantic infralittoral mobile clean sand' (EUNIS: MB5231 / JNCC: SS.SSa.IFiSa.IMoSa).
- From approximately 15 to 40 km along the Offshore Cable Corridor there was a station which was assigned the habitat *'Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment' (EUNIS: MC2211 / JNCC: SS.SBR.PoR.SspiMx) , and there was another station allocated this biotope between 115 to 125 km. However, there was no evidence of *Sabellaria* reef along the Offshore Cable Corridor.
- From approximately 40 to 115 km, the predominant recorded habitat was *'Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand' (EUNIS: MC5211 / JNCC: SS.SSa.CFiSa.EpusOborApri)
- From approximately 125 to 205 km, the predominant recorded habitat was '*Protodorvillea kefersteini* and other polychaetes in impoverished Atlantic circalittoral mixed gravelly sand' (EUNIS: MC3213 / JNCC: SS.SCS.CCS.Pkef)
- For the remainder of the Offshore Cable Corridor, approximately 205 to 373 km, the predominant recorded habitats were *'Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand' (EUNIS: MC5211 / JNCC: SS.SSa.CFiSa.EpusOborApri) and 'Polychaete-rich deep Venus community in offshore circalittoral mixed sediment' (EUNIS: MD4211 / JNCC: SS.SMx.OMx.PoVen)

1.5.15 The survey found that Annelida (segmented worms) was the most abundant taxonomic group across the grab stations. One of the most abundant species was the echinoderm *Echinocyamus pusillus*, which was found at 85 of the 96 grab sample replicates taken for macrofaunal analysis (noting that two replicates were analysed for each benthic station and grab samples could not be collected at three of the 51 target grab stations). Other frequently occurring and abundant species included the polychaetes *Magelona minuta* (recorded at 18 grab stations) and *Ampharete falcata* (recorded at 23 grab stations).

1.5.16 Four species of conservation interest were recorded with the species *Apherusa ovalipes, Harpinia laevis, Eriopisa elongata*, and *Thia scutellata* being currently listed as 'Nationally Scarce' by the Joint Nature Conservation Committee (JNCC).

1.5.17 Ten non-native species were identified in the survey area during this study:

- *Goniadella gracilis* (listed as Non-native)
- *Syllis garciai* (Not formally recorded from UK)
- *Syllis parapari* (Not formally recorded from UK)
- *Syllis pontxioi*(Not formally recorded from UK)
- *Prosphaerosyllis chauseyensis* (Not formally recorded from UK)
- *Lumbrinerides amoureuxi* (Not formally recorded from UK)
- *Aricidea philbinae* (Not formally recorded from UK)

- *Paradoneis ilvana* (Not formally recorded from UK)
- *Spio symphyta* (Not formally recorded from UK)
- *Vitreolina antiflexa* (Not formally recorded from UK)

Habitat assignment across the Offshore Cable Corridor

1.5.18 In addition to the station-specific habitat information, EUNIS Level 4 (and where appropriate EUNIS Level 5) habitat mapping has been performed for the entire UK survey corridor based on consideration of geophysical survey outputs and the results of the benthic grab and underwater video ground-truthing surveys (See GEOxyz (2024) for further information) (Volume 3, Figure 1.7 to Figure 1.10).

1.5.19 The predominant habitat from 0 to 100 km of the Offshore Cable Corridor was ‘Atlantic offshore circalittoral sand’ (EUNIS level 4 code: MD32) (Figure 1.7). The predominant habitat nearest to the landfall was ‘Atlantic infralittoral sand’ (EUNIS level 4 code: MB52). Three EUNIS level 5 code habitats were mapped from 0 to 100 km, ‘infralittoral mobile clean sand with sparse fauna’ (EUNIS level 5 code: A5.231), ‘*Sabellaria spinulosa* on stable circalittoral mixed sediment’ (EUNIS level 5 code: A5.611), and ‘sparse sponges, *Nemertesia spp*. and *Alyconidium diaphanum* on circalittoral mixed substrata’ (EUNIS level 5 code: A4.135).

1.5.20 The predominant habitat from 100 to 200 km was ‘Atlantic offshore circalittoral coarse sediment’ (EUNIS level 4 code: MD32). No EUNIS level 5 code habitats were mapped from 100 to 200 km for the full Offshore Cable Corridor mapping.

1.5.21 The predominant habitat from 200 to 300 km was ‘polychaete-rich deep venus community in offshore circalittoral mixed sediment’ (EUNIS level 5 code: MD4211). There were also extensive areas of ‘Atlantic offshore circalittoral coarse sediment’ (EUNIS level 4 code: MD32), and ‘Atlantic offshore circalittoral sand’ (EUNIS level 4 code: MD32).

1.5.22 The predominant habitats from 300 to 373 km were ‘Atlantic offshore circallitoral sediment’ (EUNIS level 4 code: MD32), and ‘Atlantic offshore circalittoral sand’ (EUNIS level 4 code: MD32) (Volume 3, Figure 1.10). There was also areas of ‘polychaete-rich deep venus community in offshore circalittoral mixed sediment’ (EUNIS level 5 code: MD4211).

Bedrock reef and stony reef

1.5.23 Bedrock and stony reef areas can be characteristic of the Annex I habitat ‘Reef’ under the Habitats Directive (code 1170).

1.5.24 An area of outcropping bedrock was evident from the video and stills data at Station 14. Bedrock was observed rising out from the silty sand seabed, forming distinctive outcrops that were often colonised by numerous species including hydrozoans, bryozoans, encrusting sponges and cup corals. From the images reviewed, this habitat also supported mobile fauna, such as several species of fish and crustaceans. A similar habitat was observed closer inshore from Stations 47 to 50, with Station 50 having more resemblance to stony reef than bedrock formations (Volume 3, Figure 1.11).

1.5.25 Consequently, the underwater video surveys identified areas of exposed bedrock that may be classified as Annex I ‘Reef’ habitat (referred to hereon as ‘bedrock reef’) at Stations 14, 47, 48 and 49. There were 142 recorded observations (stills) of ‘Annex I bedrock reef with low biodiversity’ across the four stations. There were only five stills of 'Annex I bedrock reef with high biodiversity'(one at Station 47 and four at Station 49), (Volume 3, Figure 1.11).

1.5.26 There were also 49 recorded observations of 'bedrock reef partially covered' at Stations 48 and 49, however, this was not considered to be representative of Annex I habitat. Further details indicating the considerations when determining which areas were bedrock reef and why the 'bedrock reef partially covered' was not considered to be Annex I habitat are provided in GEOxyz (2024).

1.5.27 Close to the Isles of Scilly and the East of Haig Fras MCZ, the sediment was rippled gravelly coarse sand with cobbles and boulders. An abundance of cobbles and boulders were observed in an area of silty sandy gravel with shell debris at Station 19. The cobbles and boulders were often colonised by *Hymedesmiidae, Caryophyllia sp.* and *Amphilectus fucorum*, with numerous hydroids and bryozoans protruding from the coarse seabed. These areas of cobble and boulders can be classed as Annex I 'Reef' habitat (referred to hereon as 'stony reef') dependent on consideration of a range of criteria for the degree of reefiness which includes extent, degree of colonisation, species observed within these areas and the distinctiveness from the surrounding seabed (Irving 2009; Golding *et al*., 2020). Detail relating to how these considerations and criteria were applied to determine classifications of the different sections of potential stony reef along the Offshore Cable Corridor is provided in GEOxyz (2024).

1.5.28 Stony reef was identified at Stations 19, 45 and 50. There were 20 recorded observations of 'Low stony reef' across stations, there was only one instance (one still) of 'Medium stony reef' which was at Station 50 (Volume 3, Figure 1.12).

1.5.29 Medium stony reef is considered to represent Annex I habitat.

1.5.30 In line with the Irving (2009) stony reef guidance, areas of 'Low reef', however, are unlikely to be classified as Annex I habitat without strong justification. Accordingly, the aforementioned areas of 'Low reef' were further evaluated to determine whether such justification was warranted by assessing whether they met the reef biotope/species characteristics outlined in Golding *et al*. (2020).

1.5.31 The transects where initial Annex I stony reef assessment were conducted and exhibited overall 'Low reef' (structure vs epifaunal coverage vs. extent) were further investigated to establish whether hard substrate areas still corresponded to reef-like structures based on the epifauna present. 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).

1.5.32 It was found that at Stations 19 and 45 the areas warranted 'no strong justification for Annex I status' (GEOxyz 2024). The transect at Station 50 had the highest abundance of epifauna with six key reef species (including *Pentapora foliacea*, *Alcyonium digitatum* and *Abietinaria abietina*) and four desirable reef species (including *Caryophyllia smithii*, *Halecium halecinum* and *Antedon bifida*), resulting in the delineation of 'Low Resemblance Reef with a strong justification to warrant Annex I status' for this transect. When overlaid on the delineated seabed features, Station 50 is situated within a large area designated as 'Pebbley Cobbley Sandy Gravel' where stony reef features can be considered supportive of diverse epifaunal communities with the potential to warrant Annex I status (GEOxyz 2024).

Other notable habitats

1.5.33 Sponges were evident across the DDV survey area, primarily associated with areas of cobbles/boulders along the route. To assess the potential occurrence of the 'deep-sea sponge aggregations' OSPAR habitat, the NOROG assessment method was applied. Most stills assessed contained no evidence of sponges and were assigned the ‘No Sponge’ category and a total of 17 patches were categorised into ‘Category 1’ with a sponge density of less than 0.5 m^2. Consequently, there is no strong justification for the 'deep-sea sponge aggregations' habitat, listed as threatened and/or declining by OSPAR, to be considered as present in the surveyed area (GEOxyz 2024).

Future Baseline Conditions

1.5.34 The EIA process considers the existing baseline conditions within the study area, and future baseline conditions (as far as reasonably practicable) in accordance with the methodology set out in Volume 1, Chapter 5: EIA Methodology, of the PEIR.

1.5.35 Cable laying in UK waters will be undertaken in several campaigns. Pre-lay works may commence in 2027, with cable lay campaigns beginning in 2028. Existing data are considered appropriate to characterise the benthic ecology baseline for the Proposed Development construction period.

1.5.36 A consideration of climate change is required for consideration of the longer (+50 years) operational phase, and subsequent decommissioning phase of the Proposed Development. The baseline environment will exhibit some degree of natural change over time, even if the Proposed Development was not to proceed. A key consideration in assessing the future baseline conditions is the influence of climate change on benthic communities.

1.5.37 There are numerous models covering the UK which simulate possible climate change scenarios and the UKCP18 (Defra 2019) Climate Projections indicate there could be increases in mean summer temperatures in the longer term and milder winters (influencing sea water temperature), changes in rainfall distribution and seasonality, more extremes of weather and sea level rise (Defra 2019). Rising sea temperatures, ocean acidification, ocean deoxygenation and rising sea levels have been identified as key stressors that are affecting marine communities and reducing ecosystem resilience (European Environmental Agency, 2023).

1.5.38 The long-term baseline conditions for benthic ecology are considered to be relatively stable within deeper, offshore waters. The existing environment is influenced by the physical processes which exist within the Celtic Sea, including waves and tidal currents driving sediment transport and seabed morphology characteristics (Volume 3, Chapter 8: Physical Processes). Long-term established patterns may be affected by climate change driven sea-level rise, however this will have a reduced impact offshore compared to along the coastline. Key threats of climate change include sea-level rise and potential for increased wave action which may cause erosion and coastal squeeze, noting that these will predominantly affect coastal habitats.

1.5.39 Warming sea temperatures and ocean acidification are likely to result in changes to the composition and geographical distribution of benthic communities, with a general north westerly shift (Hiddink *et al*., 2015) in the latitudinal ranges of many species.

1.5.40 Anthropogenic pressures that currently exist across the study area such as commercial fishing, particularly using bottom towed gear, have the potential to influence future change in the existing benthic environment (Volume 3, Chapter 3: Commercial Fisheries).

Key Receptors

1.5.41 The conservation value of the key receptors taken forward into the assessment is provided in **Table 1.18**.

Table 1.18: Key receptors considered in assessment and conservation value

Receptor	Representative biotope recorded within the benthic ecology study area	Designation status	Conservation Interest	Distribution within the Benthic Study Area	Value and Justification
Annex I habitats					
Bedrock reef	N/A	Not a feature of any SACs potentially affected by the Proposed Development	Annex I habitat (EC Habitats Directive)	Subtidal survey recorded very small isolated areas of Annex I Bedrock Reef with high biodiversity bedrock reef in a small number of stills at two stations, and bedrock reef with low biodiversity was recorded in numerous stills across four stations locations within the Offshore Cable Corridor. High and low biodiversity bedrock reef is considered to represent Annex I habitat (see Volume 3, Figure 1.11).	**National** (listed as National as not a qualifying feature of an SAC in the study area)
Stony reef	N/A	Not a feature of any SACs potentially affected by the Proposed Development	Annex I habitat (EC Habitats Directive)	Subtidal survey recorded Annex I Medium stony reef at one discrete location at Station 50 within the Offshore Cable Corridor. Low reef habitat at Station 50 was considered to have a strong justification to warrant Annex I status (see Volume 3, Figure 1.12).	**National** (listed as National as not a qualifying feature of an SAC in the study area)
Granite and slate reef system	N/A	A primary reason for site selection for Lundy SAC which is within the benthic ecology study area.	Annex I habitat (EC Habitats Directive)	SAC boundary is 3.5 km from the Offshore Cable Corridor	**International** (qualifying feature of SAC in the study area)

Receptor	Representative biotope recorded within the benthic ecology study area	Designation status	Conservation Interest	Distribution within the Benthic Study Area	Value and Justification
Sandbanks which are slightly covered by sea water all of the time	N/A	A qualifying feature of the Lundy SAC which is within the benthic ecology study area, but not a primary reason for site selection	Annex I habitat (EC Habitats Directive)	SAC boundary is 3.5 km from the Offshore Cable Corridor	**International** (qualifying feature of SAC in the study area)
Submerged or partly submerged sea caves	N/A	A qualifying feature of the Lundy SAC which is within the benthic ecology study area, but not a primary reason for site selection	Annex I habitat (EC Habitats Directive)	SAC boundary is 3.5 km from the Offshore Cable Corridor	**International** (qualifying feature of SAC in the study area)
Habitats of Principal Importance					
Subtidal sand sediment habitats	Sparse fauna in Atlantic infralittoral mobile clean sand (MB5231) *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (MC5211) *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment (MC5214) *Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand (MD5212)	Not a feature of any SACs potentially affected by the Proposed Development	Section 41 NERC Act Habitat of Principal Importance (2006), (Subtidal Sands and Gravels)	Widespread throughout Offshore Cable Corridor (see Volume 3, Figure 1.7 to Figure 1.10)	**Regional** (taking into account extent of this Habitat of Principal Importance in the region)

Receptor	Representative biotope recorded within the benthic ecology study area	Designation status	Conservation Interest	Distribution within the Benthic Study Area	Value and Justification
Subtidal coarse sediment habitats	*Protodorvillea kefersteini* and other polychaetes in impoverished Atlantic circalittoral mixed gravelly sand (MC3213)	Not a feature of any SACs potentially affected by the Proposed Development	Section 41 NERC Act Habitat of Principal Importance (2006), (Subtidal Sands and Gravels)	Widespread throughout Offshore Cable Corridor (see Volume 3, Figure 1.7 to 1.10)	**Regional** (taking into account extent of this Habitat of Principal Importance in the region)
Subtidal mixed sediment habitats	Polychaete-rich deep Venus community in offshore circalittoral mixed sediment (MD4211) Sparse sponges, *Nemertesia spp.*, and *Alcyonidium diaphanum* on Atlantic circalittoral mixed substrata (MC1217)	Not a feature of any SACs potentially affected by the Proposed Development	Section 41 NERC Act Habitat of Principal Importance (2006), (Subtidal Sands and Gravels)	Widespread throughout Offshore Cable Corridor (see Volume 3, Figure 1.7 to 1.10)	**Regional** (taking into account extent of this Habitat of Principal Importance in the region)
Sabellaria habitat (not reef)	*Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment (MC2211)	Not a feature of any SACs potentially affected by the Proposed Development	Section 41 NERC Act Habitat of Principal Importance (2006), (Subtidal Sands and Gravels)	Subtidal survey recorded representative biotope at two discrete locations within the Offshore Cable Corridor (see Volume 3, Figure 1.7)	**Regional** (taking into account extent of this Habitat of Principal Importance in the region)
Features of MCZs					

Receptor	Representative biotope recorded within the benthic ecology study area	Designation status	Conservation Interest	Distribution within the Benthic Study Area	Value and Justification
Subtidal sand[2]	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the South West Approaches to Bristol Channel MCZ; Bideford to Foreland Point MCZ; and East of Haig Fras MCZ	South West Approaches to Bristol Channel MCZ, Bideford to Foreland Point MCZ and East of Haig Fras MCZ overlap with the Benthic Ecology Study Area	**National** (listed as a feature of the indicated MCZs)
Subtidal coarse sediment	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the South West Approaches to Bristol Channel MCZ; Bideford to Foreland Point MCZ; and the East of Haig Fras MCZ (as part of subtidal coarse sediment / subtidal mixed sediments mosaic)	South West Approaches to Bristol Channel MCZ, Bideford to Foreland Point MCZ and East of Haig Fras MCZ overlap with the Benthic Ecology Study Area	**National** (listed as a feature of the indicated MCZs)
Subtidal mixed sediment	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the Bideford to Foreland Point MCZ; and East of Haig Fras MCZ (as part of subtidal coarse sediment / subtidal mixed sediments mosaic)	Bideford to Foreland Point MCZ and East of Haig Fras MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the indicated MCZs)

[2] It should be noted that although these specific MCZ habitat features have been listed here, some of them are also covered by the first part of the table but not in the context of being an MCZ feature.

Receptor	Representative biotope recorded within the benthic ecology study area	Designation status	Conservation Interest	Distribution within the Benthic Study Area	Value and Justification
Subtidal mud	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the East of Haig Fras MCZ	East of Haig Fras MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the East of Haig Fras MCZ)
Sea-pen and burrowing megafauna communities	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the East of Haig Fras MCZ	East of Haig Fras MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the East of Haig Fras MCZ)
Fan mussel *Atrina fragilis*	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the East of Haig Fras MCZ	East of Haig Fras MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the East of Haig Fras MCZ)
High energy circalittoral rock	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the Bideford to Foreland Point MCZ and East of Haig Fras MCZ	Bideford to Foreland Point MCZ and East of Haig Fras MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the indicated MCZs)
Moderate energy circalittoral rock	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the Bideford to Foreland Point MCZ and East of Haig Fras MCZ	Bideford to Foreland Point MCZ and East of Haig Fras MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the indicated MCZs)
Honeycomb worm, *Sabellaria alveolata* reefs	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the Bideford to Foreland Point MCZ	Bideford to Foreland Point MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the Bideford to Foreland Point MCZ)
Intertidal under boulder communities	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the Bideford to Foreland Point MCZ	Bideford to Foreland Point MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the Bideford to Foreland Point MCZ)

Receptor	Representative biotope recorded within the benthic ecology study area	Designation status	Conservation Interest	Distribution within the Benthic Study Area	Value and Justification
Fragile sponge and anthozoan communities on subtidal rocky habitats	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the Bideford to Foreland Point MCZ	Bideford to Foreland Point MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the Bideford to Foreland Point MCZ)
Pink sea fan, *Eunicella verrucosa*	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the Bideford to Foreland Point MCZ	Bideford to Foreland Point MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the Bideford to Foreland Point MCZ)
Low energy intertidal rock	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the Bideford to Foreland Point MCZ	Bideford to Foreland Point MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the Bideford to Foreland Point MCZ)
Moderate energy intertidal rock	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the Bideford to Foreland Point MCZ	Bideford to Foreland Point MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the Bideford to Foreland Point MCZ)
High energy intertidal rock	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the Bideford to Foreland Point MCZ	Bideford to Foreland Point MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the Bideford to Foreland Point MCZ)
Intertidal coarse sediment	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the Bideford to Foreland Point MCZ	Bideford to Foreland Point MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the Bideford to Foreland Point MCZ)
Intertidal mixed sediments	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the Bideford to Foreland Point MCZ	Bideford to Foreland Point MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the Bideford to Foreland Point MCZ)

Receptor	Representative biotope recorded within the benthic ecology study area	Designation status	Conservation Interest	Distribution within the Benthic Study Area	Value and Justification
Intertidal sand and muddy sand	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the Bideford to Foreland Point MCZ	Bideford to Foreland Point MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the Bideford to Foreland Point MCZ)
Littoral chalk communities	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the Bideford to Foreland Point MCZ	Bideford to Foreland Point MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the Bideford to Foreland Point MCZ)
Low energy infralittoral rock	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the Bideford to Foreland Point MCZ	Bideford to Foreland Point MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the Bideford to Foreland Point MCZ)
Moderate energy infralittoral rock	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the Bideford to Foreland Point MCZ	Bideford to Foreland Point MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the Bideford to Foreland Point MCZ)
High energy infralittoral rock	Not applicable as no surveys were conducted within the MCZ	MCZ	Protected feature within the Bideford to Foreland Point MCZ	Bideford to Foreland Point MCZ overlaps with the Benthic Ecology Study Area	**National** (listed as a feature of the Bideford to Foreland Point MCZ)

1.6 Key Parameters for Assessment

Maximum Design Scenario

1.6.1 The maximum design scenarios identified in **Table 1.19** have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from the Project Design Envelope provided in Volume 1, Chapter 3: Project description of the PEIR. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the Project Design Envelope (e.g., different cable installation method), to that assessed here be taken forward in the final design scheme. Therefore, this comprises a conservative assessment of a worst case scenario.

Table 1.19: Maximum Design Scenario considered for the assessment of potential impacts. Y = Yes; N = No

Potential Impact	Phase[1]					Maximum Design Scenario	Justification
	C	Op	Op repair	D In situ	D removal		
Temporary habitat loss/disturbance	Yes	No	Yes	No	Yes	**Construction phase** Temporary habitat loss / disturbance as a result of sandwave clearance, boulder clearance, pre-lay ploughing and seabed debris removal: • 7,400,000 m^2 footprint for sandwave clearance, use of mass flow excavation and/or seabed surface plough. Precautionary estimate assuming clearance along 50% of Offshore Cable Corridor (20 [w] x 370,000 [l] x 2 [n] x 50%). Seabed surface plough with swath width of 10-20 m wide. • 6,000,000 m^2 for boulder clearance, pre-lay plough with swath width of 10-15 m assumed across approximately 200 km of the cable route (15 [w] x 200,000 [l] x 2 [n]). • 740,000 m^2 for max (precautionary) seabed debris removal, pre-lay grapnel run with 1 m width and at maximum penetration depth of 1 m (1 [w] x 370,000 [l] x 2 [n]). • 11,100,000 m^2 for max (precautionary) pre-lay trench ploughing with disturbance width of 15 m (15 [w] x 370,000 [l] x 2 [n]. • 440,000 m^2 for max (precautionary) build up of sediment either side of cables along 220 km of buried cable with a maximum width of 0.5 m either side of cable (1 [w] x 220,000 [l] x 2 [n]). Habitat loss as a result of cable burial: • Burial techniques including trench ploughing, trench jetting or mechanical trench excavation.	Maximum effect of temporary habitat loss / disturbance will occur as result of the maximum area of seabed disturbed. Temporary habitat loss / disturbance does not factor in in-service cables which would be covered in rock protection and therefore has been factored into long term habitat loss/change.

Potential Impact	Phase[1]					Maximum Design Scenario	Justification
	C	Op	Op repair	D In situ	D removal		
						• Mechanical trenching, ROV on seabed with footprint up to 126 m² (10 m width and 12.6 m length). • For water jetting ROV, seabed footprint of up to 55.2 m² (6 m width and 9.2 m length). • Cable spacing 50 – 180 m between the two bundles. • Trench width of 0.5 to 1.5 m. • Cable burial across entire length, with estimated up to 150 km of route requiring potential additional rock protection. Habitat loss as a result of removal of out of service cables and associated rock protection: • 28 crossings (cutting and removal of existing cables assumed to be within the maximum construction disturbance footprints above). Habitat loss as a result of the use of jack-up vessels at the HDD • Maximum of two jack-up vessels required (assumed to be less than the associated sediment removal area below). Habitat loss as a result of excavations at HDD exit pits, if required: • Localised excavations using either a back-hoe dredger (long arm barge mounted excavator), mass flow excavation (MFE) or a Trailing Suction Hopper Dredger (TSHD). Sediment will be removed from an area of approximately 15 m x 15 m around the (x4) exit points.	
						Operational phase repair activities	

Potential Impact	Phase[1]					Maximum Design Scenario	Justification
	C	Op	Op repair	D In situ	D removal		
						De-burial and re-burial of cable failure points across two 370 km bundled cables. (Infrequent, isolated repair activities).	
						Decommissioning phase Two scenarios to assess: - Cable could be removed - Cable could be left *in-situ*	
Temporary increase in suspended sediments and sediment deposition	Yes	No	Yes	No	Yes	**Construction phase** Temporary seabed disturbance as a result of sandwave clearance, boulder clearance, pre-lay ploughing and seabed debris removal: • 7,400,000 m^2 footprint for sandwave clearance, use of Mass flow excavation and/or seabed surface plough. Precautionary estimate assuming clearance along 50% of Offshore Cable Corridor (20 [w] x 370,000 [l] x 2 [n] x 50%). Seabed surface plough with swath width of 10-20 m wide. • 6,000,000 m^2 for boulder clearance, pre-lay plough with swath width of 10-15 m assumed across approximately 200 km of the cable route (15 [w] x 200,000 [l] x 2 [n]). • 740,000 m^2 for max (precautionary) seabed debris removal, pre-lay grapnel run with 1 m width and at maximum penetration depth of 1 m (1 [w] x 370,000 [l] x 2 [n]). • 11,100,000 m^2 for max (precautionary) pre-lay trench ploughing with disturbance width of 15 m (15 [w] x 370,000 [l] x 2 [n]). Seabed disturbance as a result of cable burial: • Burial techniques including trench ploughing, trench jetting or mechanical trench excavation.	Maximum effect of increased suspended sediments and sediment deposition will occur as result of the maximum area and volume of seabed disturbed.

Potential Impact	Phase[1]					Maximum Design Scenario	Justification
	C	Op	Op repair	D In situ	D removal		
						• Mechanical trenching, ROV on seabed with footprint up to 126 m² (10 m width and 12.6 m length) • For water jetting ROV, seabed footprint of up to 55.2 m² (6 m width and 9.2 m length) • Cable spacing 50 – 180 m between the two • Trench width of 0.5 to 1.5 m • Cable burial across entire length, with estimated up to 150 km of route requiring potential additional rock protection • Target cable burial depth of 1.5 m Increase in suspended sediments as a result of disturbance at out of service and in-service cables and associated rock protection: • 28 out of service cable crossings • 21 in-service cable crossings Seabed disturbance as a result of the use of jack-up vessels at the HDD • Maximum of two jack-up vessels required (assumed to be less than the associated sediment removal area below). Habitat loss as a result of excavations at HDD exit pits, if required: • Localised excavations using either a back-hoe dredger (long arm barge mounted excavator), mass flow excavation (MFE) or a Trailing Suction Hopper Dredger (TSHD). Sediment will be removed from an area of approximately 15 m x 15 m around the (x4) exit points	

Potential Impact	Phase[1]					Maximum Design Scenario	Justification
	C	Op	Op repair	D In situ	D removal		
						Operation phase repair activities • De-burial and re-burial of cable failure points across two 370 km bundled cables. (Infrequent, isolated repair activities.) **Decommissioning phase** Two scenarios to assess: - Cable could be removed - Cable could be left *in-situ*	
Changes to water quality (release of hazardous substances from sediments)	Yes	No	Yes	No	Yes	**Construction phase** As per Temporary increase in suspended sediments and sediment deposition **Operation phase repair activities** As per Temporary increase in suspended sediments and sediment deposition **Decommissioning phase** As per Temporary increase in suspended sediments and sediment deposition	Maximum effects of changes to water quality as a result of resuspension of suspended sediments will results from the maximum amount of disturbance and chemical composition of the sediment.
Introduction and spread of INNS	Yes	No	Yes	Yes	Yes	**Construction phase** Where equipment or structures are introduced to the water column there is risk of introduction and spread of INNS. Consequently, those activities outlined in the above sections of the table apply. A key consideration for INNS is the potential risk of introduction and spread due to vessel activity, either via ballast water discharge or biofouling of the vessel hull or other vessel structures. Consequently, a description of likely vessel groups to be utilised during the installation activities of the Proposed Development is provided below (as outlined in the Project Description (Volume 1: Chapter 3):	The most likely pathway for INNS is via vessel activities, therefore the maximum number of vessels will represent the maximum risk of introduction of INNS.

Potential Impact	Phase[1]					Maximum Design Scenario	Justification
	C	Op	Op repair	D In situ	D removal		

						• Vessels for pre and post-installation surveys;
						
						• Workboats/construction vessels and tugs for all works including route clearance/preparation, trenching, installation of rock protection/concrete mattresses, duct installation, cable pull and floating in, and dive support, depending on requirements. These workboats often deploy ROVs and would utilise geophysical survey and positioning equipment to monitor the progress of the works, and for positioning of any ROVs or other underwater equipment needed to complete the works;
						
						• Cable-laying vessels (CLVs);
						
						• Guard vessels – as necessary, these would accompany the CLV to maintain surveillance around the worksite ensuring other vessels are kept clear, reducing the risk of collision and to protect the cable prior to burial;
						
						    • Rock placement vessel – where rock placement is required for additional cable protection (e.g. at cable crossings), a rock placement vessel may be used. Such vessels feature a rock storage hopper and equipment by which rock can be placed in-situ on the seabed, such as fall pipes; and
						
						    • Jack up vessel / multi-cat vessel – for the HDD works (breakthrough, duct push/pull and duct sealing works) near the landfall, jack up vessels	

Potential Impact	Phase[1]					Maximum Design Scenario	Justification
	C	Op	Op repair	D In situ	D removal		
						would be deployed to enable stable and safe marine works in the tidal environment. The precise number of vessels to be used is to be determined by the Cable Contractor, however, it is expected that two pre-installation survey vessels, four trenching vessels, two rock placement vessels, one CLV (two for brief periods during changeovers), and 20 guard vessels stationed every 10 nautical miles (nm) would be required. It is anticipated that a maximum of two jack up / multi-cat vessels would be required for the offshore HDD works. **Operation phase repair activities** The number of vessels required during the operational phase is not clear, however, the number of vessels involved would be less than for the construction phase. **Decommissioning phase** Two scenarios to assess, impact is relevant to both as vessels would be required for both approaches although vessels activity would be greater with the removal option: - Cable could be removed - Cable could be left *in situ*	
Underwater noise & vibration	Yes	No	No	No	No	**Construction phase** Only vibration from HDD has been considered for benthic invertebrates. There will be four borehole drills, and four exit points.	Vibration in sediments due to HDD has the potential to affect benthic invertebrates.

Potential Impact	Phase[1]					Maximum Design Scenario	Justification
	C	Op	Op repair	D In situ	D removal		
Change in hydrodynamic regime (scour & accretion)	No	Yes	No^	No	Yes	**Construction phase** 597,000 m² of long term habitat loss /change as a result of: Additional rock protection across cables equating to a estimated maximum rock protection footprint of 450,000 m² (225,000 m² per cable bundle): • Rock protection across a maximum of 150 km of cable. • Rock protection assumed 1.5 m wide. Rock protection over in-service cable crossings equating to a maximum rock protection footprint of 147,000 m²: • 21 in service cable crossings • Maximum rock protection footprint of 3,500 m2 per crossing (7 m wide and 500 m long) • 2 cable bundles	The maximum change in hydrodynamic regime will result from the maximum area and height of rock protection.
						Operational phase 597,000 m² of long term habitat loss /change as a result of: Additional rock protection across cables equating to an estimated maximum rock protection footprint of 450,000 m² (225,000 m² per cable bundle): • Rock protection across an estimated maximum of 150 km of cable. • Rock protection assumed 1.5 m wide.	

Potential Impact	Phase[1]					Maximum Design Scenario	Justification
	C	Op	Op repair	D In situ	D removal		
						Rock protection over in-service cable crossings equating to a maximum rock protection footprint of 147,000 m²: • 21 in service cable crossings • Maximum rock protection footprint of 3,500 m2 per crossing (7 m wide and 500 m long) • 2 cable bundles **Decommissioning phase** Potential impact if cable was removed – adopting similar MDS assumptions to construction phase above (noting this is a precautionary worst case).	
Sediment heating	No	Yes	No^	No	No	**Operational phase** • 4 x 525 kV HVDC cables (175 mm in diameter) with a length of 370 km. • Rock protection (up to max.1 m high) required for an estimated maximum of 150 km of cable. • Cable will be buried along entire length. Target burial depth of 1.5 m (average minimum possible burial depth – based on provisional burial risk assessment - of 0.8 m)	The maximum heat change will result from the maximum cable voltage. Maximum extent of heat change will result from the maximum length of the cable bundles.

Potential Impact	Phase[1]					Maximum Design Scenario	Justification
	C	Op	Op repair	D In situ	D removal		
Electromagnetic field (EMF) effects	No	Yes	No^	No	No	**Operational phase** • 4 525 kV HVDC cables (175 mm in diameter) with a length of 370 km. • Rock protection 1 m high required for a maximum of 150 km of cable. • A maximum of 220 km of cable route to be buried to a maximum depth of 1.5 m (average minimum depth of 0.8 m)	The operation of the cable could result in the generation of EMFs which could affect benthic invertebrates. Maximum EMF values emitted from cable and extent of the EMFs will vary in relation to a number of aspects including the maximum cable voltage, distance from the seafloor and length of the cable.
Long-term habitat loss/change	No	Yes	No	Yes	No	**Operational phase** 597,000 m^2 of long term habitat loss /change as a result of: Additional rock protection across cables equating to an estimated maximum rock protection footprint of 450,000 m^2 (225,000 m^2 per cable bundle): • Rock protection across an estimated maximum of 150 km of cable. • Rock protection assumed 1.5 m wide. Rock protection over in-service cable crossings equating to a maximum rock protection footprint of 147,000 m^2: • 21 in service cable crossings • Maximum rock protection footprint of 3,500 m2 per crossing (7 m wide and 500 m long) • 2 cable bundles **Decommissioning phase** Potential impact if cable was left *in-situ*	Maximum effect of long-term habitat loss will occur as a result of the maximum area of seabed covered by cable protection and cable crossings protection (i.e., rock berms).

<table>
<tr><th rowspan="2">Potential Impact</th><th colspan="5">Phase[1]</th><th rowspan="2">Maximum Design Scenario</th><th rowspan="2">Justification</th></tr>
<tr><th>C</th><th>Op</th><th>Op repair</th><th>D In situ</th><th>D removal</th></tr>
<tr><td rowspan="3">Accidental pollution</td><td rowspan="3">Yes</td><td rowspan="3">No</td><td rowspan="3">Yes</td><td rowspan="3">Yes</td><td rowspan="3">Yes</td><td>Construction phase
See ‘Temporary habitat loss/disturbance’ for general construction information.

See ‘Introduction and spread of INNS’ for vessel information.

Potential accidental release of bentonite during HDD</td><td rowspan="3">There is a risk of chemicals being accidentally released from sources including vessels/vehicles and equipment/machinery. The greatest likelihood of accidental pollution will result from the maximum number of vessels on site at any one time. The MDS also considers the release of bentonite from HDD.</td></tr>
<tr><td>Operation phase repair activities
The number of vessels required during the operational phase is not clear, however, as a minimum there would be:
• One survey vessel to conduct cable inspection surveys.
• Surveys up to once a year for the first 5 years, and then approximately every 5 years for the remainder of the operational life of the cables (anticipated 50 years).</td></tr>
<tr><td>Decommissioning phase
Two scenarios to assess, impact relevant to both options:
- Cable could be removed
- Cable could be left in-situ

• Where the Proposed Development is to be left in-situ, vessels will be required to secure cables.
• Where the Proposed Development is to be fully or partially removed, vessels similar to those used for installation would be used.</td></tr>
</table>

[1] C=Construction phase, Op=Operational phase, Op_{repair}=Operational phase repair activities, $D_{in\text{-}situ}$=Decommissioning phase assuming cable de-energised and left *in-situ,* $D_{removal}$=Decommissioning phase assuming cable removed, ^=on assumption that covered by normal operation.

1.7 Mitigation Measures Adopted as Part of the Proposed Development

1.7.1 As part of the Proposed Development design process, a number of designed-in mitigation measures have been proposed to reduce the potential for impacts on benthic ecology (**Table 1.20**). This approach has been employed in order to demonstrate commitment to measures by including them in the design of the Proposed Development, and have therefore been considered in the assessment presented in **Sections 1.8, 1.9** and **1.10**. These measures are considered standard industry practice for this type of development. Assessment of sensitivity, magnitude and therefore significance includes implementation of these measures.

1.7.2 The mitigation measures proposed as part of the Proposed Development include the following types of mitigation:

- Primary (inherent) mitigation – measures included as part of the Proposed Development design. The Institute of Environmental Management and Assessment (IEMA) describes these as '*modifications to the location or design of the development made during the pre-application phase that are an inherent part of the Proposed Development and do not require additional action to be taken*'. This includes modifications arising through the iterative design process. These measures will be secured through the consent itself, through the description of the Proposed Development and the parameters secured in the DCO and/or marine licences. For example, a reduction in footprint or height.
- Secondary (foreseeable) mitigation. IEMA describes these as '*actions that will require further activity in order to achieve the anticipated outcome'*. These include measures required to reduce the significance of environmental effects and may be secured through an environmental management plan.
- Tertiary (inexorable) mitigation. IEMA describes these as '*actions that would occur with or without input from the EIA feeding into the design process. These include actions that will be undertaken to meet other existing legislative requirements, or actions that are considered to be standard practices used to manage commonly occurring environmental effects'*. It may be helpful to secure such measures through the Offshore Construction Environmental Management Plan (an outline Offshore CEMP is provided as PEIR Volume 1, Appendix 3.3, which will continue to be developed and submitted as part of the DCO application).

Table 1.20: Mitigation measures adopted as part of the Proposed Development

Measure Adopted	How the Measure Will be Secured
Primary mitigation	
Cable burial	Cables will be buried (where possible) up to 1.5 m below the seabed, subject to a detailed Cable Burial Risk Assessment (CBRA). Only when full burial is not possible will additional protection be installed. Secured via inherent design associated with the DCO.
Cable protection measures	Where possible cable protection structures would be kept level with the seabed, and if above the seabed they would be kept to a maximum of 1 m above seabed level.

Measure Adopted	How the Measure Will be Secured
	Secured via inherent design associated with the DCO.
Secondary mitigation	
There will be micro-routing of the cable to minimise any potential damage to Annex I habitats.	It is anticipated that this will be implemented as a consent condition during the construction phase (requirement of the final CEMP).
Tertiary mitigation	
Ballast Water Management Convention (2017)	All ships subject to the Ballast Water Management Convention (2017) requirements will be obliged to conduct ballast water management in accordance with the contractual provisions and those within the Convention.
Offshore Construction Environmental Management Plan (CEMP)	An Offshore CEMP will detail the best practice approach to offshore activities and would implement those measures and environmental commitments identified in the EIA. The following measures will be included in the Offshore CEMP: marine pollution prevention; waste management; marine invasive species; and dropped object procedures. An Outline Offshore CEMP will form part of the DCO (with a final Offshore CEMP finalised by offshore contractor).
Offshore Biosecurity Plan	In order to reduce the likelihood of introducing Marine Invasive Non-Native Species (MINNS) during all phases of the Proposed Development, an Offshore Biosecurity Plan will be adhered to with the incorporation of a biosecurity risk assessment.
Marine Pollution Contingency Plan (MPCP)	An MPCP will be produced as part of the Offshore CEMP and will include measures to minimise the impact of any events as well as compliance with the International Convention for the Prevention of Pollution from Ships (MARPOL).
Shipboard Oil Pollution Emergency Plan (SOPEP)	For compliance with the requirements of MARPOL, all Project vessels with a gross tonnage (GT) above 400 tonnes would require a SOPEP detailing the emergency actions to be taken in the event of an oil spill.
Use of Bentonite during HDD	Bentonite will be used during HDD as the best practice drill lubricant.
HDD drill fluid system	The use of a HDD drill fluid system that allows for the monitoring of pressure loss and therefore allows for the rapid identification of potential break outs
Vessel Management Plan (VMP)	The VMP will confirm the types and numbers of vessels that would be engaged on the Proposed Development and consider vessel coordination including indicative transit route planning. Pre-requisite contractor requirement – secured via final CEMP.

1.8 Preliminary Assessment of Construction Effects

1.8.1 The impacts of the construction phase of the Proposed Development have been assessed. The potential preliminary impacts arising from the construction phase of the Proposed Development are listed in **Table 1.19**, along with the MDS against which each impact has been assessed.

1.8.2 A description of the potential effect on receptors caused by each identified impact is given below.

1.8.3 The Offshore Cable Corridor runs immediately adjacent to the South West Approaches to Bristol Channel MCZ for about 50 km. The Offshore Cable Corridor also runs adjacent to a corner of the East of Haig Fras MCZ and part of the nearshore section is in the vicinity of the Bideford to Foreland Point MCZ. An MCZ assessment will be conducted and submitted with the EIA application providing a full assessment of potential effects on the South West Approaches to Bristol Channel MCZ, East of Haig Fras MCZ and Bideford to Foreland Point MCZ. The only impacts which are considered to have the potential to have any effects on the MCZs are: temporary increase in suspended sediments and sediment deposition; changes to water quality (release of hazardous substances from sediments); introduction of INNS; and accidental pollution. Consequently, for these impacts additional information is provided for MCZ Features of Conservation Interest (FOCI) as appropriate, and an assessment is provided here of whether there is a risk of conservation objectives for MCZs being hindered.

Temporary habitat loss / disturbance

1.8.4 Temporary habitat loss / disturbance within the Offshore Cable Corridor may occur during the construction phase as a result of a range of activities. This includes associated seabed preparation (including sandwave clearance, boulder clearance, pre-lay ploughing and seabed debris removal), and cable burial activities. Temporary habitat loss will also occur due to the use of construction vessels including jack-up vessels, during HDD operations. Where habitats are subsequently covered with infrastructure (e.g. rock berm for cable protection and cable crossings) habitat loss/change is considered long-term and has therefore been assessed as an operational impact in Section 1.9 of this Chapter and is not considered further here.

Sensitivity of the Receptor

1.8.5 The sensitivity of the receptors identified in the Benthic Ecology Study Area have been assessed in relation to the following MarESA pressures relevant to temporary habitat loss/disturbance:

- Habitat structure changes – removal of substratum (extraction).
- Abrasion / disturbance of the surface of the substratum or seabed.
- Penetration or disturbance of the substratum subsurface.
- Smothering and siltation rate changes (heavy i.e. 5 to 30 cm deposition).

1.8.6 The sensitivity of representative biotopes to temporary habitat loss/disturbance pressures are summarised in **Table 1.21**.

1.8.7 The boundaries of SACs and MCZs within the Benthic Ecology Study Area are located beyond the Cable Corridor (Volume 3, Figure 1.4). Consequently, there is no potential for interaction between benthic habitat/species features of these SACs and MCZs (**Table 1.17**) and the activities associated with temporary habitat loss/disturbance (this is noting that 'Temporary increase in suspended sediments and sediment deposition' has been considered as a separate impact). Therefore, these receptors have not been considered in this 'Temporary habitat loss/disturbance' assessment section.

1.8.8 Similarly, there is no potential for interaction between activities associated with temporary habitat loss and intertidal benthic receptors due to the installation of cables at the landfall via HDD. Therefore, these receptors have not been assessed.

1.8.9 There will be micro-routing of the cable to avoid potential impacts on Annex I bedrock and stony reef habitats.

1.8.10 The MarESA assessment indicated that subtidal biotopes recorded during surveys have a Medium sensitivity to 'habitat structure changes – removal of substratum (extraction)' (**Table 1.21**). Construction activities such as pre-lay ploughing will result in the redistribution of sediment within the footprint of the Offshore Cable Corridor (along the line of the cable installation) and the subsequent removal of characterising species within the upper layers of sediment. However, it is anticipated that representative biotopes may recover following cable burial. For instance, characterising species of the biotope '*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment' (MC5214), may take up to two years to re-establish (Tillin *et al*., 2023). Hill *et al*. (2011) reviewed the recoverability of seabed sediments following marine aggregate extraction, with rapid recovery (approximately 8 months) was reported in areas with high levels of sediment mobility. Consequently, these receptors will have a limited capacity to avoid adapt to or tolerate the impact with partial recovery anticipated within 5 years and full recovery within 10 years. Benthic receptors are also considered to be of Regional value. These receptors are therefore assessed as having **medium** sensitivity to 'habitat structure changes – removal of substratum (extraction)'.

1.8.11 The MarESA assessment indicated that a number of recorded subtidal biotopes including 'Sparse fauna in Atlantic infralittoral mobile clean sand' (MB5231), '*Protodorvillea kefersteini* and other polychaetes in impoverished Atlantic circalittoral mixed gravelly sand' (MC3213), '*Echinocyamus pusillus*, *Ophelia borealis*, *Abra prismatica* in circalittoral fine sand' (MC5211), 'Polychaete-rich deep Venus community in offshore circalittoral mixed sediment' (MD4211) and '*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment' (MC5214) had a Low sensitivity to 'abrasion / disturbance of the surface of the substratum or seabed' and 'penetration or disturbance of the substratum surface' (**Table 1.21**). Associated species of the biotope 'Sparse fauna in Atlantic infralittoral mobile clean sand' (MB5231) such as the white catworm *Nephtys cirrosa*, amphipods and isopods are generally present in low abundance and are adapted to frequent sediment disturbance (Elliot *et al.* 1998). For the biotopes '*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand' (MC5211), '*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment' (MC5214) and 'Polychaete-rich deep Venus community in offshore circalittoral mixed sediment' (MD4211), abrasion is likely to damage epifauna and flora and may damage a proportion of the characterising species (Tillin & Watson, 2024; Tillin *et al*., 2023; Tillin & Watson, 2023). However, opportunistic species are likely to rapidly recruit to damaged areas and some damaged characterising species may recover or recolonise (Tillin & Watson, 2023). Consequently, these receptors will have a limited capacity to avoid adapt to or tolerate the impact. However, full recovery may occur within 5 years. These benthic receptors are also considered to be of Regional value. These receptors are therefore assessed as having **Low** sensitivity to 'abrasion / disturbance of the surface of the substratum or seabed' and 'penetration or disturbance of the substratum surface'.

1.8.12 Other representative biotopes including '*Sparse sponges, Nemertesia* spp*., and Alcyonidium diaphanum on Atlantic circalittoral mixed substrata*' (MC1217), '*Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment' (MC2211) and '*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand' (MD5212) have a Medium sensitivity to 'abrasion / disturbance of the surface of the substratum or seabed' and 'penetration or disturbance of the substratum surface' (**Table 1.21**). Characterising sponges, hydroids and bryozoans will likely suffer damage and mortality following abrasion and penetration of the substratum surface (Readman *et al*., 2023). However, species such as *Nemertesia* spp. may show signs of resistance to abrasion and benthic larvae could rapidly colonise disturbed areas (Bradshaw *et al*., 2002). Similarly, if *S. spinulosa* was directly exposed to physical abrasion and penetration, there could be damage and mortality, but recovery may occur (within 2 years) if individuals are not completely removed (Tillin *et al*., 2023). Consequently, these receptors will have a very low capacity to avoid adapt to or tolerate the impact. However, partial recovery may occur within 5 years. These benthic receptors are also considered to be of Regional value. These receptors are therefore assessed as having **medium** sensitivity to 'abrasion / disturbance of the surface of the substratum or seabed' and 'penetration or disturbance of the substratum surface'.

1.8.13 The impact 'Smothering and siltation rate changes (heavy)' was included as sediment displaced from the cable trench is anticipated to be deposited along the trench at a depth greater than 5 cm, so a very localised area of sediment adjacent to the trench would be exposed to this impact. Heavy smothering is likely to result in the mortality of some characterising species of the biotope 'Atlantic infralittoral mobile clean sand' (MB5231). However, some polychaete species may escape up to 90 cm of burial (Speybroek *et al*., 2007). Additionally, Lewis *et al*., (2012), found that recovery of original abundances appear to occur within one year in response to burial. Consequently, these receptors will have a limited capacity to avoid adapt to or tolerate the impact. However, full recovery may occur within 5 years. These benthic receptors are also considered to be of Regional value. These receptors are therefore assessed as having **low** sensitivity to 'Smothering and siltation rate changes (heavy)'.

1.8.14 Other representative biotopes including '*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (MC5211), '*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment' (MC5214), '*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand' (MD5212), 'Polychaete-rich deep Venus community in offshore circalittoral mixed sediment' (MD4211) and '*Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment' (MC2211) have a Medium sensitivity to smothering and siltation rate changes (heavy). For the characterising species for these biotopes, heavy smothering is likely to result in a significant burden, resulting in mortality (De-Bastos, 2023). In the case of *S. spinulosa*, no direct evidence is available for the length of time the species can survive. However, in areas of high water flow, dispersion of fine sediments may be rapid and this will mitigate the magnitude of this pressure by reducing the time exposed (Tillin *et al*., 2023). Consequently, these receptors will have a very low capacity to avoid adapt to or tolerate the impact. However, partial recovery may occur within 5 years and full recovery within 10 years. These benthic receptors are also considered to be of Regional value. These receptors are therefore assessed as having **medium** sensitivity to 'Smothering and siltation rate changes (heavy)'.

Table 1.21: Sensitivity of benthic receptors to temporary habit loss/disturbance

Habitats	Representative biotopes	MarESA Assessment			
		Habitat structure changes – removal of substratum (extraction)	Abrasion / disturbance of the surface of the substratum or seabed	Penetration or disturbance of the substratum subsurface	Smothering and siltation rate changes (heavy)
Annex I Habitats					
Bedrock reef [3]	Not applicable	Not Applicable	Medium Sensitivity	Not Applicable	Medium Sensitivity
Stony reef	Not applicable	Medium	Medium	Medium	Medium
Subtidal sand sediment habitats					
Atlantic infralittoral sand (MB52)	Sparse fauna in Atlantic infralittoral mobile clean sand (MB5231)	Medium Sensitivity (based on No resistance and High resilience)	Low Sensitivity (based on Low resistance and High resilience)	Low Sensitivity (based on Medium resistance and High resilience)	Low Sensitivity (based on Low resistance and High resilience)
Atlantic circalittoral sand (MC52)	*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (MC5211) *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment (MC5214)	Medium Sensitivity (based on No resistance and Medium resilience)	Low Sensitivity (based on Medium resistance and High resilience)	Low Sensitivity (based on Medium resistance and High resilience)	Medium Sensitivity (based on Low resistance and Medium resilience)
Atlantic offshore circalittoral sand (MD52)	*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand (MD5212)	Medium Sensitivity (based on No resistance and Very Low resilience)	Medium Sensitivity (based on Low resistance and Medium resilience)	Medium Sensitivity (based on Low resistance and Medium resilience)	Medium Sensitivity (based on Low resistance and Medium resilience)
Subtidal coarse sediment habitats					
Atlantic circalittoral coarse	*Protodorvillea kefersteini* and other polychaetes in impoverished	Medium Sensitivity (based on No resistance and	Low Sensitivity (based on Medium resistance and	Low Sensitivity (based on Medium resistance and	No Evidence

[3] Note that MarESA does not provide assessments for these impacts for Bedrock reef and Stony reef, and Medium has been indicated as an indicative level of sensitivity to the impacts based on professional judgement.

Habitats	Representative biotopes	MarESA Assessment			
		Habitat structure changes – removal of substratum (extraction)	Abrasion / disturbance of the surface of the substratum or seabed	Penetration or disturbance of the substratum subsurface	Smothering and siltation rate changes (heavy)
sediment (MC32)	Atlantic circalittoral mixed gravelly sand (MC3213)	Medium resilience)	High resilience)	High resilience)	
Subtidal mixed sediment habitats					
Atlantic circalittoral mixed sediment (MD42)	Polychaete-rich deep Venus community in offshore circalittoral mixed sediment (MD4211)	Medium Sensitivity (based on No resistance and Medium resilience)	Low Sensitivity (based on Medium resistance and High resilience)	Low Sensitivity (based on Medium resistance and High resilience)	Medium Sensitivity (based on Medium resistance and Medium resilience)
Atlantic circalittoral rock (MC12)	Sparse sponges, *Nemertesia spp.*, and *Alcyonidium diaphanum* on Atlantic circalittoral mixed substrata (MC1217)	Medium Sensitivity (based on No resistance and Medium resilience)	Medium Sensitivity (based on Low resistance and Medium resilience)	Medium Sensitivity (based on Low resistance and Medium resilience)	Low Sensitivity (based on Medium resistance and High resilience)
***Sabellaria* habitats**					
Atlantic circalittoral biogenic habitat (MC22)	*Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment (MC2211) (no *Sabellaria* reef was recorded)	Medium Sensitivity (based on No resistance and Medium resilience)	Medium Sensitivity (based on Low resistance and Medium resilience)	Medium Sensitivity (based on No resistance and Medium resilience)	Medium Sensitivity (based on No resistance and Medium resilience)

Magnitude of Impact

1.8.15 The MDS considers the following maximum temporary habitat loss/disturbance areas: sandwave clearance - 7,400,000 m^2; boulder clearance - 6,000,000 m^2, pre-lay ploughing - 11,100,000 m^2, seabed debris removal - 740,000 m^2, and cable burial - 660,000 m^2. It should be noted, however, that the seabed area disturbance areas are considered conservatively high and assume for example that sandwave clearance, seabed debris removal and pre-lay trenching will take place across the entire 370 km stretch for the two cable bundles.

1.8.16 The MDS also factors in a maximum of 28 out of service cable crossings requiring removal and the presence of two jack-up vessels for HDD operations. The seabed area disturbed as a result of these activities is expected to be small when compared to the MDS for all other activities. Jack-up footprints will result in compression of seabed sediments beneath spud cans or tubular legs, however post-construction monitoring at Barrow OWF has demonstrated that depressions associated with jack-up operations quickly infill approximately one year after construction (BoWind, 2008).

1.8.17 The impact will directly affect receptors through the temporary loss of benthic habitats and will be intermittent throughout the construction phase of the Proposed Development, taking place over several months split over two years. A precautionary estimate of total temporary habitat loss / disturbance area (25,240,000 m^2) is estimated by adding all the maximum areas above. This estimated area discounts the fact that the footprint of these activities will clearly overlap, thus the total area of disturbance could reasonably be expected to be far less in reality.

1.8.18 Notwithstanding the precautionary estimate of total disturbance area, this still represents only a small proportion of the habitats present across the Benthic Ecology Study Area (3,956.75 km^2) and will be restricted to the footprint of the Offshore Cable Corridor. This equates to approximately 0.64% of temporary habitat loss within the Benthic Ecology Study Area.

1.8.19 The impact is predicted to be of local spatial extent and of short-term duration. The magnitude is therefore **low**.

1.8.20 In relation to conservation objective 3 for the Bristol Channel Approaches SAC which relates to supporting habitats for harbour porpoise, the area of habitat potentially affected by this impact is extremely small in relation to the availability of similar habitats in the SAC and magnitude and significance of any indirect effect on harbour porpoise is considered to be negligible.

Significance of the Effect

1.8.21 The sensitivity of receptors is assessed to be **low** to **medium**, and the magnitude of the impact is considered to be **low**. Overall, it is considered that the effect will be of **minor** adverse significance, which is not significant in EIA terms.

1.8.22 The effect in relation to conservation objective 3 for the Bristol Channel Approaches SAC is considered in the HRA Screening Report which is issued alongside this PEIR.

Further Mitigation

1.8.23 The effect of 'Temporary habitat loss/disturbance' is not significant, therefore, no mitigation measures are proposed (beyond the embedded mitigation presented in **Table 1.20**).

Future Monitoring

1.8.24 No significant effects have been identified and no future monitoring is proposed.

Temporary increase in suspended sediments and sediment deposition

1.8.25 Increases in suspended sediment concentrations (SSC) and associated deposition will occur during the construction phase as a result of a range of activities, including sandwave clearance, boulder clearance and cable burial. Increased SSC can have impacts on benthic species. Increased suspended sediment can lead to greater levels of abrasion of animals, there is the potential of clogging of up of organs, disrupting the normal functioning of breathing and filter feeding apparatus making respiration and feeding difficult.

Sensitivity of the Receptor

1.8.26 The sensitivity of the receptors identified in the Benthic Ecology Study Area have been assessed in relation to the following MarESA pressures relevant to temporary habitat loss/disturbance:

- Changes in suspended solids (water clarity).
- Smothering and siltation rate changes (light i.e. <5 cm deposition).

1.8.27 The sensitivity of representative biotopes to temporary increases in suspended sediments and sediment deposition pressures are summarised in **Table 1.22**.

1.8.28 The MarESA assessment indicated that the sensitivity of subtidal sand biotopes recorded during the survey ranged from Not Sensitive to Low sensitivity to both ‘changes in suspended solids (water clarity)’ and ‘smothering and siltation rate changes (light)’, (**Table 1.22**). For the biotope ‘Infralittoral mobile clean sand with sparse fauna’ (MB5231), some effects on feeding and diatom productivity may occur from increases in suspended solids. However, characterising species within mobile sand sediments are well adapted to storm events or spring tides resulting in varying levels of suspended solids such as the polychaete *Nephtys cirrosa*, amphipods and the isopod *Eurydice pulchra* (Tillin *et al*., 2023). Additionally, where the biotope is associated with wave exposed habitats or those with strong currents, sediment removal will occur and mitigate the effects of deposition and smothering (Tillin *et al*., 2023).

1.8.29 For the biotopes ‘*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand’ (MC5211) and ‘*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment’ (MC5214), increases in suspended solids may have negative impacts on growth and fecundity of characterising bivalves by reducing filter feeding efficiency and imposing costs on clearing (Tillin & Watson, 2024; Tillin *et al.,* 2023). However, these species are predicted to be tolerant of short-term increases in turbidity following sediment mobilisation by storms and other events (Tillin & Watson, 2024; Tillin *et al*., 2023).

1.8.30 For the biotope ‘*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand’ (MD5212), an increase in SSC is unlikely to directly affect characterising species, and suspended matter settling out may increase food availability (De-Bastos, 2023).

1.8.31 Consequently, subtidal sand biotope receptors are generally considered to be adaptable to the changing environment, with high recoverability and tolerance and are of Regional value. The receptor is therefore assessed as having **low** sensitivity to ‘changes in suspended solids (water clarity)’ and ‘smothering and siltation rate changes (light)’.

1.8.32 The MarESA assessment indicated that the subtidal coarse sediment habitat ‘*Protodorvillea kefersteini* and other polychaetes in impoverished Atlantic circalittoral mixed gravelly sand’ (MC3213) is not sensitive to ‘changes in suspended solids (water clarity) and no evidence is available for ‘smothering and siltation rate changes (light)’ (**Table 1.22**). Characterising polychaetes are both infaunal and predatory and therefore, may not directly be affected by an increase in SSC (Tillin & Watson, 2023). Similarly, amphipod species are tolerant to high turbidity and may gather suspended sediment for the construction of tubes (Mills, 1967). Consequently, this biotope is adaptable to the changing environment, with high recoverability and tolerance and is of Regional value. The receptor is therefore assessed as having **low** sensitivity to ‘changes in suspended solids (water clarity)’ and ‘smothering and siltation rate changes (light)’.

1.8.33 The MarESA assessment indicated that the sensitivity of the subtidal mixed sediments habitat ranged from Not Sensitive to Low sensitivity for ‘changes in suspended solids (water clarity)’ and ‘smothering and siltation rate changes (light)’, (**Table 1.22**). For characterising venerid bivalves of ‘Polychaete-rich deep Venus community in offshore circalittoral mixed sediment’ (MD4211), increases in SSC may affect growth and fecundity by reducing filter feeding efficiency and imposing costs on gill clearing (Tillin & Watson, 2023), however, these bivalves are predicted to be tolerant of short-term increases of SSC following sediment mobilisation (Tillin & Watson, 2023). Similarly, shallow burying bivalve suspension feeders are typically able to escape smothering of 10-50 cm of their native sediment and relocate to their preferred depth by burrowing (Maurer, 1986). Smothering will result in temporary cessation of feeding and respiration which may impair growth and reproduction for bivalves but is unlikely to cause mortality (Tillin & Watson, 2023).

1.8.34 For the biotope ‘Sparse sponges, *Nemertesia* spp., and *Alcyonidium diaphanum* on Atlantic circalittoral mixed substrata’ (MC1217), characterising sponges may adversely be affected by increases in suspended sediment, due to clogging of their feeding apparatus (Readman *et al*., 2023). However, many bryozoans and encrusting sponges are able to survive in highly sedimented conditions such as *Flustra foliacea* and *Dysidea fragilis* (Tyler-Walters & Ballerstedt, 2007; Castric-Fey & Chassé, 1991). In response to light smothering (up to 5 cm), encrusting sponges may be buried by deposition but are generally able to survive. Additionally, where there is moderate water flow any sediment deposition is likely to be removed rapidly (Readman *et* al., 2023). Consequently, the subtidal mixed sediments biotopes are generally considered to be adaptable to the changing environment, with high recoverability and tolerance, and are of Regional value. The subtidal mixed sediments receptor is therefore assessed as having **low** sensitivity to ‘changes in suspended solids (water clarity)’ and ‘smothering and siltation rate changes (light)’.

1.8.35 The MarESA assessment indicates that ‘*Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment' (MC2211) is Not Sensitive to ‘changes in suspended solids (water clarity)’ and ‘smothering and siltation rate changes (light)’ (**Table 1.22**). *S. spinulosa* relies on a supply of suspended solids and organic matter to filter feed and build protective tubes and so can tolerate a broad range of SSC (Davies *et al*., 2009; Tillin, 2010). *S. spinulosa* may be sensitive to smothering events (Hendrick *et al*., 2011), however, Last *et al*., (2011) found that *S. spinulosa* can survive short-term (32 days), periodic sand burial of up to 7 cm. It is anticipated that this depth of burial will be similar or less than that experienced during natural storm events and, in areas of high-water movement, deposits of fine sediments are likely to be remobilised and moved (Tillin *et* al., 2023). Consequently, ‘*Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment' is adaptable to the changing environment, with high recoverability and tolerance, and has Regional value. The receptor is therefore assessed as having **negligible** sensitivity to ‘changes in suspended solids (water clarity)’ and ‘smothering and siltation rate changes (light)’.

1.8.36 Habitat features of the Lundy SAC are indicated in **Table 1.17**. Sediment dispersion calculations i.e. maximum potential sediment mobilisation distances and direction at each of the sediment grab locations (PEIR Appendix 8.1: High Level Assessment of Sediment Dispersion) confirms no pathway for sediment dispersion to reach Lundy SAC. As a result, there will be no potential effect on benthic habitat features of the Lundy SAC (see HRA Screening Report which is issued alongside this PEIR).

1.8.37 Habitat features of the Taw-Torridge Estuary SSSI are indicated in **Table 1.17**. The SSSI is located beyond the maximum sediment dispersal distance across all sites which was calculated to be 3.9 km (PEIR Appendix 8.1: High Level Assessment of Sediment Dispersion). In addition, the mudflats and sandbanks in the SSSI are anticipated to have negligible or low sensitivity to any changes in suspended sediment levels and it is considered that any effects on the SSSI would be negligible.

1.8.38 Habitat FOCI of the South West Approaches to Bristol Channel MCZ are ‘Subtidal coarse sediment’ and ‘Subtidal sand’. They are considered to be of National value as a FOCI of the MCZ but as indicated above, these habitat types have **low** sensitivity to ‘changes in suspended solids (water clarity)’ and ‘smothering and siltation rate changes (light)’, (**Table 1.22**).

1.8.39 Many of the Habitat FOCI of the Bideford to Foreland Point MCZ are intertidal (**Table 1.17)**, and as HDD will be deployed to route the cable under the intertidal zone, dispersal of sediments to the intertidal zone is considered to be minimal and intertidal habitats are not considered further here (c.f. the ‘Accidental Pollution’ section of this chapter for consideration of accidental ‘frack out’). As indicated above, the subtidal mixed sediment, coarse sediment and sand habitats are Not sensitive or have Low sensitivity to ‘changes in suspended solids (water clarity)’ and ‘smothering and siltation rate changes (light)’ (**Table 1.22**). The circalittoral rock biotopes are generally Not sensitive to ‘changes in suspended solids (water clarity)’ and ‘smothering and siltation rate changes (light)’. The infralittoral rock biotopes have a range of sensitivities from Low to Medium sensitivity for ‘changes in suspended solids (water clarity)’ and Not sensitive to Medium sensitivity for ‘smothering and siltation rate changes (light)’ (**Table 1.22**). Representative biotopes for fragile sponge and anthozoan communities on subtidal rocky habitats are generally Not sensitive for both of these impacts, which is also the case for pink sea fan (**Table 1.22**).

1.8.40 The East of Haig Fras MCZ is designated due to the FOCI: Subtidal coarse sediment / subtidal mixed sediment mosaic; subtidal sand; subtidal mud; high energy circalittoral rock; moderate energy circalittoral rock; sea-pen and burrowing megafauna communities; and fan mussel *Atrina fragilis.* As indicated above, the subtidal mixed sediment, coarse sediment and sand habitats are Not sensitive or have Low sensitivity to ‘changes in suspended solids (water clarity)’ and ‘smothering and siltation rate changes (light)’ (**Table 1.22**). According to MarESA, ‘sea-pen and burrowing megafauna communities’, ‘high energy circalittoral rock’ representative biotopes and ‘moderate energy circalittoral rock’ biotopes are generally Not sensitive to ‘changes in suspended solids (water clarity)’ and ‘smothering and siltation rate changes (light)’. Fan mussel *Atrina fragilis*, however, is considered to have Medium sensitivity to changes in suspended solids (water clarity)’ and ‘smothering and siltation rate changes (light)’, (**Table 1.22**). All of the MCZ FOCI are considered to be of National value.

Table 1.22: Sensitivity of benthic receptors to temporary increase in suspended sediments and sediment deposition

Habitats	Representative biotopes	MarESA Assessment	
		Changes in suspended solids (water clarity)	Smothering and siltation rate changes (light)
Annex I Habitats			
Bedrock reef	Not applicable	Not Applicable	Medium Sensitivity (not MarESA)
Stony reef	Not applicable	Medium (not MarESA)	Medium (not MarESA)
Subtidal sand sediment habitats			
Atlantic infralittoral sand (MB52)	Sparse fauna in Atlantic infralittoral mobile clean sand (MB5231)	Low Sensitivity (based on Medium resistance and High resilience)	Not Sensitive (based on High resistance and High resilience)
Atlantic circalittoral sand (MC52)	*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (MC5211) *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment (MC5214)	Low Sensitivity (based on Medium resistance and High resilience)	Low Sensitivity (based on Medium resistance and High resilience)
Atlantic offshore circalittoral sand (MD52)	*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand (MD5212)	Not Sensitive (based on High resistance and High resilience)	Low Sensitivity (based on Medium resistance and High resilience)
Subtidal coarse sediment habitats			
Atlantic circalittoral coarse sediment (MC32)	*Protodorvillea kefersteini* and other polychaetes in impoverished Atlantic circalittoral mixed gravelly sand (MC3213)	Not Sensitive (based on High resistance and High resilience)	No Evidence[4]
Subtidal mixed sediment habitats			
Atlantic circalittoral mixed sediment (MD42)	Polychaete-rich deep Venus community in offshore circalittoral mixed sediment (MD4211)	Low Sensitivity (based on Medium resistance and High resilience)	Low Sensitivity (based on Medium resistance and High resilience)
Atlantic circalittoral rock (MC12)	Sparse sponges, *Nemertesia spp.*, and *Alcyonidium diaphanum* on Atlantic circalittoral mixed substrata (MC1217)	Not Sensitive (based on High resistance and High resilience)	Not Sensitive (based on High resistance and High resilience)
Sabellaria habitat			

[4] No direct evidence relating to the impacts of smothering and siltation rate changes (light) on '*Protodorvillea kefersteini* and other polychaetes in impoverished Atlantic circalittoral mixed gravelly sand' (MC3213).

Habitats	Representative biotopes	MarESA Assessment	
		Changes in suspended solids (water clarity)	Smothering and siltation rate changes (light)
Atlantic circalittoral biogenic habitat (MC22)	*Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment (MC2211) (no *Sabellaria* reef was recorded)	Not Sensitive (based on High resistance and High resilience)	Not Sensitive (based on High resistance and High resilience)
MCZ FOCI			
Subtidal coarse sediment	Representative biotope indicated above	Not Sensitive (based on High resistance and High resilience)	No evidence
Subtidal sand	Representative biotopes indicated above	Low Sensitivity (based on Medium resistance and High resilience)	Low Sensitivity (based on Medium resistance and High resilience)
Subtidal mixed sediment	Representative biotopes indicated above	Low Sensitivity (based on Medium resistance and High resilience)	Low Sensitivity (based on Medium resistance and High resilience)
Subtidal mud	Range of representative biotopes considered	Low to Medium Sensitivity (variable resistance and resilience for representative biotopes)	Low to Medium Sensitivity (variable resistance and resilience for representative biotopes)
High energy circalittoral rock	Range of representative biotopes considered	Not Sensitive (based on High resistance and High resilience)	Generally Not Sensitive (based on High resistance and High resilience), some representative biotopes with Low to Medium sensitivity
Moderate energy circalittoral rock	Range of representative biotopes considered	Not Sensitive (based on High resistance and High resilience)	Generally Not Sensitive (based on High resistance and High resilience), some representative biotopes with Low to Medium sensitivity
High energy infralittoral rock	Range of representative biotopes considered	Low to Medium Sensitivity (variable resistance and resilience for representative biotopes)	Not sensitive to Medium Sensitivity (variable resistance and resilience for representative biotopes)
Moderate energy infralittoral rock	Range of representative biotopes considered	Low to Medium Sensitivity (variable resistance and resilience for representative biotopes)	Not sensitive to Medium Sensitivity (variable resistance and resilience for representative biotopes)
Low energy infralittoral rock	Range of representative biotopes considered	Low to Medium Sensitivity (variable resistance and resilience for representative biotopes)	Not sensitive to Medium Sensitivity (variable resistance and resilience for representative biotopes)

Habitats	Representative biotopes	MarESA Assessment	
		Changes in suspended solids (water clarity)	Smothering and siltation rate changes (light)
Fragile sponge and anthozoan communities on subtidal rocky habitats	Range of representative biotopes considered	Not sensitive (based on High resistance and High resilience)	Generally Not sensitive (based on High resistance and High resilience) some Low (based on Medium resistance and High resilience)
Pink sea fan	Not applicable	Not sensitive (based on High resistance and High resilience)	Not sensitive (based on High resistance and High resilience)
Sea-pen and burrowing megafauna communities	Limited number of representative biotopes, information provided based on 'seapens and burrowing megafauna in Atlantic circalittoral fine mud' (MC6216)	Not Sensitive (based on High resistance and High resilience)	Not Sensitive (based on High resistance and High resilience)
Fan mussel *Atrina fragilis*	Not applicable	Medium Sensitivity (based on Medium resistance and Low resilience)	Medium Sensitivity (based on Medium resistance and Low resilience)

Magnitude of Impact

1.8.41 During construction a range of activities will disturb the seabed resulting in potential for increased levels of SSC and associated increases in sediment deposition. The MDS assumes a range of seabed preparation activities including sandwave clearance, boulder clearance, seabed debris removal and pre-lay trenching. Also included within the MDS is the disturbance of sediments as a result of cable burial (220 km to target depth of 1.5 m) and HDD (localised excavations and use of jack-up vessels).

1.8.42 The distance over which there would be elevated SSC levels and the duration of increased SSC will depend upon factors such as particle size and water movement within the area (current and wave energy). For example, coarser sand and gravels would settle rapidly and therefore any increases in SSC would be relatively small in extent, while finer sediments remain in suspension longer and as such any increases in SSC would extend over a greater distance.

1.8.43 BERR (2008) reviewed a number of case studies that had modelled or monitored suspended sediment release and deposition during the construction of Offshore Wind Farms (OWF). They concluded that SSC and associated deposition resulting from cable burial operations were short term and localised, with the majority of sediment deposition falling immediately to the seabed. For example, for Norfolk OWF, coarse sediments were modelled to be deposited at a maximum distance of 200 m away from source, with 90% of SSC being deposited within 20 m. Modelling for Sheringham Shoal OWF for sandy gravel with low fines, found

SSC would drop to less than 1 mg/l above baseline levels within a single ebb or flood tidal excursion (9 km in extent).

1.8.44 BERR (2008) also reviewed the SSC associated with various cable laying methods at Nysted OWF (Seacon, 2005 as referenced in BERR, 2008). They found 200 m away from the source, maximum SSC levels would be 75 mg/l for trenching, 35 mg/l for backfilling and 18 mg/l for jetting.

1.8.45 Semi-empirical methods have been applied for the Proposed Development to indicate potential increases in SSC and the extent of a potential sediment plume, with the results indicated in Volume 3, Chapter 8 of this PEIR: Physical Processes. Estimates based on 2D depth averaged tidal currents with no inclusion of wave climate, found Fine Sand (Wentworth) in depths between 10.1 m and 123.3 m would travel between approximately 0.05 and 3.8 km from source, with time in suspension ranging from 1 to 4 hours. For Very Fine Sand, in depths between 18.5 and 104.1 m, maximum distance travelled ranged from approximately 2 km to 3.9 km, with time in suspension being 5 hours.

1.8.46 Temporary increase in suspended sediments and sediment deposition will directly affect benthic receptors during the construction phase. However, the impact is predicted to be of very localised spatial extent (restricted to within the Benthic Study Area and close proximity to the source) and would have short-term duration for any specific area of habitat (any suspended sediment will disperse quickly). The magnitude of impact is, therefore, considered to be **low**.

1.8.47 There is potential for sediment resuspended during the works to be transported over the South West Approaches to Bristol Channel MCZ, Bideford to Foreland Point MCZ and East of Haig Fras MCZ and then fall out of suspension. The maximum distance over which this could occur has been calculated to be 3.9 km based on semi-empirical calculations, however, these calculations also indicate that in the areas near the South West Approaches to Bristol Channel MCZ and East of Haig Fras MCZ all of the sediment is anticipated to fall out of suspension in the immediate vicinity of the cable route (PEIR Appendix 8.1: High Level Assessment of Sediment Dispersion).

1.8.48 Only Bideford to Foreland Point MCZ coincides with an area where it is considered sediment could be dispersed a greater distance (under maximum Spring tide currents). Even though there is potential for some sediment to be transported to the Bideford to Foreland Point MCZ (which is 0.5 km from the Offshore Cable Corridor), most sediment is still anticipated to be deposited within tens to hundreds of metres from the cable trench with only finer materials remaining in solution and travelling further distances during isolated peak current events only. Even if sediment was transported into the MCZ, it has been calculated that it would be deposited within about 5 hours of being resuspended (PEIR Appendix 8.1: High Level Assessment of Sediment Dispersion), and would result in a highly localised area of very light smothering. The deposited sediment would likely be redistributed by water movements and organisms are generally adapted to such levels of deposition during e.g. storm events or other disturbance events. The effects on the MCZ would also be temporary with only a very small area of the MCZ being potentially affected, with the effects only being encountered in the vicinity of active trenching or other activities generating sediment disturbance. Overall, the magnitude of impact on the MCZ is considered to be **negligible**.

1.8.49 Based on the expectation that sediment will be deposited in the immediate vicinity of the Offshore Cable Corridor in the areas near the South West Approaches to

Bristol Channel MCZ and East of Haig Fras MCZ, the magnitude of impact on these MCZs is considered to be **negligible**.

Significance of the Effect

1.8.50 The sensitivity of the benthic receptors is **negligible** to **low**, and the magnitude of the impact is considered to be **low**. Overall, the effect is assessed to be of **minor** adverse significance, which is not significant in EIA terms.

1.8.51 Sediment dispersion calculations i.e. maximum potential sediment mobilisation distances and direction at each of the sediment grab locations (PEIR Appendix 8.1: High Level Assessment of Sediment Dispersion) confirm no pathway for sediment dispersion to reach Lundy SAC. As a result any effects on the SAC would be **negligible** (see HRA Screening Report accompanying the PEIR)

1.8.52 Sediment dispersion calculations confirm no pathway for sediment dispersion to reach the Taw-Torridge Estuary SSSI. As a result any effects on the SSSI would be **negligible**.

1.8.53 When considering the Bideford to Foreland Point MCZ, the sensitivity of the FOCI is negligible to medium, and the magnitude of impact is considered to be negligible. Overall, it is considered that the effect on the MCZ would be negligible and would not hinder the achievement of the conservation objectives stated for the MCZ (an MCZ assessment will be provided with the ES).

1.8.54 When considering the South West Approaches to Bristol Channel MCZ, the sensitivity of the FOCI is low, and the magnitude of impact is considered to be **negligible**. It is considered that the effect on the MCZ would be negligible and would not hinder the achievement of the conservation objectives stated for the MCZ.

1.8.55 When considering the East of Haig Fras MCZ, the sensitivity of the FOCI is negligible to medium, and the magnitude of impact is considered to be negligible. It is considered that the effect on the MCZ would be negligible and would not hinder the achievement of the conservation objectives stated for the MCZ.

Further Mitigation

1.8.56 The effect of ‘Temporary increase in suspended sediments and sediment deposition’ is not significant, therefore, no mitigation measures are proposed (beyond the embedded mitigation presented in **Table 1.20**).

Future Monitoring

1.8.57 No significant effects have been identified and no future monitoring is proposed.

Changes to water quality (release of hazardous substances from sediments)

1.8.58 During construction, the potential for disturbance and re-suspension of sediments could lead to the release of any contaminants that may be present within these sediments, which may in turn affect water quality. Increased chemical parameter concentrations have the potential to affect benthic organisms, inhibiting their growth and development and affecting reproduction as well as potentially having lethal and non-lethal effects on embryos and larvae (Suchanek, 1993).

Sensitivity of the Receptor

1.8.59 The MarESA assessment does not provide an assessment of the relevant chemical pressures for the identified benthic receptors due to limited evidence. The MarESA evidence base considers the effects of pollutants and chemicals should they be accidently released at concentrations that exceed environmental protection standards, However, as indicated in the magnitude section it is anticipated that any release of hazardous substances from sediments will generally be at concentrations below these thresholds.

1.8.60 Many of the benthic habitats recorded are characterised by sessile or low mobility species which will be unable to avoid any release of hazardous substances from sediments as a result of construction and these species may absorb contaminants directly from the water through suspended particulate matter via suspension feeding.

1.8.61 For example, bivalve species are able to accumulate heavy metals into their tissues at levels much higher than environmental levels, indicating a degree of tolerance (Widdows and Donkin, 1992). However, sub-lethal levels of heavy metals may cause a range of effects including siphon retraction, valve closure, inhibition of byssal thread production, disruption of burrowing behaviour, inhibition of respiration, inhibition of filtration rate and suppressed growth (Aberkali & Trueman, 1985). Echinoderms are considered to be intolerant of heavy metals, whilst polychaetes are more tolerant (Bryan, 1984; Kinne, 1984).

1.8.62 Echinoderms and amphipods are also regarded as being intolerant of hydrocarbons, whilst polychaetes are considered to be tolerant of elevated hydrocarbon levels (Suchanek, 1993; Cabioch et al., 1978).

1.8.63 Recoverability of benthic receptors from chemical contamination will vary considerably between species. For instance, bivalves and crustaceans typically have high fecundity and may recover fully. However, it should be noted that even with good annual recruitment/reproduction, this may take several years (Tyler-Walters, 2008; Sabatini and Hill, 2008). It is anticipated that, following cessation of any potential impact, re-colonisation of affected areas would occur via adult migration and larval settlement. Consequently, benthic subtidal receptors are considered to be sensitive to the changing environment but may have a good capacity to recover from the impact and they are of Regional value. These receptors are therefore assessed as having **medium** sensitivity to ‘changes in water quality (release of hazardous substances from sediments)’.

1.8.64 The habitat types which are FOCI of the South West Approaches to Bristol Channel MCZ, Bideford to Foreland Point MCZ and East of Haig Fras MCZ (Table 1.17), are also considered to have up to **medium** sensitivity to ‘changes in water quality (release of hazardous substances from sediments)’.

Magnitude of Impact

1.8.65 During construction a range of activities will potentially disturb the seabed resulting in the potential release of hazardous substances where these are present within the baseline sediments. The MDS assumes a range of seabed preparation activities including sandwave clearance, boulder clearance, seabed debris removal and pre-lay trenching. Also included within the MDS is the disturbance of sediments as a result of cable burial and HDD (localised excavations and use of jack-up vessels). Burial is the preferential protection mechanism—to a target depth of 1.5 m—along the entire Offshore Cable Corridor, recognising that supplementary rock protection is likely to be required along up to 150 km of that total length.

1.8.66 Chemical Action Levels (cALs) (or Cefas Action Levels) and Canadian marine Sediment Quality Guidelines were used to characterise the broad contamination status of sediment samples taken during the subtidal ecology surveys for the Proposed Development as detailed in GEOxyz (2024). cALs are used as a framework for assessment of sediment contamination status in marine licensing decision making associated with disposal of dredge arisings at marine disposal sites. Concentrations below cAL1 are of no concern, chemical levels between cAL1 and cAL2 generally would indicate further consideration would be required for disposal at sea, while dredged material with chemical levels above cAL2 is generally considered unsuitable for sea disposal (MMO 2015).

1.8.67 The Proposed Development analyses of sediment concentrations of heavy metals indicated that arsenic concentrations exceeded cAL1 at eight stations, but they were below cAL2 and the Probable Effects Level (PEL). All of these samples were located within Bideford Bay and off the north coast of Devon and results from the Burial Assessment Study indicate that there are no identified sand waves and/ or large ripples present and as a result, no seabed preparation will be required in this area. Heavy metal concentrations were found below cAL1 at all other stations. Concentrations for hydrocarbon compounds (total PAHs) were found to exceed cAL1 at a number of stations sampled during the survey.

1.8.68 Cable laying and rock placement will result in minimal sediment suspension which will likely settle before impacting upon any sensitive receptors in these locations. There may be more potential for chemical distribution at the HDD exit points, however, based on the high-level sediment dispersion assessment completed to inform this PEIR, sediment in this location (Bideford Bay) could be distributed 0.1 to 3.9 km (estimated to settle within approximately one to five hours). The HDD exit points will be in water depths of between 6 m and 9 m where frequent reworking of sediments (and associated distribution of any baseline contamination) is likely to be a feature of the baseline environment.

1.8.69 Changes to water quality (release of hazardous substances from sediments) will directly affect benthic receptors and will be continuous during the construction phase (intermittent / highly temporary at any one location). However, the impact is predicted to be of local spatial extent (restricted to within the Benthic Study Area and in close proximity to the source of the chemical release), and of short-term duration (with any release chemicals likely rapidly diluted and dispersed in the water column). The magnitude is, therefore, considered to be **low**.

1.8.70 Potential effects on MCZ FOCI are anticipated to be minimal as any increases in chemical concentration in the water column will be rapidly diluted and increases in chemical concentrations due to the Proposed Development are anticipated to be very low for waters in the MCZs. In addition, only a very small area of an MCZ could potentially be affected. Where effects are associated with sediment dispersal they are not anticipated to reach the South West Approaches to Bristol Channel MCZ or East of Haig Fras MCZ (PEIR Appendix 8.1: High Level Assessment of Sediment Dispersion). Overall, the magnitude of impact on MCZs is considered to be **negligible**.

Significance of the Effect

1.8.71 The sensitivity of the receptor is **medium** and the magnitude of the impact is considered to be **low**. Overall, the effect is assessed to be of **minor** adverse significance, which is not significant in EIA terms.

1.8.72 Lundy SAC and Taw-Torridge Estuary SSSI are considered to be beyond the ZoI for changes to water quality and any effects would be negligible.

1.8.73 When considering the Bideford to Foreland Point MCZ, South West Approaches to Bristol Channel MCZ and East of Haig Fras MCZ the sensitivity of the FOCI is medium, and the magnitude of impact is considered to be **negligible**. Overall, it is considered that the effect on these MCZs would be negligible and would not hinder the achievement of the conservation objectives stated for the MCZs (an MCZ assessment will be provided with the ES).

Further Mitigation

1.8.74 The effect of changes to water quality (release of hazardous substances from sediments) is not significant, therefore, no mitigation measures are proposed (beyond the embedded mitigation presented in **Table 1.20**).

Future Monitoring

1.8.75 No significant effects have been identified and no future monitoring is proposed.

Introduction and spread of INNS

1.8.76 The introduction and spread of Marine Invasive Non-Native Species (INNS) may occur during the construction phase of the Proposed Development due to the introduction of structures to the marine environment (e.g. cable protection and cable crossings), and due to the presence of vessels (due to ballast water exchange, and biofouling of hulls and vessel infrastructure).

Sensitivity of the Receptor

1.8.77 The sensitivity of the receptors identified in the Benthic Ecology Study Area have been assessed in relation to the following MarESA pressure:

- Introduction or spread of invasive non-indigenous species.

1.8.78 The sensitivity of representative biotopes to INNS is summarised in **Table 1.23**.

1.8.79 Invasive non-native benthic species can include broad groups including molluscs, crustaceans, sea squirts, bryozoans and macroalgae. However, for the purposes of this assessment only key species are mentioned. It should be noted that similar considerations apply to a wide range of invasive and non-native species.

1.8.80 The MarESA assessment indicates that the sensitivity of subtidal sands habitats to INNS ranged from Not Sensitive to High sensitivity (**Table 1.23**). The biotope 'Infralittoral mobile clean sand with sparse fauna' (MB5231) is characterised by unsuitable habitat conditions and low species richness, limiting the potential for establishment of invasive species such as the slipper limpet *Crepidula fornicata* due to the mobility of the sediment (Bohn *et al*. 2015; Blanchard, 2009). Similarly, the sediments characterising the biotopes '*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment' (MC5214) and '*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand' (MC5211) are likely too mobile and unstable for most INNS. However, other INNS such as *C. fornicata* and the colonial ascidian *Didemnum vexillum* may colonise these biotopes, resulting in potential changes to assemblages. Once established, potential for removal of INNS would be unlikely. There is no available evidence or records of the introduction or spread of INNS for the biotope '*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand' (MD5212). However, any introduction or spread of INNS could potentially have adverse effects on the characterising benthic community. Consequently, representative the subtidal sand biotopes are considered to be sensitive to the potential introduction of INNS, with recovery unlikely if colonisation occurs even at lower densities and are of Regional value. The receptor is therefore assessed as having **high** sensitivity.

1.8.81 The MarESA assessment indicated that the sensitivity of the subtidal coarse sediment habitat '*Protodorvillea kefersteini* and other polychaetes in impoverished Atlantic circalittoral mixed gravelly sand' (MC3213) to this impact was High (Table 1.23). For instance, *C. fornicata* has been shown to have a preference for gravelly habitats and has the potential to modify the biotope and its associated benthic community (Blanchard, 2009; Bohn *et al*., 2015; Tillin *et al*., 2020). Natural storm events mobilise sediment and can prevent the colonisation of *C. fornicata* at high densities, however, *C. fornicata* has also previously been recorded from areas of strong tidal streams (Hinz *et al*., 2011). Consequently, representative biotopes of the subtidal sand sediments receptor are considered to be sensitive to the introduction of INNS, recovery is unlikely unless by artificial means and the receptor is of Regional value. The receptor is therefore assessed as having **high** sensitivity to this impact.

1.8.82 The MarESA assessment indicated that the subtidal mixed sediment habitats has a High sensitivity to the impact (**Table 1.23**). *C. fornicata* has the potential to colonise the offshore mixed sediment typical of the representative biotope 'Polychaete-rich deep Venus community in offshore circalittoral mixed sediment' (MD4211) due to the presence of gravel, shells, or any other hard substrata embedded in the substratum that can be used for larvae settlement (Tillin *et al*., 2020). No evidence is available for the effect of *C. fornicata* on the biotope 'Sparse sponges*, Nemertesia spp.,* and *Alcyonidium diaphanum* on Atlantic circalittoral mixed substrata' (MC1217). However, the sediment characterising the biotope is likely unsuitable for colonisation due to wave action, scour and storms inhibiting the introduction of INNS. Consequently, the subtidal mixed sediment biotopes are considered to be sensitive to the potential introduction of INNS, recovery is unlikely unless by artificial means and the habitat is of Regional value. The receptor is therefore assessed as having **high** sensitivity to this impact.

1.8.83 The MarESA assessment indicates that there is no direct evidence relating to the impact of the introduction or spread of non-indigenous species on the *Sabellaria* habitat recorded. Characterising sediments of the representative biotope '*Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment' (MC2211) are likely to be unsuitable for the colonisation of these species due to wave exposed conditions and storm events (Tillin *et al.,* 2023). Consequently, representative biotopes of the *Sabellaria* habitat receptor may be sensitive to the potential introduction of INNS, recovery is unlikely unless by artificial means and the receptor is of Regional value. The receptor is therefore assessed as having **medium** sensitivity to this impact.

1.8.84 The FOCI receptors associated with the Bideford to Foreland MCZ, South West Approaches to Bristol Channel MCZ and East of Haig Fras MCZ are indicated in **Table 1.18**. Taking a precautionary approach, it is anticipated that representative biotopes for these FOCI could have up to **high** sensitivity to this impact.

Table 1.23: Sensitivity of benthic receptors to the introduction and spread of INNS

Habitats	Representative biotopes	MarESA Assessment Introduction or spread of INNS
Annex I habitat		
Rocky reef	Not applicable	High (not MarESA)
Stony reef	Not applicable	High (not MarESA)
Subtidal sand sediment habitat		
Atlantic infralittoral sand (MB52)	Sparse fauna in Atlantic infralittoral mobile clean sand (MB5231)	Not sensitive (based on High resistance and High resilience)
Atlantic circalittoral sand (MC52)	*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (MC5211) *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment (MC5214)	Medium to High sensitivity (based on No to Medium resistance and Very Low resilience)
Atlantic offshore circalittoral sand (MD52)	*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand (MD5212)	Not Relevant[5]
Subtidal coarse sediment habitat		
Atlantic circalittoral coarse sediment (MC32)	*Protodorvillea kefersteini* and other polychaetes in impoverished Atlantic circalittoral mixed gravelly sand (MC3213)	High sensitivity (based on Low resistance and Very Low resilience)
Subtidal mixed sediment habitat		
Atlantic circalittoral mixed sediment (MD42)	Polychaete-rich deep Venus community in offshore circalittoral mixed sediment (MD4211)	High sensitivity (based on Low resistance and Very Low resilience)

[5] There are no records of the introduction or spread of non-indigenous species for the biotope '*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand' (MD5212). This pressure is therefore considered Not Relevant.

Habitats	Representative biotopes	MarESA Assessment
		Introduction or spread of INNS
Atlantic circalittoral rock (MC12)	Sparse sponges, *Nemertesia spp.*, and *Alcyonidium diaphanum* on Atlantic circalittoral mixed substrata (MC1217)	Insufficient Evidence[6]
Sabellaria habitat		
Atlantic circalittoral biogenic habitat (MC22)	*Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment (MC2211) (no *Sabellaria* reef was recorded)	No Evidence[7]

Magnitude of Impact

1.8.85 The presence and movement of construction vessels and introduction of associated cable protection and cable crossings may lead to the introduction and spread of INNS. Within the UK, pathways of introduction involving vessel movements have been identified as the highest potential risk routes for the introduction of non-native species (Carlton, 1992; Pearce *et al*., 2012). This could either be from the discharge of ballast water across the Proposed Development area or via transportation on vessel hulls. Similarly, the introduction of structures (rock placement and cable crossing structures) within the marine environment also represents a pathway for the introduction of INNS.

1.8.86 A number of non-native species are known to present within the Benthic Ecology Study Area (see Baseline conditions above). For example, site-specific benthic surveys identified the polychaete *Goniadella gracilis*, which is thought to have been introduced to the UK through shipping (JNCC, 1997). Desktop review of the NBN Atlas database has identified 469 distinct taxa within the study area. These taxa will be reviewed as part of the ES to identify any non-native species and any associated implications for the wider benthic ecology assessment.

1.8.87 Once non-native species become established and disperse within a new habitat they can out-compete local species for space and resources, prey directly on local species, or introduce pathogens (Roy *et al*., 2012). Consequently, the introduction and spread of INNS represents a potential direct impact to Benthic Ecology.

1.8.88 The MDS assumes up to 32 vessels across the Proposed Development at any given time during the construction phase (likely to be much less than this number in reality). Vessel types include guard vessels, rock placement vessels, cable laying vessels, trenching vessels, pre-instillation vessels and jack-up vessels. The precise number of vessel return trips and ports of origin are yet to be determined. However, the increase in vessel numbers as a result of construction activities will

[6] At present, there is Insufficient Evidence to suggest that the biotope 'Sparse sponges, *Nemertesia* spp., and *Alcyonidium diaphanum* on Atlantic circalittoral mixed substrata' (MC1217) is sensitive to colonisation by invasive species and further evidence is required.

[7] No direct evidence relating to the impacts of the introduction of non-indigenous species on '*Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment' (MC2211).

be small when compared to the baseline environment presented in Volume 3, Chapter 5 of this PEIR: Shipping and Navigation. The baseline characterisation found an average number of 90 vessels operating per day within 5 nm of the Offshore Cable Corridor.

1.8.89 Additionally, the MDS assumes cable protection (rock protection) covering a maximum footprint of 450,000 m^2, and cable crossings covering a maximum footprint of 147,000 m^2 will be installed during the construction phase, which INNS could colonise. However, the area of cable protection and cable crossings for colonisation of INNS (597,000 m^2) only represents a small proportion of the habitats present across the Benthic Study Area (3,956.75 km^2), which is approximately 0.02%.

1.8.90 As set out in **Table 1.20**, to reduce the likelihood of the introduction and spread of INNS a biosecurity risk assessment will be conducted to determine potential sources of risk and a Biosecurity Plan will be adhered to, outlining measures to be applied to minimise the risk of introduction and spread of INNS. Additionally, all ships will be subject to the Ballast Water Management Convention (2017) requirements and will be obliged to conduct ballast water management in accordance with the Convention (enforced via the CEMP).

1.8.91 The impact is predicted to be of regional spatial extent and long-term duration. However, with the implementation of the embedded mitigation measures mentioned above, the risk of the introduction and spread of INNS is low. The magnitude is therefore **low**.

Significance of the Effect

1.8.92 The sensitivity of the subtidal sand, subtidal coarse and subtidal mixed sediment habitat receptors is **medium** to **high**. The magnitude of the impact is considered to be **low.** Overall, the effect is assessed to be of **minor** adverse significance, which is not significant in EIA terms.

1.8.93 When considering Bideford to Foreland MCZ, South West Approaches to Bristol Channel MCZ and East of Haig Fras MCZ the sensitivity of receptors is up to **high**. The magnitude of the impact is considered to be **low**. Overall, it is considered that any effects would be minor and would not hinder the achievement of the conservation objectives stated for the MCZs (an MCZ assessment will be provided with the ES).

Further Mitigation

1.8.94 The effect of introduction or spread of INNS is not significant, therefore, no mitigation measures are proposed (beyond the embedded mitigation presented in **Table 1.20**).

Future Monitoring

1.8.95 No significant effects have been identified and no future monitoring is proposed.

Underwater noise & vibration

1.8.96 Vibration due to HDD at the landfall has the potential to cause some effects on benthic invertebrates in the intertidal and shallow subtidal zone close to the landfall.

Sensitivity of the Receptor

1.8.97 There is some evidence that anthropogenic sources of underwater noise and vibration could potentially have an effect on benthic invertebrates. Studies of invertebrates have indicated that increased noise and vibration levels can result in increased mortality, injury to tissues, and increased growth and reproductive rates, and food uptake in invertebrates (Popper & Hawkins, 2018; Hawkins & Popper, 2016; Solan *et al*., 2016; Aguilar de Soto *et al*., 2016; Spiga *et al*., 2012). For example, the effects of pile driving (which is a much louder activity than the cable laying activities associated with this Proposed Development) on bivalve molluscs have been studied by Spiga *et al*. (2016). It was found that individuals subjected to pile driving exhibiting increased feeding (filtering) rate compared to those in ambient conditions (Spiga *et al*. 2016).

1.8.98 The effects of underwater noise and vibration on benthic invertebrates is a developing area of research, and currently there are insufficient data on the effects of underwater noise and vibration on invertebrates to establish noise criteria (Popper *et al*., 2014). It is currently assumed that invertebrates are sensitive to particle motion and are not sensitive to the sound pressure component of underwater noise and vibration.

1.8.99 Invertebrate species are unable to detect sound pressure but are likely to be able to detect particle motion through a variety of organs such as hairs on the body that respond to mechanical stimulation, chordotonal organs associated with joints, or vibrations transmitted through the exoskeleton from the substrate (Popper & Hawkins, 2018). The benthic invertebrates within the study area vary in value from **local** to **regional** value. Overall, benthic species are considered to have a **low** sensitivity to underwater noise and vibration effects.

Magnitude of Impact

1.8.100 The noise levels that would be generated by construction vessels, by cable laying equipment and during boulder clearance would be very low compared to e.g. those generated by pile driving, and therefore any effects on benthic invertebrates are anticipated to be minimal. Due to potential effects of vibration, focus is placed here on the HDD aspects of the works.

1.8.101 HDD will take place on a (worst case) 24-hour operating period, intermittently over a period of up to 18 months, but during only a small proportion of this time would there be potential vibration affecting intertidal and subtidal habitats. HDD rigs operate from on shore and the sound and vibration that reaches the water column is often negligible (Hall & Francine 1991; Nguyen 1996; Willis *et al*. 2010). Sparse data are available for sound levels generated by HDD works, however, for HDD operations within a riverine environment 39 m below the riverbed, Nedwell *et al*. (2012) indicated that an unweighted Sound Pressure Level of 129.5 dB re: 1 µPa was recorded, although no frequency data were available. Corrected to a measurement at 1 m, the SPL would be 153 dB_{rms} re 1 µPa@1m.

1.8.102 Studies of vibration levels have been conducted for a 450 mm diameter HDD operation in south Dublin, Ireland (Reilly *et al*. 2020). The operation was on land with a HDD profile approximately 150 m long, and the drill was 9 m below the ground level. During this project vibration limits of no more than 10 mm/s were imposed during the HDD works and the vibration levels recorded were typically less than 1 mm/s with a maximum of 5 mm/s.

1.8.103 Specific vibration levels have not been modelled for the Proposed Development. In the absence of other sources of information, however, the British Standards Institute has published empirical predictors for groundborne vibration arising from mechanised construction works including tunnelling (BS 5228-2:2009; BSI 2009). This equation is:

$$v_{res} \leq \frac{180}{x^{1.3}}$$

Where v_{res} is the resultant Peak Particle Velocity (PPV) in millimetres per second (mm/s) and x is the distance measured along the ground surface in metres (m).

1.8.104 Application of the equation requires the assumption that vibration travels up through the sediment in the same way as along the ground surface. As the drill depth is proposed at 20 m below the seabed the v_{res} is calculated to be 3.66 mm/s which is within the range reported by Reilly *et al*. (2020).

1.8.105 Sparse information is available to relate these vibration levels to effects on benthic invertebrates, however, Spiga *et al*. (2016) found that blue mussels (*Mytilus edulis*) exhibited higher clearance rates during pile driving when the peak velocity for one strike was measured to be 0.025 m/s (25 mm/s) which was measured at approximately 25 m range. This could have been a stress response to the particle motion caused by piling.

1.8.106 Based on the information available, the magnitude of the impact is assessed to be of localised spatial extent and medium term duration resulting in behavioural changes in small proportion of the benthic invertebrate population. The magnitude of impact is therefore **low**.

Significance of the Effect

1.8.107 The sensitivity of the receptor is **low** and the magnitude of the impact is considered to be **low**. Overall, the effect is assessed to be of **minor** adverse significance, which is not significant in EIA terms.

Further Mitigation

1.8.108 The effect of underwater noise and vibration is not significant, therefore, no mitigation measures are proposed (beyond the embedded mitigation presented in **Table 1.20**).

Future Monitoring

1.8.109 No significant effects have been identified and no future monitoring is proposed.

Accidental Pollution

1.8.110 The effects of accidental pollution may arise from vessels, vehicles, equipment and machinery undertaking construction activities, namely: seabed preparation, route clearance, cable laying, HDD and burial activities.

1.8.111 Accidental pollution may be associated with e.g. unintended release of pollutants such as fuel, lubricants (including drill fluids), and anti-fouling biocides.

Sensitivity of the Receptor

1.8.112 The MarESA assessment does not provide an assessment of the relevant chemical pressures for the identified benthic receptors due to limited evidence. The MarESA evidence base considers the effects of pollutants and chemicals should they be accidently released at concentrations that exceed environmental protection standards. However, it is anticipated that any accidental pollution released from the Proposed Development would be less than environmental standards as detailed further in the magnitude section below.

1.8.113 Benthic subtidal and intertidal habitats recorded during the surveys for the Proposed Development are largely characterised by sessile or low mobility species which will be unable to avoid any accidental pollution from the Proposed Development and many of these suspension feeding species may absorb contaminants directly from the water column by taking in suspended particulate matter. Further survey of the intertidal habitats is planned, which will inform the ES.

1.8.114 Hydrocarbons and PAH contamination can occur as a result of oil spills and during high swell and winds, this can cause oil pollutants to mix with the seawater and potentially negatively affect sublittoral habitats (Castège *et al*., 2014). Filter feeders are highly sensitive to oil pollution, particularly bottom dwelling organisms in areas where oil components are deposited by sedimentation (Zahn *et al*., 1981). Bivalve contact with oil causes an increase in energy expenditure and a decrease in feeding rate, resulting in less energy available for growth and reproduction (Suchanek, 1993). Echinoderms and amphipods are also regarded as being intolerant of hydrocarbons, whilst polychaetes are considered to be tolerant of elevated hydrocarbon levels (Suchanek, 1993; Cabioch *et al*., 1978). Limited evidence is available for the effects of oil pollution on hydroids. Houghton *et al*. (1996) found a reduction in abundance of encrusting bryozoa following an oil spill, however, Soule & Soule (1979) found that broyoza returned to an area close to an oil spill within 5 months of the incident, suggesting that recoverability is high. Crustaceans are widely reported to be intolerant of synthetic chemicals (Cole *et al*., 1999).

1.8.115 Recoverability of benthic receptors will vary considerably between species. For instance, bivalves and crustaceans typically have high fecundity and may recover fully. However, it should be noted that even with good annual recruitment/reproduction, this may take several years (Tyler-Walters, 2008; Sabatini and Hill, 2008). It is anticipated that, following cessation of any potential impact, re-colonisation of affected areas would occur via adult migration and larval settlement thereby allowing a return to ecological baseline conditions and baseline levels of contaminants. Consequently, benthic subtidal and intertidal receptors are considered to be sensitive to the changing environment but may have a good capacity to recover from the impact and are of **regional** value. These receptors are therefore assessed as having **medium** sensitivity to this impact.

1.8.116 The FOCI receptors associated with the Bideford to Foreland MCZ, South West Approaches to Bristol Channel MCZ and East of Haig Fras MCZ are indicated in **Table 1.18**. Overall, it is considered that representative biotopes for these FOCI could have up to **medium** sensitivity to this impact.

Magnitude of Impact

1.8.117 Proposed Development construction activities may lead to the accidental release of pollutants through spills and leaks from vessels and equipment. The MDS indicates up to 32 vessels on site at any given time (worst case). Vessel types include guard vessels, rock placement vessels, cable laying vessels, trenching vessels, pre-installation vessels and jack-up vessels. Whilst this will lead to an uplift in vessel activity, the movements will primarily be along the Offshore Cable Corridor and along existing shipping routes to / from port. Vessel traffic associated with the Proposed Development will lead to an increase in vessel movements within the Study Area, albeit to a small degree when compared to the baseline numbers (Volume 3, Chapter 5 of this PEIR: Shipping and Navigation). This increase could lead to an increased risk of accidental pollution through the release of synthetic compounds, for example from antifouling biocides, heavy metal, and hydrocarbon contamination as a result of seabed preparation, route clearance, cable laying and burial activities.

1.8.118 Although many of the large vessels (e.g., installation vessels) may contain large quantities of diesel oil, any accidental spill from vessels, vehicles, machinery from construction activities would be subject to immediate dilution and rapid dispersal.

1.8.119 The embedded mitigation measures include the application of an Environmental Management Plan (EMP) and Marine Pollution Contingency Plan (MPCP), and Shipboard Oil Pollution Emergency Plan (SOPEP). Adherence to the embedded measures and good working practices outlined in **section 1.7** will significantly reduce the likelihood of an accidental pollution incident occurring and the magnitude of its impact. Given the embedded measures, the likelihood of accidental release is considered to be extremely low.

1.8.120 There is also a risk to benthic habitats and species from water-based drilling mud, including bentonite, which is used as a lubricant during the HDD process. HDD will be undertaken to install the cable at the landfall and nearshore environment. Drilling muds are used in a closed system to minimise loss to the environment, however, it is possible that muds (including bentonite) could accidentally break out during drilling operations, which may occur in intertidal or subtidal areas (in addition to modest unavoidable releases when the borehole breaks through the seabed). Bentonite is low toxicity drilling mud and therefore the risk to benthic receptors is minimal (an intertidal survey will further inform any specific intertidal sensitivity at the ES stage), particularly when considering that any break outs will be quickly diluted (seawater degrades the bentonite fluid, causing it to flocculate and allowing faster dispersal). However, any potential break outs or accidental spills of bentonite will be managed via good working practices (e.g., monitoring of mud volumes and pressure, detection of break outs and pausing drilling, self-sealing platelet drill fluid [including Bentonite] and ongoing monitoring) such that any accidental loss of bentonite to the environment is likely minimal.

1.8.121 Accidental release of pollutants during the construction phase will directly affect benthic receptors. However, the impact is predicted to be of local spatial extent and short-term duration (any pollutant will be quickly dispersed or contained) and highly intermittent. The magnitude of impact is, therefore, considered to be **Low**.

Significance of the Effect

1.8.122 The sensitivity of the receptor is **medium** and the magnitude of the impact is considered to be **low**. Overall, the effect is assessed to be of **minor** adverse significance, which is not significant in EIA terms.

1.8.123 When considering Bideford to Foreland MCZ, South West Approaches to Bristol Channel MCZ and East of Haig Fras MCZ the sensitivity of receptors is up to **medium**. The magnitude of the impact is considered to be **low**. Overall, it is considered that any effects would be minor and would not hinder the achievement of the conservation objectives stated for the MCZs (an MCZ assessment will be provided with the ES).

Further Mitigation

1.8.124 The effect of accidental pollution is not significant, therefore, no further mitigation measures are proposed (beyond the embedded mitigation presented in **Table 1.20**).

Future Monitoring

1.8.125 No significant effects have been identified and no future monitoring is proposed.

1.9 Preliminary Assessment of Operational Effects

1.9.1 The impacts of the operational and maintenance phases of the Proposed Development have been assessed. The potential preliminary impacts arising from the operation and maintenance phase of the Proposed Development are listed in Table 1.19, along with the MDS against which each impact has been assessed.

1.9.2 A description of the potential effect on receptors caused by each identified impact is given below.

Long-term habitat loss/change

1.9.3 During the operational and maintenance phase, permanent habitat loss/change will occur as a result of the installation and presence of rock placement for cable protection to achieve sufficient burial depth (where full target depth is unable to be trenched due to local bed conditions) and at crossings of pre-existing in-service cables.

Sensitivity of the Receptor

1.9.4 The installation of rock protection (or concrete mattresses) for the cable at crossings and in very hard seabed areas would result in the loss of subtidal habitat and potentially the characterising benthic communities.

1.9.5 The sensitivity of the receptors identified in the Benthic Ecology Study Area have been assessed in relation to the following MarESA pressures relevant to long-term habitat loss/change:

- Physical change (to another seabed type).

1.9.6 The sensitivity of representative biotopes to temporary habitat loss/disturbance pressures is summarised in **Table 1.24**.

1.9.7 The boundaries of SACs and MCZs within the Benthic Ecology Study Area are located beyond the Cable Corridor (Volume 3, Figure 1.4). Consequently, there is no potential for interaction between benthic habitat/species features of these SACs and MCZs (**Table 1.17**) and the activities associated with long-term habitat loss/change. Therefore, these receptors have not been considered in this 'long-term habitat loss/change' assessment section.

1.9.8 Similarly, there is no potential for interaction between activities associated with long-term habitat loss/change and intertidal benthic receptors due to the installation of cables at the landfall via HDD. Therefore, these receptors have not been considered in the assessment.

1.9.9 There will also be micro-routing of the cable to avoid potential impacts on Annex I bedrock and stony reef habitats.

1.9.10 The MarESA assessment of the subtidal habitats recorded during the site-specific surveys, suggests that all representative habitats have no resistance and very low resilience to physical change (to another seabed type), (**Table 1.24**).

1.9.11 Biotopes including 'Sparse fauna in Atlantic infralittoral mobile clean sand' (MB5231), '*Protodorvillea kefersteini* and other polychaetes in impoverished Atlantic circalittoral mixed gravelly sand' (MC3213), '*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand' (MC5211), '*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment' (MC5214) and 'Polychaete-rich deep Venus community in offshore circalittoral mixed sediment' (MD4211) are characterised by sand and mixed sediment habitat whilst the biotope '*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand' (MD5212) is characterised by muddy habitat. Change to artificial or rock substratum would alter the character of the biotope leading to the reclassification and loss of the sedimentary community including characterising polychaetes, amphipods, isopods and echinoderms. Consequently, these receptors are considered to have low capacity to recover or adapt to the impact and are of Regional value. These receptors are therefore assessed as having **high** sensitivity.

1.9.12 For the biotope '*Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment' (MC2211), it has been noted that *S. spinulosa* can colonise bedrock and artificial structures and an increase in the availability of hard substrate may support the recovery of characterising species (Mistakidis, 1956). However, a change to artificial or rock substratum would alter the character of the biotope leading to the reclassification of the biotope (Tillin *et al*., 2023). Consequently, the receptor is considered to be highly sensitive to the changing environment but may have a good capacity to recover from the impact and is of Regional value. This receptor is therefore assessed to have **medium** sensitivity to long-term habitat loss/change.

Table 1.24: Sensitivity of benthic receptors to long-term habitat loss/change

Habitats	Representative biotopes	MarESA Assessment Physical Change (to another seabed type)
Annex I habitat		
Rocky reef	Not applicable	High (not MarESA)
Stony reef	Not applicable	High (not MarESA)
Subtidal sand sediment habitat		
Atlantic infralittoral sand (MB52)	Sparse fauna in Atlantic infralittoral mobile clean sand (MB5231)	High Sensitivity (based on No resistance and Very Low resilience)
Atlantic circalittoral sand (MC52)	*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (MC5211) *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment (MC5214)	High Sensitivity (based on No resistance and Very Low resilience)
Atlantic offshore circalittoral sand (MD52)	*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand (MD5212)	High Sensitivity (based on No resistance and Very Low resilience)
Subtidal coarse sediment habitat		
Atlantic circalittoral coarse sediment (MC32)	*Protodorvillea kefersteini* and other polychaetes in impoverished Atlantic circalittoral mixed gravelly sand (MC3213)	High Sensitivity (based on No resistance and Very Low resilience)
Subtidal mixed sediment habitat		
Atlantic circalittoral mixed sediment (MD42)	Polychaete-rich deep Venus community in offshore circalittoral mixed sediment (MD4211)	High Sensitivity (based on No resistance and Very Low resilience)
Atlantic circalittoral rock (MC12)	Sparse sponges, *Nemertesia spp.*, and *Alcyonidium diaphanum* on Atlantic circalittoral mixed substrata (MC1217)	High Sensitivity (based on No resistance and Very Low resilience)
***Sabellaria* habitat**		
Atlantic circalittoral biogenic habitat (MC22)	*Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment (MC2211) (no *Sabellaria* reef was recorded)	High Sensitivity (based on No resistance and Very Low resilience)

Magnitude of Impact

1.9.13 The MDS considers a maximum of 597,000 m^2 of permanent habitat loss/change as a result of the installation and presence of rock placement for cable protection and at cable crossings (of in-service cables).

1.9.14 The impact will directly affect receptors through the long-term loss / change of benthic habitats and will occur continuously throughout the lifetime of the Proposed Development. However, long-term habitat loss/change (max. 597,000 m^2) will only affect a small proportion of the habitats present across the Benthic Study Area (3,957 km^2) and will be restricted to the footprint of the Offshore Cable Corridor. This equates to approximately 0.02% of long-term habitat loss/change within the Benthic Ecology Study Area.

1.9.15 There is potential for epifauna to colonise cable protection measures which could lead to a localised increase in biodiversity along the cable route. However, where such changes differ considerably from the type of habitat previously in place (e.g. soft substrate habitats), such increases in biodiversity may not necessarily be considered as beneficial change.

1.9.16 The impact is predicted to be of local spatial extent and long-term duration. The magnitude is therefore **low**.

Significance of the Effect

1.9.17 The sensitivity of the benthic receptors is **medium** to **high** and the magnitude of the impact is considered to be **low**. Overall, the effect is assessed to be of **minor** adverse significance, which is not significant in EIA terms.

Further Mitigation

1.9.18 The effect of 'Long-term habitat loss/change' is not significant, therefore, no mitigation measures are proposed (beyond the embedded mitigation presented in **Table 1.20**).

Future Monitoring

1.9.19 No significant effects have been identified and there is no future monitoring proposed beyond the operational phase geophysical inspection surveys. The operational monitoring is anticipated to include geophysical surveys up to once a year for the first 5 years, and then approximately every 5 years for the remainder of the operational life of the cables (anticipated 50 years), (as indicated in Volume 1, Chapter 3: Project Description).

Temporary habitat loss/disturbance

1.9.20 Temporary habitat loss / disturbance will occur during the operation and maintenance phase as a result of repair and reburial activities.

Sensitivity of receptor

1.9.21 The sensitivity of benthic receptors to temporary habitat loss/disturbance is the same as that described for the construction phase in **section 1.8** of this PEIR chapter. They are generally considered to have Low or Medium sensitivity to ‘abrasion / disturbance of the surface of the substratum or seabed’ and ‘penetration or disturbance of the substratum surface’, and Medium sensitivity to ‘Smothering and siltation rate changes (heavy)’.

Magnitude of impact

1.9.22 The MDS considers the de-burial, repair and re-burial of segments of the cable at failure points when they are required. In the event of a cable failure the cable would be cut, recovered to the surface, repaired using a section of new cable and redeployed for reburial using similar methods to those used for installation. Given additional cable length would be required to join the cut ends at the surface, the relayed cable would take up a greater footprint than the original cable. However, the relayed cable would still fall within the Offshore Cable Corridor. The magnitude of temporary habitat loss / disturbance from operation and maintenance is expected to be significantly less than that for construction.

1.9.23 Temporary habitat loss/disturbance will directly affect benthic receptors. However, the impact will be intermittent throughout the operational phase, would be of localised spatial extent (restricted to the footprint of the Offshore Cable Corridor, and the locality of the repair) and of short-term duration. The magnitude is, therefore, considered to be **low**.

Significance of effect

1.9.24 The sensitivity of receptors is **low** to **medium** and the magnitude of the impact is considered to be **low**. Overall, it is considered that the effect will be of **minor** adverse significance, which is not significant in EIA terms.

Further Mitigation

1.9.25 The effect of ‘Temporary habitat loss/disturbance’ is not significant, therefore, no mitigation measures are proposed (beyond the embedded mitigation presented in **Table 1.20**).

Future Monitoring

1.9.26 No significant effects have been identified and no future monitoring is proposed.

Temporary increase in suspended sediments and sediment deposition

1.9.27 Increases in suspended sediments and deposition will occur during the operation and maintenance phase as a result of repair activities.

Sensitivity of receptor

1.9.28 The sensitivity of benthic receptors to temporary increase in suspended solids and sediment deposition is the same as that described for the construction phase in **section 1.8** of this PEIR chapter. They are generally considered to have Low sensitivity to ‘changes in suspended solids (water clarity)’ and ‘smothering and siltation rate changes (light)’. No MarESA assessment is available for these impacts for bedrock and stony reef but taking a precautionary approach a sensitivity of Medium has been applied, noting for example that the level of sediment coverage can influence the number of organisms visible on bedrock and if a low percentage of bedrock is visible under the sediment with sparse fauna it can affect whether it is considered to represent reef habitat or not (Golding *et al*. 2020).

Magnitude of impact

1.9.29 The MDS considers the de-burial, repair and re-burial of segments of the cable at failure points when they are required. In the event of a cable failure the cable would be cut, recovered to the surface, repaired using a section of spare cable and redeployed for reburial using similar methods to those used for installation. The magnitude of increased suspended sediments and deposition from operation and maintenance is expected to be significantly less than that for construction.

1.9.30 Temporary increase in suspended sediments and sediment deposition will directly affect benthic receptors during the operational phase. However, the impact is predicted to be of local spatial extent (restricted to within the Benthic Study Area and in close proximity to the source), short-term duration (any suspended sediment will disperse quickly) and highly intermittent. The magnitude is, therefore, considered to be **low**.

Significance of effect

1.9.31 The sensitivity of the receptor is **medium** the magnitude of the impact is considered to be **low**. Overall, the effect is assessed to be of **minor** adverse significance, which is not significant in EIA terms.

1.9.32 As indicated in **section 1.8**, any effects on Lundy SAC, Taw-Torridge Estuary SSSI would be negligible as they are beyond the ZoI for sediment dispersal (PEIR Appendix 8.1: High Level Assessment of Sediment Dispersion). It is considered that any effects on Bideford to Foreland Point MCZ**,** South West Approaches to Bristol Channel MCZ and East of Haig Fras MCZ would be negligible and would not hinder the achievement of the conservation objectives stated for the MCZs.

Further Mitigation

1.9.33 The effect of ‘Temporary increase in suspended sediment and sediment deposition’ is not significant, therefore, no mitigation measures are proposed (beyond the embedded mitigation presented in **Table 1.20**).

Future Monitoring

1.9.34 No significant effects have been identified and no future monitoring is proposed.

Changes to water quality (release of hazardous substances from sediments)

1.9.35 Release of any (baseline existing) hazardous substances from sediments may occur during the operation and maintenance phase as a result of repair and reburial activities.

Sensitivity of receptor

1.9.36 The sensitivity of benthic receptors to changes to water quality (release of hazardous substances from sediments) is the same as that described for the construction phase in **section 1.8**. They are generally considered to have **medium** sensitivity to 'changes to water quality (release of hazardous substances from sediments)'.

Magnitude of impact

1.9.37 The MDS considers the de-burial, repair and re-burial of segments of the cable at failure points when they are required. In the event of a cable failure the cable would be cut, recovered to the surface, repaired using a section of spare cable and redeployed for reburial using similar methods to those used for installation. The magnitude of changes to water quality from resuspension of sediments from operation and maintenance is expected to be less than that for construction (very small volumes of disturbed sediment associated with isolated works).

1.9.38 Changes to water quality (release of hazardous substances from sediments) will directly affect benthic receptors during the operational phase. However, the impact is predicted to be of local spatial extent (restricted to within the Benthic Study Area and in close proximity to the source), of short-term duration (any suspended sediment will disperse quickly) and intermittent. The magnitude is, therefore, considered to be **low**.

Significance of the Effect

1.9.39 The sensitivity of the receptor is **medium** and the magnitude of the impact is considered to be **low**. Overall, the effect is assessed to be of **minor** adverse significance, which is not significant in EIA terms.

1.9.40 As indicated in **section 1.8**, any effects on Lundy SAC, Taw-Torridge Estuary SSSI would be negligible. It is considered that any effects on Bideford to Foreland Point MCZ**,** South West Approaches to Bristol Channel MCZ and East of Haig Fras MCZ would be negligible and would not hinder the achievement of the conservation objectives stated for the MCZs.

Further Mitigation

1.9.41 The effect of 'changes to water quality (release of hazardous substances from sediments)' is not significant, therefore, no mitigation measures are proposed (beyond the embedded mitigation presented in **Table 1.20**).

Future Monitoring

1.9.42 No significant effects have been identified and no future monitoring is proposed.

Introduction and spread of INNS

1.9.43 The introduction and spread of INNS may occur during the operational phase of the Proposed Development. The main risks would be associated with introduction of any new materials to the water column, discharge of ballast water and potential biofouling of vessel hulls or other parts of vessel infrastructure.

Sensitivity of receptor

1.9.44 The sensitivity of benthic receptors to introduction and spread of INNS is the same as that described for the construction phase in **section 1.8** of this PEIR. They are generally considered to have up to a **high** sensitivity to ‘introduction and spread of INNS’.

Magnitude of impact

1.9.45 The introduction and spread of INNS may occur during the operation and maintenance phase of the Proposed Development due to the presence and movement of vessels. The MDS considers the presence of one survey vessel to undertake routine surveys once a year for the first 5 years of operation, then every 5 years for the remainder of the cable lifetime (50 years). Additionally, vessels to support unplanned maintenance and repair will also be present, when required. The precise number of vessels, vessel return trips and ports of origin are yet to be determined. However, the increase in vessel numbers as a result of construction activities will be small when compared to the baseline environment presented in Volume 3, Chapter 5 of this PEIR: Shipping and Navigation. The baseline activity is described as an average of 90 vessels per day within 5 nm of the Offshore Cable Corridor.

1.9.46 As set out in Volume 1, Chapter 3: Project Description, to reduce the likelihood of the introduction and spread of INNS a Biosecurity Plan will be adhered to, with the incorporation of a biosecurity risk assessment to identify potential pathways of introduction for INNS, and critical control points for minimising the risks. Additionally, all ships will be subject to the Ballast Water Management Convention (2017) requirements and will be obliged to conduct ballast water management in accordance with the Convention. These measures will be enforced via the CEMP.

1.9.47 The impact is predicted to be of regional spatial extent and long-term duration. However, with the implementation of the embedded mitigation measures mentioned above, the risk of the introduction and spread of INNS is low. The magnitude is therefore **low**.

Significance of effect

1.9.48 The sensitivity of the subtidal sand, subtidal coarse and subtidal mixed sediment habitat receptors is **high** and the sensitivity of the *Sabellaria* habitat receptor is **medium**. Overall, the magnitude of the impact is considered to be **low.**

1.9.49 The effect is assessed to be of **minor** adverse significance, which is not significant in EIA terms.

1.9.50 As indicated in **section 1.8**, any effects on Bideford to Foreland MCZ, South West Approaches to Bristol Channel MCZ and East of Haig Fras MCZ are considered to be minor and would not hinder the achievement of the conservation objectives stated for the MCZs.

Further Mitigation

1.9.51 The effect of introduction or spread of INNS is not significant in EIA terms, therefore, no mitigation measures are proposed beyond those embedded measures outlined above (beyond the embedded mitigation presented in **Table 1.20**).

Future Monitoring

1.9.52 No significant effects have been identified and no future monitoring is proposed.

Change in hydrodynamic regime (scour & accretion)

1.9.53 Changes in hydrodynamic regime (scour & accretion) may occur as a result of the presence of cable protection and cable crossings during the operational phase of the Proposed Development, which could subsequently affect seabed habitats through changes to locations of sediment scour, sediment deposition and grain size distribution.

1.9.54 The sensitivity of the receptors identified in the Benthic Ecology Study Area have been assessed in relation to the following MarESA pressure relevant to change in hydrodynamic regime (scour & accretion):

- Water flow (tidal current) changes (local).

1.9.55 The sensitivity of representative biotopes to changes in hydrodynamic regime (scour & accretion) pressures are summarised in **Table 1.25**.

1.9.56 The MarESA assessment of representative biotopes indicates that the subtidal sands sediment, subtidal coarse sediment, subtidal mixed sediment and *Sabellaria* habitat receptors are not sensitive to water flow (tidal current) changes (local) (**Table 1.25**).

1.9.57 Water movement is a key factor determining the physical structure of biotopes. Representative biotopes of subtidal benthic receptors, occur where tidal streams range from strong to weak and organisms in these habitats may be tolerant of changes to water flow. For the biotope, ‘*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand’ (MD5212), characterising species show behavioural adaptations to changes in which a decrease in water flow and subsequently sediment deposition may allow species to utilise the additional deposits and burrow through sediment (De-Bastos, 2023). Characterising species of the representative biotopes ‘*Protodorvillea kefersteini* and other polychaetes in impoverished Atlantic circalittoral mixed gravelly sand’ (MC3213) and ‘Polychaete-rich deep Venus community in offshore circalittoral mixed sediment’ (MD4211) are infaunal and generally intolerant of changes to water flow (Tillin & Watson, 2023). Water flow is important for the bryozoan communities of the biotope ‘Sparse sponges*, Nemertesia spp.,* and *Alcyonidium diaphanum* on Atlantic circalittoral mixed substrata’ (MC1217) and any substantial decrease in water flow may result in impaired growth due to a reduction in food availability (Readman *et al*., 2023). Similarly, reduced water flow for the biotope ‘*Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment’ (MC2211) may result in in a reduction in the supply of suspended sediment for tube building and growth (Tillin *et al*., 2023). However, these biotopes have been indicated to have a broad tolerance to different levels of water flow (Jones *et al*., 2000; Braithwaite *et al*., 2006; Davies *et al*., 2009). Consequently, representative biotopes of benthic subtidal receptors will have a reasonable capacity to tolerate the impact with good recovery (i.e. within 5 years) and are of Regional value. The receptors are therefore assessed as having **low** sensitivity.

Table 1.25: Sensitivity of benthic receptors to change in hydrodynamic regime (scour & accretion)

Habitats	Representative biotopes	MarESA Assessment
		Water flow (tidal current) changes (local)
Bedrock reef	Not applicable	Not Applicable
Stony reef	Not applicable	Medium (not MarESA)
Subtidal sand sediment habitats		
Atlantic infralittoral sand (MB52)	Sparse fauna in Atlantic infralittoral mobile clean sand (MB5231)	Not Sensitive (based on High resistance and High resilience)
Atlantic circalittoral sand (MC52)	*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (MC5211) *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment (MC5214)	Not Sensitive (based on High resistance and High resilience)
Atlantic offshore circalittoral sand (MD52)	*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand (MD5212)	Not Sensitive (based on High resistance and High resilience)
Subtidal coarse sediment habitats		
Atlantic circalittoral coarse sediment (MC32)	*Protodorvillea kefersteini* and other polychaetes in impoverished Atlantic circalittoral mixed gravelly sand (MC3213)	Not Sensitive (based on High resistance and High resilience)
Subtidal mixed sediment habitats		
Atlantic circalittoral mixed sediment (MD42)	Polychaete-rich deep Venus community in offshore circalittoral mixed sediment (MD4211)	Not Sensitive (based on High resistance and High resilience)
Atlantic circalittoral rock (MC12)	Sparse sponges, *Nemertesia spp.*, and *Alcyonidium diaphanum* on Atlantic circalittoral mixed substrata (MC1217)	Not Sensitive (based on High resistance and High resilience)
Sabellaria habitat		
Atlantic circalittoral biogenic habitat (MC22)	*Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment (MC2211) (no *Sabellaria* reef was recorded)	Not Sensitive (based on High resistance and High resilience)

Magnitude of impact

1.9.58 The MDS considers a maximum of 597,000 m^2 of placed rock (and other protection including concrete mattresses) for cable protection and cable crossings at in-service cables.

1.9.59 The cable protection will be designed to have a low profile (maximum of 1 m above the seabed for cable protection; 1.4 m maximum height at crossings) which will minimise potential effects on water flow and local hydrodynamics. All crossings will utilise best practice design, which includes shallow (1:3) slopes which will further mitigate against impacts on local currents, and associated scour.

1.9.60 The impact will directly affect benthic receptors through highly localised changes to physical processes and will occur continuously throughout the lifetime of the Proposed Development. However, it is anticipated that any changes in hydrodynamic regime as a result of cable protection will only affect a small proportion of the habitats immediately adjacent to the Offshore Cable Corridor.

1.9.61 The impact is predicted to be of local spatial extent and long-term duration. Overall, the magnitude of impact is considered to be **low**.

Significance of effect

1.9.62 The sensitivity of the receptor is **low** and the magnitude of the impact is considered to be **low**. Overall, the effect is assessed to be of **minor** adverse significance, which is not significant in EIA terms.

Further Mitigation

1.9.63 The effect of 'temporary increase in change in hydrodynamic regime (scour & accretion)' is not significant, therefore, no mitigation measures are proposed (beyond the embedded mitigation presented in **Table 1.20**).

Future Monitoring

1.9.64 No significant effects have been identified and no future monitoring is proposed.

Sediment heating

1.9.65 When operational, the HVDC cables will emit heat causing a rise in local sediment temperature and possibly of the water column in the immediate vicinity of the buried cables. A project specific study on the likely temperature increase resulting from the cables was conducted to inform the assessment.

Sensitivity of the Receptor

1.9.66 A rise in sediment temperature could have an effect on benthic species as the resident species in the area may not be able to tolerate an increase in temperature causing mobile individuals within the ZoI to move away. Sessile species may become stressed which could reduce their survival rate. MarESA does not assess the sensitivity of increased temperature in sediment on benthic invertebrates but does assess their sensitivity to increases in temperature of water and so these sensitivity assessments have been used as a proxy in this assessment. Decapods such as the edible crab (*Cancer pagurus*) have a low sensitivity to increase in temperature based on an intermediate intolerance and very high recoverability (Neal & Wilson, 2008).

1.9.67 Sensitivities of key benthic species and habitats within the study area (**Table 1.26**) range between **not sensitive** and **low**.

Table 1.26: Sensitivity of benthic receptors to sediment heating

Receptor	Representative Biotope	MarESA Assessment
Edible crab (*Cancer pagurus*)	Not applicable	Low (based on Intermediate resistance and Very high resilience)
Blue mussel (*Mytilus edulis*)	Not applicable	Very low (based on Low resistance and Very high resilience)
Subtidal sand sediment habitats		
Atlantic infralittoral sand (MB52)	Sparse fauna in Atlantic infralittoral mobile clean sand (MB5231)	Not sensitive (based on High resistance and High resilience)
Atlantic circalittoral sand (MC52)	*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand (MC5211) *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment (MC5214)	Low (based on Medium resistance and High resilience)
Atlantic offshore circalittoral sand (MD52)	*Owenia fusiformis* and *Amphiura filiformis* in deep circalittoral sand or muddy sand (MD5212)	Not sensitive (based on High resistance and High resilience)
Subtidal coarse sediment habitats		
Atlantic circalittoral coarse sediment (MC32)	*Protodorvillea kefersteini* and other polychaetes in impoverished Atlantic circalittoral mixed gravelly sand (MC3213)	Not sensitive (based on High resistance and High resilience)
Subtidal mixed sediment habitats		
Atlantic circalittoral mixed sediment (MD42)	Polychaete-rich deep Venus community in offshore circalittoral mixed sediment (MD4211)	Low (based on Medium resistance and High resilience)
Atlantic circalittoral rock (C12)	Sparse sponges, *Nemertesia spp.*, and *Alcyonidium diaphanum* on Atlantic circalittoral mixed substrata (MC1217)	Not sensitive (based on High resistance and High resilience)
***Sabellaria* habitat**		
Atlantic circalittoral biogenic habitat (MC22)	*Sabellaria spinulosa* on stable Atlantic circalittoral mixed sediment (MC2211) (no *Sabellaria* reef was recorded)	Not sensitive (based on High resistance and High resilience)

Magnitude of impact

1.9.68 The Electromagnetic Field and Thermal Study (Amplitude Consultants, 2021) presents increases to ambient sediment temperature associated with the proposed HVDC cable technology. Temperature uplift (sediment heating) predictions for the planned cable bundle(s) can be made by assuming a precautionary 15°C 'soil' ambient temperature (anticipated to be 5 – 10°C along the Offshore Cable Corridor) and a seabed thermal resistivity of 0.7 K.m/W. The target burial depth across the Offshore Cable Corridor is 1.5 m (as indicated by the provisional BAS) therefore the max temp uplift of the surface sediment directly above the cable is estimated to be 4ºC[8], which would rapidly decrease (exponential temperature decline) to a negligible temperature increase at approximately 2.5 m distance from the cable. Given that in most locations the cable will be buried below the seabed surface, the horizontal seabed surface distance to negligible temperature uplift would therefore be less than 2.5 m.

1.9.69 Any effects associated with localised sediment / sea bed temperatures will therefore be limited to the immediate seabed overlying the cable bundles.

1.9.70 For context, the cable specifications for the Greenlink Interconnector are equivalent to those for the Project cable. The Environmental Impact Assessment for Greenlink acknowledged a potential influence of temperature on receptors, but it was Scoped out at the Scoping stage on the basis that it was not anticipated to have a potential significant effect (Intertek, 2018).

1.9.71 The impact of sediment heating from the cables is predicted to be of highly local spatial extent and long-term duration. The magnitude of impact is therefore assessed to be **low**.

Significance of effect

1.9.72 Overall, the magnitude of the impact is **low** and the sensitivity of the most sensitive receptors is **low**. The effect will, therefore, be of **negligible** adverse significance.

Further Mitigation

1.9.73 The effect of 'sediment heating' is not significant, therefore, no mitigation measures are proposed (beyond the embedded mitigation presented in **Table 1.20**).

Future Monitoring

1.9.74 No significant effects have been identified and no future monitoring is proposed.

Electromagnetic field (EMF) effects

1.9.75 EMFs are generated by the current that passes through an electric cable. It is known that EMF can be detected by fish and elasmobranchs and it is thought that

[8] Temperature/Distance to cable estimates based on modelled horizontal temperature decay relationships derived at 1.05m depth (Amplitude Consultants, 2021)

benthic invertebrates can also detect EMF. Three types of fields are generated by underwater electric cables: electric fields (E-fields), magnetic fields (B-fields) and induced electric fields (iE-fields). Standard industry practice is for the cables used to have sufficient shielding to contain the E-fields generated. Shielding and/or burial does not reduce the B-fields and it is these fields that allow the formation of iE-fields. As such, further reference here to EMF is limited to B-fields and associated iE-fields.

Sensitivity of receptor

1.9.76 The sensitivity of benthic invertebrates to EMF has not been assessed by MarLIN using the MarESA approach as there is currently a lack of evidence to determine sensitivity (Gibson-Hall *et al*. 2020; Perry *et al.*, 2023; Tillin *et al*., 2017; Tyler-Walters & Sabatini, 2017).

1.9.77 Sparse experimental data are available to consider effects, for example Bochert and Zettler (2004) exposed the blue mussel (*Mytilus edulis*), brown shrimp (*Crangon crangon*) and estuarine mud crab (*Rhithropanopeus harrisii*) to a static B-field of 3.7 µT (37 G) for several weeks, however, no differences in survival between experimental and control animals was detected (Bochert and Zettler 2004). In contrast, B-fields were found to have effects on biochemical parameters in blue mussel (Aristharkhov *et al*., 1988). It was found that changes in B-field action of 5.8, 8, and 80 µT (58, 80, 800 G, respectively) led to a 20% decrease in hydration and a 15% decrease in amine nitrogen values, regardless of the induction value (Aristharkhov *et al*., 1988).

1.9.78 Love *et al*. (2016) studied the benthic community occupying two energised submarine power cables (average 73 µT / 730 mG and 91.4 µT / 914 mG) in comparison to adjacent non-energised pipes and natural habitats, off Southern California over a two-year period. They failed to find any significant difference in fish or invertebrate assemblages between energised cables, non-energised pipes and natural habitat. They concluded that EMF are unlikely to impact fish and invertebrate assemblages to any great extent.

1.9.79 Based on the information currently available, benthic invertebrates have been assessed to have a **Low** sensitivity to EMFs.

Magnitude of impact

1.9.80 EMF occurs naturally in the marine environment. The Earth's static magnetic field (geomagnetic field) is present in all environments, terrestrial and aquatic, and lies in the range of 25 to 65 µT (250 to 650 mG) (Hutchison *et al*., 2018; Normandeau *et al*., 2011). Movement of seawater through the Earth's magnetic field (geomagnetic field) creates localised E-fields, which are typically very small, in the order of 10s of µV m-1 (Tasker *et al*., 2010; Normandeau *et al*., 2011). Small electric fields are also directly produced by marine organisms.

1.9.81 The Maximum Design Scenario assumes the presence of four 525 kV HVDC cables, with a diameter of 175 mm, across a length of 370 km. Cables are intended to be buried along their entire length, to a target depth of 1.5 m. Where full target trench depth is not able to be achieved because of bed conditions, or where softer sediments are unavailable to backfill the installation trench, additional rock protection will be installed. The calculated static magnetic field levels of the bundled cables is 79 µT (790 mG), with no static electric fields being emitted due to the cable shielding system (Amplitude Consultants, 2021).

1.9.82 CSA (2019) compared offshore subsea cables and found magnetic fields between seafloor and 1 m above seafloor (for buried 75 – 500 kV cables) to range between 590 and 1250 mG for Direct Current (DC) export cables. CSA (2019) also compared offshore Alternating Current (AC) subsea cables from wind farms and found magnetic field levels directly over the cables to range between 20 to 65 mG for 34.5 to 161 kV inter-array cables and 30 to 165 mG for 138 to 400 kV export cables at the seafloor. A reduction in magnetic field levels was seen 1 m above the seafloor, with 5 to 15 mG for inter-array cables and 10 to 40 mG for export cables. Induced electric field levels were 0.1 to 1.2 mV/m for inter-array and 0.2 to 2.0 mV/m for export cables, 1 m above the seafloor. Love *et al*. (2016) made a similar observation, with EMF levels being undetectable 1 m away from most of the energised submarine power cables monitored as part of their study.

1.9.83 Impacts from changes in EMFs arising from cables, are not considered to result in a measurable change in benthic subtidal and intertidal receptors. EMFs generated by subsea cables are considered likely to be detectable above background levels only in close (immediate) proximity to the cables. Although burial does not mask EMFs, it increases the distance between species that may be affected by EMFs and the source.

It is considered that any potential effects of EMFs on benthic invertebrates would be confined to a very localised area surrounding the cables and will be long-term. Overall, the magnitude of impact is assessed to be **low**.

Significance of effect

1.9.84 The sensitivity of the most sensitive receptors is **low** and the magnitude of the impact is considered to be Low. Overall, the effect is assessed to be of **negligible** significance.

Further Mitigation

1.9.85 The effect of ‘electromagnetic fields’ is not significant, therefore, no mitigation measures are proposed (beyond the embedded mitigation presented in **Table 1.20**).

Future Monitoring

1.9.86 No significant effects have been identified and no future monitoring is proposed.

Accidental Pollution

1.9.87 Accidental release of pollutants (such as fuel, lubricants, and anti-fouling biocides) from vessels or equipment associated with the Proposed Development has the potential to occur during maintenance and repair activities.

Sensitivity of receptor

1.9.88 The sensitivity of benthic receptors to accidental pollution is the same as that described for the construction phase in **section 1.8**. They are generally considered to have **medium** sensitivity to ‘accidental pollution’.

Magnitude of impact

1.9.89 The maintenance associated with the Proposed Development Operational phase may lead to the accidental release of pollutants through spills and leaks from vessels and equipment. The MDS considers the presence of one survey vessel to undertake routine surveys once a year for the first 5 years of operation, then every 5 years for the remainder of the cable lifetime (50 years). Additionally, vessels to support unplanned maintenance and repair will also be present, when required. Whilst this will lead to an uplift in vessel activity, the movements will primarily be along the Offshore Cable Corridor and along existing shipping routes to / from port. Vessel traffic associated with the Proposed Development will lead to an increase in vessel movements within the Study Area, albeit to a very small degree when compared to the baseline numbers. This increase could lead to an increased risk of accidental pollution through the release of synthetic compounds, for example from antifouling biocides, heavy metal, and hydrocarbon contamination as a result of seabed preparation, route clearance, cable laying and burial activities.

1.9.90 Although many of the large vessels (e.g., installation vessels) may contain large quantities of diesel oil, any accidental spill from vessels, vehicles, machinery from construction activities would be subject to immediate dilution and rapid dispersal.

1.9.91 The embedded mitigation measures include the application of an offshore CEMP, which will include a Marine Pollution Contingency Plan (MPCP). Where relevant (as per MARPOL requirements), Project vessels will ensure a Shipboard Oil Pollution Emergency Plan (SOPEP). Adherence to the embedded measures and good working practices outlined in **section 1.7** of this chapter will significantly reduce the likelihood of an accidental pollution incident occurring and the magnitude of its impact. Given the embedded measures, the likelihood of accidental release is considered to be extremely low.

1.9.92 Accidental release of pollutants during the operational phase would directly affect benthic receptors. However, the impact is predicted to be of local spatial extent and short-term duration (any pollutant will be quickly dispersed) and highly intermittent (unlikely). The magnitude of impact is, therefore, considered to be **low**.

Significance of effect

1.9.93 The sensitivity of the receptor is **medium** and the magnitude of the impact is considered to be **low**. Overall, the effect is assessed to be of **minor** adverse significance, which is not significant in EIA terms.

1.9.94 As indicated in **section 1.8**, any effects on Bideford to Foreland MCZ, South West Approaches to Bristol Channel MCZ and East of Haig Fras MCZ are considered to be minor and would not hinder the achievement of the conservation objectives stated for the MCZs

Further Mitigation

1.9.95 The effect of accidental pollution is not significant, therefore, no further mitigation measures are proposed (beyond the embedded mitigation presented in **Table 1.20**).

Future Monitoring

1.9.96 No significant effects have been identified and no future monitoring is proposed.

1.10 Preliminary Assessment of Decommissioning Effects

1.10.1 At the end of the operational life of the cable (c.50 years after commissioning) the options for decommissioning will be evaluated and having regard for other Proposed Development constraints (e.g., safety and liability), the least environmentally damaging option would be chosen where possible.

1.10.2 Should full removal of the cable from the seabed be required, this would have the potential to cause similar impacts to those associated with the construction phase (**section 1.8**), noting that the magnitude of impact associated with cable removal would likely be reduced relative to construction phase impacts. As a precautionary approach, the impacts identified in the assessment for the construction phase are considered to also apply to cable removal during decommissioning.

1.10.3 If cables are de-energised and left in situ, this would result in permanent impacts similar to those identified for the operational phase (**section 1.9**), with the exclusion of those impacts associated with the energised cable i.e. EMF and sediment heating. In addition, potential impacts have been considered for INNS and Accidental pollution for the in situ option as vessels may be required.

1.10.4 Overall, no effects from decommissioning activities are considered to be significant in EIA terms.

1.11 Cumulative Environmental Assessment

1.11.1 The Cumulative Effects Assessment (CEA) takes into account the impact associated with the Proposed Development together with other projects and plans. The projects and plans selected as relevant to the CEA presented within this chapter are based upon the results of a screening exercise (see Volume 1, Appendix 5.3 of this PEIR: CEA screening matrix). Each project has been considered on a case-by-case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.

1.11.2 The Benthic Ecology CEA methodology has followed the methodology set out in Volume 1, Chapter 5: EIA methodology of the PEIR. As part of the assessment, all projects and plans considered alongside the Proposed Development have been allocated into ‘tiers’ reflecting their current stage within the planning and development process (as advocated under the Planning Act, 2008).

- Tier 1
  - Under construction
  - Permitted application
  - Submitted application
  - Those currently operational that were not operational when baseline data were collected, and/or those that are operational but have an ongoing impact

- Tier 2
  - Scoping report has been submitted
- Tier 3
  - Scoping report has not been submitted
  - Identified in the relevant Development Plan
  - Identified in other plans and programmes.

1.11.3 This tiered approach is adopted to provide a clear assessment of the Proposed Development alongside other projects, plans and activities.

1.11.4 The specific projects, plans and activities scoped into the CEA, are outlined in **Table 1.27**.

1.11.5 All of the identified projects, plans and activities are currently at the Tier 1 or Tier 3 stage.

Table 1.27: List of cumulative developments considered within the CEA

Project	Status	Distance from Proposed Development (nearest point, km)	Description	Dates of Construction (if available)	Dates of Operation (if available)	Overlap with the Proposed Development?
Tier 1						
Aqua Botanika Nearshore seaweed cultivation of native species	Pending	27.4	A Kelp Farm on ropes with buoys anchored to the seabed or to blocks in roughly 50-meter frequencies, main ropes connecting the buoys in each direction creating a grid. Growing ropes are then connected to main ropes to run parallel at 10-meter centres. Proposal is for multiple bays which equate to an area of 100 hectares.	Autumn 2024	Winter 2024 - Spring 2025	No overlap with construction, however there will be operational overlap with the Proposed Development
TwinHub Floating Offshore Wind Demonstration Project	Under construction	29.5	Two semisubmersible platforms with two turbines each in order to generate up to 32MW power from renewable floating offshore wind energy. The Site already consists of existing cables and onshore infrastructure which was originally granted consent in 2007. No further work to existing infrastructure is anticipated.	Q4 2024	Q2 2025	No overlap with construction, however there will be operational overlap with the Proposed Development
White Cross Floating Offshore Windfarm	Permitted	7.8 (with the Offshore Cable Corridor overlapping / directly adjacent to the White Cross Cable Corridor)	Proposed offshore windfarm located in the Celtic Sea with a capacity of up to 100MW. The Windfarm Site is located over 52km off the North Cornwall and North Devon coast (west-north-west of Hartland Point), in a water depth of 60m – 80m. The Windfarm Site covers 50km2. The current wind turbine design envelope for the project is a WTG capacity of 12-24 MW, 6-8 three bladed horizontal axis turbines with a rotor diamater of 220-300 m.	Mid 2024	2026	No overlap with construction, however there will be operational overlap with the Proposed Development
Celtic Interconnector	Permitted	Crosses offshore cable corridor	700 MW high-voltage direct current submarine power cable under construction between the	2024	2027	No overlap with construction, however there will

Project	Status	Distance from Proposed Development (nearest point, km)	Description	Dates of Construction (if available)	Dates of Operation (if available)	Overlap with the Proposed Development?
			southern coast of Ireland and the north-west coast of France. The UK elements of the Celtic Interconnector comprise: • A submarine cable within the UK EEZ approximately 211km in length placed on or beneath the seabed. It passes approximately 30km west of the Isles of Scilly and approximately 75km west of Land's End, but does not enter UK Territorial Waters. • Secondary rock protection using rock placement (if required), where target depth of cable lowering is not fully achieved or at cable crossings, with a linear extent of between 0km and 80km or 0 to 270 tonnes. • A fibre optic link shall be laid along the cable route for operational control, communication and telemetry purposes.			be operational overlap with the Proposed Development
Tier 2						
None identified						
Tier 3						
The Crown Estate's Celtic Sea Floating Offshore Wind Leasing Round 5 - Project Development Area 2 (PDA2)	Future planned development	20.1	PDA 2 sits within Welsh and English Governance and is one of three suitable PDAs identified within the Celtic Sea for floating offshore wind development, each of which having a potential capacity of up to 1.5 GW.	Unknown (the schedule for PDA 2 is unknown, however, pre-consent metocean surveys are planned for early	Unknown	As the schedule for PDA 2 is currently unknown, there is the potential for overlap with both the construction and operational phases of the

Project	Status	Distance from Proposed Development (nearest point, km)	Description	Dates of Construction (if available)	Dates of Operation (if available)	Overlap with the Proposed Development?
				2024 and geotechnical investigations are planned for summer 2024)		Proposed Development
The Crown Estate's Celtic Sea Floating Offshore Wind Leasing Round 5 - Project Development Area 3 (PDA3)	Future planned development	Overlaps with portion of the offshore cable corridor	PDA 3 sits within English Governance and is one of three suitable PDAs identified within the Celtic Sea for floating offshore wind development, each of which having a potential capacity of up to 1.5 GW.	Unknown (the schedule for PDA 3 is unknown, however, pre-consent metocean surveys are planned for early 2024 and geotechnical investigations are planned for summer 2024)	Unknown	As the schedule for PDA 3 is currently unknown, there is the potential for overlap with both the construction and operational phases of the Proposed Development

Cumulative Effects Assessment

1.11.6 A description of the significance of cumulative effects upon benthic ecology receptors arising from construction and operation is given below.

Construction

Tier 1 Projects

1.11.7 There is potential for cumulative impacts with the other projects identified. The Tier 1 projects, which include offshore wind farms and a subsea cable, will be operational at the time that the Proposed Development enters construction (i.e. there will be no overlap of construction of the Proposed Development with the construction of other projects).

1.11.8 Operation and maintenance activities associated with these Tier 1 projects is expected to be similar in nature and scale to that of the Proposed Development's Operational phase. Cumulative impacts between the construction phase of the Proposed Development and the operational phase of the Tier 1 projects may include temporary habitat loss / disturbance, temporary increases in suspended sediments and changes to water quality. All of these impacts are expected to be very infrequent, short term in duration and low in extent with regards to operation and maintenance activities. While there may be some overlap with these activities with that of the construction of the Proposed Development, it is expected for the majority of the time these impacts would be temporally and / or physically separated. Therefore, the risk of impact on benthic ecology receptors is not higher than that described in **section 1.8**.

Operation and Maintenance

Tier 1 Projects

1.11.9 Cumulative impacts may arise as a result of the operation and maintenance phase of the Proposed Development overlapping with that of the other Tier 1 projects.

1.11.10 Operation and maintenance activities associated with other Tier 1 projects is expected to be similar in nature to that of the Proposed Development. Cumulative impacts between the operation and maintenance phase of the Proposed Development and the operational phase of the Tier 1 projects may include temporary habitat loss / disturbance, temporary increases in suspended sediments and changes to water quality. All of these impacts are expected to occur very infrequently, be short term in duration and restricted in extent. While there may be some theoretical overlap between repair activities associated with the Proposed Development and that of other Tier 1 projects, it is expected for the majority of the time these impacts would be temporally separated.

1.11.11 Cumulative impacts may also arise from non-repair activity related impacts, which include EMF effects, long-term habitat loss, changes in hydrodynamic regime and sediment heating. While all of these impacts are continuous and long-term they are small in terms of spatial scale.

1.11.12 Therefore, the risk of impact on benthic ecology receptors is not higher than that described in **section 1.9**.

1.12 Transboundary Effects

1.12.1 A screening of transboundary impacts has been carried out (Volume 1, Appendix 5.2 of this PEIR: Transboundary Screening).

1.12.2 The screening exercise identified that there is potential for transboundary impacts upon benthic ecology due to construction, operational (and maintenance) and decommissioning impacts of the Proposed Development.

1.12.3 Those UK activities with potential to disturb sediment, will result in a sediment plume. This plume could potentially cause some transboundary effects, in the French Exclusive Economic Zone (EEZ), given that the Proposed Development boundary extends up to the UK EEZ boundary. Similarly the Proposed Development in the vicinity of the UK EEZ boundary could cause changes in the hydrodynamic regime within the French jurisdiction.

1.12.4 The Project will extend in an uninterrupted linear fashion, into the French EEZ (beyond the UK Proposed Development), with installation works undertaken in a continuous manner across jurisdictions and using the same construction methods. Parallel French environmental assessments will be undertaken which will be submitted to the French consenting authorities. Furthermore the benthic habitat types and macrofaunal assemblages in the vicinity of the UK / French EEZ boundary are sufficiently broadscale (see Volume 3, Figure 1.2 and Figure 1.3) to have confidence that the characterisation of effects will be very similar on either side (within the near vicinity) of the EEZ boundary. Thus, any transboundary effects from the UK Proposed Development on benthic ecology receptors in French waters, or vice versa, will, on account of inherently greater distance from the impact generating activity, be of lesser impact magnitude than the similar impacts deriving from the immediate jurisdiction.

1.12.5 No other effects on benthic ecology receptors are likely to be transboundary other than those occurring at the boundary of the UK EEZ.

1.12.6 Referring to the assessments of each individual Proposed Development phase (**sections 1.8** to **1.11** of this chapter), it is concluded that there is no potential for significant transboundary effects on Benthic Ecology receptors from the Proposed Development upon the interests of other states.

1.13 Inter-related Effects

1.13.1 Inter-relationships are the impacts and associated effects of different aspects of the Proposed Development on the same receptor. These are as follows.

- Project lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of the Proposed Development (construction, operation and maintenance), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three phases.
- Receptor led effects: Assessment of the scope for all effects (including inter-relationships between environmental topics) to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on benthic ecology, such as temporary habitat loss/disturbance, temporary increase in suspended sediment and sediment deposition, changes to water quality (release of hazardous substances from sediments) etc., may interact to produce a different, or greater effect on this receptor than when the

effects are considered in isolation. Receptor-led effects may be short term, temporary or transient effects, or incorporate longer term effects.

1.13.2 A description of the likely interactive effects arising across the Proposed Development is provided in PEIR Volume 4, Chapter 5: Inter-Related Effects.

1.14 Summary of Impacts, Mitigation Measures and Monitoring

1.14.1 Information on Benthic Ecology within the study area was collected through desk-based review and site-specific surveys.

1.14.2 **Table 1.28** presents a summary of the impacts, measures adopted as part of the Proposed Development and residual effects in respect to Benthic Ecology. The impacts assessed were:

- Temporary habitat loss/disturbance
- Temporary increase in suspended sediments and sediment deposition
- Changes to water quality (release of hazardous substances from sediments)
- Introduction and spread of INNS
- Underwater noise & vibration
- Change in hydrodynamic regime (scour & accretion)
- Sediment heating
- Electromagnetic Fields
- Long-term habitat loss/change
- Accidental pollution

1.14.3 Overall, it is concluded that there will be **no significant effects** on benthic ecology receptors arising from the Proposed Development during the construction, operation and maintenance or decommissioning phases.

1.14.4 The magnitude and significance of any potential habitat effects on conservation objective 3 for the Bristol Channel Approaches SAC (i.e. 'The condition of supporting habitats and processes, and the availability of prey is maintained' – with respect to harbour porpoise) were considered to be **negligible**.

1.14.5 Potential effects on the Lundy SAC and Taw-Torridge SSSI were considered to be **negligible** (as they were beyond the calculated zone of sediment dispersal).

1.14.6 Potential effects on the Bideford to Foreland Point MCZ, South West Approaches to Bristol Channel MCZ and the East of Haig Fras MCZ due to temporary increase in suspended sediments and sediment deposition, changes to water quality (release of hazardous substances from sediments), introduction and spread of INNS and accidental pollution were determined to be **negligible** or **minor** and it was considered that they would not hinder achievement of the conservation objectives for the MCZs (an MCZ assessment will be provided with the ES).

1.14.7 **Section 1.11** presents a summary of the potential cumulative impacts, and overall it is concluded that there will be no significant cumulative effects from the Proposed Development alongside other projects/plans.

1.14.8 No potentially significant transboundary impacts have been identified in regard to benthic ecology effects from the Proposed Development.

Table 1.28: Summary of potential environmental effects

Impact	Sensitivity of receptor	Short / medium / long-term	Magnitude of impact	Significance of effect	Significant / Not significant	Notes	Residual significance
Construction phase							
Temporary habitat loss/disturbance	Low to Medium	Short term	Low	Minor adverse	Not significant	No additional mitigation or monitoring required	Not significant
Temporary increase in suspended sediments and sediment deposition	Negligible to Low	Short term	Low	Minor adverse	Not significant	No additional mitigation or monitoring required	Not significant
Changes to water quality (release of hazardous substances from sediments)	Medium	Short term	Low	Minor adverse	Not significant	No additional mitigation or monitoring required	Not significant
Introduction and spread of INNS	Medium to High	Long-term	Low	Minor adverse	Not significant	No additional mitigation or monitoring required	Not significant
Underwater noise & vibration	Low	Medium term	Low	Minor adverse	Not significant	No additional mitigation or monitoring required	Not significant
Accidental pollution	Medium	Short term	Low	Minor adverse	Not significant	No additional mitigation or monitoring required	Not significant

Impact	Sensitivity of receptor	Short / medium / long-term	Magnitude of impact	Significance of effect	Significant / Not significant	Notes	Residual significance
Operational phase							
Long-term habitat loss/change	Medium to High	Long-term	Low	Minor adverse	Not significant	No additional mitigation or monitoring required	Not significant
Temporary habitat loss/disturbance	Low to Medium	Short term	Low	Minor adverse	Not significant	No additional mitigation or monitoring required	Not significant
Temporary increase in suspended sediments and sediment deposition	Negligible to Low	Short term	Low	Minor adverse	Not significant	No additional mitigation or monitoring required	Not significant
Changes to water quality (release of hazardous substances from sediments)	Medium	Short term	Low	Minor adverse	Not significant	No additional mitigation or monitoring required	Not significant
Introduction and spread of INNS	Medium to High	Long-term	Low	Minor adverse	Not significant	No additional mitigation or monitoring required	Not significant
Change in hydrodynamic regime (scour & accretion)	Low	Long-term	Low	Minor adverse	Not significant	No additional mitigation or monitoring required	Not significant
Sediment heating	Low	Long-term	Low	Negligible	Not significant	No additional mitigation or monitoring required	Not significant

Impact	Sensitivity of receptor	Short / medium / long-term	Magnitude of impact	Significance of effect	Significant / Not significant	Notes	Residual significance
EMF effects	Low	Long-term	Low	Minor adverse	Not significant	No additional mitigation or monitoring required	Not significant
Accidental pollution	Medium	Short term	Low	Minor	Not significant	No additional mitigation or monitoring required	Not significant
Decommissioning phase							
Should full removal of the cable from the seabed be required, this would have the potential to cause similar impacts to the construction phase (recognising that this is a precautionary approach and that in reality, impact magnitudes would likely be reduced relative to construction phase on account of e.g. reduced disturbance footprints). If cables are left in situ, this would result in permanent impacts similar to that identified for the operational phase (normal) with exclusion of any sediment heating or EMF effects. Significance of all decommissioning effects deemed Not Significant.							

1.15 Next Steps

1.15.1 An intertidal survey will be completed and results from the survey will be used to further inform the assessment in the ES.

1.15.2 Statutory and non-statutory consultations and ongoing engagement with relevant stakeholders will inform the benthic ecology assessment presented within the ES.

1.16 References

Aberkali, H.B. and Trueman, E.R. (1985) Effects of environmental stress on marine bivalve molluscs. Mar. Biol., 22: 101–198.

Amplitude Consultants (2021) Xlinks HVDC Interconnector: Electromagnetic Field and Thermal Study. Ref PAU0147-REPT-001

Aristharkhov VM, Arkhipova GV, Pashkova GK (1988) Changes in common mussel biochemical parameters at combined action of hypoxia, temperature and magnetic field. Seria biologisceskaja 2:238-245. As cited in Köller, J., J. Köppel, and W. Peters (eds). 2005. Offshore Wind Energy – Research on Environmental Impacts. Springer Publishers.

BERR (2008) Review of cabling techniques and environmental effects applicable to the offshore wind farm industry. Technical report. January 2008

Blanchard, M. (2009) Recent expansion of the slipper limpet population (Crepidula fornicata) in the Bay of Mont-Saint-Michel (Western Channel, France). Aquatic Living Resources, 22 (1), 11-19.

Bochert, R. and M.L. Zettler (2004) Long-term Exposure of Several Marine Benthic Animals to Static Magnetic Fields. Bioelectromagnetics 25: 498-502.

Bohn, K., Richardson, C.A. & Jenkins, S.R. (2015) The distribution of the invasive non-native gastropod Crepidula fornicata in the Milford Haven Waterway, its northernmost population along the west coast of Britain. Helgoland Marine Research, 69 (4), 313.

Bradshaw, C., Veale, L.O., Hill, A.S. & Brand, A.R. (2002) The role of scallop-dredge disturbance in long-term changes in Irish Sea benthic communities: a re-analysis of an historical dataset. Journal of Sea Research, 47, 161-184.

Braithwaite, C., Robinson, R., & Jones, G. (2006) Sabellarids: a hidden danger or an aid to subsea pipelines? Quarterly Journal of Engineering Geology and Hydrogeology, 39(3), 259-265.

Bryan, G.W. (1984) Pollution due to heavy metals and their compounds. In Marine Ecology: A Comprehensive, Integrated Treatise on Life in the Oceans and Coastal Waters, vol. 5. Ocean Management, part 3, (ed. O. Kinne), pp.1289-1431. New York: John Wiley & Sons.

Cabioch, L., Dauvin, J.C. & Gentil, F. (1978) Preliminary observations on pollution of the sea bed and disturbance of sub-littoral communities in northern Brittany by oil from the Amoco Cadiz. Marine Pollution Bulletin, 9, 303-307.

Carlton J.T. (1992) Marine species introductions by ships' ballast water: an overview. In: Proceedings of the conference and workshop on introductions and transfers of marine species: achieving a balance between economic development and resource protection, Hilton Head Island, South Carolina October 30 - November 2, 1991, ed. by M.R. De Voe. pp. 23-25. South Carolina Sea Grant Consortium.

Castège, I., Milon, E. & Pautrizel, F. (2014) Response of benthic macrofauna to an oil pollution: Lessons from the "Prestige" oil spill on the rocky shore of Guéthary (south of the Bay of Biscay, France). Deep Sea Research Part II: Topical Studies in Oceanography, 106, 192-197.

Castric-Fey, A. & Chassé, C. (1991) Factorial analysis in the ecology of rocky subtidal areas near Brest (west Brittany, France). Journal of the Marine Biological Association of the United Kingdom, 71, 515-536.

Centre for Environment, Fisheries and Aquaculture Science (2023) OneBenthic Portal. Available: https://rconnect.cefas.co.uk/onebenthic_portal/

CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (version 1.2 – Updated April 2022).

Cole, S., Codling, I.D., Parr, W. & Zabel, T. (1999) Guidelines for managing water quality impacts within UK European Marine sites. Natura 2000 report prepared for the UK Marine SACs Project. 441 pp., Swindon: Water Research Council on behalf of EN, SNH, CCW, JNCC, SAMS and EHS. [UK Marine SACs Project.]. Available: http://ukmpa.marinebiodiversity.org/uk_sacs/pdfs/water_quality.pdf

Davies, A.J., Last, K.S., Attard, K. & Hendrick, V.J. (2009) Maintaining turbidity and current flow in laboratory aquarium studies, a case study using Sabellaria spinulosa. Journal of Experimental Marine Biology and Ecology, 370, 35-40

De-Bastos, E.S.R. (2023) Owenia fusiformis and Amphiura filiformis in offshore circalittoral sand or muddy sand. 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: https://www.marlin.ac.uk/habitat/detail/381

Department for Energy Security & Net Zero (2023a) Overarching National Policy Statement for Energy (NPS EN-1). Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147380/NPS_EN-1.pdf

Department for Energy Security & Net Zero (2023b) National Policy Statement for Renewable Energy Infrastructure (NPS EN-3). Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147382/NPS_EN-3.pdf

Department for Energy Security & Net Zero (2023c) National Policy Statements for Electricity Networks Infrastructure (NPS EN-5). Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147384/NPS_EN-5.pdf

Department for Environment, Food and Rural Affairs (2019) UKCP18 Derived Projections of Future Climate over the UK. Available: https://www.metoffice.gov.uk/pub/data/weather/uk/ukcp18/science-reports/UKCP18-Derived-Projections-of-Future-Climate-over-the-UK.pdf.

Department for Environment, Food and Rural Affairs (2023) MAGIC Map Application. Available: https://magic.defra.gov.uk/magicmap.aspx

Department for Levelling Up, Housing and Communities (2023) National Planning Policy Framework. Available at: https://www.gov.uk/guidance/national-planning-policy-framework

Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities and Local Government (2021) Planning Practice Guidance. https://www.gov.uk/government/collections/planning-practice-guidance

Elliot, M., Nedwell, S., Jones, N.V., Read, S.J., Cutts, N.D. & Hemingway, K.L. (1998) Intertidal sand and mudflats & subtidal mobile sandbanks (Vol. II). An overview of dynamic and sensitivity for conservation management of marine SACs. Prepared by the Scottish Association for Marine Science for the UK Marine SACs Project. Available: http://ukmpa.marinebiodiversity.org/uk_sacs/pdfs/sandmud.pdf

EMODnet (2023) EMODnet Map Viewer. Available: https://emodnet.ec.europa.eu/geoviewer/

European Environmental Agency. (2023) How climate change impacts marine life. Available at: https://www.eea.europa.eu/publications/how-climate-change-impacts. Accessed on: 22/02/2024.

GEOxyz (2023) Geotech, Env and Reconnaisance surveys. Environmental Fieldwork Report - UK. Ref: 6050H-837-OR-02 (ENV)

GEOxyz (2024) Geotech, Env and Reconnaisance surveys. Environmental Report - UK. Ref: 6050H-837-RR-05

Gibson-Hall, E., Jackson, A., Wilding, C.M. & Marshall, C.E (2020) *Palinurus elephas* European spiny lobster. 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: https://www.marlin.ac.uk/species/detail/1145

Golding, N., Albrecht, J. and McBreen, F (2020) Refining the criteria for defining areas with a 'low resemblance' to Annex I stony reef.

Hall, J.D. & J. Francine (1991) Measurements of underwater sounds from a concrete island drilling structure located in the Alaskan sector of the Beaufort Sea. Journal of the Acoustical Society of America 90(3): 1665-1667

Hendrick, V., Foster-Smith, R., Davies, A. & Newell, R. (2011) Biogenic Reefs and the Marine Aggregate Industry. Marine ALSF Science Monograph Series, Cefas, 60pp.

Hiddink, J.G., Burrows, M.T. and García Molinos, J., 2015. Temperature tracking by North Sea benthic invertebrates in response to climate change. Global Change Biology, 21(1), pp.117-129.

Hill, J., Marzialetti, S., Pearce, B. & Newell, R. (2011) Recovery of seabed resources following marine aggregate extraction.Marine ALSF Science Monograph Series, 0907545459, 44 pp.

Hinz, H., Capasso, E., Lilley, M., Frost, M. & Jenkins, S.R. (2011) Temporal differences across a bio-geographical boundary reveal slow response of sub-littoral benthos to climate change. Marine Ecology Progress Series, 423, 69-82.

HM Government (2011) UK Marine Policy Statement. Available: https://assets.publishing.service.gov.uk/media/5a795700ed915d042206795b/pb3654-marine-policy-statement-110316.pdf.

IEMA (2016) Environmental Impact Assessment. Guide to Delivering Quality Development. Available: https://www.iema.net/download-document/7014.

Intertek (2018) Greenlink Interconnector. Environmental Scoping Report - UK Marine Route. P1975_R3994_Rev2| 30/10/2018.

Irving, R. (2009) The identification of the main characteristics of stony reef habitats under the Habitats Directive (p. 44). Peterborough, UK: Joint Nature Conservation Committee.

JNCC (2017) Non-Native Species [Online]. Available: http://jncc.defra.gov.uk/page-1532.

Jones, L.A., Hiscock, K. & Connor, D.W. (2000) Marine habitat reviews. A summary of ecological requirements and sensitivity characteristics for the conservation and management of marine SACs. Joint Nature Conservation Committee, Peterborough. (UK Marine SACs Project report.). Available: http://ukmpa.marinebiodiversity.org/uk_sacs/pdfs/marine-habitats-review.pdf

Kinne, O. (ed.) (1984) Marine Ecology: A Comprehensive, Integrated Treatise on Life in Oceans and Coastal Waters.Vol. V. Ocean Management Part 3: Pollution and Protection of the Seas - Radioactive Materials, Heavy Metals and Oil. Chichester: John Wiley & Sons.

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, 69 pp.

Maurer, D., Keck, R.T., Tinsman, J.C., Leatham, W.A., Wethe, C., Lord, C. & Church, T.M.(1986) Vertical migration and mortality of marine benthos in dredged material: a synthesis. Internationale Revue der Gesamten Hydrobiologie, 71, 49-63.

Mills, E.L. (1967) The biology of an ampeliscid amphipod crustacean sibling species pair. Journal of the Fisheries Research Board of Canada, 24, 305-355.

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

MMO (2021) Southwest Inshore and South West Offshore Marine Plan, June 2021.

NBN Trust (2023) NBN Atlas. Available: https://species.nbnatlas.org/

Neal, K.J. & Wilson, E (2008) Cancer pagurus Edible crab. 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: https://www.marlin.ac.uk/species/detail/1179

Nguyen, J.-P (1996) Drilling: Oil and gas field development techniques. Balvet, B.B. (trans.). Editions TECHNIP. Institut Français du Pétrole, Paris. 384 p.

NDB (undated). North Devon Biosphere Reserve Strategy for Sustainable Development 2014 to 2024. Available at https://www.northdevonbiosphere.org.uk/uploads/1/5/4/4/15448192/the_biosphere_reserve_strategy_2014_to_2024_final_version_3.pdf (accessed March 2024).

North Devon Biosphere (2022) North Devon Marine Nature Recovery Plan 2022-2027. Available: https://www.northdevonbiosphere.org.uk/uploads/1/5/4/4/15448192/revised_north_devon_marine_natre_recovery_plan.pdf

North Devon Council and Torridge District Council (2018) North Devon and Torridge Local Plan 2011-2031. Available: https://consult.torridge.gov.uk/file/5860516

Pearce F., Peeler E. & Stebbing, P. (2012) Modelling the risk of the introduction and spread of non-indigenous species in the UK and Ireland. Project report for E5405W.

Perry, F., Jackson, A., Garrard, S.L., Williams, E. & Tyler-Walters, H. (2023) *Ostrea edulis* Native oyster. 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: https://www.marlin.ac.uk/species/detail/1146

Readman, J.A.J., Lloyd, K.A., & Watson, A. (2023) Sparse sponges, Nemertesia spp. and Alcyonidium diaphanum on circalittoral mixed substrata. 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: https://www.marlin.ac.uk/habitat/detail/119

Roy H.E., Bacon J., Beckmann B., Harrower C.A., Hill M.O., Isaac N. J.B., Preston C.D., Rathod B., Rorke S.L., Marchant J.H., Musgrove A., Noble D., Sewell J., Seeley B., Sweet N., Adams L., Bishop J., Jukes A.R., Walker K. J & Pearman D. (2012) Non-Native Species in Great Britain: establishment, detection and reporting to inform effective decision making. Report to Defra WC0738.

Sabatini, M. and Hill, J.M. (2008) *Nephrops norvegicus* Norway lobster. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 26-09-2019]. Available: https://www.marlin.ac.uk/species/detail/1672.

Soule, D.F. & Soule, J.D. (1979) Bryozoa (Ectoprocta). In Hart, C.W. & Fuller, S.L.H. (eds), Pollution ecology of estuarine invertebrates. New York: Academic Press, pp. 35-76.

Suchanek, T.H. (1993) Oil impacts on marine invertebrate populations and communities. American Zoologist, 33, 510-523.

The Planning Inspectorate (2017) Advice Note Ten, Habitat Regulations Assessment relevant to Nationally Significant Infrastructure Projects. Version 8. Available: https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advice-notes/advice-note-ten/.

Tillin, H.M., Jackson, A. & Readman, J. (2017) *Amphianthus dohrnii* Sea fan anemone. In Tyler-Walters H. and Hiscock K. *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 04-03-2024]. Available: https://www.marlin.ac.uk/species/detail/1120

Tillin, H.M. & Watson, A. (2023a) *Protodorvillea kefersteini* and other polychaetes in impoverished circalittoral mixed gravelly sand. 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: https://www.marlin.ac.uk/habitat/detail/1115

Tillin, H.M. & Watson, A. (2023b) Polychaete-rich deep Venus community in offshore gravelly muddy sand. 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: https://www.marlin.ac.uk/habitat/detail/1117

Tillin, H.M. & Watson, A. (2024) *Echinocyamus pusillus*, Ophelia borealis and Abra prismatica in circalittoral fine sand. 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: https://www.marlin.ac.uk/habitat/detail/1131

Tillin, H.M., Kessel, C., Sewell, J., Wood, C.A. & Bishop, J.D.D. (2020) Assessing the impact of key Marine Invasive Non-Native Species on Welsh MPA habitat features, fisheries and aquaculture. NRW Evidence Report. Report No: 454. Natural Resources Wales, Bangor, 260 pp. Available: https://naturalresourceswales.gov.uk/media/696519/assessing-the-impact-of-key-marine-invasive-non-native-species-on-welsh-mpa-habitat-features-fisheries-and-aquaculture.pdf

Tillin, H.M., Garrard, S.L., Tyler-Walters, H., Lloyd, K.A., & Watson, A. (2023a) Infralittoral mobile clean sand with sparse fauna. 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: https://www.marlin.ac.uk/habitat/detail/262

Tillin, H.M., Budd, G.C., Lloyd, K.A., & Watson, A. (2023b) *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available: https://www.marlin.ac.uk/habitat/detail/62

Tillin, H.M., Marshall, C.E., Garrard, S.L., & Gibb, N. (2023c) *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, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available: https://www.marlin.ac.uk/habitat/detail/377

Tyler-Walters, H. & Ballerstedt, S. (2007) Flustra foliacea Hornwrack. In Tyler-Walters H. and Hiscock K. (eds) Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available: http://www.marlin.ac.uk/species/detail/1609

Tyler-Walters, H. (2008) *Mytilus edulis* Common mussel. 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: https://www.marlin.ac.uk/species/detail/1421

Tyler-Walters, H., & Sabatini, M. 2017. *Arctica islandica* Icelandic cyprine. 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: https://www.marlin.ac.uk/species/detail/1519

Tyler-Walters, H. & White, N. (2017) *Alkmaria romijni* Tentacled lagoon worm. In Tyler-Walters H. and Hiscock K. *Marine Life Information Network: Biology and Sensitivity Key Information Reviews*, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available: https://www.marlin.ac.uk/species/detail/1200

Tyler-Walters, H., Tillin, H.M., Perry, F., Stamp, T. and d'Avack, E.A.S. (2018) Marine evidence-based sensitivity assessment (MarESA)–A guide.

Widdows, J. and Donkin, P. (1992) Mussels and environmental contaminants: bioaccumulation and physiological aspects. In The mussel Mytilus: ecology, physiology, genetics and culture, (ed. E.M. Gosling), 383-424. Amsterdam: Elsevier Science Publ. [Developments in Aquaculture and Fisheries Science, no. 25].

Willis, M.R., M. Broudic, M. Bhurosah, and I. Masters. (2010) Noise associated with small scale drilling operations. 3rd International Conference on Ocean Energy. 6 Oct 2010, Bilbao. 1-5pp.

Zahn, R., Zahn, G., Müller, W., Kurelec, B., Rijavec, M., Batel, R. & Given, R. (1981) Assessing consequences of marine pollution by hydrocarbons using sponges as model organisms. Science of The Total Environment, 20 (2), 147-169.