# LLŶR FLOATING OFFSHORE WIND PROJECT

**Llŷr 1 Floating Offshore Wind Farm**

**Environmental Statement**

**Chapter 19: Benthic Ecology**

**August 2024**

Prepared by: Llŷr Floating Wind Ltd

## Document Status

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## Acronyms and Abbreviations

| Acronym or Abbreviation | Definition | Acronym or Abbreviation | Definition |
|---|---|---|---|
| AL | Action Level | INNS | Invasive non-native species |
| BAC | Background Assessment Concentrations | JNCC | Joint Nature Conservation Committee |
| CCME | Canadian Council of Ministers of the Environment | KP | Kilometre Point |
| CEFAS | Centre for Environment, Fisheries and Aquaculture Science | MARPOL | The Convention for Prevention of Marine Pollution |
| CEMP | Construction Environmental Management Plan | MCZ | Marine Conservation Zone |
| CIEEM | Chartered Institute for Ecology and Environmental Management | Mg/l | Milligrams per litre |
| CRoW | Countryside and Rights of Way Act | MMO | Marine Management Organisation |
| CSQG | Canadian Sediment Quality Guidelines | mT | Millitesla |
| DDC | Drop-down camera | NERC | Natural Environment and Rural Communities |
| EEA | European Environment Agency | NM | Nautical Mile |
| EIA | Environmental Impact Assessment | NRW | Natural Resources Wales |
| EMF | Electromagnetic Field | NVC | National Vegetation Classification |
| ERL | Effect Range Low | PAH | Polycyclic Aromatic Hydrocarbon |
| ERM | Effect Range Median | PCB | Polychlorinated Biphenyl |
| ES | Environmental Statement | PEL | Probable Effect Level |
| EUNIS | European Nature Information System | PLONOR | Pose Little or No Risk to the Environment |
| EQS | Environmental Quality Standards | OSPAR | Oslo and Paris Conventions |
| HDD | Horizontal Directional Drilling | OWF | Offshore Wind Farm |
| HOCI | Habitat of Conservation Importance | SAC | Special Area of Conservation |
| HOPI | Habitat of Principle Importance | SSC | Suspended sediment concentration |
| HSE | Health, Safety and Environment | SSSI | Site of Special Scientific Interest |
| IAC | Inter-array Cable | µT | Microtesla |
| IMO | International Maritime Organisation | | |

## Glossary of Project Terms

| Term | Definition |
|---|---|
| The Applicant | The developer of the Project, Llŷr Floating Wind Limited. |
| Array | All wind turbine generators, inter array cables, mooring lines, floating sub-structures and supporting subsea infrastructure within the Array Area, as defined, when considered collectively, excluding the offshore export cable(s). |
| Array Area | The area within which the wind turbine generators, inter array cables, mooring lines, floating sub-structures and supporting subsea infrastructure will be located. |
| Floventis Energy | A joint venture company between Cierco Ltd and SBM Offshore Ltd of which Llŷr Floating Wind Limited is a wholly owned subsidiary. |
| Landfall | The location where the offshore export cable(s) from the Array Area, as defined, are brought onshore and connected to the onshore export cables (as defined) via the transition joint bays (TJB). |
| Llŷr 1 | The proposed Project, for which the Applicant is applying for Section 36 and Marine Licence consents. Including all offshore and onshore infrastructure and activities, and all project phases. |
| Marine Licence | A licence required under the Marine and Coastal Access Act 2009 for marine works which is administered by Natural Resources Wales (NRW) Marine Licensing Team (MLT) on behalf of the Welsh Ministers. |
| Offshore Development Area | The footprint of the offshore infrastructure and associated temporary works, comprised of the Array Area and the Offshore Export Cable Corridor, as defined, that forms the offshore boundary for the S36 Consent and Marine Licence application |
| Offshore Export Cable | The cable(s) that transmit electricity produced by the WTGs to landfall. |
| Offshore Export Cable Corridor (OfECC) | The area within which the offshore export cable circuit(s) will be located, from the Array Area to the Landfall. |
| Onshore Development Area | The footprint of the onshore infrastructure and associated temporary works, comprised of the Onshore Export Cable Corridor and the Onshore Substation, as defined, and including new access routes and visibility splays, that forms the onshore boundary for the planning application. |
| Onshore Export Cable(s) | The cable(s) that transmit electricity from the landfall to the onshore substation |
| Onshore Export Cable Corridor (OnECC) | The area within which the onshore export cable circuit(s) will be located. |
| proposed Project | All aspects of the Llŷr development (i.e. the onshore and offshore components). |
| Onshore Substation | Located within the Onshore Development Area, converts high voltage generated electricity into low voltage electricity that can be used for the grid and domestic consumption. |

| Term | Definition |
| --- | --- |
| Section 36 consent | Consent to construct and operate an offshore generating station, under Section 36 (S.36) of the Electricity Act 1989. This includes deemed planning permission for onshore works. |

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# 19. BENTHIC ECOLOGY

## 19.1 Introduction

1. Llŷr Floating Wind Ltd (hereafter the Applicant) is proposing to develop the Llŷr 1 Floating Offshore Wind Farm (hereafter referred to as the proposed Project), located approximately 35 km off the coast of Pembrokeshire in the Celtic Sea.
2. The proposed Project is a test and demonstration wind farm development, comprising up to 10 wind turbine generators (WTGs). The proposed Project will make landfall at Freshwater West before connecting into Pembroke Dock power station and the national grid network.
3. The Applicant is seeking a Section 36 consent and Marine Licence for Llŷr 1, and this chapter forms part of the Environmental Statement (ES) which is submitted in support of those consent applications. This chapter describes the potential impacts and effects of the proposed Project on benthic ecology during the construction, operation and maintenance and decommissioning phases, and includes mitigation and good practice measures to reduce the impacts of the proposed Project on benthic ecology.
4. **Section 19.10** of this ES chapter provides a summary of the impact assessment undertaken and any residual significant effects on benthic ecology following consideration of any mitigation measures.
5. The assessment presented in this chapter should be read in conjunction with the following linked and supporting chapters:
    - **Chapter 04 - Description of the Proposed Project** provides further details of the project design parameters;
    - **Chapter 05 - EIA Approach and Methodology** provides further details of the general framework and approach to the EIA;
    - **Chapter 17 - Physical Environment** assesses project impacts on physical processes such as sediment dispersal that can have relevance to benthic receptors; and
    - **Chapter 18 – Marine Water and Sediment Quality** assesses project impacts on water and sediments from the proposed Project.
6. Additional information to support the assessment includes:
    - **Appendix 04A**: Outline CEMP
    - **Appendix 04B**: Invasive Non-Native Species Management Plan
    - **Appendix 04C**: Post Consent Environmental Management Plan
    - **Appendix 08D**: HRA Screening
    - **Appendix 08E**: Report to Inform Appropriate Assessment
    - **Appendix 17B:** 2024 MBES Survey Report
    - **Appendix 19A**: 2023 Nearshore Benthic Survey Report
    - **Appendix 19B**: 2023 Offshore Benthic Survey Report
    - **Appendix 19C**: EMF Report
    - **Appendix 19D**: 2024 DDV Survey Report
    - **Appendix 19E**: 2024 Habitat Assessment Report
    - **Appendix 20B**: MCZ Assessment
7. For the purposes of the assessment in this chapter, the marine environment and thus the benthic environment is defined as any area seaward of the mean high-water springs (MHWS) mark of any water body which is tidally influenced. Any terrestrial and/or aquatic habitats,

species and designations above MHWS have been assessed in **Chapter 08: Ecology and Biodiversity**.

8. The assessment has been undertaken by the AECOM Marine Team. Further details of the proposed Project Team's competency are provided in **Appendix 1A: Statement of Competence**.

## 19.2 Legislation, Policy and Guidance

*9.* The following sections identify specific legislation, policy and guidance that is applicable to the assessment of benthic ecology. Further detail on the wider legislation, policy and guidance relevant to this ES is provided in **Chapter 02: Regulatory and Planning Policy Context**.

### *19.2.1. Legislation*

10. The legislation that is applicable to the assessment of benthic ecology is summarised below.

- **The Conservation of Habitats and Species Regulations 2017** transposes the Habitats Directive (92/43/EEC) into UK legislation out to the 12 nautical mile (NM) limit;
- **The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019** which transferred functions from the European Commission to relevant authorities in England and Wales to allow efficient operation of the regulations following the exit of the United Kingdom from the European Union in 2019. This included the creation of a new national site network comprising of the designated sites (SACs, SPAs etc) which were already protected under the Nature Directives. Many of these sites are designated for benthic features or provide supporting habitat for qualifying species such as foraging grounds for birds. Designated sites are considered in **Section 19.5.1**;
- **The Conservation of Offshore Marine Habitats and Species Regulations 2017**, that apply within UK Offshore Marine Area (beyond 12 NM limit) as defined in the Marine and Coastal Access Act 2009;
- **Marine and Coastal Access Act 2009**, which provides the legal mechanism to help ensure clean, healthy, safe and productive and biological diverse oceans and seas;
- **Environment (Wales) Act 2016**, **Section 6** requires public authorities that exercise their functions in relation to Wales have a duty to maintain and enhance biodiversity and promote the resilience of ecosystems;
- **Environment (Wales) Act 2016**, **Section 7** lists the habitats and species of Principle Importance which supersedes the duty of Section 42 of the Natural Environment and Rural Communities (NERC) Act 2006 (as amended). The habitats and species included within this list can be regarded as 'threatened or declining' under the OSPAR Convention 1992;
- **The Marine Strategy Regulations 2010**, which transpose the Marine Strategy Framework Directive (2008/56/EC) into UK legislation;
- **The Wildlife and Countryside Act 1981** (as amended), which includes provisions relating to nature conservation;
- **The Access to the Countryside** (Coastal Margin) (England) Order 2010 under The Countryside and Rights of Way (CRoW) Act 2000 (as amended);
- The Water Environment (Water Framework Directive (England and Wales)) Regulations 2017, which transposes the EU Water Framework Directive (2000/60/EC) in UK legislation;
- **The Electricity Works (EIA) (England and Wales) Regulations 2017**, which sets out requirements for conducting environmental impact assessments for applications for development relating to the provision or generation of electricity; and

- **The Marine Works (EIA) Regulations 2007**, which sets out measures relating to the requirement for an assessment of the impact on the environment of marine-associated projects likely to have significant effects.

### *19.2.2. National Planning Policy*

11. National planning policies taken into consideration within the Benthic Ecology assessment are set out in **Table 19-1**. National Policy Statements (NPS) on Energy have been designated by the UK government to guide decision making on Nationally Significant Infrastructure Projects (NSIPs) consented under the Planning Act 2008. Given that the NPSs only applies to offshore wind projects that exceed 350 MW in capacity, they would not directly guide decision making on the proposed Project. However, because they were written to guide decision making on offshore wind projects, they are considered relevant as material considerations.
12. The key policies, as detailed below (**Table 19-1**) that are relevant to benthic ecology include:

- **UK Marine Policy Statement**, which aims to achieve sustainable development in the UK marine area.
- **Overarching National Policy Statement (NPS) for Energy (EN-1) (2023)**, which sets out national policy for the energy infrastructure, effecting decisions by the Infrastructure Planning Commissions (IPC) on applications for energy developments falling within the scope of the NPSs; and
- **NPS for Renewable Energy Infrastructure (EN-3) (2023)**, which provides the primary basis for decisions made by the IPC on applications for nationally significant renewable energy infrastructure.

*Table 19-1. A summary of national planning policy relevant to benthic ecology*

| Summary of policy | How and where it is considered in the chapter |
|---|---|
| **EN-1** | |
| *4.5.7... "Applicants are encouraged to approach the marine licensing regulator (MMO in England and Natural Resources Wales in Wales) in pre-application, to ensure that they are aware of any needs for additional marine licences alongside their DCO application".* | Consultation with Natural Resources Wales has been carried out during scoping and pre-application. A summary of the consultation is provided in **Section 19.3**. |
| *4.5.9…"Applicants are encouraged to refer to Marine Plans at an early stage, such as in preapplication, to inform project planning, for example to avoid less favourable locations as a result of other uses or environmental constraints".* | Relevant Marine Plans have been considered in **Section 19.2.1**. |
| *5.4.17 (part)"... 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".* | Details of designated sites and protected species and habitats of principal importance are discussed in **Section 19.5.1**. A full assessment of the impacts of the proposed Project on these species is provided in **Section 19.8**. Designated sites are considered in **Appendix 08E - Report to Inform Appropriate Assessment**. |

| Summary of policy | How and where it is considered in the chapter |
|---|---|
| *5.4.19 "… The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests".* | Project design and embedded mitigation measures (including best practice) to conserve and enhance biodiversity are provided in Volume 1 **Chapter 3: Alternatives** and **Section 19.7** respectively. |
| *5.4.23 "Energy projects will need to ensure vessels used by the project follow existing regulations and guidelines to manage ballast water."* | Mitigation measures for the proposed Project, including those regarding the use of vessels, are provided in **Section 19.7**. Biosecurity risk and INNS have also been considered in the proposed Project **Appendix 04B: Invasive Non-Native Species Management Plan.** |
| **EN-3** | |
| *2.8.68 "The applicant should assess the effects of the offshore transmission and any associated infrastructure on the marine… environment."* | All likely impacts from the proposed Project infrastructure on the marine environment have been assessed in **Section 19.8**. |
| *2.8.72 "Assessment of environmental effects of transmission infrastructure and any proposed offshore…..substations should assess effects both alone and cumulatively with other existing and proposed infrastructure".* | All likely offshore impacts from the proposed Project infrastructure and cumulative impacts have been assessed in **Section 19.8** and **Section 19.11** respectively. |
| *2.8.73 "Applicants should include details on how avoidance has been achieved, good design principles have been followed and provide proposals for mitigation."* | Project design and embedded mitigation measures including specific routing to avoid Annex 1 Reef protected by the Pembrokeshire Marine SAC, and best practice measures, to conserve and enhance biodiversity are provided in **Volume 1 Chapter 3: Alternatives and Section 19.7** respectively. |
| *2.8.98 "Applicants should have regard to the specific ecological and biodiversity considerations that relate to proposed offshore renewable energy infrastructure"* | Likely impacts to the benthic environment resulting from the proposed Project are assessed in **Section 19.8**. |
| *2.8.104…"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 with Natural Resources Wales and Joint Nature Conservation Committee (JNCC). Relevant comments are provided in **Section 19.3.** |
| *2.8.126 "Applicant assessment of the effects on the subtidal environment should include:*<br>• *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;*<br>• *environmental appraisal of inter-array and other offshore* | Potential effects from the impact pathways listed to the benthic environment resulting from the proposed Project are assessed in **Section 19.8.** |

| Summary of policy | How and where it is considered in the chapter |
|---|---|
| *transmission and installation/maintenance methods, including predicted loss of habitat due to predicted scour and scour/cable protection and sandwave/boulder/UXO clearance;*<br>• *habitat disturbance from construction and maintenance/repair vessels' extendable legs and anchors;*<br>• *increased suspended sediment loads during construction and from maintenance/repairs;*<br>• *predicted rates at which the subtidal zone might recover from temporary effects;*<br>• *potential impacts from EMF on benthic fauna;*<br>• *potential impacts upon natural ecosystem functioning;*<br>• *protected sites; and*<br>• *potential for invasive/non-native species introduction.* | |
| *2.8.310 "should also consider any negative impacts from external cable protection on benthic habitats, and a balance between protection of various receptors must be made, with all mitigation and alternatives reviewed.".* | The effects of external cable protection on the benthic environment are considered in **Section 19.8.** |
| *2.8.122 "Offshore wind construction, maintenance and decommissioning activities can cause loss and temporary disturbance of subtidal habitat and benthic ecology".......2.8.123..."The applicant should demonstrate compliance with mitigation measures identified by The Crown Estate in any plan-level HRA produced as part of its leasing round".* | Relevant embedded mitigation measures to benthic ecology are provided in **Section 19.7**. Impacts to biodiversity are considered in **Section 19.8** and in **Volume 6, Appendix 08D: HRA Screening Report** and **Appendix 08E:** HRA Report to Inform Appropriate Assessment. |
| **UK Marine Policy Statement** | |
| The UK MPS ensures that marine resources are used in a sustainable way by ensuring biodiversity is protected and conserved by using the precautionary principle and relying on sound evidence. | In line with policy objectives in the MPS, this ES Chapter has taken into consideration measures that can be taken to avoid biodiversity loss. Where possible, consideration has been given to conserving and avoiding harm to benthic ecology through routeing, mitigation, and consideration of reasonable alternatives. Potential impacts to designated sites and protected features have |

| Summary of policy | How and where it is considered in the chapter |
|---|---|
| | been avoided where possible. Details of protected sites and species designations are provided in **Section 19.5.1**, with an assessment of potential impacts in **Section 19.8**. Relevant mitigation is detailed in **Section 19.7**. |

### *19.2.3. Regional Planning Policy*

13. The key Welsh planning policies that are relevant to benthic ecology include:

- **Welsh National Marine Plan**;
- **Planning Policy Wales**;
- **Future Wales – The National Plan 2040**;
- **The Second State of Natural Resources Report 2020**; and
- **Nature Recovery Action Plan Wales**.

*Table 19-2. A summary of regional planning policy relevant to benthic ecology*

| Summary of policy | How and where it is considered in the chapter |
|---|---|
| *The **Welsh National Marine Plan** sets out a single framework for sustainable development within Wales marine area, including the requirement to maintain seafloor integrity and safeguard benthic ecosystems.* | The identification of the benthic environment is set out in **Section 19.5.1**. A full impact assessment is provided in **Section 19.8**, with embedded mitigation measures to safeguard benthic ecosystems set out in **Section 19.7** |
| **Planning Policy Wales – Edition 12** highlights the importance of biodiversity for natural services, sustainability and the Welsh economy. It includes objectives to achieve efficient use and protection of natural resources and enhancing biodiversity. | A full impact assessment is provided in **Section 19.8**. A full list of embedded mitigation measures of relevance to protecting benthic ecology is provided in **Section 19.7**. |
| ***Future Wales – The National Plan 2040** sets out a development strategy for key national priorities, which includes developing strong ecosystems and climate-resilience in Wales' marine environment.* | A full impact assessment is provided in **Section 19.8**. A full list of embedded mitigation measures of relevance to protecting benthic ecology is provided in **Section 19.7**. |
| ***The Second State of Natural Resources Report 2020** aims to achieve sustainable management of natural resources and to protect the environment for future generations in Wales, including in the marine environment.* | A full impact assessment is provided in **Section 19.8**. A full list of embedded mitigation measures of relevance to protecting benthic ecology is provided in **Section 19.7**. |
| ***Nature Recovery Action Plan Wales** is a strategy for Wales which aims to address declining biodiversity, including marine habitats, ecosystems and fisheries.* | A full impact assessment is provided in **Section 19.8**. A full list of embedded mitigation measures of relevance to protecting benthic ecology is provided in **Section 19.8**. |

### *19.2.4. Local Planning Policy*

14. Key local policies that are relevant to benthic ecology include:

- **Pembrokeshire Coast National Park Development Plan 2**, which sets out policies for local developments in Pembrokeshire to determine the outcome of planning applications; and
- **South West Wales Area Statement**, which identifies the key risks, opportunities and priorities needed to build the resilience of our ecosystems and support sustainable management of the natural resources.

*Table 19-3. A summary of local planning policy relevant to benthic ecology*

| Summary of policy | How and where it is considered in the chapter |
|---|---|
| **Pembrokeshire Coast National Park Development Plan** | |
| *The Pembrokeshire Coast National Park Development Plan includes several policies to ensure the biodiversity of the National Park is conserved, including….Policy 8: "The special qualities of the Pembrokeshire Coast National Park will be conserved and enhanced. The priorities will be to ensure that:…. Species and habitats are conserved and enhanced for their amenity, landscape and biodiversity value."* | The plan includes the offshore islands of Skomer and Stockholm, that are subject to a number of designated sites for marine receptors that have been scoped into the ES. Mitigation measures to conserve benthic ecology in the Study Area are discussed in **Section 19.7**. A full assessment of impacts is provided in **Section 19.8**.<br>Reference should also be made to **Appendix 08D: HRA Screening, Appendix 08E: Report to Inform Appropriate Assessment** and **Appendix 20B: MCZ Assessment.** |
| **South West Wales Area Statement** | |
| *The South West Wales Area Statement has a theme of "Reversing the decline of, and enhancing, biodiversity", through enhancing species and habitat connectivity to allow habitats to function effectively.* | Mitigation measures to conserve benthic ecology in the Study Area are discussed in **Section 19.7**. A full assessment of impacts is provided in **Section 19.8**. |

### *19.2.5. Guidance*

15. In addition to the legislation and policies outlined above, the following guidance is also applicable for benthic ecology in UK, and has been used in the assessment:
    - Chartered Institute for Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in Britain and Ireland – Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018, and updated September 2019);
    - Defining and managing *Sabellaria spinulosa* reefs (Gubbay, 2007);
    - Refining the criteria for defining areas with a 'low resemblance' to Annex I stony reef (Golding, Albrecht, & McBreen, 2020);
    - The identification of the main characteristics of Annex I stony reef habitats under the Habitats Directive (Irving, 2009);
    - Benthic habitat assessment guidance for marine developments and activities: Guidance for undertaking benthic marine habitat survey and monitoring. (NRW, 2019a); and
    - Business, Energy and Industrial Strategy (BEIS). 2019. Decommissioning of Offshore Renewable Energy Installations under the Energy Act 2004. Guidance notes for industry (England and Wales).
16. In the absence of Environmental Quality Standards for in situ sediments in the UK, the following guidance has been used to inform a 'Weight of Evidence' (WoE) approach to assess

whether benthic ecology is at risk from concentrations of contaminants at threshold levels reported for benthic invertebrates:

- Centre for Environment, Fisheries and Aquaculture Science (Cefas) Chemical Action Levels (Marine Management Organisation, 2014) (Reviewed 2020). These values are used in conjunction with a range of other assessment methods to make management decisions regarding the fate of dredged material. The action levels are not 'pass/fail' criteria but triggers for further assessment. In general, contaminant levels in dredged material below Action Level 1 are of no concern and are unlikely to influence the licensing decision. However, dredged material with contaminant levels above Action Level 2 is generally considered unsuitable for sea disposal. Dredged material with contaminant levels between Action Levels 1 and 2 requires further consideration and testing before a decision can be made. Action Levels are therefore used as a guide in assessments of sediment contamination in non-dredging activities;
- UK Offshore Operators Association (UKOOA) sediment quality guidelines for the UK North Sea (UKOOA, 2001);
- OSPAR background concentrations and background assessment concentrations and effect range low (ERL) and effect range median (ERM) concentrations for contaminants (OSPAR, 2009); and
- Canadian Sediment Quality Guidelines (Canadian Council of Ministers of the Environment (CCME), 2001) applied to contaminants where no other regional threshold value is available. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life. The Canadian Sediment Quality Guidelines were developed by the Canadian Council of Ministers of the Environment as broadly protective tools to support the functioning of healthy aquatic ecosystems.

## 19.3 Stakeholder Engagement and Consultation

17. Consultation with statutory and non-statutory organisations is a key element of the EIA process. Consultation with regards to (benthic ecology) has been undertaken to inform the approach to, and scope of, the assessment.
18. Stakeholders for the proposed Project include statutory consultees, landowners, local communities and other sea users. In addition to the statutory consultation process, there has been ongoing engagement with statutory and non-statutory consultees to steer the development of the proposed Project and this is detailed in Table 19-4.

### *19.3.6. Summary of Stakeholder Consultations*

*Table 19-4. Summary of the key issues raised by consultees and how each issue was addressed*

| Consultee | Consultation type and date | Comment raised | How issue has been addressed and location of response in chapter |
|---|---|---|---|
| **Scoping** | | | |
| NRW | Scoping opinion | Designated Sites and Protected Species: Native oyster *Ostrea edulis* beds are also present within the offshore cable scoping boundary. *Ostrea edulis* beds is also a habitat present within the Annex I Estuaries and Large Shallow inlets and Bays | We have been provided with the data showing *Ostrea edulis* beds from NRW and have mapped the shapefile in relation to the project. This habitat is at least 6.74 km from the offshore export cable corridor (OfECC), with the closest records of |

| Consultee | Consultation type and date | Comment raised | How issue has been addressed and location of response in chapter |
|---|---|---|---|
| | | features of the Pembrokeshire Marine SAC, a Section 7 species and an OSPAR habitat. NRW advise that the applicant contact NRW data distribution team to be provided with a copy of the data points. | oyster presence in Pennar Mouth within Milford Haven Waterway. See **Section 19.5.1**. |
| NRW | Scoping Opinion | Limestone Coast of South West Wales SAC: NRW advise potential impacts to this designated site are also scoped in as the "Submerged or partially submerged sea caves" feature are cross-boundary features between the Limestone Coast SAC and the Pembrokeshire Marine SAC. Whilst NRW acknowledge the sensitivity of this feature to proposed Project secondary effects may be lower than for other habitat features, some biotopes within this feature may still be sensitive to project secondary effects. | Limestone Coast of South West Wales SAC is now included in **Section 19.5.1** and has been taken into consideration in the Assessment of Potential Impacts. The submerged or partially submerged sea caves have also been included in the baseline and impact assessment.<br>The Potential for Likely Significant Effect (LSE) to designated sites or features are addressed in the HRA Screening and the Report to Inform Appropriate Assessment.<br>See **Section 19.5.1**.<br><br>Potential for Likely Significant Effect (LSE) to Designated Sites or features are addressed in **Appendix 08D: HRA Screening Report** and **Appendix 08E: Report to Inform Appropriate Assessment.** |
| NRW | Scoping Opinion | Potential impacts to intertidal and subtidal benthic habitats and species as a result of the proposed Project:<br>Operation: Introduction and spread of Invasive non-native species (INNS): New infrastructure may also act as a stepping-stone for the introduction of INNS. NRW advise this is also considered/assessed in the operation phase. Furthermore, the applicant should indicate the intention to undertake a | Impact pathways associated with the introduction of hard substratum into sediment based habitats are assessed as part of the INNS impact pathway in **Section 19.8**.<br>A Project Environment Management Plan (PEMP) has been produced for the proposed Project. A biosecurity risk assessment will be undertaken as part of the Project Environmental Monitoring Plan by the contractor to reduce impacts from introduction of INNS. |

| Consultee | Consultation type and date | Comment raised | How issue has been addressed and location of response in chapter |
| --- | --- | --- | --- |
| | | biosecurity risk assessment for all stages of marine development and incorporate them into the Project Environmental Monitoring Plan (PEMP).<br>The rationale for inclusion of this pathway notes that "Studies have indicated that the introduction of hard substrate in otherwise barren areas are quick to be colonised and used by local species". It is important to note the introduction of hard substrate in a soft sediment habitat is a change of habitat type. The loss of a sedimentary habitat to a different habitat type (hard substrate in this case) is not beneficial even if the anthropogenic structure is colonised by local species as the sedimentary habitat is lost and will not be replaced. | See assessment of potential risk in **Section 19.8** and outline INNS plan in **Appendix 04B - Invasive Non-Native Species Management Plan.**<br><br>See **Volume 6: Appendix 4C - Post Consent Environmental Management Plan Log** and **Appendix 04B: Invasive Non-Native Species Management Plan** |
| NRW | Scoping Opinion | Operation: Maintenance potential effects the same as route preparation and cable construction: NRW advise this potential impact pathway should be refined further as it currently encompasses a number of potential impacts. See detailed comments in **Appendix 05C: EIA Scoping Opinion Responses**. | The impact pathways listed in the response have been now been included in the ES assessments and included in **Section 19.8**.<br>See **Section 19.8.2** and **Table 19-10** Impact pathways and associated design scenario scoped into the assessment. |
| NRW | Scoping Opinion | Further clarity required for the assessment methodology for benthic ecology in respect of the standard methodology for ecological receptors in line with CIEEM guidance for ecological impact assessments (CIEEM, 2018).<br>This methodology relates to terrestrial receptors, and NRW TE indicates that some of the | The CIEEM guidance provides an assessment methodology for all ecological receptors including marine. Some of the criteria, particularly geographical references such as local, regional etc. are not however, always applicable to marine ecosystems. For this reason, the sensitivity criteria have been amended to reflect marine ecology and does include the specific geographical |

| Consultee | Consultation type and date | Comment raised | How issue has been addressed and location of response in chapter |
|---|---|---|---|
| | | criteria are not appropriate for benthic habitats. For example, Section 8.7.3.2 describes how the sensitivity of the receptor will be assessed based on geographical frames of reference, some of which are not relevant in the marine environment. NRW TE recommend further clarity is requested on the frames of reference that will be used for marine receptors. | frames of reference that are more applicable to terrestrial ecology.<br><br>A detailed description of the assessment methodology for benthic ecology is provided in **Section 19.4.1**. |
| JNCC | Scoping Opinion | JNCC note that "a buffer distance of 10 km of the proposed Project has been considered which encompasses all likely ZOI to benthic receptors within the subtidal". We await the establishment of the Project's ZOI as per Section 30.3.2.1. and further clarity as to how the ZOI has been determined. | Further clarification has been made on the Study Area in **Section 19.4.3**. The Study Area has been defined based on project specific hydrodynamic modelling undertaken (see **Chapter 17: Physical Environment**). This defines the tidal excursion distance for a mean spring tide and therefore the theoretical distance from the offshore development to which disturbed particles could be transported. The tidal excursion distance varies depending on location with the Offshore Development Area. However, the greatest mean spring tidal excursion distance of 14 km occurs in the nearshore on approach to the landfall (where depths during a mean spring tide range are approximately 6.3 m). Therefore, the Study Area is the mean spring tidal excursion ellipse buffer, of 14 km, around the OfECC and the Array Area.<br>See **Section 19.4.3** Study Area and the definition and determination of the mean spring tidal excursion distance and direction ZOI in **Chapter 17: Physical Environment**. |
| JNCC | Scoping Opinion | Overall JNCC agree with the potential impacts that will be | The assessment of potential impacts of scour protection have |

| Consultee | Consultation type and date | Comment raised | How issue has been addressed and location of response in chapter |
|---|---|---|---|
| | | scoped in and will require further assessment at an EIA stage. However, JNCC would like to highlight that impacts from the introduction of scour protection have not been, and should be, considered here. | now been included in **Section 19.8.2.** |
| JNCC | Scoping Opinion | JNCC would consider, given that the turbine's anchor placement will be in place for the duration of the project, that these impacts should be considered long term disturbance of the seabed. Further discussion on the timescales of what would be considered a permanent and/or temporary loss may be required. | Detail on the definition of temporary and permanent impacts has been added to the introductory paragraph of **Section 19.7**.<br>See introductory text of **Section 19.7** Assessment of Potential Impacts and long-term disturbance from anchor chains has been considered in the operation phase impact assessment **Section 19.8.2.** |
| JNCC | Scoping Opinion | JNCC acknowledge that key data sources used for the assessment will include "Project-specific survey data" and that "project specific intertidal and subtidal benthic surveys will be completed to ensure the full range of habitats and any potentially sensitive and / or protected species located within proximity to the project are identified". JNCC would await further details regarding said surveys before providing further comment. | Further information on the proposed Project-specific survey has been provided in **Section 19.4.4**. Horizontal directional drilling (HDD) will be used at the landfall to connect the cable between shallow subtidal waters and the terrestrial zone. Therefore, the cable will not interact with the intertidal zone. As a result, intertidal surveys have not been carried out and no impact pathways have been identified. See **Section 19.4.4** for full survey results. |
| **Meetings** | | | |
| NRW | Benthic ecology topic online meeting on 29/03/2024 | Project update provided by Floventis and discussion of the scoping opinion received from NRW and to provide an indication of how the matters raised therein are being considered. | Benthic ecology aspects discussed in relation to impacts re. Annex 1 habitats, EMF, INNS and impact pathways more generally. Minutes circulated and agreed with NRW.<br>Impacts of habitat loss, EMF and INNS addressed in **Section 19.8** and considered in **Appendix 04B: Invasive Non-Native Species Management Plan** and **Appendix 19C: EMF Report**. |

| Consultee | Consultation type and date | Comment raised | How issue has been addressed and location of response in chapter |
|---|---|---|---|
| | | | See also responses to specific points on these subject areas raised in the scoping opinion as detailed below. |
| NRW | Progress meeting online 14/06/2023 | General discussion regarding programme, stakeholder feedback and review of the Offshore Development Area boundaries. | Project updates provided to NRW, and cable routing studies reviewed. Relevant design revisions for the Offshore Development Area are detailed in **Chapter 3: Site Selection and Alternatives**. |
| NRW and JNCC | In person workshop with some attendees dialling in via MS Teams | Project update provided by Floventis, including proposed Array Area changes and cable route/protection options. AECOM provided a summary of the environmental constraints with focus on Turbot Bank. | Discussion of boundary change and environmental constraints occurred, including confirmation of nearshore project plans, discussion of methods to avoid Turbot Bank and options for micrositing.<br>The OfECC has since been updated, following additional surveys in 2024 (**Appendix 19D: DDV Survey Report and Appendix 19E: Habitat Assessment Report)** to define a route that avoids designating features (Annex I reef and sandbanks).<br>A full assessment of the impact of the Project on benthic receptors in the Study Area is provided in **Section 19.8** of this chapter. |
| NRW | Survey Report Advice (PDF via email): 19.07.2023 | NRW provided advice on the geophysical survey report, **Appendix 19A: Nearshore 2023 benthic survey report** and **Appendix 19B: Offshore 2023 benthic survey report**. This included highlighting gaps in data collection required for protection measures on Annex I sandbank Turbot Bank, and insufficient information to understand potential impacts on designated features of the surrounding designated sites. | These reports have been used to inform the baseline and impact assessment in this chapter where applicable and have been supplemented with further publicly available spatial data sets and information from 2024 DDV benthic surveys. This has resulted in a revision of the OfECC in the nearshore area in relation to designated features. |
| NRW and Marine Licensing | Online meetings on 15/08/2023 | Discussion regarding the interactions with NRW Advisory | Revision of the OfECC and subsequent survey design to avoid Annex 1 features. |

| Consultee | Consultation type and date | Comment raised | How issue has been addressed and location of response in chapter |
|---|---|---|---|
| | and 16/08/2023 | and NRW MLT, with specific focus on Annex 1 habitats | Description of habitats within the revised OfECC are discussed in **Section 19.5.1** and impacts to Annex I features in **Section 19.8**. |

## 19.4 Approach to Assessment

### *19.4.1. Assessment Methodology*

19. **Chapter 05 EIA Approach and Methodology** provides a summary of the general impact assessment methodology applied in this ES. The following sections provide further detail on the specific methodology used to assess the potential impacts on benthic ecology.
20. The approach to the assessment of cumulative impacts, transboundary impacts and interrelated effects is provided in **Section 19.11**.
21. The significance of potential effects has been evaluated using a systematic approach together with the expert judgement of the specialist consultant as recommended in the CIEEM Guidelines for Ecological Impact Assessment in Britain and Ireland – Terrestrial, Freshwater, Coastal, and Marine (CIEEM, 2018). The systematic approach is based upon the identification of the importance / value of receptors and their sensitivity to the proposed Project together with the predicted magnitude of the potential impact.
22. The criteria used for benthic ecology vary from the example criteria presented in **Chapter 05: EIA Approaches and Methodology**, as they have been developed specifically for assessment of benthic habitats and species, based on specialist marine ecological knowledge and experience.

### *19.4.2. Significance Criteria*

**Magnitude of Impact**

23. The scale or magnitude of potential impacts (both beneficial and adverse) is determined by a combination of three criteria: scale of change, spatial extent of change and duration of change, as outlined in **Chapter 05: EIA Approach and Methodology**, Section 5.4.9. Intensity and volume of change are also considered, and magnitude quantified where possible, i.e. the amount of habitat loss or percentage of change to a habitat area (CIEEM, 2018).
24. The criteria for defining magnitude of impact for the purpose of the assessment on benthic ecology are provided in **Table 19-5**.

*Table 19-5. A summary of the magnitude criteria that are associated to specific impacts*

| Magnitude Criteria | Definition |
|---|---|
| Large | The impact occurs over a large spatial extent resulting in widespread, long-term, or permanent changes in baseline conditions or affects a large proportion of a receptor population. The impact is very likely to occur and/or will occur at a high frequency or intensity.<br><br>**Adverse:** Loss of resource and / or quality and integrity of resource; severe damage to key characteristics, features or elements<br><br>**Beneficial:** Large scale or major improvement of resource = quality; extensive restoration; major improvement of attribute quality |

| Magnitude Criteria | Definition |
|---|---|
| Medium | The impact occurs over a medium spatial extent resulting in medium-term, or partial changes in baseline conditions or partially affects a proportion of a receptor population. The impact is likely to occur and/or will occur at a medium frequency or intensity.<br><br>**Adverse:** Loss of resource, but not adversely affecting the integrity; partial loss of / damage to key characteristics, features or elements<br><br>**Beneficial:** benefit to, or addition of, key characteristics, features or elements; improvement of attribute quality |
| Small | The impact occurs over a small spatial extent resulting in short-term, or small changes in baseline conditions or partially affects a small proportion of a receptor population. The impact has a low likelihood of occurring and/or will occur at a low frequency or intensity.<br><br>**Adverse:** Some measurable change in attributes, quality, minor loss of, or alteration to, one or more key characteristics, features or elements.<br>**Beneficial:** Minor benefit to, or in addition of, one (maybe more) key characteristics, features or elements; some beneficial impact on attribute or a reduced risk or negative impact occurring |
| Negligible | The impact occurs over a minor spatial extent resulting in very short-term, or minor changes in baseline conditions or partially affects a very small proportion of a receptor population. The impact has a very low likelihood of occurring and/or will occur at a very low frequency or intensity.<br><br>**Adverse:** Very minor loss of detrimental alteration to one or more characteristics, features or elements.<br><br>**Beneficial:** Very minor benefit to or positive addition of one or more characteristics, features or elements |

**Sensitivity of Receptor**

25. Receptor sensitivity is defined as the degree to which a receptor would be affected by an impact. The sensitivity of the receptor is characterised by three factors: vulnerability, recoverability and importance, as outlined in **Chapter 05 EIA Approach and Methodology**, Section 5.4.10.

26. The criteria for defining receptor sensitivity for the purpose of the assessment on benthic ecology are provided in **Table 19-6**.

*Table 19-6. A summary of the criteria determining a receptor's sensitivity*

| Receptor Sensitivity Criteria | Definitions |
|---|---|
| Very High | Very high importance and/or rarity, internationally important receptor with little or no ability to absorb change without fundamentally altering its character. Limited potential for substitution. |
| High | High importance and/or rarity, nationally important, limited ability to absorb change and limited potential for substitution. |
| Medium | Medium or high importance and/or rarity, regional scale, limited potential for<br>Substitution, with a medium ability to absorb change. |

| Receptor Sensitivity Criteria | Definitions |
|---|---|
| Low | Low or medium importance and/or rarity, local scale, with some ability to absorb change. |
| Negligible | Very low importance and/or rarity, local scale, with good ability to absorb change. |

27. Characterisation of the impacts and resultant effects takes into consideration the following aspects (where appropriate), adapted from CIEEM guidelines (CIEEM, 2019) and using professional judgement:

- **Frequency and timing** - of an activity can influence the resulting impact which occurs. If an activity only occurs once, the likely effect is considered to be very limited. However, if an activity (i.e. piling) continuously occurs over a considerable amount of time (for example the duration of the construction period) which results in frequent disturbance to ecological features and their behaviours this could result in adverse effects. In addition, if this disturbance occurs during a time period which coincides with critical life stages and behaviours, for example during specific spawning seasons, further adverse effects could also occur; and
- **Reversibility -** effects resulting from project activities can be reversible or irreversible. Irreversible effects are those for which recovery is not considered to occur within a reasonable timescale, or at all. For effects which are reversible, recovery may occur due to natural processes which may or may not be facilitated by mitigation. Both irreversible and reversible effects on different ecological receptors could occur from the same activity depending on receptor sensitivity, magnitude, frequency and timing.

28. In addition, a precautionary approach has been taken with the reasonable worst-case scenario assessed for each impact pathway, in order to account for uncertainty or lack of baseline survey data in the assessment. Consideration should particularly be given to whether the proposed Project and associated activities could undermine the conservation objectives for a designated site or whether it could have positive or negative effects on qualifying features (CIEEM, 2018). For ecosystems, it should also be determined whether the proposed Project could result in a change of the ecosystem structure. The marine environment is highly dynamic with high levels of physical and ecological connectivity which can influence the nature, extent and scale of environmental change.

**Significance of Effect**

29. As set out in **Chapter 05: EIA Approaches and Methodology**, an impact assessment determines the significance of effect which is a function of the sensitivity of the receptor and the magnitude of the impact, as shown in Table 19-7. The Impact Assessment Matrix (IAM) acts as guiding framework for the consistent and transparent assessment of predicted effects across all receptor topics; however, assessments also allow for the application of expert judgement which may deviate from the rigid outcomes of the IAM. Criteria are therefore assigned to consider the likely effects, rather than a check list whereby all definitions are met for the category to be used.

30. Following this, levels of effect significance ranging from major to negligible are assigned. Assignment of significance is carried out with consideration of embedded mitigation measures. Embedded mitigation measures (including project design measures and best practice) are presented within **Section 19.7**. Details on additional mitigation measures and associated definitions can be found in **Section 19.9**. For the purposes of this assessment, Moderate and Major levels of significance are defined as significant, and will require additional mitigation measures, whilst Negligible or Minor impacts are defined as not significant.

*Table 19-7. A summary of the definitions of each significant of effect criteria*

| Significance Category | Definitions | Significant / Not Significant Effect |
|---|---|---|
| Major | A large and detrimental change to a valuable / sensitive receptor; likely or apparent exceeding of accepted (often legal) threshold. Or<br>A large and beneficial change, resulting in improvements to the baseline result in previously poor conditions being replaced by new legal compliance or a major contribution being made to national targets.<br>These effects may represent key factors in the decision-making process. Potentially associated with sites and features of national importance or likely to be important considerations at a regional or district scale. Major effects may relate to resources or features which are unique and which, if lost, cannot be replaced or relocated. | Significant |
| Moderate | A medium scale change which, although not beyond an acceptable threshold, is still considered to be generally unacceptable, unless balanced out by other significant positive benefits of a project. Likely to be in breach of planning policy rather than a legal statute. Or<br>A positive moderate effect is a medium scale change that is significant in that the baseline conditions are improved to the extent that guideline targets (e.g. UK BAP targets) are contributed to.<br>These effects, if adverse, are likely to be important at a local scale and on their own could have a material influence on decision making. | Significant (unless otherwise specified) |
| Minor | A small change that, whilst adverse, does not exceed legal or guideline standards. Unlikely to breach planning policy. Or<br>A small positive change, but not one that is likely to be a key factor in the overall balance of issues.<br>These effects may be raised as local issues and may be of relevance in the detailed design of a project but are unlikely to be critical in the decision-making process. | Not Significant |
| Negligible | A very small change that is so small and unimportant that it is considered acceptable to disregard.<br>Effects which are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.<br>These effects are unlikely to influence decision making irrespective of other effects. | Not Significant |

### *19.4.3. Study Area*

31. The Offshore Development Area is located in the Celtic Sea, with the export cable landfall located at Freshwater West, approximately 4 km from the entrance to Milford Haven (**Figure 19-1**). The components of the proposed Project within the Offshore Development Area include the offshore array area comprising the floating WTGs and the inter-array cables (IACs), the OfECC and cable landfall area up to MHWS. The offshore area also includes mooring lines, anchors and associated infrastructure including clump weights and scour protection.

32. The study area for benthic ecology (here after referred to as the "Study Area") takes a precautionary approach, as detailed below, to ensure the assessment incorporates all areas where significant effects could occur throughout the life of the proposed Project.
33. For the purposes of this assessment, a maximum Zone of Influence (ZoI) for project activity potential effects to benthic ecology has been defined based on the maximum potential distance to which disturbed sediment particles could be dispersed by water movements. This is defined by the mean spring tidal excursion distance and direction and therefore represents the maximum distance from the Offshore Development Area at which benthic habitats and species may be affected by proposed Project-related impacts.
34. The tidal excursion distances during a mean spring tide are approximately 6 – 8 km in the offshore array area, 8 - 10 km in the middle of the OfECC and 14 km in the nearshore on approach to the landfall (where depths during a mean spring tide range are approximately 6.3 m (see **Chapter 17: Physical Environment**)). Therefore, the mean spring tidal excursion distance of 14 km is considered to represent the maximum ZoI and is thus considered be the most appropriate extent of the Study Area (**Figure 19-1** and **Figure 19-2**).
35. The Study Area extends up to MHWS, which includes intertidal habitats, as described in **Section 19.4.3**. However, as HDD will be used to connect the proposed Project between the subtidal and terrestrial, there are no impact pathways that are likely to impact intertidal habitats and species. For completeness, a brief baseline is provided but the intertidal zone is not considered further in the assessment. All habitat and species present above MHWS are considered in **Chapter 08: Ecology and Biodiversity**.

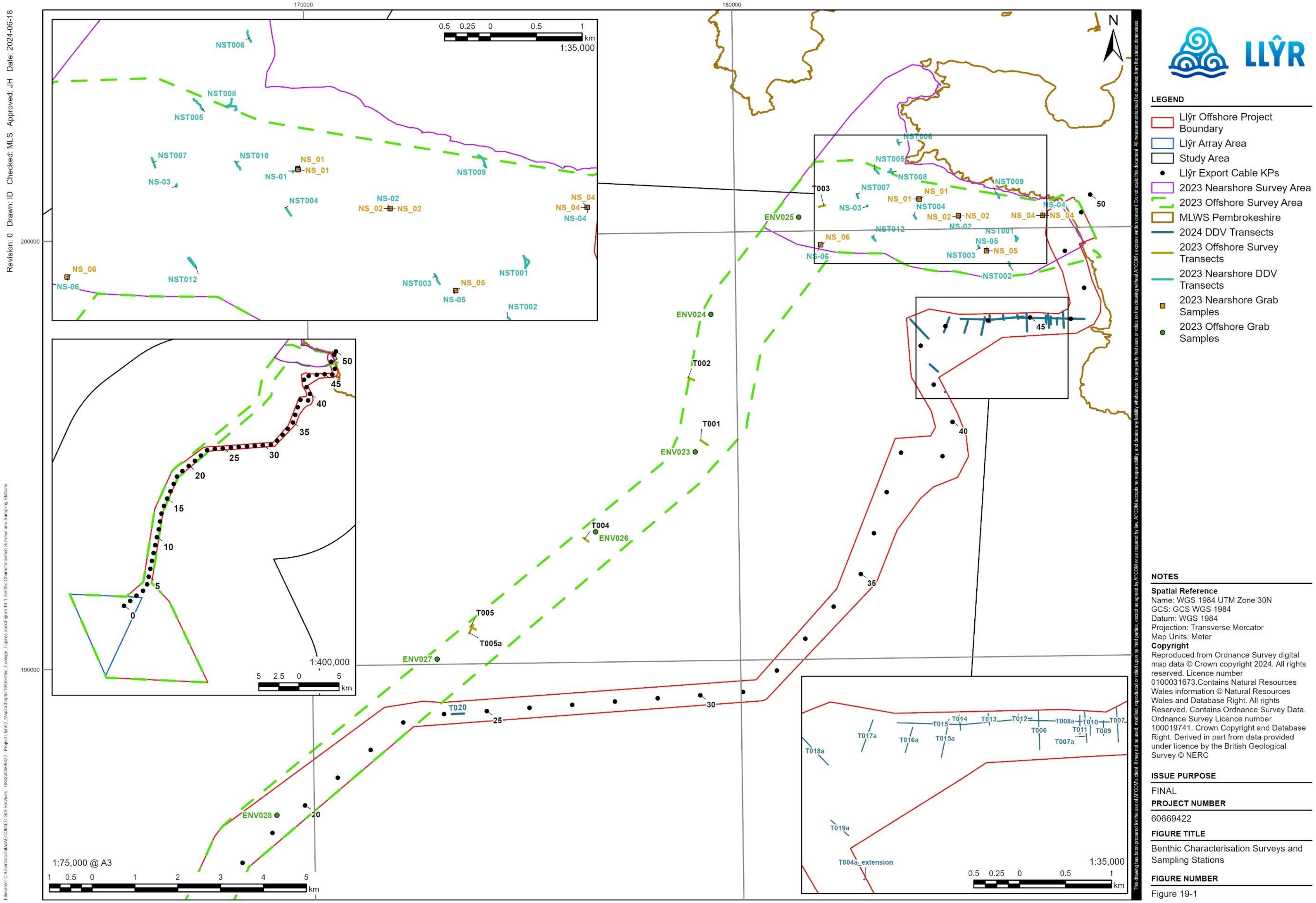


*Figure 19-1 Benthic Ecology Study Area and Summary Project Specific Survey Data Collection*

### *19.4.4. Data Sources*

36. The benthic ecology baseline has been completed based on a combination of a desktop review of published, publicly available information including spatial data, data collected during the Project-specific surveys and consultation with the relevant stakeholders and advisors (see **Section 19.3**).

**Site Specific Surveys**

37. No intertidal surveys were required as HDD will be used at the proposed Landfall location, to connect the proposed Project between subtidal (at a distance approximately 1 km away from MLWS) and terrestrial habitats. However, for completeness, brief information on intertidal habitats and species, using publicly available data sources, is provided in **Section 19.5.1**.
38. In order to provide site specific information on which to base the impact assessment for subtidal benthic ecology, a number of site-specific surveys have been conducted.
39. Dedicated offshore and nearshore benthic characterisation studies were undertaken, mobilising on 8th December 2022 and 5th February 2023 respectively, within the Offshore Development Area and on the approach to the landfall at Freshwater West (**Figure 19-1**). There were a total of 35 sampling locations which were spread across the offshore and nearshore portions of the 2023 Survey Area. The survey was undertaken following regulator guidance for benthic surveys (NRW, 2019a; Natural England, 2021). Full details of the methodology used during the initial 2023 Benthic Characterisation Studies can be found in **Appendix 19A – 2023 Nearshore Benthic Survey Report** and **Appendix 19B – 2023 Offshore Benthic Survey Report**.
40. The 2023 project-specific benthic surveys comprised drop-down video (DDV) and sediment grab sampling at target stations and DDV transects at a number of subtidal locations along the OfECC and the Array Area. These survey methods were used to determine sediment and habitat types and faunal composition. Sample processing was undertaken following NE Atlantic Marine Biological Analytical Quality Control (NMBAQC) standards (Worsfold and Hall, 2010; Mason, 2016).
41. The results of video and grab samples were combined to classify the habitats and associated biological communities in terms of biotopes in line with the European Nature Identification System (EUNIS) habitat classification (EEA, 2019). EUNIS classifications were assigned based on the latest JNCC guidance (Parry, 2019). This allowed an evaluation of the presence and extent of habitats, with a focus on habitats of conservation importance (HOCI) including Annex I habitats and species, and any designated features of nearby designated sites. The latest guidance for the determination of Annex I habitats such as stony reef and *Sabellaria spinulosa* (e.g. Brazier, 2020; Golding *et al*., 2020; Irving, 2009; Jenkins *et al*., 2018; Collins, 2010) were followed where required.
42. In early 2024 a further habitat survey was undertaken in the nearshore area of Freshwater West to review the distribution of protected Annex I reef and the presence of sediment habitats within the same area. This survey undertook a significant number of drop down video (DDV) transects (see transect locations in **Figure 19-1**), specifically targeting areas of sediment and potential Annex I reef in order to revise the OfECC. Since the completion of the surveys in 2023, the OfECC has been revised and some of the data collected in 2023 is now outside the OfECC red line boundary but does provide general baseline data within the Study Area. Data collected in 2024 can be found in **Appendix 19D: 2024 DDV Survey Report**.
43. In July 2024 additional MBES data were collected along the OfECC, in the region between the 2017 SEACAMS MBES and the 2012 CCW Turbot Bank MBES data so that there is now almost complete MBES coverage of the route from KP48, at the HDD exit point, to KP38 at the bottom

of Turbot Bank. Data collected by DDV and all MBES data sets were combined to provide an analysis of reef habitat types and the presence of Annex 1 reef (**Appendix 19E: 2024 Habitat Assessment Report**).

44. Detailed geophysical and geotechnical surveys will be conducted post determination. As part of these pre-construction surveys (the scope of which will be agreed with NRW), data will be analysed to ascertain the location of the offshore export cable routes along with the potential for micrositing of the proposed Project infrastructure within the OfECC. This will also identify routing in an east-west channel in the reef, and surrounding region, that will avoid direct impacts on Annex I Reef.

**Desk Study**

45. A comprehensive desk-based review was undertaken to inform the baseline for benthic ecology. Key data sources used to inform the assessment are set out in **Table 19-8**. A number of habitat mapping and bathymetry data sets that have specific spatial coverage relevant to particular areas of the Offshore Development Area are also shown in **Figure 19-2.**

*Table 19-8. Summary of key desktop sources*

| Title | Source | Year | Brief description | Author |
|---|---|---|---|---|
| EUSeaMap (2021) habitat types (EUNIS 2007 / full-detail classification | EUSeaMap | 2021 | Habitat mapping of EUNIS biotope classifications | EUSeaMap |
| EUNIS habitat classifications | European Environment Agency (EEA) | 2012 | Classification system for benthic habitats | EEA |
| Freshwater West MBES data (KP49 – KP44); | iMarDIS (https://www.imardis.org/ | 2017 | High resolution bathymetry data | SEACAMS |
| JNCC Pembrokeshire Marine SAC Annex 1 habitat | JNCC | 2012 | Habitat polygons with confidence ratings | JNCC |
| Turbot Bank MBES data | Countryside Council for Wales (CCW) | 2012 | Bathymetry data for Turbot Bank | CCW |
| Bathymetry data (~KP37 – KP13); | United Kingdom Hydrographic Office (UKHO) | 2011 | Multibeam data at 4 m resolution | UKHO |
| Bathymetry data (~KP37); | | 2011 | Multibeam data at 4 m resolution | UKHO |
| Bathymetry data (KP13 – KP0 and full coverage of the Array Area) | | 2003 | Single beam data | UKHO |
| Bathymetry data (KP35 to KP27). | iMarDIS | 2018 | Multibeam data | SEACAMS |
| Environment Information Portal | Natural Resources Wales (NRW) | 2023 | Mapping of marine habitats and species distributions | NRW |
| Marine Intertidal Phase 1 Species | Countryside Council for Wales (CCW) | 2022 | Dataset of phase 1 marine | NRW |

| Title | Source | Year | Brief description | Author |
|---|---|---|---|---|
| | | | intertidal species from 1996-2005 | |
| Designated site condition assessments and citations | NRW | Various | A collection of reports produced by NRW which provide information on designated sites in Wales | NRW |
| Marine Life Information Network (MarLIN) | Marine Biological Association of the UK | Various | Sensitivity assessments for habitats and species | Various |
| Environmental Statements from other similar projects | Various (referenced in text) | Various | Relevant ES chapters | Various |
| Various academic papers and online reports | Various | Various | Publicly available information covering the Study Area in full or in part | Various |

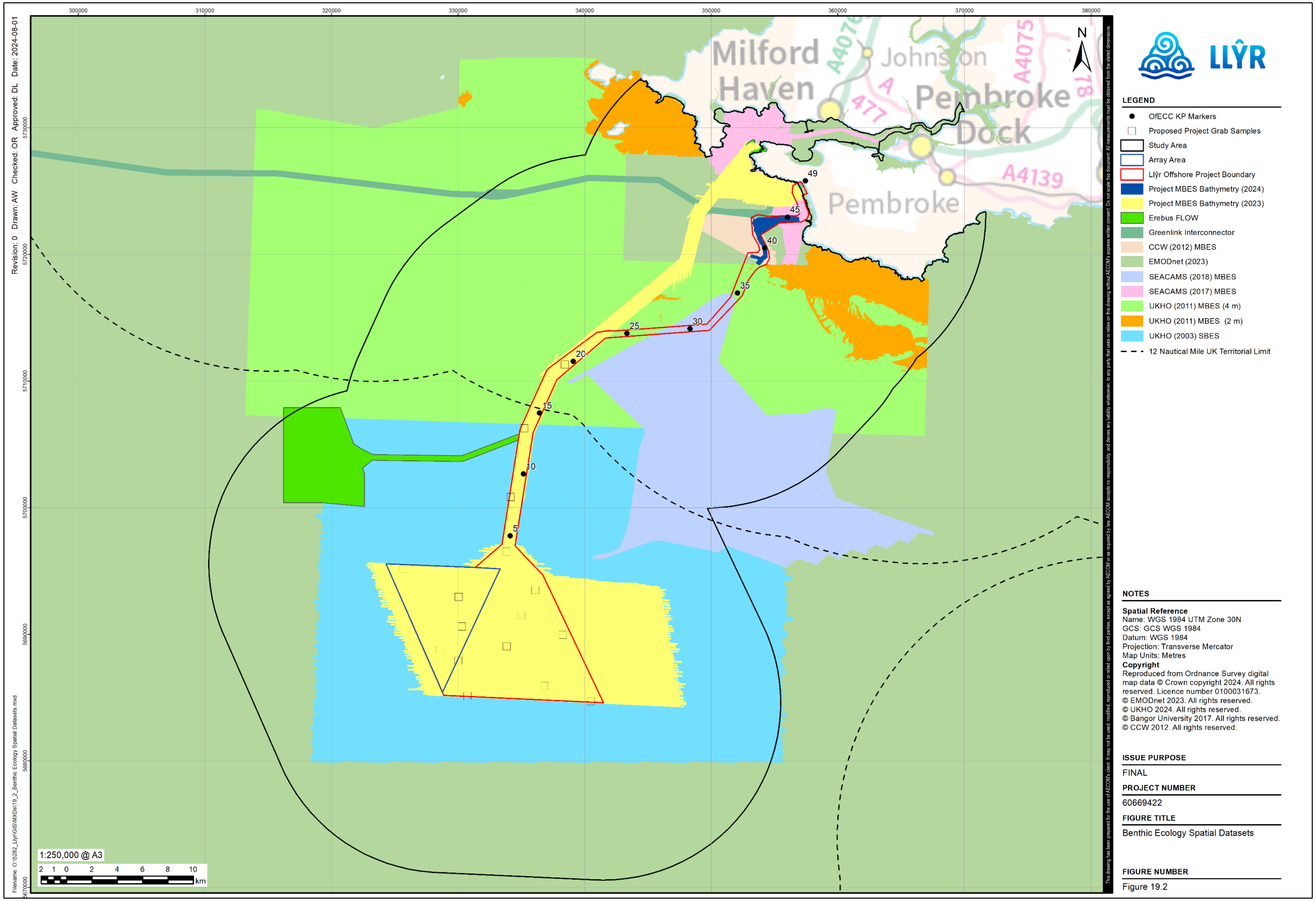


*Figure 19-2 Spatial Datasets across the Benthic Ecology Study Area*

## 19.5 Baseline

### *19.5.1. Existing Baseline*

46. The following section describes the existing intertidal and subtidal ecology of the Study Area (see **Section 19.4.3**), which encompasses the OfECC and the Array Area. The intertidal ecology section covers the proposed landfall at Freshwater West. The subtidal ecology section discusses the habitats present within the Study Area and the results of the 2023 nearshore and offshore project specific benthic characterisation surveys, and the 2024 DDV and MBES surveys, undertaken to determine habitats and species present within the OfECC and the Array Area. Note the 2023 OfECC has been revised following the 2024 survey campaign.

**Intertidal Ecology**

47. The proposed cable route reaches landfall on approach to Freshwater West (inset, **Figure 19-1**). The cable will be installed via HDD between the shallow subtidal and the terrestrial environment, completely avoiding all intertidal habitats. Therefore, no intertidal surveys were undertaken and no impact assessment for these habitats is necessary. However, for completeness a brief description of habitats in the intertidal area is provided below.

48. The intertidal zone extends from the MHWS tide mark down to mean low water springs (MLWS). Freshwater West is a popular surfing location and a classic example of a wave exposed sandy beach (CCW, 2007). The intertidal area is largely comprised of clean, fine, littoral sandy habitat with typical intertidal infaunal species including polychaetes and isopods (NRW, 2022; Greenlink, 2019). A strip of barren littoral shingle is also present across the upper intertidal zone. To the north and south, Freshwater West is bordered by exposed intertidal rocky shore with areas of shingle and mud. The rocky shore extends around the Angle Peninsula to the north and supports fucoid and red seaweeds and communities of intertidal species such as mussels, barnacles and lichens (NRW, 2022; Greenlink, 2019). Freshwater West is protected by the Pembrokeshire Marine / Sir Benfro Forol Special Area of Conservation (SAC), designated for several Annex I habitats including intertidal rocky reef and mudflats and sandflats.

49. There is a low abundance of benthic organisms in the intertidal zone of Freshwater West, considered to be due to the highly mobile nature of the sandy shore and exposed location due to a lack of shelter from prevailing winds (Greenlink, 2019).

**Subtidal Ecology**

50. Subtidal habitats in the Study Area have been determined on the basis of a large range of publicly available data sets (see **Table 19-8**) which includes existing regional broadscale habitat mapping data (e.g. UKSeaMap, 2023), detailed bathymetry data and SAC protected habitat mapping (**Section 19.4.4)**, and the results of the project specific 2023 benthic characterisation (**Appendix 19A: Nearshore 2023 Benthic Survey Report** and **19B: Offshore 2023 Benthic Survey Report**) and 2024 DDV (**Appendix 19D: 2024 DDV Survey Report**) and MBES studies (**Appendix 19E: 2024 Habitat Assessment Report**.

51. Since the 2023 surveys were undertaken the OfECC route has been revised and the detailed 2023 survey data from KP23.5 to the landfall HDD exit point at KP48 is now outside the OfECC but is still within the general project Study Area (see **Figure 19-1**). Further survey work was undertaken in 2024, using DDV and additional MBES data collection for the determination of habitats present in the shallow region of Freshwater West**.** The 2024 DDV survey data, together with detailed existing MBES mosaic data (SEACAMS, 2017) provides sufficient information of the presence of habitat types within the OfECC for a robust baseline and assessment.

**Study Area**

52. Broadscale predictive habitat mapping (UKSeaMap, 2023) indicates the Study Area, and wider region, is dominated by sandy habitats, with small areas of coarse sediments and, in nearshore waters particularly, bedrock habitats (**Figure 19-3**). Within the Study Area, there are five habitat types, mapped by UKSeaMap data, that account for almost 97% of the seabed:

- A5.27: Deep circalittoral sand (73.5%);
- A5.14: Circalittoral coarse sediment (12.4%);
- A5.25 or A5.26: Circalittoral fine sand or Circalittoral muddy sand (7.3%);
- A5.15: Deep circalittoral coarse sediment (1.9%); and
- A4.1: Atlantic and mediterranean high energy circalittoral rock (1.7%).

53. Nearshore seabed habitats to the north and south of Freshwater West consist of rocky substrate in high energy environments. Habitat mapping published by NRW (2023) has indicated the presence of Annex I habitats in this nearshore region, with rocky habitats qualifying as Annex I reef, and areas of sand, such as Turbot Bank, categorised as Annex I sandbanks. These Annex I habitats are present in (**Figure 19-5** ). There were no other Annex I habitats identified within the Study Area.

*Annex I Sandbank*

54. Both 'high' confidence and 'potential' confidence Annex I sandbank habitat were identified using seabed imagery outwith the OfECC based on descriptors provided by Pinder (2000 The 'high' confidence Annex I sandbank habitat was identified to the north of the OfECC in nearshore waters (**Figure 19-5** ), and forms / intersects part of the Turbot Bank Annex I sandbank, a qualifying feature of the Pembrokeshire Marine SAC.

55. During the January 2023 benthic survey (**Appendix 19B: Offshore 2023 Benthic Survey Report**), the Turbot Bank sandbank was identified as gravelly and clean sands based on the uniform bedforms observed in acoustic data and sediment composition in particle size analysis. Habitats such as these typically consist of burrowing fauna including polychaetes, echinoderms, crustaceans and bivalve molluscs, as well as shrimps, crabs and fish including sandeels (*Ammodytes* sp.). However, the OfECC avoids routing directly through any Annex I sandbanks but runs alongside the boundary of Turbot Bank (**Figure 19-5** ).

*Annex I Stony Reef and Bedrock Reef*

56. Stony reef and bedrock reef (known collectively as geogenic reefs) form a mosaic of habitats in the nearshore area. Existing habitat mapping data and the February 2023 project-specific nearshore benthic survey (**Appendix 19A: Nearshore 2023 Benthic Survey Report**) identified small patches of low and medium resemblance stony reef, and larger patches of bedrock reef, outwith the proposed OfECC in the nearshore area towards Freshwater West and Angle Peninsula (**Figure 19-6**).

57. Stony reef habitats consist of stable, hard substrata including cobbles and boulders and provide increased habitat complexity for several species to colonise. Communities which form in stony reefs include assemblages of coral, sponges, fish, crustaceans, and ascidians. Mobile fauna including echinoderms and squat lobster are common in this habitat.

58. Bedrock reef occurs in areas of either soft sediment such as clay or harder bedrock, in comparison to stony reefs which are only present in areas of hard substrate. Bedrock reefs are diverse habitats with variations in topography and complexity, resulting in several different communities and species present including corals, sponges and ascidians which represent key prey items for further species including fish and crustaceans.

59. Reef, which is a primary qualifying feature of the Pembrokeshire Marine SAC, is found in much of the nearshore area. The current mapping for Annex I reef habitat is based on a range of data sources (as mapped on the Wales Environmental Information Portal) which has identified many areas of reef, though much of this has been identified as potential and/or with low confidence (**Figure 19-5** ).

60. A number of other important habitats are present within the Study Area, though presence within the proposed Project OfECC or Array Area is either minimal or completely absent. There were some small patches of blue mussels (*Mytilus edulis*) on bedrock observed in images from transect T017a but these were not in close proximity to the region of sediment habitat suitable for cable lay identified at KP43 (**Appendix 19E: 2024 Habitat Assessment Report**). A small patch was also identified on bedrock reef close to Turbot Bank and also in nearshore waters on the approach to Freshwater West during the 2023 nearshore survey (Transect NST012), but this is now outside of the current OfECC (**Figure 19-5** , **Appendix 19A: Nearshore 2023 Benthic Survey Report**). There were no oyster beds identified in the Study Area and available data indicates presence only in Milford Haven (NRW, 2019b).

61. Limited patches of *Sabellaria spinulosa* were observed close to Milford Haven Waterway but abundance was generally low and not indicative of Annex I reef habitat. Some *Sabellaria spinulosa* individuals were recorded in the nearshore region (Station ENV025 shown on **Figure 19-1**), but this was outside the current OfECC and not in biogenic reef form (**Appendix 19B: 2023 Offshore Survey Report**). There were no other data found to indicate the presence of this species in forms of conservation importance and there were no *Sabellaria* recorded in any of the hundreds of images from the 20 transects in the 2024 DDV survey. This is consistent with the findings of surveys conducted for Project Erebus, which also identified areas of *S. spinulosa* aggregations but not in Annex I form (Marine Space Ltd, 2019a). The aggregations identified during the Project Erebus surveys were located within Milford Haven Waterway around West Angle Beach, and in small numbers in offshore waters.

62. There are also several 'submerged or partially submerged sea caves' in the Study Area including on the intertidal rocky coastlines of Angle Peninsula, Skomer Island south of Freshwater West (NRW, 2023). These caves are a qualifying feature of the Pembrokeshire Marine / Sir Benfro Forol SAC and Limestone Coast of South West Wales / Arfordir Calchfaen de Orllewin Cymru SAC (JNCC, 2023), supporting a diverse range of epifaunal species (NRW, 2023). The nearest seacaves are however, approximately 3 km from the OfECC (Source: Data Map Wales, 2024).

63. In addition, several other species and habitats of principle importance (HOPI) listed under Section 7 of the Environment Wales Act (2016) have been identified in the nearshore Study Area (**Figure 19-4**), based on habitat mapping data provided by NRW (2023). There were no records for these habitats and species within the OfECC or Array Area but they are present within the wider Study Area and have the potential to be within the ZoI for some impact pathways. These are listed below together with the closest distance to the OfECC and are shown in **Figure 19-4**.

- Fragile Sponge and Anthozoans, 0.7 km
- Seagrass Beds, 2.9 km
- Tide Swept Channels, 3.4 km
- Blue Mussel Beds, 3.8 km
- Maerl Beds, 4.0 km
- *Cruoria Cruoriiformis*, 4.1 km
- *Eunicella Verrucosa* Pink Sea Fan, 4.5 km
- *Lithothamnion Coralloides* Coral Maerl, 4.6 km

- *Musculus Discors* Green Crenella Beds, 5.1 km
- *Haliclystus Auricula* Stalked Jellyfish, 8.0 km
- *Lucernariopsis Campanulata* Stalked Jellyfish, 8.8 km

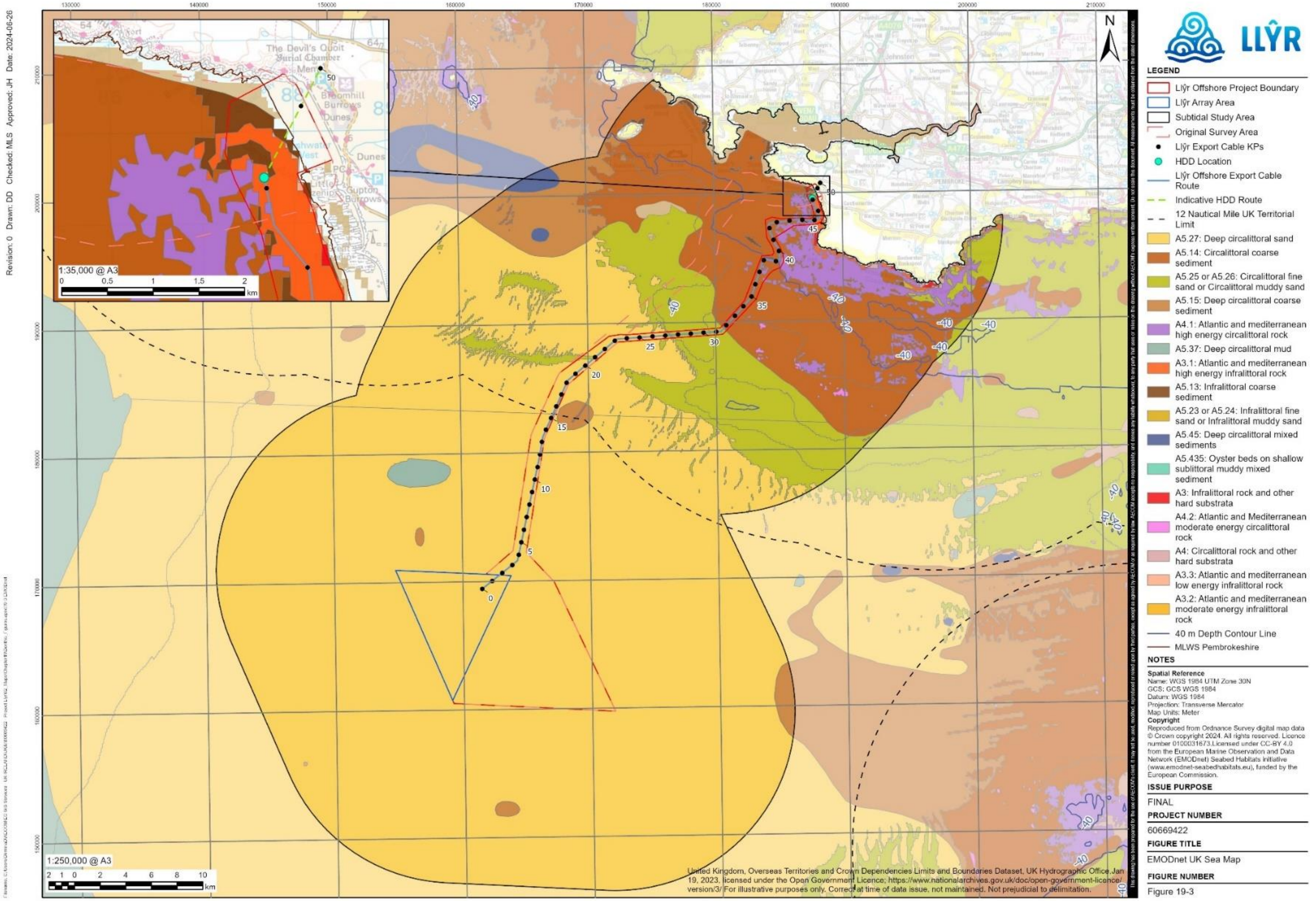


*Figure 19-3 UKSeaMap Broadscale Predictive Habitat Mapping in the Study Area*

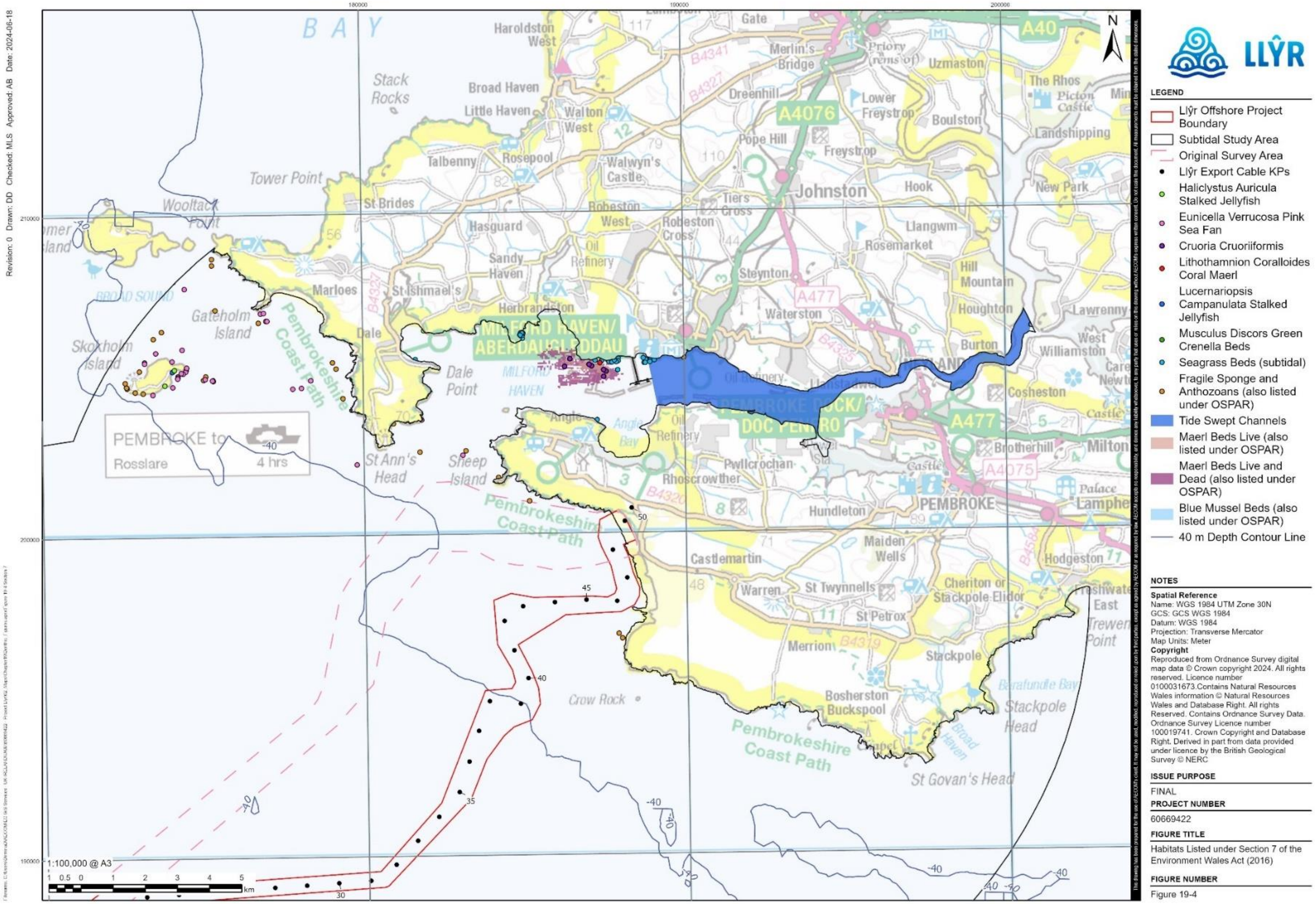


*Figure 19-4 Habitats listed under Section 7 of the Environment Wales Act found within in the Study Area*

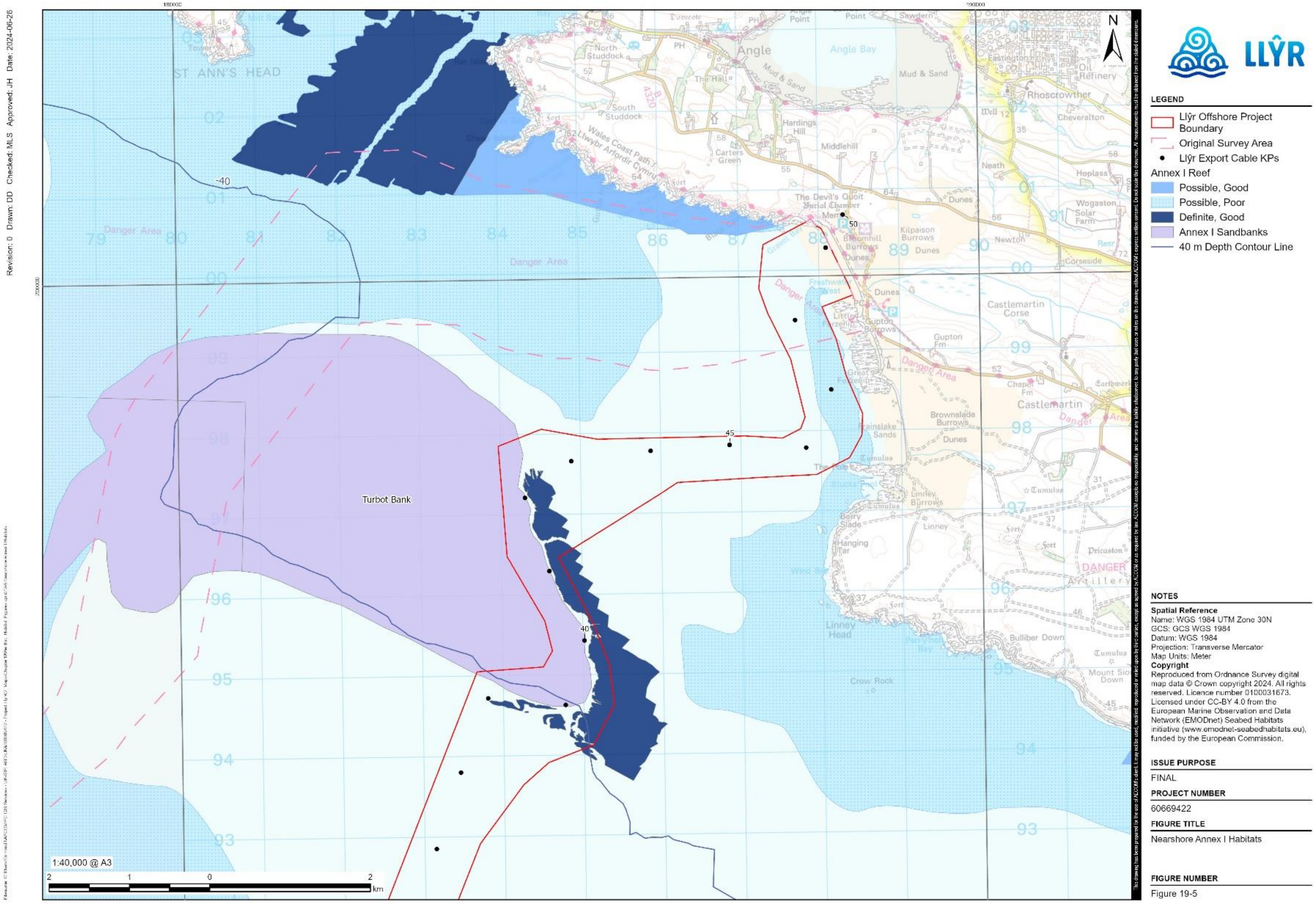


*Figure 19-5 Nearshore Annex I Reef and Sandbank Habitats*

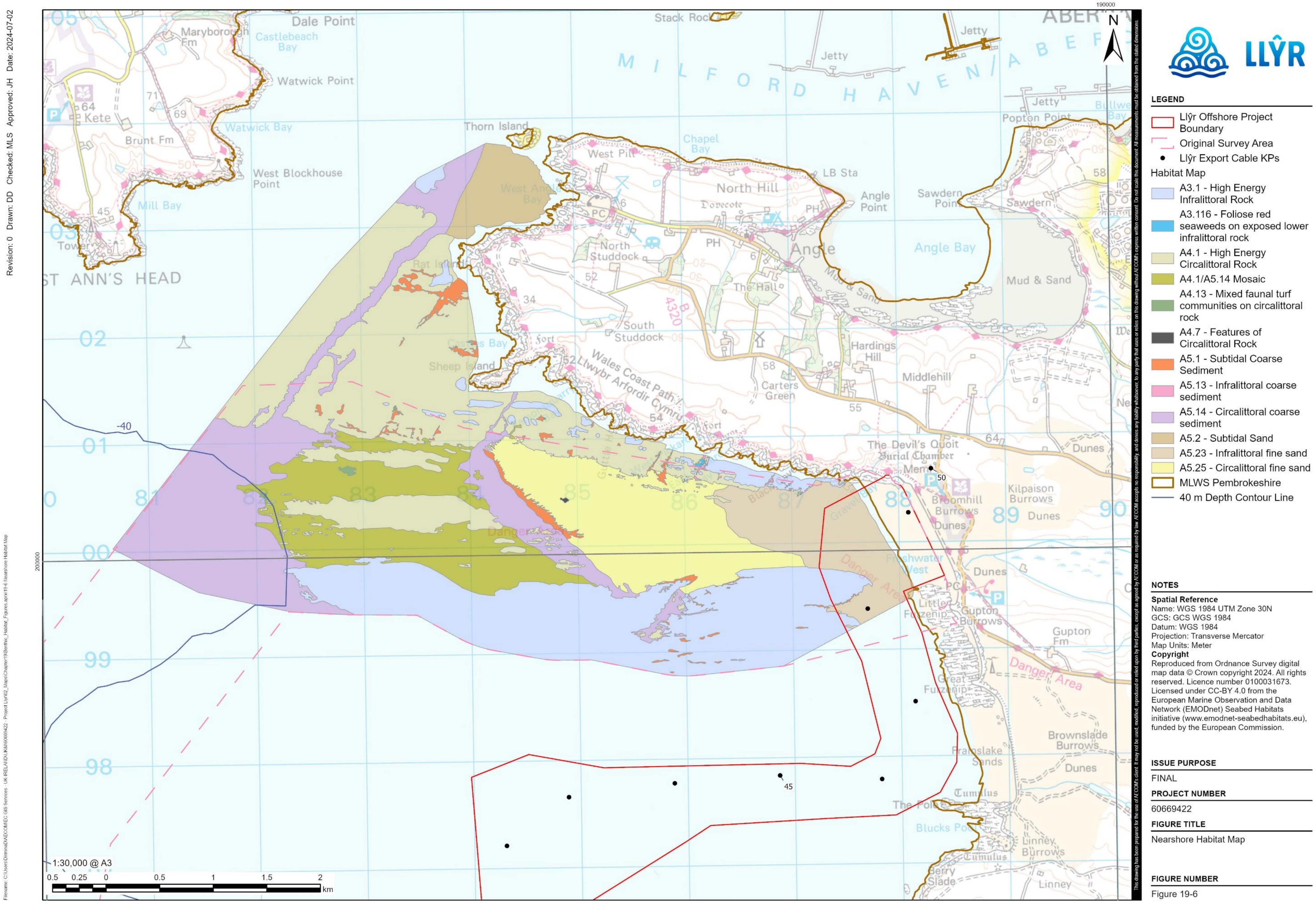


*Figure 19-6 Nearshore habitats mapped from a combination of 2023 Project benthic surveys and NRW habitat mapping*

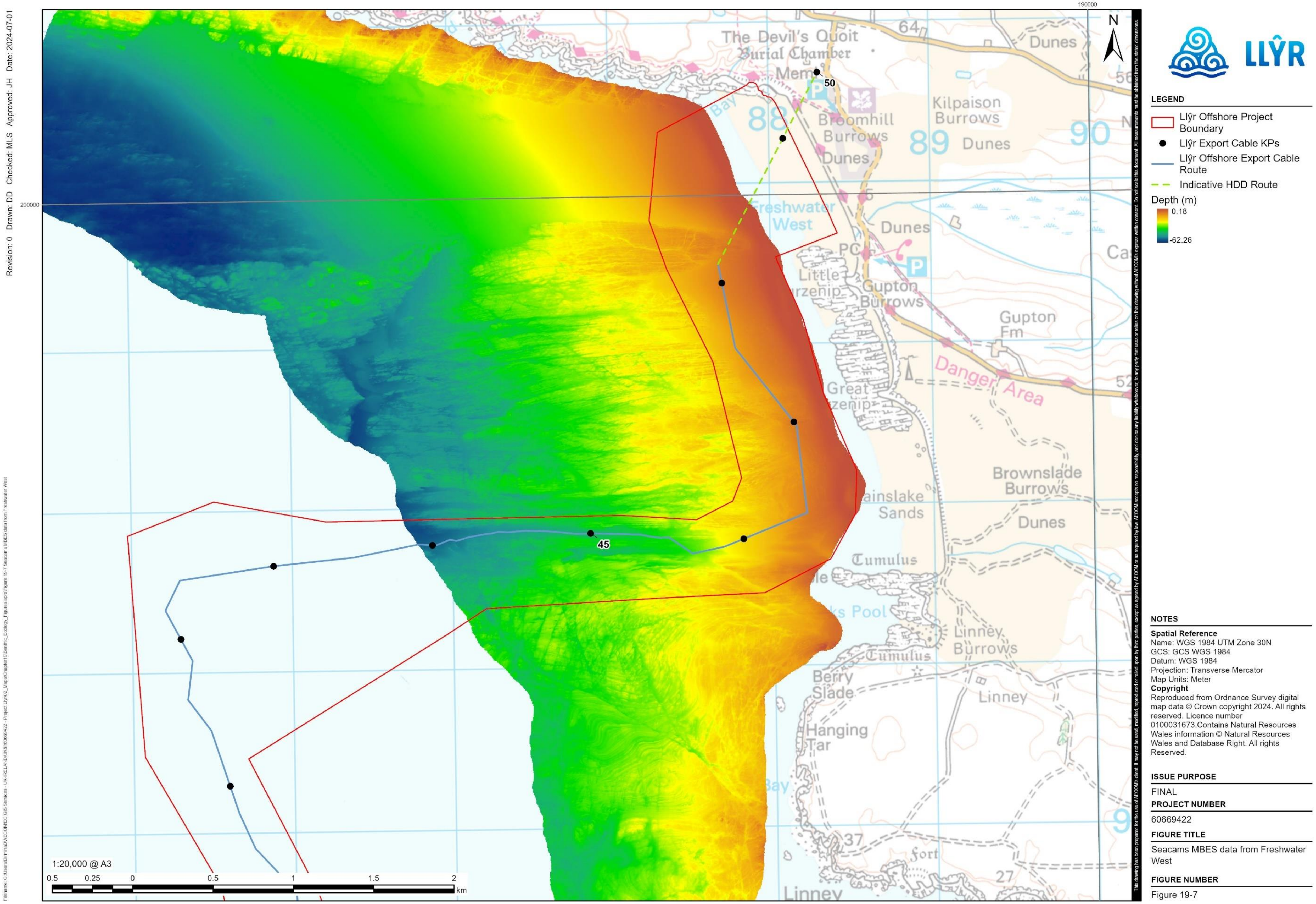


*Figure 19-7 Seacams 2017 MBES data from Freshwater West with indicative offshore export cable route*

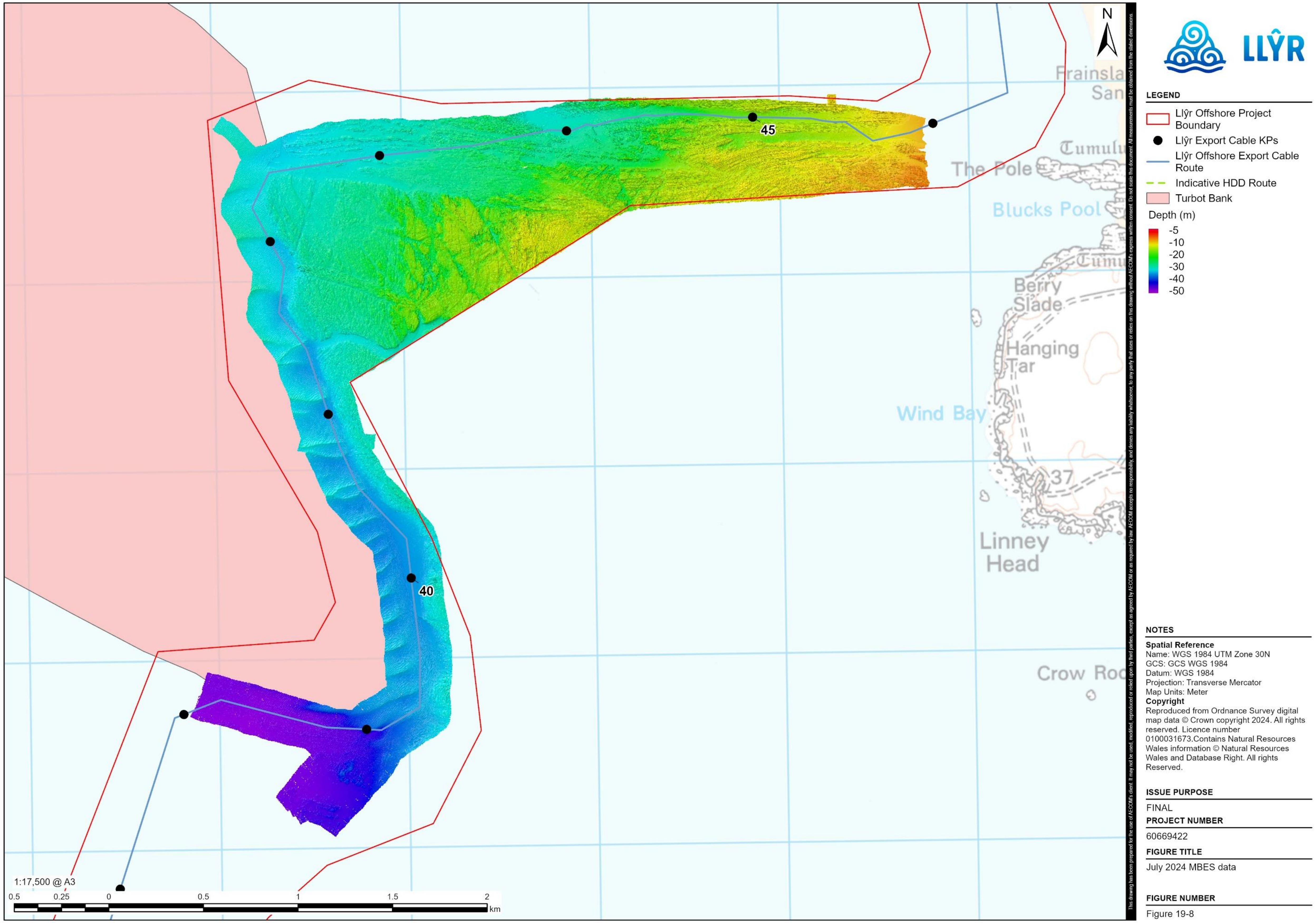


*Figure 19-8 2024 MBES data collected from KP46 to KP38 in the OfECC, with indicative offshore export cable route*

**Offshore Export Cable Corridor**

64. The OfECC is approximately 50 km long from the HDD exit point in the shallow subtidal region of Freshwater West to the Array Area in deeper waters away from the coast (**Figure 19-1**). The baseline characterisation of the OfECC is divided into sections, largely based on the data sets available to describe the habitats present, as detailed below.

*Freshwater West (KP49.0 - KP46.5)*

65. In the very shallow waters (< 5 m water depth) of Freshwater West, the HDD exit point for the cable is at KP48. In this region, grab samples taken in the 2023 nearshore survey show there are areas of sand dominated sediment in the bay (**Figure 19-6**).
66. From KP48 to KP46.5, the OfECC runs north to south in the shallow waters of bay, parallel to the shore. The benthos was found to be dominated by sand, with small proportions of mud and gravel also present, based on a mixture of nearshore survey grab sampling data described above (**Appendix 19A: Nearshore 2023 Benthic Survey Report**) and MBES data (SEACAMS, 2017) ground truthed with 2024 DDV data (**Appendix 19D: 2024 DDV Survey Report**). A distinct channel, running east-west was observed in the DDV survey (**Figure 19-7**).
67. Grab samples taken in the northern region indicated there was a very sparse faunal community found in the sandy sediments, comprised of organisms typical of infralittoral sandy habitats including unidentified ribbon worms and roundworms, and the amphipod crustacean *Bathyporeia elegans*. Stations sampled had an average of 7 taxa and 17 individuals per grab sample.
68. The 2024 DDV survey from Transect 7, running parallel to the Freshwater West shore (**Figure 19-9**) showed very high correspondence between the 2017 SEACAMs MBES data (showing areas of sand and hard substrate and areas of fine sand as observed during the 2023 nearshore grab survey. Thus, there is high confidence that the seabed type for the section of the OfECC route from the HDD punch out point, at KP48, to KP46.5 at the southern end of Freshwater West, is sand and Annex 1 habitat is not present.
69. In deeper water, west of and beyond the OfECC boundary, sandy habitat is replaced by large patches of high energy circalittoral rock (**Figure 19-6**). Project data collected in this region shows many areas of reef habitat dominated by epifaunal species including sponges such as the breadcrumb sponge (*Halichondria panicea*), branching (*Stelligera montagui*) and cushion sponges (*Dysidea fragilis*), dense carpets of oaten pipes hydroid (*Tubularia indivisa*), high numbers of acorn barnacles (*Balanus crenatus* and *Semibalanus balanoides*), cup corals (*Caryophillia smithii*) and soft coral species such as dead man's fingers (*Alcyonium digitatum*). Such species are typical of this habitat type, which has, in large parts of the nearshore area, been mapped as Annex 1 reef.

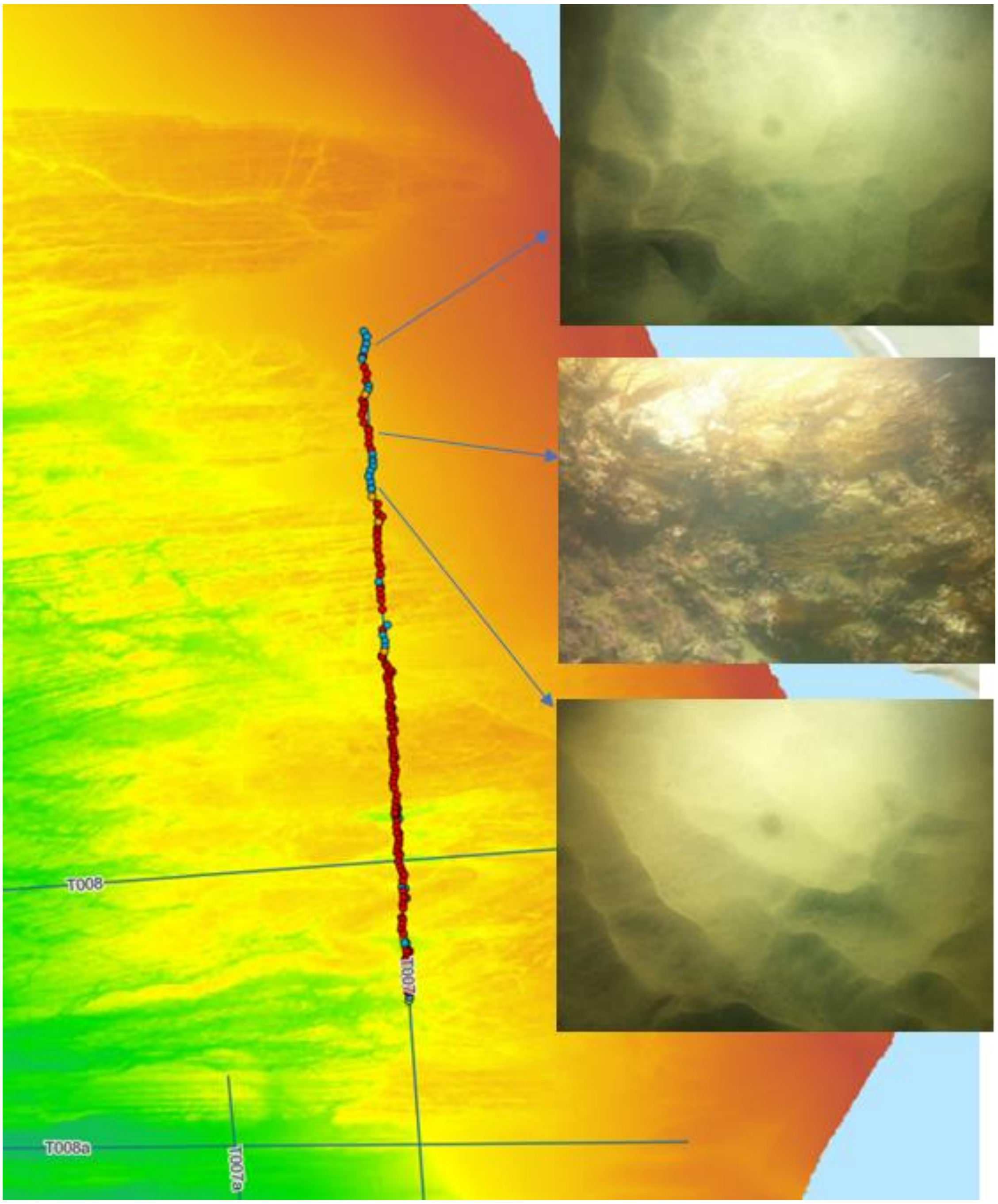


*Figure 19-9 Selected images from Transect 7 of the 2024 DDV Survey at Freshwater West*

*Reef channel (KP46.5 – KP41.5)*

70. From KP46.5 to KP41.5 a distinct east-west channel or gorge in the reef extent was evident in the 2017 MBES data (**Figure 19-7**). DDV transects targeted this channel in the 2024 survey and data were collected along Transect 08a running east-west, and from smaller transects place at right angles to the main channel, to discriminate between areas of hard substratum and sediment (**Appendix 19D: 20245 DDV Survey Report**).

71. The DDV data show the channel is largely comprised of sediment-based habitats, with a small region of exposed rock, particularly around KP45.5 (**Figure 19-10**). However, the transects perpendicular to the main channel indicate a mosaic of reef and sediment habitat, with areas of sediment between potential Annex I reef.

72. A further MBES survey was undertaken in July 2024, within the proposed OfECC between KP46 at the bottom of the bay and KP38 below the southeastern edge of Turbot Bank (**Figure 19-8**). This MBES data overlaps with the 2017 SEACAMS data from KP46 to KP44 and shows the reef formation to be the same. The MBES data in the 'gap' from KP44 to KP42 shows extensive regions of reef in a mosaic with channels and regions of flat seabed (**Appendix 17B: 2024 MBES Survey Report**).

73. A habitat assessment, based on DDV images, was undertaken using the latest guidance to determine the presence of Annex 1 reef in the nearshore area of OfECC (**Appendix 19E: 2024 Habitats Assessment Report**). Of the 852 seabed images analysed, from 20 transects covering a total distance of 10.8 km, close to half (49.2%) have been determined to not classify as Annex 1 reef.

74. Together with the detailed MBES data from 2017 and 2024 it is considered these data provide sufficient evidence that two cables can be installed between KP46 and KP42, in areas that will avoid direct impacts on Annex 1 reef. Some regions require further data for micrositing small sections of the route, such as in the region KP44 to KP43 where the currently mapped route is indicative only, but the overall data sets show a number of suitable channels in the reef and many areas surrounding them comprised of sediment and non-Annex 1 stony ground.

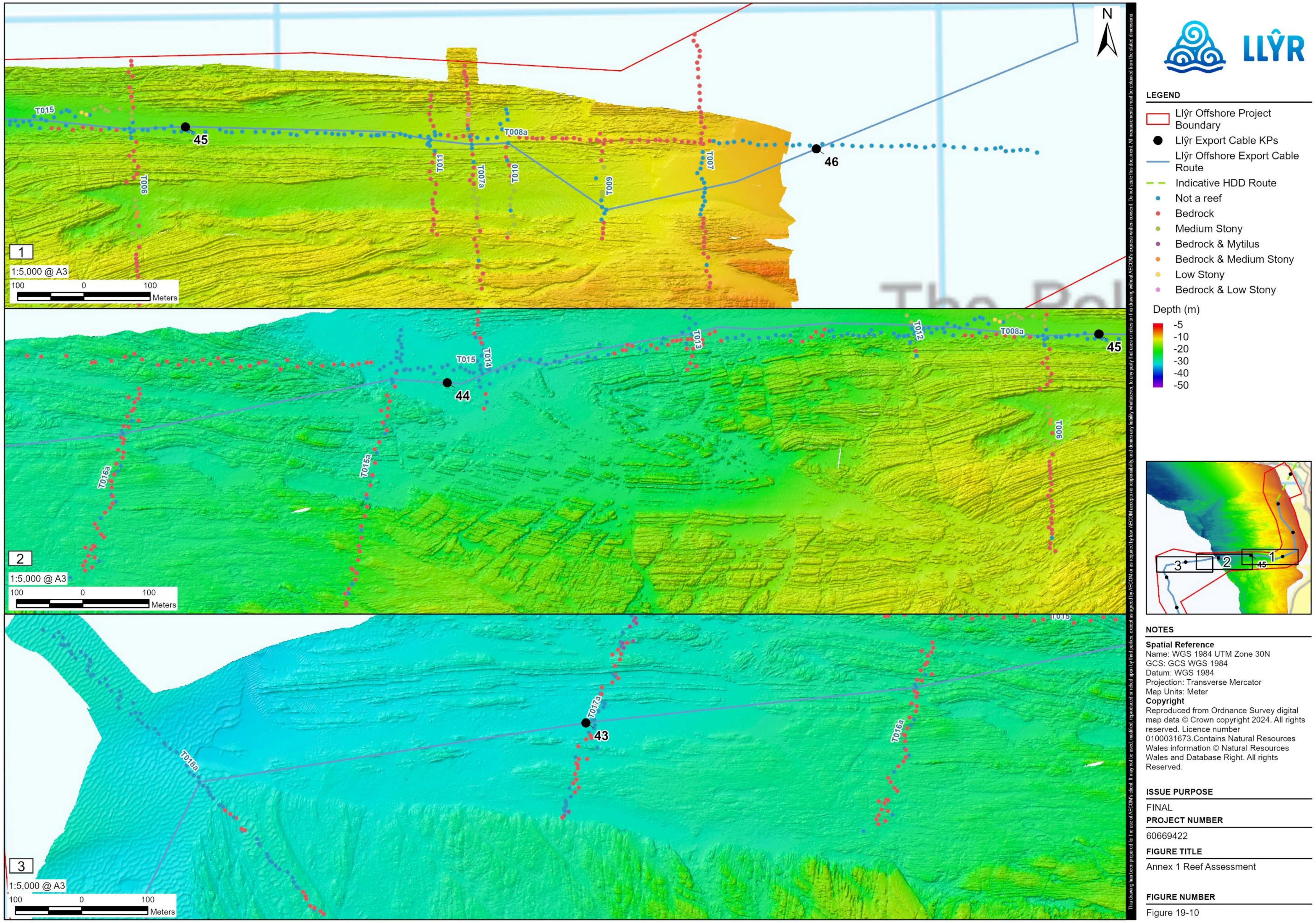


*Figure 19-10 Annex 1 Reef Assessment, with indicative offshore export cable rou*

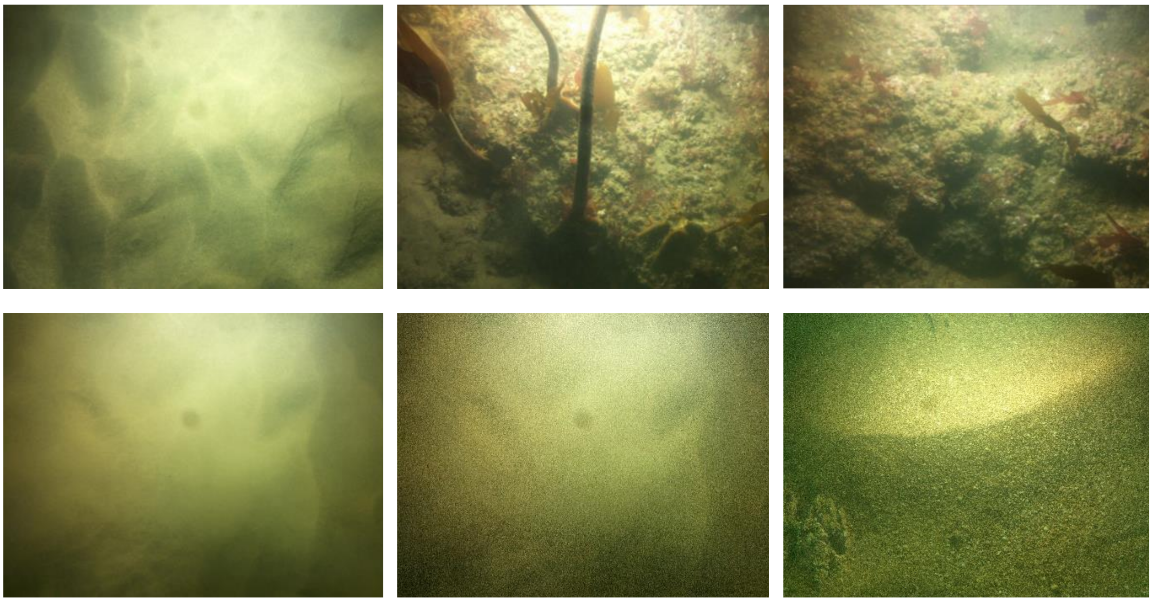

*Plate 19-1 DDV Images of habitats from Transect 8a*

<u>*Eastern boundary of Turbot Bank (KP41.5 – KP38.0)*</u>

75. From KP41.5, where large areas of sediment dominated habitat is identified, the OfECC route then runs in a north-south direction, in a channel between reef and Turbot Bank, to the southeastern edge of the bank at KP38. This channel within the updated OfECC does not overlap with the Article 17 boundary of Turbot Bank but instead passes circa 600 m to the east of it (**Chapter 17: Physical Environment**).
76. An assessment of the physical processes operating in this area indicate that the proposed orientation of the cable is broadly aligned to the direction of net sediment transport circulation around the western end of Turbot Bank (**Chapter 17. Physical Environment**). A comparison between 2012 CCW MBES data and 2024 MBES data collected specifically for the project further confirms that the sandwaves are migrating in a general southerly direction in the OfECC running to the east of Turbot Bank.

<u>*South of Turbot Bank (From KP38 to KP23.5)*</u>

77. This region of the OfECC is from the southeastern edge of Turbot Bank to the intersection between current and previous (2023) OfECC and so was not included in the 2023 survey works. However, there are several data sets that show the seabed in this region is sediment dominated and no areas of reef have been identified.
78. The 2023 UKSeaMap data indicates the seabed is dominated by sediments with coarse sediments (EUNIS habitat code A5.14) from KP38 - KP31.5 and sand habitats (EUNIS A5.25, A5.26 and A5.27) from KP31.5 to KP23.5. UKHO bathymetry data indicates the presence of sandwaves in the region from KP31 to KP27 and 2024 project DDV transects at KP24 show an extensive area of fine sand (**Appendix 19D**: **2024 DDV Survey Report**) with circular net sediment transport and limited changes in bed levels (see **Figure 17-3** and further detail in **Chapter 17: Physical Environment**). There is no evidence of rocky areas in this region.

<u>*KP23.5 to the Array Area (KP0)*</u>

79. Project specific grab and DDV data from the 2023 Offshore survey **(Appendix 19.B 2023 Offshore Benthic Survey)** shows seabed habitats dominated by sediment, mostly defined as fine sand (**Plate 19-1**), including sublittoral sands and muddy sands (A5.2) and circalittoral fine

sand (A5.25). These habitats are included within the 'Sublittoral sands and gravel' habitat listed under Section 7 of the Environment (Wales) Act 2016, generally characterised by species including bivalves and echinoderms.

80. Grab samples taken in this region of the OfECC identified two similar macrofaunal species assemblages (**Appendix 19B: Offshore 2023 Benthic Survey Report)**. Community Type A, was characterised by Amphiuridae, the two-toothed Montagu shell (*Kurtiella bidentata*) and the armoured bristle worm (*Scoloplos armiger*), and Community Type B characterised by Amphiuridae, the two-toothed Montagu shell and the brittle star (*Amphiura filiformis*). The majority of biomass identified comprised species of Mollusca, bivalves in particular.


*Plate 19-2 Sand dominated seabed habitats observed within the OfECC at KP8 (ENV030) and KP24 (T020)*

**Array Area**

81. The benthic habitat in the Array Area was largely featureless with small rippled sandy bedforms, consisting of fine sand mixed with varying compositions of gravel and mud ( **Plate** 19-3**).** The whole of the Array Area was mapped as 'A5.26 Circalittoral muddy sand' based on DDV data but grab samples and PSA identified most samples to have a lower mud component and were subsequently classified as the A5.25 Circalittoral fine sand biotope. At one DDV location mixed sediment (A5.44) was observed ( **Plate** 19-3**)** but this was a localised patch. Only one location, in the south-west of the Array Area, had a high enough mud content to be described as sandy mud (**Figure 19-11** ).


*Plate 19-3 Seabed images taken during the DDV surveys of habitats present in the Array Area*

82. The survey findings in the Array Area correspond well to the UKSeaMap habitat mapping which identifies a large extent of seabed in the region to be EUNIS biotope 'A5.27 Deep circalittoral sand'. The biotopes found in the Array Area are components of 'Sublittoral sands and gravels' identified as a habitat of principal importance in Section 7 of the Environment (Wales) Act 2016 (previously BAP/NERC S42 lists).
83. The grab sample composition analysis identified two macrobenthic groupings in the Array Area, though they are similar as both were dominated by echinoderms with juvenile brittle star species identified as the most abundant. Community type A, characterised by Amphiurid brittle stars, the two-toothed Montagu shell (*Kurtiella bidentata*) and the armoured bristle worm (*Scoloplos armiger*), was dominant in the Array Area. Community type B was also characterised by Amphiuridae, the two-toothed Montagu shell and the brittle star (*Amphiura filiformis*). This community was mostly identified in the southern sections of the Array Area. Several individuals of *S. sabellaria* were also found in the Array Area but no reef formations were observed.
84. No notable, rare or protected species were observed in the 2023 Array Area survey data though there were some species of interest recorded from surveys undertaken for the Erebus FLOW project, approximately 4.71 km to the north west of the Array Area. However, notable species, such as the Atlantic mud shrimp (*Solenocera membranacea*) which is unusual in UK waters though recorded to be present in temperate waters (WORMS, 2024), and the thumbnail crab (*Thia scutellate*) which is a nationally scarce species (Marine Space Ltd, 2019a), are found regionally.

**Invasive and Non-Native Species**

85. There were no INNS identified across the Study Area during the project-specific benthic surveys. However, a small number of INNS species were observed nearby, during surveys undertaken for Project Erebus (Marine Space, 2019a). This included the American slipper

limpet (*Crepidula fornicata*), the modest barnacle (*Austrominiius modestus*) typically found in intertidal zones, a polychaete (*Goniadella gracilis*) and the leathery sea squirt (*Styela clava*) (Marine Space Ltd, 2019b). However, these were mostly found in Milford Haven Waterway and in nearshore waters and are unlikely to be present in the Llŷr Project Area which is entirely subtidal. Also, several of these species, particularly the slipper limpet and the barnacle are already well established and very widespread in UK waters.

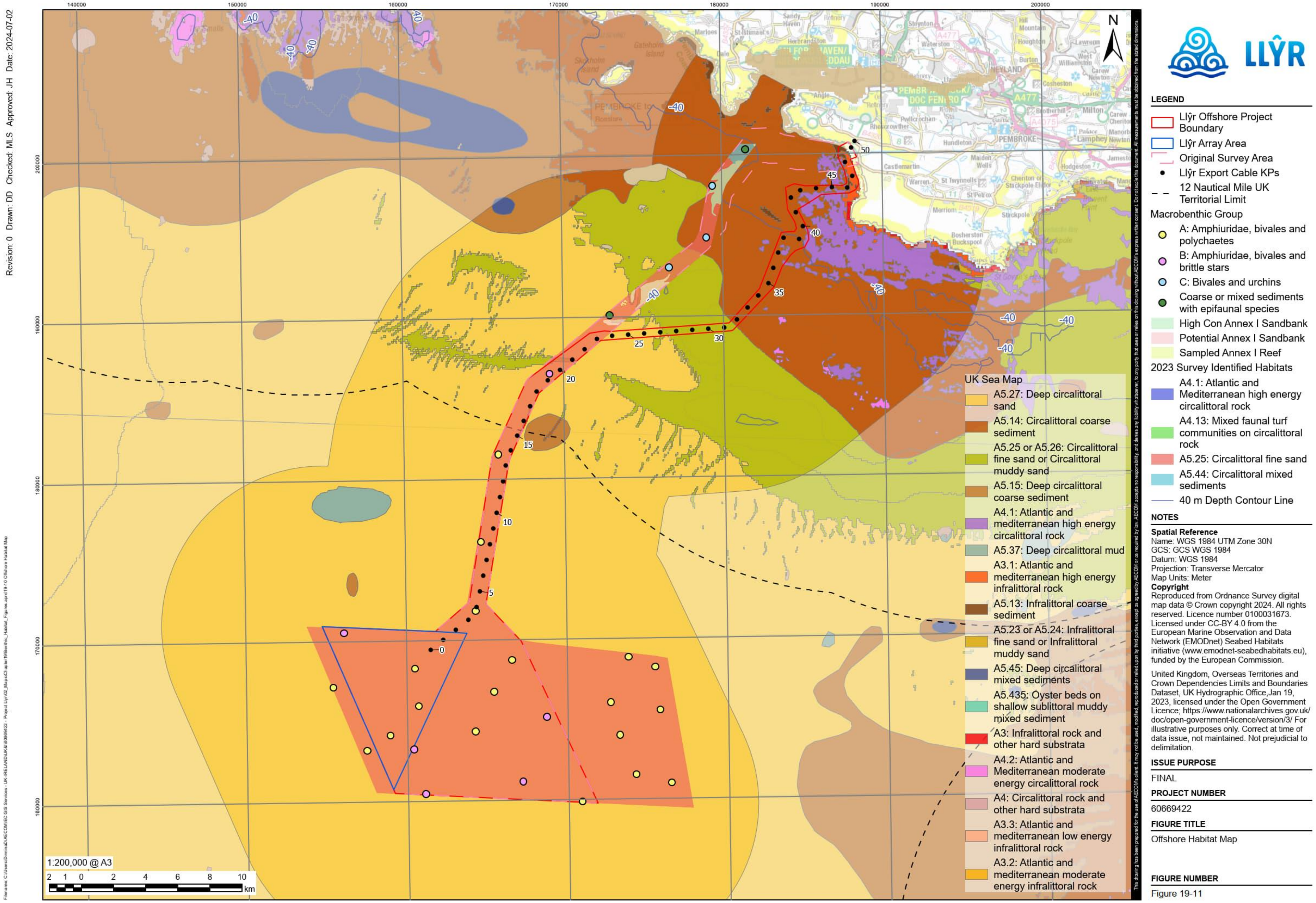


*Figure 19-11 Offshore habitats identified during 2023 project benthic surveys*

### Relevant Designated Sites

86. The sites which are designated for the protection of benthic features within the Study Area are outlined in **Table 19-9** and shown on **Figure 19-12**. The sites consist of two SACS, six Sites of Special Scientific Interest (SSSI) and one Marine Conservation Zone (MCZ).

*Table 19-9. Designated Sites in the Study Area of relevance to benthic ecology*

| Site name | Distance from OfECC and Array Area (km) | Summary and Benthic Marine Qualifying Features |
|---|---|---|
| Pembrokeshire Marine / Sir Benfro Forol SAC | 0 and 23.0 | The Offshore Project Boundary intersects this SAC for approximately 15.14 km. The site is designated for the following marine Annex I habitats (JNCC, 2023b) which are a primary reason for selection:<br>– Estuaries;<br>– Large shallow inlets and bays; and<br>– Reefs.<br>Annex I habitats which are a qualifying feature, but not a primary reason for selection:<br>– Sandbanks which are slightly covered by sea water all the time; and<br>– Submerged or partially submerged sea caves.<br>During the project-specific benthic surveys, bedrock and stony reefs, sandbanks and large shallow inlets and bay, which are all Annex I habitats protected by the SAC, were found in the nearshore area (**Figure 19-5** ). |
| Limestone Coast of South West Wales / Arfordir Calchfaen de Orllewin Cymru SAC | 0 and 23.0 | This SAC encompasses Freshwater West where the OfECC makes landfall. The site mostly protects intertidal and terrestrial habitats. However, the site also protects 'Submerged or partially submerged sea caves' which is an Annex I qualifying feature but not a primary reason for selection. However, the nearest sea caves are at least 3 km from the OfECC. |
| Castlemartin Range SSSI | 0 and > 30 | This SSSI is located towards the southern extent of Freshwater West and around the south coast of Wales to St Govan's Head (CCW, 2011). It overlaps with the Offshore Project Boundary for approximately 0.4 km. Marine habitats and species protected by this site include rocky shores and boulder beaches with dense barnacle and limpet communities. This site is intertidal and will be avoided by any project activities as the cable will be constructed below this zone via HDD, and therefore there are no impact pathways to the intertidal elements of this designated site and it has not been considered further in this chapter. The terrestrial elements of this site have been considered in **Chapter 8: Ecology and Biodiversity**. |

| Site name | Distance from OfECC and Array Area (km) | Summary and Benthic Marine Qualifying Features |
|---|---|---|
| Angle Peninsula Coast/Arfordir Penrhyn Angle SSSI | 0.15 and >30 | The boundary of this SSSI is located on the periphery of Freshwater West (NRW, 2003) and is 0.15 km from the Offshore Project Boundary where the OfECC makes landfall. This site is in place for the protection of the intertidal habitats and species of West Angle Bay and northern Freshwater West (NRW, 2003). As there are no project activities in this zone because of the use of HDD between the onshore landfall and the offshore exit point this designated site is not considered further. |
| Milford Haven Waterway SSSI | 1.35 and >30 | The Milford Haven Waterway SSSI is located 1.35 km north of the Offshore Project Boundary where it approaches landfall in Freshwater West. It protects a range of intertidal habitats and species including the native oyster (*Ostrea edulis*) and eelgrass beds (*Zostera spp.*). Due to the intertidal nature of Milford Haven Waterway SSSI, and the absence of project activities in this zone because of the use of HDD between onshore and offshore landfalls, it has not been considered further. |
| Dale and South Marloes Coast SSSI | 5.73 and >30 | Dale and South Marloes Coast SSSI is located on the west coast of the estuary in Milford Haven and extends round the coastline towards Jack Sound, covering both intertidal and subtidal habitats. The site consists of rocky and sandy shore marine communities, including rockpools, nationally scarce green algal community on the upper shore and nationally scarce red alga (*Gigartina pistillata*) (CCW, 2002). The sublittoral fringe of the rocky shore is dominated by kelp and occasional understories of encrusting coralline algae. The nationally scarce green alga (*Ulothrix flacca*) is also present on the littoral fringe at Little Castle Bay. |
| Skomer MCZ | 11.74 and >30 | Skomer MCZ is located almost 12 km to the north west of the Offshore Project Boundary, designated for the protection of benthic habitat and species, including kelp forests, rocky shores and turfs. |
| Stokholm SSSI | 12.0 and >30 | The Skokholm SSSI is located on Skokholm Island to the north west of the Offshore project Boundary. The site mostly protects exposed intertidal shores on the island. However, subtidal dense thongweed (*Himanthalia elongata*) and understories of mussels and coralline algae (CCW, 2001b) are also protected, in addition to sub-tidal fringe rock with kelp, nationally scarce tide-swept kelp communities. |

| Site name | Distance from OfECC and Array Area (km) | Summary and Benthic Marine Qualifying Features |
|---|---|---|
| Skomer Island and Middleholm SSSI | 14.1 and >30 | Skomer Island and Middleholm SSSI is located 14.46 north west of the Offshore Project Boundary. The SSSI mostly protects important benthic habitats and species (CCW, 2001a). However, sea caves are also protected. |

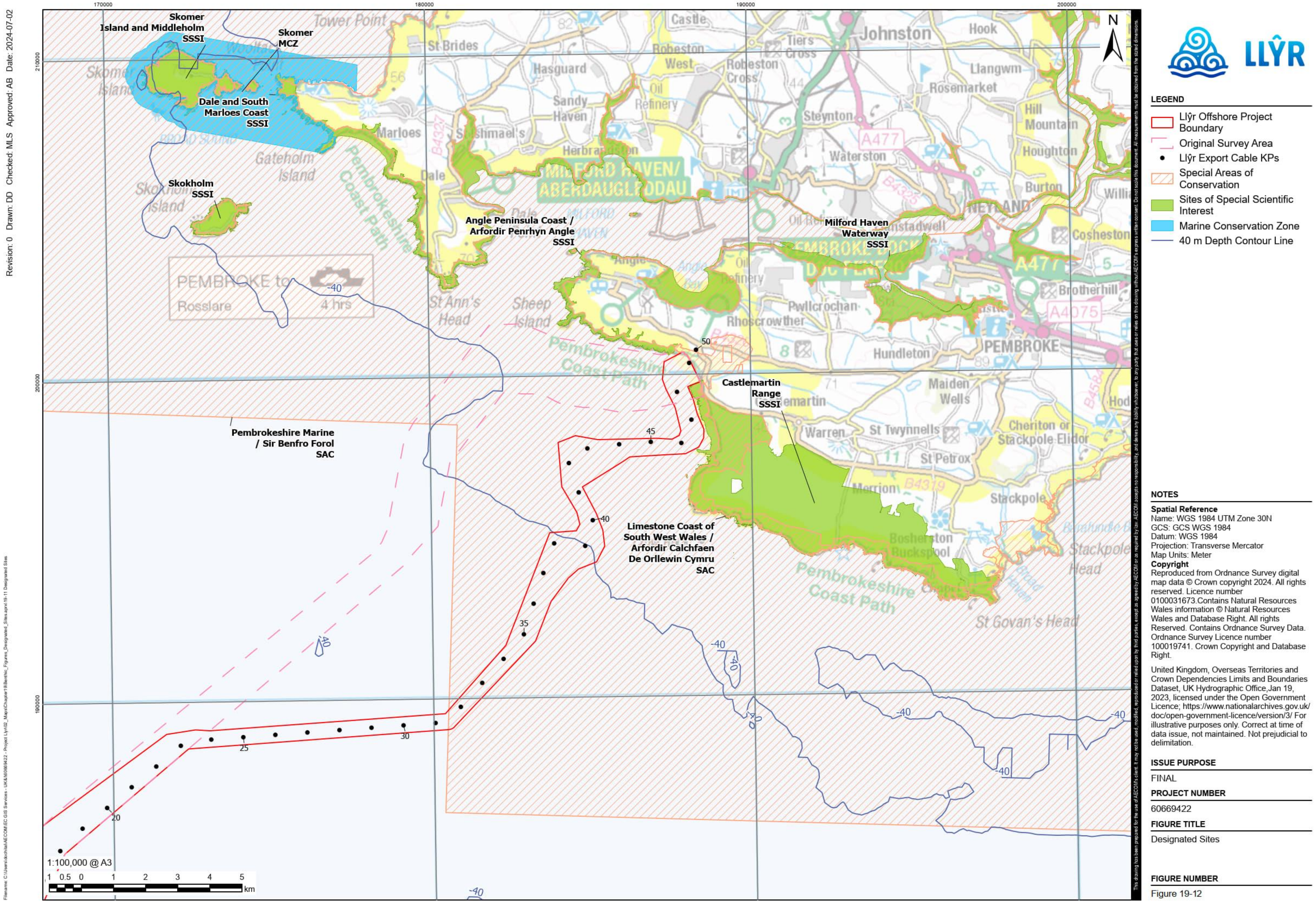


*Figure 19-12. Designated Sites in the Study Area*

**Chemical Analysis**

87. The sediments of the Bristol Channel and Celtic Sea are considered to contain some contamination due to the industrial use of the area and multiple riverine inputs along the coastline (Cefas, 2007). Riverine inputs are the major contributor to contamination in these waters, due to diffuse sources resulting from agricultural and urban runoff. However, a review of contaminant levels in the Bristol Channel and the Celtic Sea found them to be low or below the level of detection, with the highest levels particularly in coastal waters close to the Severn Estuary and other major industrial and riverine inputs. Contamination levels in the Bristol Channel and the Celtic Sea are considered to be lower than those in the Irish Sea and the North Sea.
88. Milford Haven Waterway and surrounding nearshore waters have a history of consistent background contamination levels of both heavy and trace metals, polycyclic aromatic hydrocarbons (PAHs) and other contaminants due to the historical use of the port for oil and gas (Marine Space Ltd, 2019b; Little *et al*., 2015). The last pollution event occurred in 2007 which was thought to be mainly due to dredging and the construction of liquid natural gas (LNG)-related facilities in Milford Haven Waterway (Little *et al*., 2015).
89. Chemical analysis of the contaminants present in the Study Area has been undertaken as part of the project-specific benthic survey to inform the impact of disturbance of sediment-bound contaminants during the Construction Phase. There are several different thresholds that contaminants can be compared against to determine whether remobilisation of sediment-bound contaminants could cause adverse effects on marine organisms, including Cefas Action Levels (AL) 1 and 2 (MMO, 2023), Canadian Sediment Quality Guidelines (CSQG), which determine threshold effect level (TEL) and probable effect level (PEL) (CCME, 2021), OSPAR Background Assessment Concentrations (BACs) (OSPAR, 2009), the USA Environmental Protection Agency (EPA) Effect Range Low (ERL) (NJDEP 2009) and Environmental Quality Standards (ESQs) (Cole *et al*., 1999). These are summarised below, and full tables of chemical analysis and the relevant threshold levels are provided in Appendix 19A: Nearshore 2023 Benthic Survey Report and Appendix 19B: Offshore 2023 Benthic Survey Report.

**Heavy and trace metals**

90. The presence of eight heavy and trace metals were analysed in sediment collected during the project-specific benthic survey: arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc.
91. Arsenic was found to be present throughout the survey area but only exceeded Cefas AL1 at four locations within the Array Area. Arsenic was found to be present in the OfECC over a widespread area including around the mouth of Milford Haven Estuary and was above ERL and the CSQG (CCME, 2021) threshold effect level (TEL) at two sampling stations in nearshore waters of Freshwater West and Angle Peninsula. It was also found to exceed Cefas AL1 in sediment sampling undertaken for the Erebus project (Marine Space Ltd, 2019b), indicating elevated levels of arsenic are common in this region.
92. No other metals in sediments collected in the Study Area exceeded Cefas AL1. Zinc was found at a concentration which exceeded TEL and ERL reference levels at two locations in nearshore waters approaching the landfall in Freshwater West.

**Total hydrocarbons (THC)**

93. In nearshore waters, THC concentrations were highest off Angle Peninsula with a concentration of 1,330 µg $kg^{-1}$. The highest concentration of Pristane was 1.46 µg $kg^{-1}$. In offshore waters, THC, n-alkanes and pristane were all most abundant in the Array Area with concentrations of 4,190 µg $kg^{-1}$, 94.4 µg $kg^{-1}$ and 6.07 µg $kg^{-1}$ respectively. However, during

Project Erebus sampling, THC was found to be highest in nearshore stations compared to offshore stations (Marine Space Ltd, 2019b).

**PAHs**

94. PAHs were compared to CEFAS AL1 (no CEFAS AL2 available for PAHs), OSPAR BAC levels and CSQG, and TEL and PEL where possible. In nearshore waters, there were no PAHs which exceeded reference levels. Phenanthrene was the most abundant PAH with a concentration of 11.0 µg $kg^{-1}$, compared to 1.62 µg $kg^{-1}$ for Fluoranthene, 1.32 µg $kg^{-1}$ for Pyrene. Naphthalene was the only PAH to exceed a threshold level, with a value of 7.21 µg $kg^{-1}$ exceeding the CSQG TEL at station ENV001 in the Array Area.

95. Fluoranthene, phenanthrene, pyrene and naphthalene were found to be the most abundant PAHs in sediment samples collected for the Project Erebus Environmental Statement (Marine Space Ltd, 2019a; 2019b). Fluoranthene, phenanthrene and naphthalene all exceeded TEL at three, two and three stations respectively. Acenaphthene, benzo[a]anthracene, chrysene, benzo[a]pyrene and dibenzo[a,h]anthracene also exceeded TEL during sampling for Project Erebus, but did not exceed the probable effect level (PEL).

**Polychlorinated Biphenyl (PCB) and organotins**

96. Both PCB and organotins were below the level of detection at all stations sampled in the Study Area (**Appendix 19A: Nearshore 2023 Benthic Survey Report** and **Appendix 19B: Offshore 2023 Benthic Survey Report**).

**Fish Supporting Habitat**

97. Benthic conditions, particularly sediment type, is an important determinant of the presence of spawning grounds and suitable habitat for demersal spawners, herring and sandeel, in particular. Small areas of potential herring spawning grounds were observed overlapping with the OfECC and potential sandeel spawning grounds cover the entire Study Area, based on data from Coull *et al*. (1998) and Ellis *et al*. (2012), and sediment data collected during the project-specific benthic survey. There were no fish, such as sandeel, caught in the Study Area during the benthic characterisation surveys. For full details on fish spawning grounds and consideration of the potential impacts to this receptor from the proposed Project, see **Chapter 20: Fish and Shellfish**.

### *19.5.2. Baseline Summary*

98. The Offshore Development Area is characterised by areas of bedrock in the nearshore region and sediment dominated habitats elsewhere. There were no protected species or INNS observed in the Offshore Development Area and there was no evidence of any sediment contaminants (heavy metals, hydrocarbons, PAHs and PCBs) that were not consistent with background levels for the region.

99. There are Annex I reef and Annex sandbank habitats designated by the Pembrokeshire Marine SAC in the Offshore Development Area though routing does, and will, avoid direct placement on these Annex I reef habitats.

100. At the landfall location at Freshwater West the OfECC HDD exit point is located in an area of sandy sediment, which dominates the shallow waters of the bay to KP46.

101. The DDV data collected in 2024, together with historical and recent MBES data sets show extensive regions of reef within a mosaic with channels and regions of flat seabed (**Appendix 17B: 2024 MBES Survey Report**). These data provide sufficient evidence that two cables can be installed between KP46 and KP42, in areas that will avoid direct impacts on Annex 1 reef. Some regions require further data for micrositing small sections of the route post-determination, such as where an indictive route only has been shown between KP44 and KP43

(e.g see **Figure 19-8**) but the data clearly show the presence of channels and surrounding areas comprised of sediment and non-Annex 1 stony ground.

102. The OfECC route is then located between the eastern border of Turbot Bank and reef habitat, avoiding direct cable placement on Annex I reef and sandbank features of the Pembrokeshire Marine SAC. The remainder of the OfECC is characterised by sublittoral sand dominated habitat, as is the entirety of the Array Area.

### *19.5.3. Future Baseline*

103. This section considers any changes to the baseline conditions described above that might occur over the lifespan of the proposed Project, regardless of its presence (i.e. in the event that they are not installed).

104. Milford Haven has had a long history of industrial use due to the proximity of several ports and as a result, disturbance to the marine environment has been considerable including long-term anthropogenic impacts such as sediment contamination from oil spills (Carey *et al*., 2015) and pollution from wastewater discharge and agricultural runoff (Langston *et al*., 2012). In addition, the Celtic Sea and the Bristol channel are also exposed to high levels of pollution due to the presence of ports on their coastlines.

105. The Milford Haven Waterway Environmental Surveillance Group has been monitoring and surveying the local environment for 30 years, including the benthos and infauna. These surveys have shown community composition of the rocky shore in Milford Haven and surrounding coastlines to experience increases in INNS species including the small red algae (*Caulacanthus okamurae*) (Archer-Thomson and Morrell, 2020). Numbers of black-footed limpets (Patella depressa) have also increased in comparison to the common limpet (*Patella vulgata*), in line with predictions of changes in relative abundance based on a warming climate.

106. There is uncertainty surrounding the impacts of climate change on benthic ecology around the UK, and whether long-term changes in ecosystems are related to changes in the climate and nutrients or internal factors such as predation (Department of Energy and Climate Change, 2016). This is particularly considered the case as sediment substrates such as these are often highly dynamic in nature with associated benthic ecology exhibiting significant natural variability. However, there is more weight of evidence to suggest climate change plays a larger role. Changes in sea temperature may also have effects on the abundance and distribution of certain species as many marine species have life cycles dependent on thermal requirements (Department of Energy and Climate Change, 2016). For example, warm-water rocky reef species have already been observed advancing northwards and this is expected to increase (MCCIP, 2013).

107. Modelling of the rate of sea surface temperature change has also shown that the rate of increase in temperature has been lower on the west coast of the UK compared to the East coast over the past 50 years, which is a trend expected to continue (MCCIP, 2013; Department of Energy and Climate Change, 2016). This may cause a regime shift, similarly to that in the North Sea in the 1980s.

108. An increase in ocean acidification is also being observed in line with rising atmospheric $CO_2$ conditions and other greenhouse gases, which can reduce the levels of important minerals such as aragonite (MCCIP, 2016; MCCIP, 2013). Many shell-forming organisms and cold-water corals rely on minerals such as aragonite, however an estimated 70% of cold-coral locations are expected to be in waters under-saturated by aragonite, but over saturated by $CO_2$, by the end of the century. In comparison, macroalgae and seagrass species are expected to thrive and grow in increased $CO_2$ conditions.

109. However, although detectable changes in baseline conditions may be observed over the lifetime of the proposed Project, these are not anticipated to occur prior to completion of construction and so there would be no change to baseline applied for the assessment of

effects for this phase of the proposed Project. Any changes in baseline conditions during operation and maintenance and decommissioning are likely to be small and are therefore not expected to alter the conclusions of the assessments.

## 19.6 Scope of the Assessment

110. An EIA Scoping Report for the proposed Project was submitted to NRW Marine Licensing Team (MLT) in April 2022. The Scoping Report was also shared with relevant consultees, inviting comment on the proposed approach adopted by the Applicant. A Scoping Opinion was provided to the Applicant by NRW MLT in July 2022. Based on the Scoping Opinion received and further consultation undertaken, potential impacts on benthic ecology scoped into the assessment are listed below in **Table 19-10**. Impacts scoped out of the assessment are listed in **Table 19-11**.
111. As set out in **Section 19.4.1**, this assessment considers the design parameters of the proposed Project which are predicted to result in the greatest environmental impact, known as the 'realistic worst-case scenario'. The realistic worst-case scenario represents, for any given receptor and potential impact on that receptor, various options in the Design Envelope that would result in the greatest potential for change to the receptor in question. This approach, generally referred to as the 'Rochdale Envelope' approach (PINS, 2018), provides confidence that the development of any alternative options within the design parameters will give rise to effects no greater or worse than those included in this impact assessment.
112. Accordingly the design scenarios identified in **Table 19-10** have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group within the benthic ecology Study Area. These scenarios have been selected from the details provided in **Chapter 04: Description of the Projects**.
113. Since the proposed Project has a known lifetime, of an estimated 30 years, all impact pathways could be considered to be temporary. However, since the operational lifetime of the project is so long, habitat loss from the placement of permanent infrastructure on the seabed is considered to be permanent, since return to baseline after such a long period may not be possible.

*Table 19-10. Impact pathways and associated design scenario scoped into the assessment*

| Potential impact | Design scenario | Justification |
|---|---|---|
| **Construction** | | |
| Temporary physical disturbance to benthic habitats and species | **OfECC**<br>Total area of temporary habitat disturbance is **3,071,148 $m^2$** based on the following assumptions:<br>• HDD breakout point (10 m wide x 5 m long per bore) gives a total for 2 bores = 100 $m^2$;<br>• Sandwave levelling for a total length of 10,351 m and width of 30 m = total disturbance of 310,524 $m^2$ per cable = 621,048 $m^2$ in total.<br>• Disturbance swathe of 25 m for construction of two cables, including clearance activities such as pre-grapnel run and boulder clearance over 49 km total length = (49,000 x 2 x 25) = 2,450,000 $m^2$ | **OfECC**<br>Assessment based on a worst case scenario for the maximum area of disturbance, which could result in a large area of temporary disturbance to sensitive species and habitats that may take a long time to recover. |

| | | |
|---|---|---|
| | **Array Area**<br><br>If burial is possible (and no cable protection is required so that only temporary habitat disturbance occurs) the entire distance of the IACs in contact with the seabed of 17.10 km would be disturbed in a swathe of up to 25 m during burial, giving a total area of temporary disturbance of **427,500 m$^2$**. | **Array Area**<br>The IAC will be installed by either cable lay on the surface with cable protection, resulting in permanent habitat loss, or burial which would cause temporary habitat disturbance. Construction may involve a combination of the two but to ensure the worst-case scenario is assessed each type is considered for the entire IAC route. Thus, temporary disturbance is assessed for the entire length of the IACs. |
| Temporary increase in suspended sediment concentration (SSC) and sediment deposition leading to contaminant mobilisation, turbidity and smothering effects | High increases in SSC up to 500 m away from disturbance from construction activities, particularly in areas of fine particulate matter, thereafter, reducing towards the 14 km tidal excursion buffer. | The use of the entire Array Area as an initial boundary for where sediment will be dispersed from is a worst-case scenario, as disturbance will be concentrated to activities associated with the location of the IACs and anchors. This worst-case scenario could result in the smothering of sensitive organisms such as those which are suspension-feeders. |
| Reduction in marine water from the use of HDD drilling fluids | HDD fluids could spill at the breakout location and enter the marine environment and settle to the benthos.<br>The total drill cuttings volume for the HDD works will be up to 1,700 m$^3$ based on the volume of drill cuttings per cable (445 m$^3$), 660 mm diameter of the ducts plus a 25% bulking factor. | The impact has been assessed on the basis of a worst-case scenario, which is the release of 1,700 m$^3$ of drill cuttings. |
| Reduction in marine water quality from accidental leaks and spills from vessels, including loss of fuel oils | Accidental release of pollutants and planned release of wastewater from a worst-case scenario of 17 Project vessels on site concurrently. | This is the maximum number of vessels anticipated to be required for the construction of the proposed Project. |
| Introduction and spread of INNS via vessel hull or ballast water from vessels | The introduction of INNS into the marine environment in the Study Area, from a worst-case scenario of 17 Project vessels on site concurrently. could negatively affect benthic receptors. | This is the maximum number of vessels anticipated to be required for the construction of the proposed Project. |
| **Operation and maintenance** | | |
| | **OfECC** | **OfECC** |

<table>
<tr><td rowspan="2">Permanent direct loss and physical disturbance to benthic habitats and species</td><td>Placement of cable and scour protection, such as rock berms, concrete mattresses and grout bags, resulting in a maximum footprint of 35,100 $m^2$ (2 cables total).<br><br>• 50 $m^2$ of protection, such as rock placement and/or concrete mattresses, per bore at HDD exit point = total area of 100 $m^2$;<br>• Cable protection (excluding crossings) in OfECC over a total distance of 1,600 m per cable, with a worst-case scenario berm width of 5 m. Total area is 1,600 m x 5 m x 2 cables = 16,000 $m^2$ in total for two cables;<br>• Four cable crossings each requiring protection (none required for Greenlink) of 200 m length and 5 m width = 4 crossings x 200 m x 5 m width x 2 cables = 8,000 $m^2$).<br>• Articulated piping = 11,000 m per cable (between KP48 and KP38). Thus, for both cables a distance of 22,000 m. Each pipe is 500 mm in diameter and so the total area of cables on the seabed is 11,000 $m^2$;</td><td>The adoption of a zone of influence for direct habitat loss from cable and scour protection is based on a 5 m wide rock berm which is a reasonable worst-case scenario as it represents the design scenario with the greatest potential for habitat loss, including maximum cable protection requirements and maximum scour protection requirements.<br><br>No other design scenario would result in greater permanent loss of benthic habitats and species.</td></tr>
<tr><td>Array Area<br><br>Total habitat loss = 56,084 $m^2$. This is based on the following calculations:<br><br>• Assuming a worst-case scenario of 20% cable protection of the 17,100 m of IAC, with a berm width of 5 m, the total area of cable protection would be 3,420 m x 5 m = 17,100 $m^2$;<br><br>• Potential placement of anchor scour protection at 80 anchors (i.e. 8 per 10 WTGs), each of 310 $m^2$ = total scour protection of 24,800 $m^2$;<br><br>• Placement of 25 clump weights (4 $m^2$ each) per mooring line, 8 mooring lines per x 10 WTGs is a total area of (25 x 4 x 8 x 10) 8,000 $m^2$;</td><td>Array Area<br><br>Cable protection is estimated to be required on a maximum of 20% of the IAC, including contingency, as a worst-case scenario for this impact pathway. The area of loss has been based on a worst-case scenario of the presence of a berm with a width of 5 m.<br><br>The worst-case scenario assumes total of 310 $m^2$ of scour protection at each anchor and assumes additional area lost to drilled pile anchors.</td></tr>
</table>

| | | |
|---|---|---|
| | • Drag embedment anchor or drilled pile anchors on seabed with max footprint of 76.5 $m^2$ with 8 anchors max per WTG = 6,120 $m^2$; and<br>• Subsea connector 64 $m^2$. | |
| Temporary increase in SSC and sediment deposition associated with maintenance activities leading to contaminant mobilisation, turbidity and smothering effects | High increases in SSC up to 500 m away from disturbance, thereafter, reducing towards the tidal excursion buffer - although it is likely to be a smaller increase in SSC during operation compared to construction. The zone of influence based on a worst-case design scenario as detailed in construction including trenching and sand wave levelling activities which encompasses activities that could be required during maintenance and repairs. | The use of the entire Array Area as an initial boundary for sediment dispersal is a worst-case scenario, as disturbance will be concentrated to activities associated with the location of the IACs and anchors. This worst-case scenario could result in the smothering of sensitive organisms such as those which are suspension-feeders. |
| Alteration and/or indirect loss of habitat during the operational lifetime of the proposed Project, including from the introduction of hard substrate resulting in increased heterogeneity and new biological communities | Placement of cable and scour protection, such as rock berms, concrete mattresses and grout bags, resulting in a maximum footprint of:<br>• 35,100 $m^2$ total protection for 2 cables in the OfECC; and<br>• 56,084 $m^2$ of cable and scour protection on IACs and associated mooring/anchoring systems and subsea connector | The worst-case scenario is based on the expected maximum area that could be affected by this type of disturbance. |
| Changes to habitats due to on-going scour, changes in hydrodynamics, increased sedimentation and smothering, and abrasions, from the movement of mooring chains | As a worst-case scenario, the maximum mooring line disturbance would occupy a total seabed footprint area of up to 700 $m^2$ per WTG. Total area of mooring line disturbance in the Array Area is therefore 5,600 m.<br><br>Maximum volume of drill arising per pile is 529 $m^3$, max volume across the Array Area 42,300 $m^3$. | Worst-case scenario which could result in a large area of permanent disturbance to sensitive species and habitats, during the total operational phase, that may take a long time to recover. |
| Disturbance to benthic habitats during planned maintenance and instances of cable | The worst-case scenario has assumed up to five cable repairs will to be required over the lifetime of the proposed Project. In the event of cable failure, the cable will be recovered and necessary repairs | The number of repairs given is a worst-case scenario given on the basis of supply chain experience on similar projects with long cables on the seabed. |

| | | |
|---|---|---|
| failure and excavation | made (i.e. splicing in a new cable section or cable replacement) and the cable will then be reburied, or additional protection installed, to maintain the target burial depth of the cable and to meet the CBRA parameters. | |
| Disturbance to benthic habitats and species due to subsea cable thermal emissions | **OfECC**<br><br>Two 66 kV or 132 kV electricity export cables transmitting electricity from the WTGs to the shore over a distance of 49 km.<br><br>**Array Area**<br><br>A total of 11 IACs within the Array Area, which will be in or on the seabed for total length of 17.10 km.<br><br>The temperature increase from direct burial laying in the sediment is considered to be up to 50°C in the direct vicinity of the cable but this decreases rapidly with distance from the cable and within 30 cm of the sediment surface, the temperature increase is estimated to be within 2ºC.<br><br>For unburied and dynamic cables any temperature increase will be rapidly attenuated in water and unlikely to have an effect on benthic receptors. | Proposed increase in temperature from cables is a reasonable worst-case scenario based on data from other similar cable projects. |
| Effects of electromagnetic field (EMF) emissions | **OfECC:**<br><br>Maximum EMF strength predicted to result from the operation of the export cables at a target burial depth of 1.2 m, when a receptor is 0 m from the seabed, is 2.6 µT (microtesla).<br><br>**Array Area:**<br><br>Maximum EMF strength predicted to result from the operation of the cables at a buried depth of 1.2 m, when a receptor is 0 m from the seabed, is 2.6 µT (microtesla). | EMF emissions are known to have the potential to affect marine receptor behaviour and these values represent the worst-case scenario for EMF emissions.<br><br>The target burial depth is 1.2 m, with a minimum burial depth of 0.8 m. |
| Introduction and spread of INNS via the presence of cable and scour | The introduction of INNS into the marine environment in the Study Area during operation which could negatively affect benthic receptors. | This could result in competition for space, food and shelter and could result in some species being pushed out of their habitat. |

| | | |
|---|---|---|
| protection and other infrastructure on the seabed | | |
| **Decommissioning** | | |
| Temporary disturbance to benthic habitats and species | Decommissioning will involve the removal of all proposed Project infrastructure, including buried cables. Although some elements such as the pin piles, will be cut and left in situ. | The removal of all infrastructure from the seabed is considered to be the worst-case scenario in relation to benthic ecology. |
| Temporary increase in SSC and sediment deposition | | |
| Spread of INNS during removal of proposed Project infrastructure | | |

### 19.6.1. *Impacts scoped out of assessment*

114. A number of impacts have been scoped out of the assessment for benthic ecology during EIA scoping. These impacts are outlined, together with the justification for scoping them out, in **Table 19-11**.

*Table 19-11. Potential impacts scoped out the assessment for benthic ecology*

| Potential impact | Justification |
|---|---|
| **Construction, Operation and Maintenance** | |
| Underwater noise Impacts on marine invertebrates during construction | There is currently very limited evidence to suggest that the type and duration of underwater noise that will be generated by the proposed Project such as from geophysical surveys, dredging, ploughing and jetting and associated vessel movements, will have any significant effect on benthic invertebrates or benthic communities.<br>Thus, underwater noise disturbance in relation to benthic ecology is scoped out from requiring further consideration. |
| Underwater noise Impacts on marine invertebrates during operation and maintenance | There is currently very limited evidence to suggest that the type and duration of underwater noise that will be generated during operation, will have any significant effect on benthic invertebrates or benthic communities.<br>Thus, underwater noise disturbance in relation to benthic ecology is scoped out from requiring further consideration. |
| **Decommissioning** | |
| N/A | N/A |

### 19.6.2. *Assessments Assumptions and Limitations*

115. There are some limitations to interpreting data by classifying and grading biotopes, despite the provision of robust survey data and sampling design. These limitations include:

- Interpolating data which have been collected from discrete sample locations can make the definition and precise extent of each biotope across the whole Study Area difficult, even with site-specific geophysical data. However, project-specific data is considered to be the most reliable data source as it is the most recent and is still considered to provide a good understanding of habitat types found in the Study Area. This can be supplemented with more widespread data from alternative sources to give a representative view of baseline conditions;

- The boundary where one biotope ends and another begins is not clear-cut and cannot be defined with absolute precision due to the transition shown by benthic communities from one biotope to another. However, where this occurs, adjacent biotopes are typically very similar and therefore a representative understanding can still be obtained in order to assess effects; and
- Classification of communities into biotopes is not always simple, as some communities do not always fit the available descriptions in the biotope classification system. The classification system for subtidal benthic communities is also generally regarded as incomplete, for example there is poor coverage of data on circalittoral rock and sediment habitats in waters deeper than 50 m[1] . However, the classification for subtidal benthic communities in the Celtic Sea shown by EUSeaMap (2021) provides a general understanding of the benthic habitats in the Study Area which can be used to inform the assessment of potential impacts.

116. Further geotechnical and geophysical surveys will be undertaken post-determination for micrositing of the OfECC.

## 19.7 Embedded Mitigation, Management Plans and Best Practice

117. As part of the project design process, a number of designed-in measures have been proposed to reduce the potential for impacts on benthic ecology (see **Table 19-12**). The design of the proposed Project therefore includes embedded mitigation measures and reference to various management plans that will be produced as conditions of consent, and which will further mitigate potential impacts. This approach has been employed in order to demonstrate commitment to mitigation measures by including them in the design of the proposed Project and as such these measures have been considered within the assessment presented in **Section 19.8** below. Assessment of sensitivity, magnitude and therefore significance includes the implementation of these measures.

*Table 19-12. Mitigation measures, management plans and best practice adopted as part of the proposed Project*

| Embedded Mitigation Measures, Management Plans and Best Practice | Justification |
|---|---|
| **Design Embedded Measures** | |
| Cable Route Protocol (CRP) Compliance with The Crown Estate "Cable Route Identification and Leasing Guidelines - Transmission Assets Infrastructure for Offshore Renewable Installations"[2] | The CRP has been identified as a requirement within the R5 Celtic Sea plan HRA undertaken for the 2024 Celtic Sea Offshore Wind Plan, and comprises a set of requirements for offshore energy developers in the planning of offshore export cable routes. Compliance with these requirements is secured within the project Agreement for Lease (AfL) and adherence |

[1] https://mhc.jncc.gov.uk/
[2] Available from: the-crown-estate-cable-route-identification-leasing-guidelines.pdf (thecrownestate.co.uk.

| Embedded Mitigation Measures, Management Plans and Best Practice | Justification |
|---|---|
| | to the CRP is a prerequisite for the Llyr project securing a lease. |
| Micro-siting of the OfECC | The 2024 OfECC route change, followed by micro-siting in sediment habitats identified in the nearshore area (and finalised based on enables the avoidance of sensitive habitats (including reef habitat) |
| Comprehensive pre-application ecological surveys have been conducted within the array area and OfECC (Offshore Development Area) | Pre-application ecological surveys have identified areas of ecological importance within the Study Area, including areas of potential Annex I reef habitat that have determined routing and micro-siting of the OfECC for avoidance of direct impacts on these protected features. |
| HDD drilling fluids will be tested and selected to curtail environmental damage and potential leakage. This chiefly includes using biodegradable substances that Pose Little or No Risk to the Environment (PLONOR) and adequate contamination testing and drilling fluid disposal | The use of non-toxic drilling fluid will reduce impacts to the marine environment |
| Scour protection and other protection measures for buried or seabed surface laid infrastructure are common infrastructure in the marine environment. The engineering design of such protection (in terms of the armour unit or clast material and dimensions, and the overall shape and structure of the protection), will take account of the environmental setting it is being located in. | Good engineering design practice will actively minimise the potential for local sediment erosion (causing scour), accretion (causing burial) and general interaction with ambient flows (to minimise the potential for erosion of the protective clasts). |
| Where possible, vessels will operate with dynamic positioning | This will minimise anchor disturbance on the seabed |
| Use of cable protection will be minimised wherever possible | This will aid in avoiding the placement of rocks in habitats which otherwise consist of soft, sandy sediments, and will reduce the amount of permanent habitat loss |
| An ROV survey of the seabed on the cable route and mooring location will be undertaken immediately prior to the installation of the export cable and FLOW array. | This will confirm that no hazardous obstructions or benthic or physical damage prior to the completion of the connection |
| To prevent disturbance by suspended sediment on benthic habitats in the jet trenching phase of cable installation ‘OSPAR Commission Guidelines on Best Environmental Practice’ in Cable Laying and Operation must be adhered to. This includes to minimise the number of export cables that require trenching, avoiding sensitive benthic habitats in the route design and coordinating trenching activity to | This is considered to reduce the effect of construction and operation on marine benthic receptors, particularly those which are sensitive to increased suspended sediment concentrations |

| Embedded Mitigation Measures, Management Plans and Best Practice | Justification |
|---|---|
| not coincide with critical life stages of benthic species such as reproductive events like spawning | |
| A biosecurity risk assessment will be undertaken as part of the PEMP by the contractor | A biodiversity risk assessment will reduce impacts to marine benthic receptors through the introduction of invasive non-native species |
| All project vessels shall adhere to the International Convention for the Control and Management of Ships' Ballast Water and Sediments (IMO, 2017) | Adhering to the convention will help comply with the aim of preventing the spread of marine INNS |
| Planned effluent dischargers will be compliant with MARPOL Annex IV 'Prevention of Pollution from Ships' standards | This will ensure that any discharges are within MARPOL standards to reduce risk to the benthic environment |
| All project vessels shall adhere to the International Maritime Organisation (IMO) Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species (Biofouling Guidelines) (IMO, 2011). | Adhering to these minimise the transfer of invasive aquatic species (Biofouling Guidelines) (IMO, 2011). |
| **Management Plans** | |
| **Appendix 04A: Outline CEMP** – Included in the Project Environmental Management Plan (PEMP), Appropriate Health, Safety, and Environment (HSE) procedures (identified in the CEMP) will also be implemented, with strict weather and personnel limits to reduce any risk of accidental spillage | Specifies the overarching principles and detailed measures to minimise and mitigate the effects of the installation activities associated with the proposed Project on the surrounding environment. |
| **Appendix 04B: Invasive Non-native Species Management Plan** | Enables marine operators and contractors to understand and minimise the risks posed by activities which could introduce and spread of marine INNS. |
| CSIP – Cable Specification and Installation Plan | Details the minimum burial depths of the offshore export cables throughout the offshore export cable routes, and indicative proposed locations where the target depth of burial may not be achievable and external protection is expected to be required.<br>Further details have been provided the **Outline CEMP, Volume 6, Appendix 4A, Section 4.4.3**. |
| CBRA – Cable Burial Risk Assessment | Provides a standardised methodology to improve risk management of offshore wind farms. |
| BMP - Biodiversity Management Plan | Outlines strategies for preserving biodiversity during construction. It includes measures to mitigate environmental impacts, protect sensitive habitats and |

| Embedded Mitigation Measures, Management Plans and Best Practice | Justification |
|---|---|
| | species, and prevent the spread of invasive plants. |
| EMMP - Excavated Materials Management Plan | Sets out the approach for proper disposal and reuse of contaminated or uncontaminated soil. |
| MPCP - Marine Pollution Contingency Plan | Outlines procedure to protect personnel working on the proposed Project and to safeguard the marine environment. |
| PEMP - Project Environmental Management Plan | An overarching document which includes all proposed Project considerations and method statements in accordance with those assessed within the Environmental Statement. Details the methods to avoid, minimise and mitigate potential environmental effects during the operational stage of the proposed Project. |
| PPMP - Pollution Prevention Management Plan | Sets out measures to avoid and control pollution. Outlines the recording and response measures to be used in the event of an incident. |
| SOPEP - Shipboard Oil Pollution Emergency Plans, which will be in place and adhered to under MARPOL Annex I requirements for all vessels | A plan consisting of procedures and descriptions of actions to be taken in the event of an oil pollution incident. Implementing a SOPEP will reduce the influence any pollution incidents from proposed Project vessels can have on benthic receptors in the Study Area. |
| VMP - Vessel Management Plan | Sets out best practice protocols for minimising potential for any impact on marine wildlife including marine mammal receptors. |
| WQPMP - Water Quality and Pollution Management Plan | Sets out measures to avoid pollution to water bodies. Outlines the recording and response measures to be used in the event of an incident. |
| SWMP - Site Waste Management Plan | The SWMP will identify obligations with regard to waste legislation, provide the details regarding roles and responsibilities of the Applicant and its contractors (including any subcontractors) to ensure that obligations (under waste legislation) and current environmental best practice are complied with. This includes the event of excess waste of HDD Drilling Fluid reaching the surface, to prevent pollution of the marine water environment. |

## 19.8 Assessment of Environmental Effects

118. The impacts and effects (both beneficial and adverse) associated with the construction, operation (including maintenance), and decommissioning of the proposed Project are outlined in the sections below. The assessments take into account the embedded mitigation measures described in **Section 19.7**. Any impacts on fish supporting habitats will be assessed in detail in **Chapter 20: Fish and Shellfish**.
119. For clarity, temporary impacts are defined as effects from which the environment can recover through natural processes before the end of the operational lifetime of the proposed Project. Permanent impacts are defined as those which will have an effect on the environment for the duration of the proposed Project due to an inability for the local environment to recover through natural processes, and in some cases effects will persist beyond decommissioning.

*Table 19-13. Sensitivities of receptor to construction, operational and decommissioning impacts*

| Impact pathway | Location | Receptor | Sensitivity |
|---|---|---|---|
| **Construction Phase** | | | |
| Temporary loss and physical disturbance to benthic habitats and species | OfECC and Array Area | Sublittoral Sands and Gravels | Low |
| Temporary increase in suspended sediment concentration (SSC) and sediment deposition leading to increased turbidity, smothering and contaminant mobilisation | OfECC | Annex I Reefs | Low |
| | OfECC | Annex I Sandbanks | Negligible |
| | OfECC | Sublittoral Sands and Gravels | Low |
| | OfECC | Other HOPI | Low |
| | Array Area | Sublittoral and Gravels | Low |
| Impact of changes to marine water quality from the use of HDD drilling fluids | OfECC | Benthic habitats and species | Low |
| Impact of changes to marine water quality from accidental leaks and spills | All | Benthic habitats and species | Low to high (species dependent) |
| Introduction and spread of INNS via vessel hull or ballast water | All | Benthic habitats and species | Negligible |
| **Operational Phase** | | | |
| Permanent direct loss and physical disturbance to benthic habitats and species | OfECC and Array Area | Sublittoral Sands and Gravels | Low |
| Temporary increase in SSC and sediment deposition associated with maintenance | OfECC and Array Area | Benthic habitats and species | Low |
| Alteration and/or indirect loss of habitat during the operational lifetime of the proposed Project, including from the introduction of hard substrate resulting in increased heterogeneity and new biological communities | OfECC and Array Area | Sublittoral Sands and Gravels | Low |
| Changes to habitats due to on-going scour, changes in hydrodynamics, increased sedimentation and smothering, and abrasions, from the movement of mooring chains | OfECC | Sublittoral Sands and Gravels | Low |
| | Array Area | Sublittoral Sands and Gravels | Low |

| Impact pathway | Location | Receptor | Sensitivity |
|---|---|---|---|
| Disturbance to benthic habitats during planned maintenance and instances of cable failure and excavation | OfECC and Array Area | Benthic habitats and species | Low |
| Effects of subsea cable thermal emissions | OfECC and Array Area | Sublittoral Sands and Gravels | Low |
| Effects of electromagnetic field (EMF) emissions | OfECC and Array Area | Sublittoral sands and gravels | Low |
| Introduction and spread of INNS via the placement of cable and scour protection during construction | OfECC and Array Area | Benthic habitats and species | Low |
| **Decommissioning** | | | |
| Temporary disturbance to benthic habitats and species | OfECC and Array Area | Benthic habitats and species | Low |
| Temporary increase in SSC and sediment deposition | OfECC and Array Area | Benthic habitats and species | Low |
| Spread of INNS during removal of proposed Project infrastructure | OfECC and Array Area | Benthic habitats and species | Negligible |

### 19.8.1. *Construction Effects*

**Temporary physical disturbance to benthic habitats and species**

120. There are a number of route preparation and cable installation activities that may cause temporary loss and/or physical disturbance to seabed habitats. Sensitivity of benthic receptors to loss and disturbance of habitat varies between habitats and species depending on their resilience to disturbance and the scale of the disturbance. In areas of sandy or other sediments, particularly in shallow waters, there is regular natural disturbance of the seabed due to wave action and tidal water movement (**Chapter 17: Physical Environment**). Therefore, communities inhabiting such environments are considered to be relatively tolerant of disturbance.
121. The OfECC and the Array Area are dominated by sand and gravel habitats, with areas of hard substratum in shallow water near the coast. However, the routing of the OfECC ensures no sensitive or protected habitats, Annex 1 reefs and Annex 1 sandbanks in particular, will be subject to direct disturbance as routing and micro-siting of the two cables shall avoid these areas.
122. Reef habitat in the nearshore region (between the HDD exit point at KP48 and KP41.5 at the top of Turbot Bank) has been avoided by routing through sediment and non-Annex 1 reef habitats east of the reef in Freshwater West and installation along an identified sediment channel in the reef with some micro-routing around small areas of outcropping rock that sits within a mosaic of rock and sediment habitats. The cables will be surface laid, using iron articulated pipe protection, in a westerly direction avoiding encroachment onto potential Annex 1 reef between KP46 and KP41.8. No other cable protection measures are proposed within this area.
123. Cable installation around Turbot Bank maintains a position outside of the designated sandbank and avoids encroachment onto potential Annex 1 reef (**Figure 19-5** ). In the channel between these two protected habitats a worst-case scenario has been assumed, where the cable will be surface laid, also using iron articulated pipe protection, to the region below Turbot Bank at KP38. No other cable protection measures are proposed between KP42 and KP38. It has been estimated that a total distance of iron-articulated pipe protection of 11,000 m will be required for each of the two cables (10,000 m plus 10% contingency between KP48 and KP38).
124. Cable burial is assumed for the remainder of the OfECC and the Array Area.
125. Most animals that are sediment dwelling may be disturbed during construction when seabed preparation activities - which may include ploughing or jetting to move sediment aside to an adjacent location - are carried out. As sediments are displaced in advance of cable laying and backfilled after the export cable is laid, there may be some loss and/or disturbance of larger and less mobile species but only relatively low numbers of individuals are expected to be affected. Additionally, for many animals, displacement will have only a temporary impact, and fauna is assumed to be able to redistribute within the sediment following completion of construction. As a result, recovery of habitats is expected to be relatively rapid.

**OfECC**

126. The activities that could cause temporary disturbance within the OfECC are route and boulder clearance, sandwave levelling and cable burial via jet-burial or plough. It has been estimated there will be a maximum area of disturbance of 3,071,148 $m^2$ in total along the OfECC, as described in Table 19-10 and shown in Figure 19-13 below.

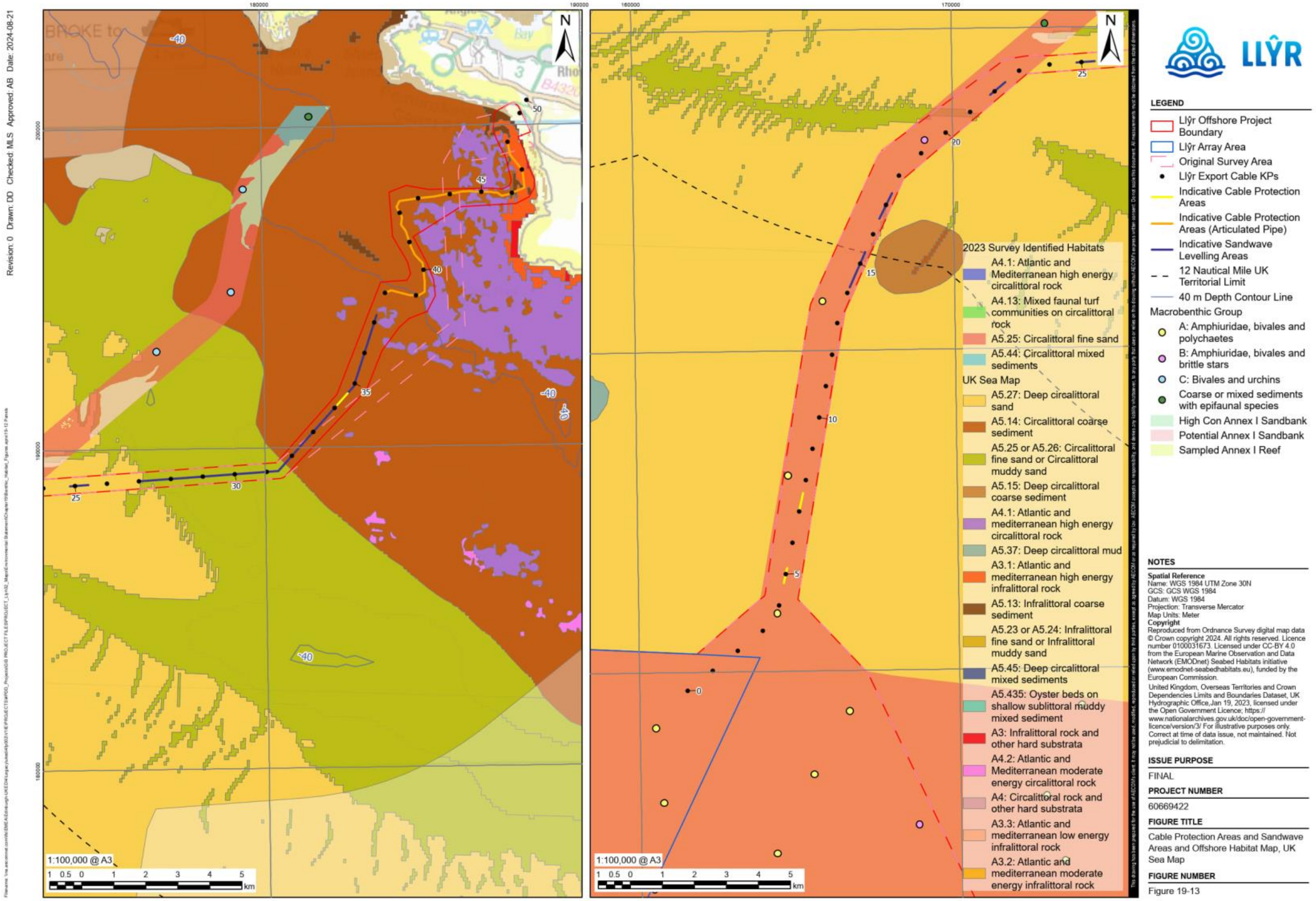


*Figure 19-13 Areas of the OfECC requiring cable protection and sand wave levelling plus seabed habitats*

**Array Area**

127. Activities occurring within the Array Area which could cause temporary disturbance are cable burial and the installation of turbine anchors and mooring lines (**Table 19-10**). Assuming all the cable can be buried this would result in a worst-case scenario of 427,500 m$^2$ of temporary disturbance. The habitat within this area was flat, featureless, sand dominated habitat with minimal sediment mobility. There is therefore, no sand wave levelling predicted to be required anywhere within the Array Area and disturbance is limited to cable installation swathe.

*Magnitude of impact*

128. Due to the extensive distribution of the sand and gravel sediment habitat throughout the region, and the small area affected, any temporary disturbance in the proposed Project Area OfECC and Array Area are not likely to have a large effect on the wider distribution and extent of such habitats. Sublittoral sands and gravels, particularly in shallow waters, are highly mobile and dynamic habitats and therefore, the sediment is expected to redistribute and recover the habitat within a short time frame of less than 12 months (RPS, 2016), resulting in a negligible magnitude.
129. In the regions of the OfECC identified as having a potential requirement for sandwave levelling (Figure 19-13) the seabed is naturally highly dynamic and has been assessed to have some capacity to recover from this disturbance (**Chapter 17: Physical Environment**). No sandwave levelling is predicted for the Array Area. The impact of disturbance from sandwave levelling was therefore assessed as temporary, with recovery likely, and as such considered to be of a small magnitude. These physically dynamic habitats support sparse faunal communities and so temporary physical disturbance is not expected to impact overall ecosystem functioning. Therefore, the magnitude of the effect to benthic ecology is considered to be **negligible**.

*Sensitivity of the receptor*

130. Sublittoral sands and gravels are considered to be regularly exposed to disturbance from wave action and currents, particularly in shallower water. Therefore, the habitat and associated fauna are considered to have some habitualisation to disturbance. In deeper waters recovery from temporary disturbance to the seabed is expected to take longer but redistributed sediments will be rapidly recolonised, by both infauna and epifauna, and habitats expected to recover within a period of a few years. Thus, this habitat is assessed as having a **low** sensitivity to temporary disturbance.

*Significance of the effect*

131. The magnitude and sensitivity are assessed as negligible/small and low respectively. Combined with a low importance, the effect of temporary disturbance on this receptor is assessed as **negligible** and therefore **Not Significant**.

**Temporary increase in suspended sediment concentration (SSC) and sediment deposition leading to temporary turbidity, smothering effects and contaminant mobilisation**

132. Construction activities associated with the proposed Project, such as ploughing and jet trenching, have the potential to temporarily increase SSC by creating sediment plumes in the water column which can travel away from the Offshore Development Area before depositing sediment elsewhere on the seabed. Increased SSC can result in several potential effects to benthic receptors, including reduced rates of photosynthesis via a reduction in light availability in turbid conditions, reduced feeding efficiency of filter feeders if clogging of filtering systems

occurs and the smothering of invertebrate species. Indirect effects on benthic species from the release of sediment contaminants, such as heavy metals and hydrocarbons, can be discounted since chemistry results indicate contamination levels are regional.

133. The largest sediment plumes and highest levels of increased SSC are associated with the disturbance of sediments which have a high proportion of fine particulate matter, such as muds and clays. These fine sediments remain in suspension for longer and therefore travel the furthest distance from the source of disturbance, settling to the seabed more slowly (**Table 19-14**). In comparison, coarser materials such as sand and gravel are expected to settle more quickly within a few hours of disturbance and within only a few tens of metres from the source (**Table 19-14; Chapter 17: Physical Environment**).

134. The extent of sediment dispersion and deposition as a result of the proposed Project activities have been assessed in **Chapter 17: Physical Environment** (see Section 17.9.1 for further detail). The results of the assessment identified four main zones of effect, based on the distance from the activity causing disturbance, which are summarised in **Table 19-14** below.

*Table 19-14. Zones of effect of increased SSC*

| Zone including distance from disturbance | At time of disturbance | More than one hour after end of disturbance |
|---|---|---|
| **0 m – 50 m**<br>Zone of highest SSC increase and greatest likely thickness of deposition. All gravel sized sediment likely deposited in this zone and large proportion of sands that are not resuspended high into the water column | Very high SSC increase (tens to hundreds of thousands of mg/l);<br>Lasting for duration of active disturbance plus up to 30 minutes following end of disturbance;<br>Sands and gravels may deposit in local thicknesses of tens of centimetres to several metres; and<br>Fine sediment unlikely to deposit in measurable thickness. | No change to SSC; and<br>No measurable ongoing deposition. |
| **50 m – 500 m**<br>Measurable SSC increase, measurable but lesser thickness of deposition.<br>Mainly sands that are released or resuspended higher in water column and resettling to seabed | High SSC increase (hundreds to low thousands of mg/l);<br>Duration of active disturbance plus up to 30 minutes following end of disturbance;<br>Sands and gravels may deposit in local thicknesses of tens of centimetres; and<br>Fine sediment unlikely to deposit in measurable thickness. | No change to SSC; and<br>No measurable ongoing deposition. |
| **500 m to tidal excursion buffer**<br>Lesser but measurable SSC increase, no measurable thickness of deposition. Mainly fines held in suspension for more than one tidal cycle. | Low to intermediate SSC increase (tens to low hundreds of mg/l);<br>SSC caused by remaining fines in suspension;<br>Narrow plume (tens to few hundred metres wide);<br>SSC rapidly dispersing to ambient levels within one day after end of active disturbance; and<br>Fine sediment unlikely to deposit in measurable thickness. | **One to six hours after end of active disturbance**<br>Decreasing to low SSC (tens of mg/l);<br>Fine sediment unlikely to deposit in measurable thickness.<br>**Six to 24 hours after end of active disturbance**<br>Decreasing gradually to background levels through dispersion; |

| Zone including distance from disturbance | At time of disturbance | More than one hour after end of disturbance |
|---|---|---|
| | | Fine sediment unlikely to deposit in measurable thickness; and<br>No measurable change from baseline SSC after 24 to 48 hours following end of activities. |
| **Beyond tidal excursion buffer** | No expected impact or change to SSC nor a measurable sediment deposition. | N/A |

135. The majority of the sediment in the OfECC and the Array Area is dominated by sand and gravel particles, which are expected to have deposited in tens of centimetres thickness on the seabed between 50 m – 500 m away of the source of disturbance (**Table 19-14**). A small proportion of the surveyed sediments across nearshore and offshore sections of the Offshore Development Area consisted of mud and therefore there is the potential for a very fine layer of mud to be deposited beyond 500 m during construction, though this will be very limited (**Table 19-14**). Thus, based on the modelling undertaken, any measurable change in suspended sediment concentrations during construction will be temporary and localised, with the majority of sediments settling close to the area of disturbance.

136. Sediment chemistry indicated contamination levels are consistent with concentrations present at a regional level and so any increase in contaminant levels as a result of sediment mobilisation is not considered likely.

137. Several mitigation measures are embedded into the proposed cable construction methods to minimise increased SSC during the construction phase of the proposed Project. These are outlined in **Section 19.7** and include the selection of the most appropriate installation method based on the local sediment conditions. Taking this into consideration, further assessment of the effect of increased SSC on benthic habitats and species in the OfECC and Array Area is provided in the relevant sections below.

**OfECC**

*Annex I Reefs*

138. Annex I Reef was identified in the Study Area, close to the OfECC in the nearshore area. These habitats could, therefore, be at risk of an impact from increased SSC and deposition from cable installation activities. Reef habitats support diverse assemblages of sessile species, such as coral, sponges and ascidians and blue mussels, that will be unable to avoid increases in SSC.

**Magnitude of impact**

139. The only construction activity that would result in any notable sediment disturbance is the break-out of the HDD drilling at KP48. All other cable installation in the nearshore area is the surface lay of iron articulated pipe directly on the seabed, resulting in minimal disturbance of sediments.

140. The volume of drilling mud that will be released into the marine environment at HDD breakout is estimated to be 1,700 $m^3$, as a worst case scenario. The drilling mud will comprise an inert fine particulate material such as bentonite. The fine particles are expected to become suspended in the water column but based on the low volume and the highly dynamic nature in the bay these will be rapidly dispersed and any settlement on the seabed will be widespread and not expected to be noticeable above the existing layer of fine sediments within turf

communities observed on much of the reef habitat (Appendix 19D: 2024 DDV Survey Report). Thus, the magnitude of impact is considered to be negligible.

**Sensitivity of the receptor**

141. The importance of this receptor is high and there will be some filter feeding animals, such as sponges and mussels, present. However, the bay is very dynamic and there was evidence of some particulate matter naturally occurring in this region, such as seen within turf communities and within some of the channels with the reef. Thus, communities in this region can be considered to be of **medium** sensitivity.

**Significance of the effect**

142. The magnitude of this impact has been assessed as negligible, and the sensitivity of the receptor is considered to be medium. This, coupled with the relatively low volume of particulate material released, the natural dispersal of sediment by water movements in the nearshore area and likely tolerance of many of the assemblages to some increased SSC and smothering the effect of SSC on Annex 1 reef in this area of the OfECC is considered to be **minor** and therefore **Not Significant**.

*Annex I Sandbanks*

143. The OfECC avoids direct impacts on the Annex 1 Turbot Bank (**Figure 19-5** ) as the cable will also be surface laid between KP42 and KP38 and there is not anticipated to be any significant level of sediment disturbance.

**Magnitude of impact**

144. On the basis of the sediment type known to be present in the OfECC and near vicinity, any increase in SSC is considered to be localised and temporary. Furthermore, the majority of the sediment consists of sand or gravel. Gravel is expected to settle to the seabed very quickly, within metres of the disturbance, and sand within a few tens of metres. Therefore, an increase in SSC and deposition of sediment into Annex I sandbanks is not anticipated to result in considerable changes to the habitat. Therefore, the magnitude is considered **negligible** due to the localised and temporary disturbance.

**Sensitivity of receptor**

145. Sandbanks are dynamic features and usually occur in shallow depths near the coastline. They are therefore, naturally exposed to wave action, turbidity and varying levels of energy. In addition, the majority of the sediment likely to be disturbed is sand, and thus, the addition of sediment from deposition following increased SSC is not expected to cause a deviation from baseline conditions. Therefore, the sensitivity to increased SSC is considered to be **negligible**.

**Significance of the effect**

146. Both the magnitude and sensitivity have been assessed as negligible. With the incorporation of mitigation measures into the cable layout design such as micro-routing and selection of suitable installation methods, the effect is therefore assessed as **negligible** and **Not Significant**.

*Subtidal Sands and Gravels*

147. Sublittoral sands and gravel were identified as having an extensive distribution in the Study Area (see **Section 19.5.1**) and within the Offshore Development Area. This habitat supports infaunal communities but there may also be some mobile species including crustaceans and echinoderms.

**Magnitude of impact**

148. SSC and depositional loads will vary along the OfECC depending upon the local environmental conditions. However, the short-term and highly localised increases of SSC and turbid conditions are considered to be of **negligible** magnitude given the wider extent of this habitat in the Celtic Sea and Bristol Channel.

**Sensitivity of receptor**

149. The infaunal communities that dominate this habitat type are generally tolerant of the levels of SSC and sediment deposition anticipated to result from construction of the proposed Project (e.g. De-Bastos and Rayment, 2022) and therefore it is expected that they will have a good capacity to quickly recover. As a result, this receptor is considered of **low** sensitivity.

**Significance of the effect**

150. The magnitude has been assessed as negligible, with receptors considered to have a low sensitivity. With the incorporation of measures into the cable layout design, the overall effect is considered to be **negligible** and therefore **Not Significant**.

<u>*Other HOPI present*</u>

151. Increased SSC also has the potential to affect HOPI listed under Section 7 of the Environment Wales Act (2016) within the Study Area (**Figure 19-4)**. Several HOPI are present at a distance of a few to several kilometres of the ECC, including green crenella beds (*Musculus discors*) and fragile sponge and anthozoans on bedrock habitats. All other HOPI listed in **Section 19.5.1** are considered to fall within the zones where increased SSC is considered to be moderate (**Table 19-14**; **Figure 19-6**) and are therefore considered to be capable of tolerating small-scale deposits of fine material.

152. Therefore, in light of the information provided above, green crenella beds, pink sea fan, fragile sponge and anthozoans and other HOPI are considered to be of **low** sensitivity to temporary increase in SSC.

**Magnitude of impact**

153. Green crenella beds are not located under the direct footprint of the proposed Project, and considering the majority of sediment is considered to be sand and therefore coarse, it is anticipated that green crenella beds will only be exposed to low levels of increased SSC and smothering. Fragile sponges and anthozoans are located within the vicinity of the vicinity of the cable corridor and may therefore experience more exposure to increased SSC. Sea caves, which are a cross-boundary feature of the Limestone Coast SAC and Pembrokeshire Marine SAC, are located beyond 500 m from the proposed Project and therefore any sediment deposition is considered to be very low. Furthermore, the sea caves are located in the intertidal zone in the Study Area and are exposed to strong wave action which disturbs coarse sediment on the cave floor. Therefore, species and communities inhabiting these caves are considered to have some habitualisation to increased SSC. Due to movement of water in the Study Area and the characterisation of soft sandy habitat, any increases in SSC are expected to be highly localised and short-term, minor and of **negligible** magnitude.

**Sensitivity of the receptor**

154. Green crenella beds are suspension feeders and are typically found in exposed areas of the coastline where there is regular disturbance to the sediment (Tyler-Walters, 2001; Readman and Hiscock, 2017). Both species are considered to have a high tolerance and low sensitivity to moderate increases in SSC and smothering with a good capacity to recover quickly.

155. Fragile sponges and anthozoans overlap with the footprint of the proposed Project, at the entrance to Milford Haven. This habitat is considered to be made up of several different

species, including *Homaxinella subdola*, ross (*Pentapora foliacea*), yellow staghorn sponge (*Axinella dissimilis*), yellow cluster anemone (*Parazoanthus axinellae*) and crumpled duster sponge (*Axinella damicornis*) (NRW, 2023). Several of these species are typically found covered in a layer of silt and/or in exposed conditions (Reeve, 2005; Jackson, 2016; Jackson, 2008; Ager, 2007) and therefore are expected to have a high tolerance to increases in SSC and subsequent deposition. In addition, the yellow cluster anemone is often encrusted with sand granules (Ager, 2007). The yellow staghorn sponge is considered to have a higher sensitivity to increased SSC and smothering, however, it is often found on open exposed coasts (Jackson, 2008) and is therefore considered to be capable of tolerating small-scale increases in SSC as a result of the proposed Project.

156. Therefore, sensitivity of the benthic habitats present in the OfECC zone of influence are considered to be **low**.

**Significance of the effect**

157. The magnitude of the impact is considered to be negligible. All receptors are also considered to have a low sensitivity to the impact. Therefore, the overall effect is considered to be **negligible** and **Not Significant**.

**Array Area**

<u>*Sublittoral Sands and Gravels*</u>

158. Soft sediments including sublittoral sands and gravel dominate the Array Area (see **Section 19.5.1**). This habitat supports infaunal communities but there may also be some mobile species including crustaceans and echinoderms which could be affected by increased SSC.

**Magnitude of impact**

159. SSC and depositional loads will vary within the Array Area depending upon the local environmental conditions. However, the short-term and highly localised increases of SSC and turbid conditions are considered to be of **negligible** magnitude given the wider extent of this habitat in the Celtic Sea and Bristol Channel.

**Sensitivity of the receptor**

160. The infaunal communities that dominate this habitat type are generally tolerant of the levels of SSC and sediment deposition anticipated to result from construction of the proposed Project (e.g. De-Bastos and Rayment, 2022) and therefore it is expected that they will have a good capacity to quickly recover. As a result, this receptor is considered of **low** sensitivity.

**Significance of the effect**

161. The magnitude has been assessed as negligible, and sensitivity is considered to be low. Therefore, the overall effect is considered to be **negligible** and thus **Not Significant**.

**Impact of changes to marine water quality from the use of HDD drilling fluids**

162. Installation of the export cable between the terrestrial and marine environment will be undertaken via HDD below the intertidal zone of Freshwater West, exiting at a water depth of around 3 - 5 m (**Volume 1, Chapter 04: Description of the Proposed Project**), and therefore in a dynamic area with considerable wave action and tidal water movement.

163. The use of HDD and therefore the discharge of drilling fluids at the breakout location at the landfall has the potential to alter marine water quality and negatively affect benthic receptors in the surrounding habitat at Freshwater West. It has been estimated that up to 1,700 $m^3$ of drill cuttings will be generated (see **Table 19-10**). However, all drilling fluids used, such as bentonite, will be selected from the OSPAR List of Substances/Preparations Used and Discharged Offshore (2021) which are considered to 'Pose Little or No Risk to the Environment' (PLONOR).

164. Due to the small amounts of fluid, if any, likely to be released, it is anticipated that only a temporary local reduction in water quality at the HDD breakout may occur. Therefore, only receptors in the immediate vicinity of the HDD breakouts have the potential to be in contact with drilling fluids if a leak or spill occurs. Much of the mud will be released in sand dominated habitat where faunal communities are unlikely to significantly affected. Some particulates from the drilling muds may settle on bedrock but due to the dynamic nature of the shallow subtidal environment, any fluid is expected to be rapidly diluted and dispersed within the marine environment (**Chapter 18: Marine Water and Sediment Quality**).

**Magnitude of the effect**

165. The magnitude of the effect of any change in water quality as a result of the release of drilling mud is considered to be **small** due to the highly localised, temporary nature of the release of inert muds, which will be rapidly ameliorated by natural processes.

**Sensitivity of receptor**

166. The HDD exit point is within largely sandy habitat, which is likely to support infaunal communities that will not have high sensitivity to drilling mud that may settle temporarily on the seabed. There are also bedrock reef habitats in the vicinity of the HDD exit point that support epifaunal species that may have higher sensitivity to increase sediment load but considering the low volume of drill arisings, the generally dynamic nature of the shallow water environment, and the presence of sandy areas, there is likely to be natural resuspension of sediments occurring due to tides and wave action. Therefore, the sensitivity of any receptors likely to be in the vicinity of any HDD fluid release is considered to be **low**.

**Significance of the effect**

167. The magnitude has been assessed as small, and sensitivity is considered to be medium. Accounting the nature of the effect, the habitats present and the likely time for recovery the effect of the release of drilling mud on water quality is assessed as **negligible** and therefore **Not Significant**.

**Impact of changes to marine water quality from accidental leaks and spills**

168. A deterioration in water quality from the accidental release of pollutants (e.g., oil, fuels, lubricants, chemicals) and planned release of wastewater from any of the vessels associated with the Construction Phase activities could result in increased turbidity, deposition and contamination that may affect benthic habitats and species. However, on the basis of the embedded mitigation measures in relation to accidental spills, and the small magnitude of any accidental releases from proposed Project activities, the impact of changes to marine water quality have been assessed as minor and Not Significant (**Chapter 18: Marine Water and Sediment Quality**).

**Magnitude of impact**

169. The benthic environment in the OfECC and Array Area consist of sand, muddy sand and gravelly sand, with areas of Annex I reefs and sandbanks supporting a diverse range of benthic fauna which could be susceptible to the effects of spills, particularly those which are less mobile. Substances from leaks and spills could also accumulate in intertidal sea caves in the Study Area, disrupting communities utilising the cave habitats. Such habitats support a range of species assemblages which could be susceptible to impacts resulting from accidental spills (**Section 19.5.1**).

170. Potential impacts can be temporary and short-term or more long-term, with the potential for contaminants to be present in the water column and also settle into sediment, remaining there for prolonged periods of time.

171. To ensure the risk of accidental spills is as low as reasonably practicable, the proposed Project will adhere to relevant guidance (e.g., Pollution Prevention Guidance). A Construction Environmental Management Plan (**Appendix 04A: Outline CEMP**) including an Emergency Spill Response Plan and Waste Management Plan will be implemented during the construction phase of the proposed Project to minimise releases. Appropriate Health, Safety, and Environment (HSE) procedures (identified in the CEMP) will also be implemented, with strict weather and personnel limits to reduce any risk of accidental spillage. Furthermore, preparedness and swift response is essential for effective spill management and as such, response plans will be in place should an incident occur. Control measures and Shipboard Oil Pollution Emergency Plans (SOPEP) will be in place and adhered to under MARPOL Annex I requirements for all vessels. Planned effluent dischargers will be compliant with MARPOL Annex IV 'Prevention of Pollution from Ships' standards.

172. With these mitigation measures in place, the risk of an accidental leak or spill is considered unlikely. However, should it occur, the leak or spill is expected to be minor, localised and temporary with only small amounts of pollutant released into the marine environment which will be subject to immediate dilution and dispersion over the tidal cycle (see **Chapter 17: Physical Environment**). Therefore, the magnitude of the impact is considered to be **small**.

**Sensitivity of the receptor**

173. The sensitivity of any benthic receptors to any leaks or spills is considered to be variable and so sensitivity is considered to range between low and **high** since toxicity and smothering could result in the mortality of some species but not others.

**Significance of the effect**

174. The magnitude has been assessed as small, with many species having high sensitivity. However, based on the low likelihood, and very localised effects because any spills would be small, plus the mitigation measures available, the effect is considered to be **minor** and therefore **Not Significant**.

**Introduction and spread of INNS from vessels**

175. The introduction of INNS could occur from the different vessels that may be required during the construction phase (and any subsequent repairs that may be required during the operational phase) of the proposed Project.

176. The Great Britain Invasive Non-Native Species Strategy provides guidance for the prevention, detection, eradication and management of INNS, including marine species (NBN, 2021). Best practice measures will be adopted, in particular, all proposed Project vessels will adhere to the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) with the aim of preventing the spread of INNS (IMO, 2017). In addition, vessels will be required to adhere to the IMO guidelines for the control and management of ships' biofouling to minimise the transfer of invasive aquatic species (Biofouling Guidelines) (resolution MEPC.207(62). These measures, implemented through the proposed Project CEMP (**Appendix 04A: Outline CEMP**) and INNS risk assessment (**Appendix 04B - Invasive Non-Native Species Management Plan**), lower the probability of INNS transmission from vessels to the marine environment.

**Magnitude of impact**

177. All proposed Project vessels involved in the construction phase of the proposed Project will adhere to the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) with the aim of preventing the spread of INNS (IMO, 2022). In addition, vessels will be required to adhere to the IMO guidelines for the control and management of ships' biofouling to minimise the transfer of invasive aquatic species

(Biofouling Guidelines) (resolution MEPC.207(62)). These measures lower the probability of non-native species transmission from vessels to the benthic habitat.

178. No INNS were identified in the OfECC during the project-specific benthic survey (**Appendix 19A: Nearshore 2023 Benthic Survey Report** and **Appendix 19B: Offshore 2023 Benthic Survey Report**). Benthic surveys conducted for Project Erebus identified several INNS towards the mouth of Milford Haven (Marine Space Ltd, 2019a) though these did not overlap with the proposed Project. In addition, there is a very low likelihood of the spread of INNS from project activities, particularly considering the protective embedded mitigation measures in place (including a proposed Project level INNS risk assessment and management plan - see **Appendix 04B - Invasive Non-Native Species Management Plan**), the introduction and subsequent risk of INNS is considered unlikely. As a result, the introduction and subsequent risk of non-native invasive species is assessed as having a **negligible** magnitude.

**Sensitivity of the receptor**

179. The sensitivity of benthic habitats and species to INNS can be high, particularly for species that outcompete native species, but the spread of INNS in intertidal habitats is more of a concern than subtidal zones (e.g. see OSPAR, 2023). Therefore, sensitivity of benthic receptors in the Project Area, which are all subtidal, is considered to be **low**.

**Significance of the effect**

180. On the basis of low sensitivity and negligible magnitude the effect is considered to be **negligible** and thus **Not Significant**.

### *19.8.2. Operation and Maintenance (O&M) Effects*

**Permanent direct loss and physical disturbance to benthic habitats and species**

**OfECC**

181. Cable and scour protection, in the form of rock berms or concrete mattresses are likely to be needed at some locations where a minimum cable burial depth of 0.8 m cannot be achieved. Introduction of hard substrate would replace the existing seabed, leading to the permanent loss of these habitats and species.

182. Until construction has commenced, it is not yet known specifically where cable protection and/or scour protection will be required along the OfECC. However, based on currently available data it has been estimated that a total distance of 1,600 m of the OfECC will require cable protection. Assuming a berm width of 5 m for each of the two cables this will cover a total area of 16,000 m$^2$, with the majority of the protection predicted to be required in the coarse sediment habitats of the nearshore area (**Figure 19-13**).

183. There will also be protection at the HDD punch-out point, which may be rock protection and/or concrete mattressing, estimated to cover a total area of 100 m$^2$ for both bores. Any cable protection installed at the HDD exit will not exceed pre-construction seabed level.

184. Concrete mattressing, or similar, has been assumed for four of the five known cable crossings **(Volume 1, Chapter 4: Project Description**) covering a total area of 8,000 m$^2$. Thus, total habitat lost due to the placement of cable or crossing protection in the OfECC has been estimated to be a maximum of 24,100 m$^2$.

185. Additionally in the nearshore area between KP38 and KP48, each cable will be protected using iron articulated pipe protection. It has been assumed 11,000 m2 of this type of protection will be required (10,000 m with a 10% contingency), which represents 22.4% of the total cable. The articulated pipe will be up to 500 mm diameter once installed per cable which will result in an area of up to 11,000 m$^2$ of seabed on which articulated cable could be lain. Within this nearshore area, no other cable protection measures are proposed.

186. The estimated locations and distances, and the habitat type present, where cable protection is considered likely, is a total distance of 1,600 m per cable, are as follows:

- KP34: a short section of 500 m in coarse sediments beyond the nearshore;
- KP7: a distance of 600 m of sand habitat; and
- KP5: a distance of 500 m of sand habitat.

187. All crossings and articulated cables will be on sand and gravel habitats.

188. No other cable protection is currently estimated for any areas where there are Annex 1 Sandbanks or Annex 1 Reefs that are designating features of the Pembrokeshire Marine SAC. Habitats identified as needing cable protection are restricted to sublittoral sands and gravels, with varying contributions of gravel and mud. These habitats are listed under the Environment (Wales) Act (2016) but are not designating features of relevant protected sites.

**Magnitude of impact**

189. Due to the widespread distribution of this habitat, the placement of some hard substrate is unavoidable. Furthermore, although such habitats are typically characterised by sandy sediment, coarser sediment types such as boulders and cobbles can also be present which could prevent the target burial depth being reached.

190. However, given the extent of this habitat within the Study Area and wider Celtic Sea, and the small spatial scale of potential permanent habitat loss through the placement of hard substrate, estimated to be a distance of only 1,600 m, this effect would not be expected to have larger effects on the widespread distribution of this habitat. Any loss is considered to be highly localised and limited to isolated areas where hard substrate is placed, and therefore, the overall functioning of the ecosystem is not expected to be impacted. Compared to the extent of this habitat in the wider area and Celtic Sea, the magnitude of the impact is assessed as **negligible**.

**Sensitivity of receptor**

191. Sands and gravels cover a large spatial range in the Celtic Sea and therefore the loss of a small amount of this habitat is not considered to result in a considerable decline of the sediment types. Therefore, this receptor is considered to be of medium importance but of **low** sensitivity.

**Significance of the effect**

192. The magnitude is assessed as negligible and the sensitivity of the receptor is considered to be low. Therefore, the overall effect is assessed as **negligible** and thus **Not Significant**.

**Array Area**

193. The sources of permanent habitat loss in the Array Area are cable and scour protection, placement of clump weights for the mooring line, scour protection for the anchors, installation of drilled pile anchors and the presence of a subsea connector on the seabed (**Table 19-10**). The total footprint of habitat loss within the Array Area is estimated to be 37,096 $m^2$. The seabed habitats in the Array Area are relatively homogenous, with sediments dominated by sand with varying compositions of gravel and small contributions of mud.

**Magnitude of impact**

194. Any effects of habitat loss are expected to be highly localised. These sediments are also present across much of the Study Area and beyond. Therefore, although this habitat is listed under the Environment (Wales) Act (2016), the total permanent loss of 37,096 $m^2$ of sublittoral sands and gravels due to placement of hard substrates is considered to represent a negligible

extent compared to the wider distribution and availability of the same habitat elsewhere in the Study Area.

195. Furthermore, upon decommissioning, if/when hard substrate is removed (see **Section 19.8.3**), the mobile nature of such sediments will result in the redeposition of sands and gravels into the affected areas. Therefore, due to the highly localised areas which could be affected, the magnitude of permanent loss to sublittoral sands and gravels in the Array Area is assessed as **negligible**.

**Sensitivity of receptor**

196. Sublittoral sands and gravels in the Array Area are considered to have a **low** sensitivity to permanent habitat loss from cable protection placement due to their widespread distribution and the habitat lost will be replaced by particulate material, albeit of a larger particle size than much of the seabed in the Array Area. They are considered to be of medium importance.

**Significance of the effect**

197. The magnitude is considered to be negligible and the receptor is considered to be of low sensitivity to the impact. Therefore, the overall effect is assessed as **negligible** and thus **Not Significant**.

**Temporary increase in SSC and sediment deposition**

198. A worst-case scenario of up to five cable repairs over the lifetime of the proposed Project has been assumed (**Table 19-10**). During cable repairs and maintenance activities, which could include the remedial reburial of exposed cables, there is the potential for small, localised, temporary increases in SSC. Such increases could lead to sediment plumes affecting the turbidity of the water column and the smothering of invertebrates during the settlement of those particles. The remobilisation of contaminants is not a concern as the concentration of heavy metals, hydrocarbons and other pollutants in the sediments of the Offshore Development Area have been found to be consistent with the wider area (**Section 19.5.1**).

199. Due to the expected shorter period of time over which each of the instances of repair and reburial would take place compared to the Construction activities, the very localised nature of the works which would occur predominantly in sand and gravel habitats, any local increases in SSC and sediment deposition will be no greater than that associated with Construction (as discussed in detail in **Section 19.8.1**).

**Magnitude of impact**

200. As a worst-case scenario, the magnitude of the impact is considered to be the same as during the construction phase. Therefore, the magnitude is assessed as **negligible** to **low** for the range of habitats present in the OfECC and Array Area.

**Sensitivity of the receptor**

201. As a worst-case scenario, the sensitivities of the receptors are considered to be the same as during the construction phase. Therefore, the sensitivity is assessed as **negligible** to **low**.

**Significance of the effect**

202. As both magnitude and sensitivity have been assessed as negligible to low, the impact is considered to be **negligible** and **Not Significant**.

**Alteration and/or indirect loss of habitat during the operational lifetime of the proposed Project**

203. The proposed Project involves the introduction of new infrastructure which could result in the alteration and/or loss of habitat during its operational lifetime. Habitat loss is considered at

the point of installation, in the construction section above, but will endure for the operational duration of the proposed Project.

204. New infrastructure present on the seabed could increase heterogeneity of the seabed habitat, facilitating the growth of new biological communities. The infrastructure includes cable protection in the OfECC and Array Area, the placement of export cables, IACs and associated mooring and anchoring systems with scour protection, and a subsea connection box in the Array Area (**Table 19-10**). The total footprint of this infrastructure is 35,100 $m^2$ in the OfECC and 37,096 $m^2$ in the Array Area.

**ECC**

*Sublittoral Sands and Gravels*

205. The ECC consists predominantly of soft sandy sediment and includes sublittoral sands and gravels which are listed under the Environment (Wales) Act (2016).

**Magnitude of impact**

206. An increase in harder ‘substrate’ could cause alterations to the local community composition which sublittoral sands and gravel habitats support. This includes positive impacts such as increasing biodiversity and heterogeneity of habitat. However, this could also result in negative impacts by reducing the amount of soft substrate available, resulting in competition for suitable habitat and foraging grounds for example. In relation to cable protection, in respect of rock protection as a worst-case, individual rock armour units that comprise cable protection berms are typically approximately 2 to 30 cm in diameter. The total area of habitat lost or altered by such hard structures is considered to be small compared to the overall availability of soft sediment in the wider marine area of the Celtic Sea and Bristol Channel, and therefore, overall ecosystem functioning is not expected to be impacted. Therefore, the magnitude of the impact is considered to be **small**.

**Sensitivity of the receptor**

207. Due to the total amount of available habitat of this nature in the wider Celtic Sea and Bristol Channel, any affected receptors are expected to exhibit avoidance behaviour and utilise other suitable areas. Therefore, sensitivity to this impact is considered to be **low**.

**Significance of the effect**

208. Magnitude has been assessed as small and sensitivity of the receptor has been assessed as low. Therefore, the effect is **negligible** and **Not Significant**.

**Array Area**

209. It is anticipated that if not dynamic in the water column, the IACs will be buried from the touchdown point (located up to 150 m from each WTG) under the soft sediment which dominates the Array Area and therefore cable protection is not expected. However, there is a possibility that it may still be required and so cable protection as a worst-case, along the entire length of the IAC, is assessed for habitat alteration.

210. The IAC cables associated with the floating WTG, as well as mooring chains, any completely or partially exposed chain links or clump weights associated with the mooring system, exposed ends of drilled piles, and the presence of the subsea connector, could result in the modification of the habitat due to the introduction of hard ‘substrate’ in a largely sediment based habitat. This could lead to the development and establishment of new biological communities which can include positive impacts such as increasing biodiversity and heterogeneity of habitat.

211. Growth and zonation of marine organisms on offshore WTG structures is commonly observed and is often influence by location, seasonality, construction materials and spatial orientation (Martinez-Luengo *et al*., 2017). Species typically recorded growing on WTG structures include

mussels *Mytilus edulis* (which are present within the OfECC but not in mussel bed form), soft corals including dead man's fingers *Alcyonium digitatum* and anemones including the frilled anemone *Metridium senile*. However, material such as concrete is usually a poor material for the development of diverse benthic communities (Natanzi *et al*., 2021) and most of the available hard surfaces, with the exception of cable protection if required, will be minimal.

**Magnitude of impact**

212. The placement of cable protection along the IAC route will cause a permanent change in the characteristics of the seabed from natural sands and gravels to introduced cable protection that is likely to be dominated by gravel, pebble and cobble sized particles, mostly larger than the natural seabed sediment. The size and nature of any protection will determine the species that colonise the introduced material and will have some coarser sediments similar to those naturally present in the region. The overall diversity of species that colonise the cable protection is not anticipated to be significantly different to the surrounding area but the density of some particular species, that are more common on large particulate material, may be higher. The extent of cable and scour protection in the Array Area is at a small spatial scale, and as the new material has some similarity with some seabed particles, the magnitude of habitat change as assessed as **small**.

213. The total footprint of mooring infrastructure in the Array Area is expected to be limited to 8,000 $m^2$ from clump weights, pin piles and the subsea connector. There are no crossings expected in the Array Area. In comparison to the total area of soft sediments in the wider Study Area, Celtic Sea and Bristol Channel, this is considered to be a small proportion of available habitat for soft-sediment-dwelling organisms. Furthermore, the placement of hard structures in the Array Area will be highly localised and will not impact overall functioning of the ecosystem. Therefore, the majority of impacts are considered to be beneficial towards benthic species. Therefore, the magnitude is assessed as **small**.

**Sensitivity of the receptor**

214. The introduction of new biological communities may result in increased competition for food, prey items and shelter. However, the introduction of new communities is considered to be localised to the hard structures rather than the existing soft-sediment habitat. Furthermore, due to the widespread distribution of this habitat in the wider Celtic Sea and Bristol Channel, the affected area is considered to be small compared to the total available, suitable habitat. Therefore, any affected receptors are considered to move away from the area. As a result, the receptor is considered to have **low** sensitivity to increased heterogeneity and new biological communities.

**Significance of the effect**

215. Magnitude has been assessed as small, with sensitivity considered to be low, resulting in a **negligible** effect that is **Not Significant**.

**Changes to benthic habitats due to on-going scour, changes in hydrodynamics, increased sedimentation and smothering, and abrasions, from the movement of mooring chains**

216. Several activities which involve the introduction of new infrastructure as part of the proposed Project that could result on-going scour and abrasion around proposed Project infrastructure. These activities include:

- The placement of cable protection (rock berms, grout bags or concrete mattresses) which would be left in place for the operational phase; and
- The placement of IACs and associated mooring/anchoring systems on the seabed.

**OfECC**

217. It is likely that cable protection will be required in several locations along the length of the OfECC where minimum burial depth of 0.8 m cannot be reached. However, the total distance for such cable protection is estimated to be 1,600 m and is therefore limited. As discussed in further detail in **Chapter 17: Physical Environment**, the design of the cable protection, based on a worst-case scenario of rock berms, is such that there is limited potential for flow disturbance and scour. However, the placement of cable protection, in the form of rock berms, grout bags or concrete mattresses, may cause local elevations in turbulence which could cause secondary scour. All scour associated with the proposed Project is anticipated to have a ZoI of a few to tens of metres from the structure and tens of centimetres deep, resulting in being highly localised. Therefore, nearby habitats such sea caves and mussel beds are not considered to be at risk of affect from this impact.

218. The changes in hydrodynamics, changes in sediment transport and abrasions from movement of mooring chains on benthic receptors as a result of the placement of the structures listed above have also been considered. As discussed in further detail in **Chapter 17: Physical Environment**, changes to tidal currents and waves are expected to be very small, with any changes to the seabed, and therefore benthic receptors, difficult to discern from those which may occur under baseline conditions. Thus, the effect on benthic receptors from changes in sediment transport due to changes in the hydrodynamics are also considered to be minor and similar to baseline conditions.

219. Thus, benthic receptors within the OfECC at risk of impact from on-going scour, changes in hydrodynamics and changes in sediment transport and abrasion are within a few metres of the installed cable and therefore, the only habitat likely to be affected is 'Sublittoral sands and gravels which cover much of the Offshore Project Boundary with varying compositions of mud and gravel and which supports communities including polychaetes, echinoderms and bivalve molluscs.

**Magnitude of impact**

220. On-going scour is not expected to cause changes to the seabed in areas of soft sediment which are significantly different to the surrounding area. However, the highly mobile nature of the area suggests that any local disturbance or loss of habitat due to scour will be followed by recovery, with the seabed expected to continually return to baseline conditions when scouring or movement occurs, and any effects are considered to be highly localised. Therefore, the impact of an alteration and/or loss of soft sediment habitats from on-going scour is considered to be of **negligible** magnitude.

**Sensitivity of the receptor**

221. The seabed in the areas within which cable protection may be required, for example in the Pembrokeshire Marine SAC, are naturally highly mobile areas (see **Chapter 17: Physical Environment**) and therefore benthic receptors are considered to have some habituation to localised disturbance from scour and the associated movement of sediment or loss of habitat. Therefore, the receptor is assessed as **low** sensitivity.

**Significance of the effect**

222. Taking into account the negligible magnitude and low sensitivity of the receptor, the effect is considered **negligible** and is therefore assessed as **Not Significant**.

**Array Area**

223. Any completely or partially exposed chain links or clump weights associated with the floating platform and mooring system (and therefore the movement of mooring chains), or exposed ends of suction piles could also cause local scour. Scour around these structures is considered

to be very limited up to a few metres deep (although this is considered a maximum and is expected to be much less in reality) and less than 10 m in extent (Marine Space Ltd, 2019c). Therefore, only habitats within, or within close proximity to the Array Area are considered to be at risk from impact.

224. The changes in hydrodynamics, changes in sediment transport and abrasions from movement of mooring chains on benthic receptors as a result of the placement of the structures listed above have also been considered. As discussed in further detail in **Chapter 17: Physical Environment**, changes to tidal currents and waves are expected to be very small, with any changes to the seabed, and therefore benthic receptors, difficult to discern from those which may occur under baseline conditions. Thus, the effect on benthic receptors from changes in sediment transport due to changes in the hydrodynamics are also considered to be minor and similar to baseline conditions.

225. It is, however, possible that abrasions may occur during operation from localised movement of mooring chains in response to movement of the semi-submersible floating platform, as described in **Chapter 17: Physical Environment**. This has the potential to disturb and cause temporary loss of benthic receptors due to the sweeping of sediment up to 50 m in opposite directions, although movement is expected to be slow and occur both vertically and laterally.

226. Thus, benthic receptors within the Array Area at risk of impact from on-going scour, changes in hydrodynamics and changes in sediment transport and abrasion. Soft sediments, mostly sands and gravel, cover much of the Array Area with varying compositions of particle sizes that support mostly infaunal communities of polychaetes and molluscs and some echinoderms living on the seabed.

**Magnitude of impact**

227. Due to the highly mobile nature of the area, any sediments such as sand, mud and gravel are expected to be redistributed towards baseline conditions by background sediment transport processes. Therefore, the magnitude of impact to benthic receptors in the Array Area from changes in hydrodynamics, increased sediment transport, and abrasions from mooring chains is considered to be **negligible**, with any changes considered to be localised and small in extent.

**Sensitivity of the receptor**

228. Species which rely on the habitats in the Array Area are also expected to be habituated to movement of sediment and therefore are anticipated to recover rapidly and return to disturbed or temporarily lost habitat following ongoing scour or disturbance to the habitat during operation of the proposed Project. Although sublittoral sands and gravels are considered to have a medium importance, due to regular natural disturbance of a similar nature, the receptors are considered to have a **low** sensitivity to this type of disturbance.

**Significance of the effect**

229. Taking into consideration the negligible magnitude and low sensitivity, the effect is considered to be **negligible** and thus **Not Significant**.

**Disturbance to benthic habitats during planned maintenance and instances of cable failure and excavation**

**Offshore Export Cable and Array Area**

230. Maintenance and cable repair activities during instances of cable failure and excavation, where required, will be carried out using the same or similar methods as the Construction Phase activities, and therefore the potential pathways for impacts to benthic ecology are expected to be the same as those identified for the Construction Phase of the proposed Project.

**Magnitude of impact**

231. Repair works are likely to be highly localised to the area of concern and therefore the spatial extent of any impacts would be small. Furthermore, any maintenance or repairs works would be of a significantly shorter duration.

232. The impact on benthic receptors from the movement of mooring chains during the operational lifetime of the proposed Project has been assessed above as not significant. Movement of chains during planned maintenance is not expected to occur on a larger scale than during the normal operation of the proposed Project and is not considered to result in impacts greater than those discussed above.

233. The target burial depth of the installed offshore export cable is 1.2 m, which will be achieved wherever possible, with a minimum accepted burial depth of 0.8 m.

234. Maintenance and unforeseen cable repair (although unlikely) are considered routine, and the procedures and processes are well defined and common in the industry. Impacts of disturbance to benthic habitats during planned maintenance and repair would therefore be of **negligible** magnitude.

**Sensitivity of the receptor**

235. Sensitivity of receptors to disturbance during maintenance is likely to be no higher than that during construction, and in most cases is considered to be lower. Therefore, sensitivity is considered to range between **low** to **high**.

**Significance of the effect**

236. Magnitude is considered to be negligible, with sensitivity assessed as low to high. As any effects would occur on a much smaller scale than during operation or construction, the effect is predicted to be **negligible** and **Not Significant**.

**Effects of subsea cable thermal emissions**

237. The operation of electricity cables generates heat due to resistance in the conductor components, which can warm the cable surface and adjacent environment (i.e. sediments; Meissner *et al*., 2008). Submarine power cables have been shown to generate and dissipate heat when active, with some reaching cable surface temperatures of up to 70°C (Emeana *et al*., 2016). Temperatures such as these have the potential to cause sediment dwelling and for demersal mobile organisms to move away from the affected area. Increased heat could also alter the physico-chemical conditions, such as oxygen concentration, and bacterial activity in surrounding sediments, which may result in alterations to faunal composition and localised ecological shifts (Meissner *et al*., 2008).

238. The full effect of temperature changes on sediment composition and related biogeochemical cycling are unknown. However, preliminary studies which have been conducted have indicated that increased temperatures could cause shifts in the community composition of bacteria, with corresponding changes in NH4 concentrations and nitrogen cycling also occurring (Hicks *et al*., 2018).

239. The proposed Project consists of up to two 66 kV or 132 kV electricity export cables transmitting electricity from the wind turbines to the shore over a maximum estimated distance of 55 km. The export cables will be laid within separate trenches (which has a lower heat profile than bundled cables), with a target cable separation of 50 m, a target burial depth of up 1.2 m and a minimum of 0.8 m. The separation between the cables may decrease in some places between KP38 and the HDD exit point (KP48) as installation will be routed through the sediment and reef matrix in this region.

240. The 11 IACs will have a combined length of 17.31 km. For the purpose of this assessment, it is assumed they will be surface laid with up to 20% requiring cable protection, an estimate which

includes contingency and represents, therefore, a worst-case scenario. In water, heat will dissipate very quickly and, therefore, thermal effects from surface laid cables, including those with cable protection, and the dynamic cables on the environment are not expected (OSPAR, 2023) and can therefore, be discounted.

**Magnitude of impact**

241. Where buried, the cable will be below the depth at which infaunal benthic organisms are present. Therefore, the temperatures that may occur at the surface of the cable will not be experienced by any benthic organism (for example, burrowing animals may be found to depths of up to 30 cm) as heat will dissipate with distance from the cable. Sediment particle size composition has been found to influence heat transfer, with coarse silts experiencing the greatest temperature change, but to a shorter distance from the source, while fine and coarse sands had a lower temperature change but a greater affected distance (Emeana *et al*., 2016). The sediments in the OfECC predominantly consist of sand with varying percentages of mud and gravels, and therefore, the effect of temperature change is expected to vary slightly.

242. The temperature associated with buried cables decreases with distance from the cable. Therefore, if a target burial of 0.8 m is reached, any increase at the sediment surface or in shallow sediment depths at which infaunal species are typically found is expected to be small and likely to be only a few degrees higher than ambient temperature. For example, in a modelling study of a 525 kV HVDC cable (a much higher power output that those to be used for the proposed Project), buried to a depth of 1.5 m, the maximum temperature increase at a sediment depth of 30 cm was predicted to be 1.68$^{o}$C (Stammen, 2020). In field measurements were taken of seabed temperature near the power cables, buried to a sediment depth of 1 m (Dong Energy, 2006), of the Nysted offshore wind farm in the Baltic Sea. The maximum temperature increase at a sediment depth of 20 cm was 1.4$^{o}$C (Meißner *et al*., 2007 cited in OSPAR, 2023). The latest OSPAR report states these indicate that for currently used power cables, the threshold of 2$^{o}$C temperature increase at a sediment depth of 20 cm will only be exceeded in rare cases and for short periods of time (OSPAR, 2023). If the burial depth is decreased to 0.8 m, then any further changes to temperature are also considered to be negligible, on the basis of the evidence provided above.

243. Sea water temperature in the Celtic Sea varies seasonally and therefore small variations due to thermal emissions from the cable are expected to be accommodated by benthic receptors.

244. Thermal effects would be long-term and occurring continuously for the operational lifetime of the proposed Project. However, any impacts that do occur would be highly localised, with marginal increases on the sediment surface, or to a small degree in sediment at depths suitable for burrowing organisms, and therefore the overall magnitude of impact on benthic ecology habitats and species is considered to be **negligible**.

**Sensitivity of the receptor**

245. Sea water temperature in the Celtic Sea is considered to vary seasonally, including at the seabed though to a smaller degree than surface waters, and therefore small, localised variations due to thermal emissions from the cable can be accommodated by benthic receptors (Greenlink, 2019). Therefore, benthic habitats and species are assessed as having a **low** sensitivity to the thermal effects of cables.

**Significance of the effect**

246. As the magnitude is assessed as negligible and the sensitivity of the receptor is assessed as low, the effect of thermal emissions from the proposed Project, on all benthic ecology across the Project Area, is assessed as **negligible** and therefore **Not Significant**.

**Effects of electromagnetic field (EMF) emissions**

247. Subsea power cables associated with OWF projects, including both IACs and export cables are known to produce EMF emissions (Hutchison *et al*., 2020). EMF has the potential to affect the foraging and migratory success and behaviour of some marine species, particularly fish, but responses in some invertebrates have also been observed.

248. When assessing the effects of EMF, several factors should be considered, including the design of the cable, the surrounding environmental conditions including water movement, and species sensitivities (Gill *et al*., 2023).

249. EMF will be emitted for the duration of operational life of the proposed Project, from both the export and the IACs. Results from the project-specific EMF assessment (**Appendix 19C - EMF Modelling Report**) found that the maximum EMF strength predicted to result from the operation of the export cables at a buried depth of 1.2 m, when a receptor is 0 m from the seabed, is 2.6 µT (microtesla). The effects of EMF reduce with distance from the cable, and the modelling shows negligible emissions beyond a distance of 2 m for this burial depth. Where burial is greater this distance will be further reduced.  Given the low level of EMF emissions predicted, if the burial depth is reduced to 0.8 m, any changes in EMF emissions are considered to be negligible and similar in effect to that provided in the modelling.

250. At crossings with other power cables, the potential increase in EMF is higher. There are however, no crossings with other power cables. The Llyr export cable will be installed by HDD between the shallow subtidal and the land station, and whilst the Greenlink HVDC cable crosses the OfECC boundary there is no surface crossing of the two cables and no potential for increased EMF.

251. For dynamic exposed cables in the water column, such as those within the Array Area, the maximum EMF strength at the surface of the cables has been calculated as ~5.2 mT (millitesla). This is significantly higher than the background level of geomagnetic field in the UK, which is around 50 µT but this also decreases rapidly with distance from the cable. At a distance of 0.44 m from the cable surface EMF is approximately equal to background levels (**Appendix 19C - EMF Modelling Report**).

**Magnitude of impact**

252. In light of the above, emissions are considered to be negligible beyond 2 m from the cable route. Therefore, where burial can be reached, EMF emissions are unlikely to be at a level likely to affect benthic habitats and species. Where target burial depth is not reached, any increase in EMF is also highly localised to the cable. Therefore, the magnitude of the impact on benthic habitats and species is considered to be negligible.

253. The majority of the dynamic exposed cables in the Array Area are considered to be mostly floating in the water column between arrays rather than on the seabed and therefore benthic organisms are not likely to be in considerable direct contact with the cables where EMF emissions are highest. Therefore, any effects that do occur are expected to be highly localised and minimal in extent, and the magnitude is assessed as **negligible**.

**Sensitivity of the receptor**

254. There is little available information on the effect of EMF on invertebrates but some laboratory studies found exposure to 30 mT resulted in potential effects to reproduction and embryonic development in sea urchins (Normandeau Associates INC *et al*., 2011; Levin and Ernst, 1997; Cameron *et al*., 1993). Similarly, in a laboratory study with common rag worm (*Hediste diversicolor*) there was no evidence of avoidance or attraction behaviours at an EMF of 1 mT (Jakubowska *et al*., 2019). For crustacean species which have a high level of association with the benthos, such as edible crab, EMF strengths of 250 µT have shown limited behavioural responses (Scott *et al*., 2021). Higher EMF strengths of 500 µT and 1000 µT resulted in small

stress responses, with crabs showing a clear attraction to elevated EMF. Similar attraction has also been observed in European lobster, resulting in concerns over the impact of elevated EMF on eggs laid in the benthos during the development stage (Harsanyi *et al*., 2021; Scott, 2019 cited in Harsanyi *et al*., 2022). In addition, EMF strengths of 85 mT have been shown to affect the internal compass of spiny lobsters / crawfish (*Palinurus* spp.) (Ernst and Lohmann, 2016). However, these investigations all used EMF strengths at a much higher intensity than that anticipated to be emitted by the proposed Project IAC and export cables. There are no other power cables that cross the OfECC to create a combined increase in EMF at crossings.

255. For embryonic stages of edible crab and European lobster a decrease in carapace heights, total lengths and eye diameters have been observed following exposure to EMF strengths of 2.8 mT (Harsanyi *et al*., 2021). The EMF level used during this study is lower than the expected EMF level to be emitted by inter-array cables (~ 5.2 mT), and therefore there is the potential for such effects to occur. However, considering these stages are found in the water column and EMF emissions from inter-array cables are expected to reduce down to background levels at a distance of 0.44 m from the cable surface, the dynamic nature of the inter-array cables in the water column, and the association of crabs and lobsters with the benthic environment, the sensitivity of such species in response to EMF emissions from the Project is expected to be much lower.

256. Therefore, benthic invertebrate species of both adult and embryonic stages, are considered to have a **low** sensitivity to EMF, particularly at the levels resulting from the proposed Project power cables.

**Significance of the effect**

257. Given the negligible magnitude of the impact and the low sensitivity of benthic habitats and species, the effect is appraised as **negligible** and therefore **Not Significant**.

**Introduction and spread of INNS during operation**

258. The spread of INNS, due to the presence of additional surfaces available for settlement of organisms, has the potential to change community composition and cause detrimental changes to benthic habitats. Additional surfaces introduced into the marine environment by the proposed Project include cable protection such as rock, grout bags and concrete mattresses, mooring systems and anchors and scour protection placed on the seabed. Non-native species can also be introduced from vessels, as considered in **Section 19.8.1**, involved in maintenance activities. Whilst most non-native species are unlikely to become invasive, those that do can out-compete native species and introduce diseases which could result in significant changes to community composition and mortality (Bax *et al*., 2003).

259. In the OfECC, the preferred construction method beyond the nearshore reef area will be burial, with a target depth of 1.2 m and minimum of 0.8 m. However, cable protection (see **Chapter 04: Description of Proposed Project**) may be required to protect the cable where the minimum burial depth of 0.8 m cannot be achieved, at HDD exits and where the cable intersects other cables or pipelines. In the Array Area some protection may be required around the anchors which connect the turbines to the seabed.

**Magnitude of impact**

260. The presence of additional hard substrate, including the cable itself and cable protection, during the operational phase of the proposed Project could create habitat for many endemic species, increasing local biodiversity. However, the introduction of hard substrate into an area otherwise characterised by soft substrate (which is present within much of the Study Area) could also act as artificial reef, providing suitable habitat and therefore an 'ecological stepping stone', facilitating the colonisation of existing or new INNS. Such colonisation could also reduce the amount of available habitat for local, endemic species. The introduction of new

anthropogenic features such as cable protection materials, although providing additional surface area for colonisation of INNS, does not provide a replicate replacement of habitat for local species. Therefore, INNS may be able to colonise at a quicker rate than local species, aiding the spread of such species. The areas requiring cable protection are however, very limited in extent and in the subtidal region where INNS are less likely to be found.

261. However, to date, no spread of INNS caused by submarine cabling has been documented (Taormina *et al*., 2018), though concerns remain given the significant growth of marine infrastructure seas around the UK. Furthermore, a recent review of the impact of cables on the environment has been produced by OSPAR (2023) and this report concludes that the majority of non-native species are observed in intertidal habitats.

262. The potential for the introduction of non-local, and potentially invasive fauna by the placement of artificial hard substrate exists, but field studies indicate that where it occurs, colonisation of the provided new habitat is by endemic, rather than invasive fauna.

263. With embedded mitigation and best practice measures in place (see Appendix 04B - Invasive Non-Native Species Management Plan), the introduction and subsequent risk of INNS is considered unlikely. As a result, the introduction and subsequent risk of non-native invasive species is assessed as having a **negligible** magnitude.

**Sensitivity of the receptor**

264. The receptors within the OfECC and Array Area could have high sensitivity to the introduction of INNS, however since evidence indicates this is much more common in intertidal environments the sensitivity of habitats and species in the OfECC and Array Area are considered to have **low** sensitivity to the introduction of INNS.

**Significance of the effect**

265. The magnitude of the effect is low and sensitivity negligible and so the effect is therefore assessed as **negligible** and **Not Significant**.

### *19.8.3. Decommissioning Effects*

266. At the end of the operational life of the proposed Project, there will be a decommissioning plan in place. Other proposed Project constraints will also be taken into consideration (e.g. safety and liability), with the least environmentally damaging option chosen if possible.

267. For the purposes of the EIA and to provide a worst-case assessment, it has been assumed that all infrastructure from the proposed Project will be removed during decommissioning. It is probable that equipment similar to that used to install the infrastructure could be used to reverse the installation process during decommissioning. Accordingly, the area of seabed impacted during decommissioning would be similar to the area impacted during construction

268. The full details of the proposed decommissioning will not be agreed until towards the end of the 30-year operational lifetime of the proposed Project. However, a ‘Rochdale Envelope’ approach for decommissioning has been adopted, with a worst-case scenario of removal of all infrastructure from the seabed, with the exception of pin piles which will be cut off below the seabed, assumed for assessments. Thus, the decommissioning phase is expected to largely mirror the construction process over a period of 12 months (see **Chapter 04: Description of the Proposed Project**).

269. Three impact pathways with the potential to affect benthic receptors have been identified (**Table 19-10**) for the decommissioning phase based on infrastructure removal.

**Temporary physical disturbance to benthic habitats and species**

270. Decommissioning will involve the removal of all infrastructure from the seabed, with the exception of the pin piles that will be cut off below the seabed surface. There are likely to be

several methods required for the removal of infrastructure including the cable itself, cable and scour protection, anchors and mooring systems and the subsea connector.

271. The Applicant intends to maximise burial during construction, wherever practically possible. During decommissioning both IAC and offshore export cables will be lifted from the water column or seabed using a grapnel and/or ROV and cables will be recovered to a vessel for onshore disposal. Therefore, the buried cable will result in disturbance to sediments as the cable is extracted. However, this is considered to affect a swathe smaller in extent that installation and so the total area of temporary disturbance will also be smaller than construction phase.

272. However as previously detailed where the target depth of cover is not achievable cable protection may be applied to the OfECC and IACs. The type of cable protection to be used for the proposed Project has not yet been decided but could include a range of measures including rock protection, grout bags, concrete mattresses. For the removal of rock and scour protection Cable or scour protection will be recovered using a grab vessel and suitable barge for transport to shore. The disturbance to sediments during this decommissioning process is anticipated to be highly localised.

273. Natural England (2022) presents options for the removal of grout bags and concrete mattresses during decommissioning, both of which are being considered as material for cable protection for the proposed Project.

274. There is an option to leave grout bags in-situ following decommissioning as they often decompose over time and no longer have lifting points attached (Natural England, 2022). Therefore, the integrity of the bag could cause issues during removal. However, grout bags are recyclable and often easy to remove if removed before decomposition has occurred. Thus, an alternative option is partial or total removal depending on the condition of the bag using cranes with ROV assistance or subsea grapples and lifting baskets. This can cause minor temporary disturbance to benthic ecology but is not expected to exceed any impacts caused during the construction or operation phase.

275. Concrete mattresses are also often left in-situ following decommissioning as they are not designed for end-of-life removal (Natural England, 2022). Therefore, if a cable is left in place following removal, the concrete mattressing is also often left in place. Partial or full removal of concrete mattressing can be attempted using several techniques including subsea grapples, lifting blankets, speed-loaders and high payload wet store systems (Natural England, 2022). Each technique has varying success in removing concrete mattresses, but the impacts resulting from this are expected to be minor, with some loss of biodiversity possible if species have colonised the hard artificial substrate.

276. Other infrastructure on the seabed will be removed using similar equipment, so could involve the use of grabs, subsea grapples, lifting blankets, speed-loaders and high payload wet store systems which will result in disturbance to sediments but only locally.

277. The total area disturbed during removal of all infrastructure is considered to be similar to, or less than, disturbance to habitats resulting from the construction phase.

**Magnitude**

278. Due to the extensive distribution of the sand and gravel sediment habitat throughout the region, and the small area affected, any temporary disturbance in the Project Area OfECC is not likely to have a large effect on the wider distribution and extent of such habitats. Sublittoral sands and gravels, particularly in shallow waters, are highly mobile and dynamic habitats and therefore, the sediment is expected to redistribute and recover the habitat within a short time frame of less than 12 months (RPS, 2016), resulting in a negligible magnitude. Therefore, temporary physical disturbance is not expected to impact overall ecosystem

functioning and the magnitude of the effect of physical disturbance to benthic ecology during decommissioning is considered to be **negligible**.

**Sensitivity of receptor**

279. In shallow waters sublittoral sands and gravels are considered to be regularly exposed to disturbance and will rapidly recover. In deeper water recovery from temporary disturbance to the seabed is expected to take longer but redistributed sediments will be rapidly recolonised, by both infauna and epifauna, and habitats expected to recover within a period of a few years. Thus, this habitat is assessed as having a **low** sensitivity to temporary disturbance.

**Significance of the effect**

280. The magnitude and sensitivity are assessed as negligible/small and low respectively. Therefore, the effect of temporary disturbance from decommissioning is assessed as **negligible** and therefore **Not Significant**.

281. As a result, the impacts of the decommissioning stage are not expected to exceed impacts of the construction phase, and are therefore, considered to be of a low magnitude. Therefore, all impacts associated with decommissioning are considered to be **Not Significant**.

**Temporary increase in SSC and sediment deposition**

282. The removal of any infrastructure from the seabed will result in disturbance to the sediment that will temporarily increase the concentration of particles in the water column. However, the magnitude of this effect is expected to be similar or smaller than that for the construction phase, and so is assessed to be of a small magnitude. The affected habitats are assessed as low sensitivity and therefore the impact of an increase in SSC during decommissioning is assessed as Not Significant.

**Spread of INNS during removal of proposed Project infrastructure**

283. As assessed in the construction and operation phases (**Sections 19.8.1** and **Section 19.8.2**) the risk of the spread or introduction of INNS is low. Studies show that INNS are more likely to colonise intertidal areas and the presence of non-native species on subsea infrastructure has been observed to be minimal, and mostly occurs within the inter tidal range/areas of those structures, such as the turbine columns or the floating platform structure. In general field studies indicate that where colonisation of new habitat occurs, it is by endemic, rather than invasive fauna (OSPAR, 2023).

**Magnitude**

284. With embedded mitigation and best practice measures in place (see **Appendix 04B - Invasive Non-Native Species Management Plan**), and the low likelihood of colonisation by non-native species anyway, the introduction and subsequent risk of INNS during construction and operation is considered unlikely. As a result, there is considered to be little potential for the spread of INNS during the removal of infrastructure and thus the magnitude of the effect is considered to be **negligible**.

**Sensitivity**

285. Many marine habitats and species have a high sensitivity to INNS as such species have the potential to outcompete local species, which could potentially result in changes in community composition. However, since evidence indicates this is much more common in intertidal environments the sensitivity of habitats and species in the OfECC and Array Area are considered to have **low** sensitivity to the introduction of INNS.

**Significance of the effect**

286. The magnitude of the effect is low and sensitivity negligible and so the effect during decommissioning is therefore assessed as **negligible** and **Not Significant**.

## 19.9 Summary of Additional Mitigation Measures

287. All impact pathways have been identified as having not-significant effects to marine benthic ecology and therefore, no additional mitigation measures, over and above embedded mitigation and best practice measures, are required.

288. Geotechnical survey data and design refinements will discern whether sand wave levelling is necessary. Geophysical surveys, for design refinements, are scheduled, specifically in relation to the final placement of the OfECC route in the nearshore region avoiding direct placement on Annex I reef. The 2024 DDV Survey works and the additional 2024 MBES surveys have confirmed the identification of the presence of significant channels and regions of sediment that are not categorised as reef. These data show there is high confidence that a potential route through the nearshore area, including a large east-west channel in the reef, that will not require the cable to laid on Annex I Reef will be available. The final pre-installation geophysical survey works will facilitate micrositing of the cables in sediment regions surrounding the main channels identified.

**Summary of Residual Environmental Effects**

289. This chapter of the ES has assessed the potential environmental effects on benthic ecology from the construction, operation and maintenance and decommissioning phases of the proposed Project. No significant effects have been identified, and therefore, no additional mitigation has been considered and incorporated into the assessment.

## 19.10 Summary of Effects and Conclusions

290. This section summarises the residual significant effects of the proposed Project on benthic ecology following the implementation of mitigation.

*Table 19-15. Assessment summary*

| Potential Impact | Location | Receptor | Receptor Sensitivity | Magnitude of impact | Significance of effect | Additional Mitigation | Residual Significance of Effect |
|---|---|---|---|---|---|---|---|
| **Construction** | | | | | | | |
| *Temporary loss and physical disturbance to benthic habitats and species* | OfECC and Array Area | Sublittoral Sands and Gravels | Low | Negligible | Not Significant | N/A | Not Significant |
| *Temporary increase in suspended sediment concentration (SSC) and sediment deposition leading to contaminant mobilisation, turbidity and smothering effects* | OfECC | Annex I Reefs | Low | Negligible | Not Significant | N/A | Not Significant |
| | | Annex I Sandbanks | Negligible | Negligible | Not Significant | N/A | Not Significant |
| | | Sublittoral Sands and Gravels | Low | Negligible | Not Significant | N/A | Not Significant |
| | | Other HOPI | Low | Negligible | Not Significant | N/A | Not Significant |
| | Array Area | Sublittoral Sands and Gravels | Low | Negligible | Not Significant | N/A | Not Significant |
| *Impact of changes to marine water quality from the use of HDD drilling fluids* | OfECC | Benthic habitats and species | Low | Small | Not Significant | N/A | Not Significant |
| *Impact of changes in marine water quality from accidental leaks and spills from vessels,* | OfECC and Array Area | Benthic habitats and species | Low to high (species dependent) | Small | Not Significant | N/A | Not Significant |

| Potential Impact | Location | Receptor | Receptor Sensitivity | Magnitude of impact | Significance of effect | Additional Mitigation | Residual Significance of Effect |
|---|---|---|---|---|---|---|---|
| *including loss of fuel oils* | | | | | | | |
| *Introduction and spread of INNS via vessel hull or ballast water and the placement if cable and scour protection during construction* | OfECC and Array Area | Benthic habitats and species | Low | Negligible | Not Significant | N/A | Not Significant |
| **Operation and Maintenance** | | | | | | | |
| *Permanent direct loss and physical disturbance to benthic habitats and species* | OfECC and Array Area | Sublittoral Sands and Gravels | Low | Negligible | Not Significant | N/A | Not Significant |
| *Temporary increase in SSC and sediment deposition associated with maintenance activities leading to contaminant mobilisation, turbidity and smothering effects* | OfECC and Array Area | Benthic habitats and species | Negligible to low (same as construction) | Negligible | Not Significant | N/A | Not Significant |
| *Alteration and/or indirect loss of habitat during the operational lifetime of the proposed Project, including from the introduction of hard substrate resulting in* | OfECC and Array Area | Sublittoral Sands and Gravels | Low | Small | Not Significant | N/A | Not Significant |

| Potential Impact | Location | Receptor | Receptor Sensitivity | Magnitude of impact | Significance of effect | Additional Mitigation | Residual Significance of Effect |
|---|---|---|---|---|---|---|---|
| *increased heterogeneity and new biological communities.* | | | | | | | |
| *Changes to habitats due to on-going scour, changes in hydrodynamics, increased sedimentation and smothering, and abrasions, from the movement of mooring chains* | OfECC and Array Area | Sublittoral Sands and Gravels | Low | Negligible | Not Significant | N/A | Not Significant |
| *Disturbance to benthic habitats during planned maintenance and instances of cable failure and excavation* | OfECC and Array Area | Benthic habitats and species | Low to high (species dependent) | Negligible | Not Significant | N/A | Not Significant |
| *Disturbance to benthic habitats and species due to subsea cable thermal emissions* | OfECC and Array Area | Sublittoral Sands and Gravels | Low | Negligible | Not Significant | N/A | Not Significant |
| *Effects of electromagnetic field (EMF) emissions* | OfECC and Array Area | Sublittoral Sands and Gravels | Low | Negligible | Not Significant | N/A | Not Significant |
| *Introduction and spread of INNS* | OfECC and Array Area | Benthic habitats and species | Negligible | Negligible | Not Significant | N/A | Not Significant |

| Potential Impact | Location | Receptor | Receptor Sensitivity | Magnitude of impact | Significance of effect | Additional Mitigation | Residual Significance of Effect |
|---|---|---|---|---|---|---|---|
| **Decommissioning** | | | | | | | |
| *Temporary physical disturbance to benthic habitats and species* | OfECC and Array Area | Benthic habitats and species | Low | Negligible | Not Significant | N/A | Not Significant |
| *Temporary increase in SSC* | OfECC and Array Area | Benthic habitats and species | Low | Negligible | Not Significant | N/A | Not Significant |
| *Spread of INNS during physical disturbance* | OfECC and Array Area | Benthic habitats and species | Low | Negligible | Not Significant | N/A | Not Significant |

## 19.11 Cumulative Effects of the Project

### *19.11.1. Introduction*

291. Cumulative effects are those effects upon receptors arising from the proposed Project alongside all existing, and/ or reasonably foreseeable projects, plans and activities that result in cumulative effects with any element of the proposed Project. Existing Projects are generally considered as part of the baseline and as such are considered within the impact assessment presented in **Section 19.8** above.

292. This section assesses potential cumulative effects on benthic ecology from identified projects, plans and activities that have the potential to act cumulatively with the proposed Project.

293. PINS Advice 17: Cumulative Effects Assessment (2019) suggests that CEA follows a four-stage process. The aim of this approach is to accurately determine relevant projects and associated relationships with scoped in receptors identified in the ES, to be included within the interproject CEA.

294. The approach to the assessment of cumulative effects is detailed in Appendix 5B: Approach to Cumulative Effects Assessment, and is also summarised in Table 19-16.

*Table 19-16. PINS Advice 17 Stages of the CEA process*

| *CEA Stage* | Activity |
|---|---|
| *Stage 1* | Determine a zone of influence (ZoI) via desk study for each topic receptor scoped into the ES. This will establish a *long list* of projects within each ZoI that will be shortlisted in Stage 2.<br>This list of plans and projects/activities is drawn up through a desk study of planning applications, development plan documents, relevant development frameworks and any other available sources to identify 'other development' within the ZoI. Information on each project (location, development type, status, etc.) is documented, along with the certainty or tier assigned to the 'other development' (i.e. confidence it will take place in the current form and when it will take place in relation to the project). PINS notes that the project should then consult with the relevant planning authority/ authorities and statutory consultees regarding the long list. |
| *Stage 2* | Screening of the long list identified in Stage 1, to establish a short list for the CEA. Screening is based on the criteria presented in the scoping report and subsequent comments by the regulator and statutory consultees.<br>PINS has provided inclusions/ exclusion threshold criteria, against which the potential for 'other development to give rise to significant cumulative effects by virtue of overlaps in temporal scope, the scale and nature of the 'other developments' and /or receiving environment, or any other relevant factors is assessed. From this assessment, a shortlist of 'other developments' to be included in the CEA is produced. It is noted that documented information on each of the 'other developments' is likely to be high level at this stage, outlining the key issues to take forward. |
| *Stage 3* | Gathering of all information available on short listed projects generated in Stage 2. At this stage all available data and information about the shortlisted projects that will be included in the CEA is collected to inform the assessment. This should utilise the most current information for each project in the public domain, and assess the assumptions and limitations of the information collected on each shortlisted project. |
| *Stage 4* | Each of the shortlisted projects are reviewed in turn by the different topics to assess whether cumulative effects may arise and the nature of those effects (i.e. beneficial or adverse). The significance of the effects on environmental receptors is established within each ES technical chapters. Where significant adverse cumulative effects are identified, mitigation measures are also considered within |

| CEA Stage | Activity |
|---|---|
| | the CEA alongside the mechanism to secure that mitigation, e.g. consent condition requirements. |

*19.11.2. Scope of Cumulative Effects Assessment for benthic ecology*

295. An initial long list of projects, which have the potential for a cumulative effect with the proposed Project, has been produced and this is presented in **Appendix 5A: Cumulative Effects Approach**. The assessment has considered projects and information available up to January 2024.

296. The most wide-ranging impacts to benthic ecology receptors relate to an increase in suspended sediment concentration, its dispersal and deposition as a result of seabed disturbance during construction. The ZOI for this pathway is determined by the nature of the sediment and the potential for it to be transported away from the site of disturbance. The proposed Project has a ZOI of 500 m for an increase in SSC, based on the nature of the sediment in the proposed Offshore Development Area, which is generally coarse in nature and rapidly settles back to the seabed. However, disturbance from other projects may occur in finer sediments and so the maximum ZOI for CEA is taken to be 14 km, the mean spring tidal excursion for the proposed project and wider region which describes the theoretical maximum distance for the transport of very fine particulate matter.

297. Thus, the project screening distance in relation to impacts on benthic ecology in combination, to refine the long-list to a short-list, with other projects is 14.5 km (500 m for the proposed project ZOI and 14 km potential for other projects).

298. The following impact has been scoped out of the CEA:

- Impact of water quality changes from discharge of HDD drilling fluids during the construction phase: there will be a very low volume and highly localised impact from the proposed Project, with any ZOI remaining within the OfECC and therefore will not overlap spatially or temporally with any other identified Project.

299. The following impacts have been scoped into the CEA for benthic ecology:

**Construction**

- Temporary physical disturbance to habitats and species
- Temporary increased SSC in subtidal habitats
- Impact of changes to water quality
- Introduction of INNS from vessels

**Operation and maintenance**

- Permanent direct habitat loss
- Alteration to benthic habitats
- EMF emissions
- Thermal emissions
- Spread of INNS from infrastructure

**Decommissioning**

300. The methods for the decommissioning of the proposed Project, and a list of other potential and proposed Project, are unknown at the time of writing. However, complete removal of all

infrastructure from the seabed would involve similar activities that can be considered to fall within the assessment envelope for the construction phase.

- Temporary physical disturbance to habitats and species
- Increased SSC in subtidal habitats
- Changes to water quality
- Spread of INNS

301. The short list of projects identified and included within the CEA for benthic ecology is provided in **Table 19-17** below. The long list of projects has been refined to the short list by temporal or spatial overlap with the proposed Project.

*Table 19-17. List of projects considered for the benthic ecology cumulative effects assessment*

| Project Name/Developer | Project Type | Tier and Status | Approx. distance from the proposed Project | Construction Timeframe |
|---|---|---|---|---|
| *Llŷr 2 Floating Offshore Wind Project* | *Offshore Wind Farm* | *Tier 2; Scoping submitted* | *<1* | *2027 / 2028* |
| *Valorous (Blue Gem Wind)* | *Offshore Wind Farm* | *Tier 2; Scoping submitted* | *<1* | *2028* |
| *Erebus (Blue Gem Wind)* | *Offshore Wind Farm* | *Tier 1; Consented* | *5* | *June 2026 – October 2026* |
| *Dragon Energy Project* | *Inshore Energy* | *Tier 2; Scoping submitted* | *7* | *Unknown* |
| *South Pembrokeshire Demonstration Zone* | *Wave Energy* | *Tier 2; Concept/In-Planning* | *8* | *2025* |

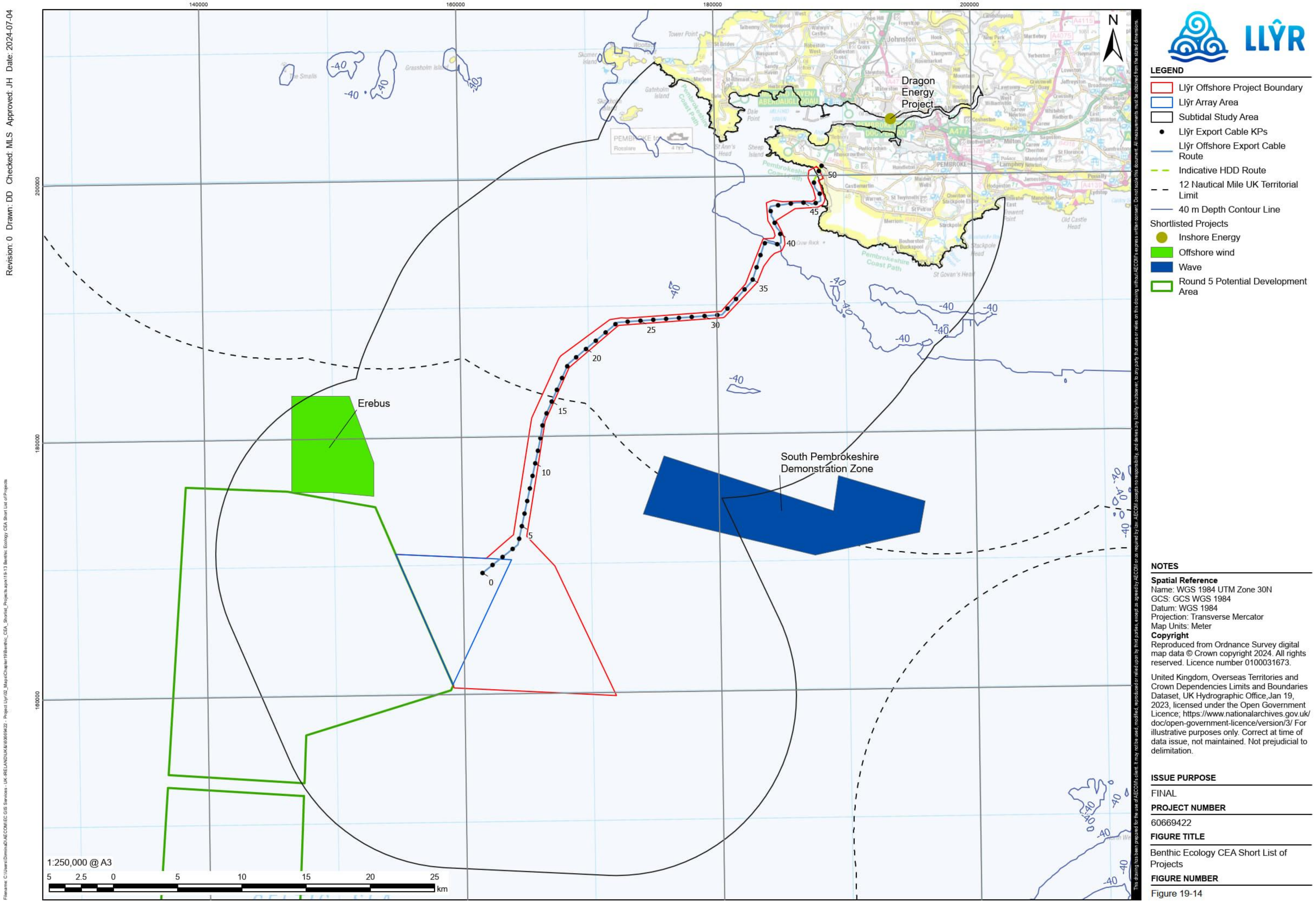


*Figure 19-14 Short list of other projects included in the Cumulative Effects Assessment*

### 19.11.3. *Cumulative Effect Assessment*

**Construction**

**Temporary physical disturbance to benthic habitats and species**

302. During the construction phase of the proposed Project there is potential for temporary disturbance to benthic habitats and species. The distance to which such physical temporary disturbance occurs for the proposed Project is estimated to be a maximum of 30 m and therefore the projects scoped into this assessment are those within the Offshore Development Area, which comprises Llŷr 2 and Valorous.

303. Llŷr 2 is being developed by the Applicant and has undertaken scoping, but on the basis of existing proposed Project survey data, the habitats in the Llŷr 2 Array Area will not require sandwave levelling and so temporary disturbance will be restricted to WTG, mooring line, anchor and cable installation activities which are limited in extent and do not overlap with proposed Project. There is the potential for simultaneous construction between the proposed Project and other developments, particularly with Lŷr 2 Floating Offshore Wind Project and Valorous (Blue Gem Wind), which both have construction planned for 2027/2028. However, temporary physical disturbance in the proposed Array Areas of both projects is expected to be limited, as the areas affected are small and the seabed identified as being subject to disturbance is of low sensitivity. There is not therefore, any anticipated spatial overlap in the areas of disturbance with the proposed project. The export cable route for Valorous has not yet been determined but should the route be close to the proposed Project, impacts will highly localised for both projects due to sediment type and significant cumulative effects to the benthos not expected. The other short-listed projects (Erebus (Blue Gem Wind), Dragon Energy Project, and South Pembrokeshire Demonstration Zone) are beyond the distance at which cumulative interactions are likely to occur, and equally construction periods are not planned to overlap.

304. In view of the above, the magnitude of this impact is therefore considered to be **minor**, given the temporary nature and relatively small spatial extent of construction activities. The habitats disturbed will have the ability to recover, as sediments will redistribute and recolonise over time. Sublittoral sands and gravels are regularly exposed to disturbance from wave action and currents, particularly in shallower water. Therefore, the habitat and associated fauna are considered to have some habitualisation to disturbance. In deeper waters recovery from temporary disturbance to the seabed is expected to take longer but redistributed sediments will be rapidly recolonised, by both infauna and epifauna, and habitats expected to recover within a period of a few years. This will be consistent across all projects in the Offshore Development Area. The habitats impacted have therefore been assessed as having a **low** sensitivity to temporary disturbance. Cumulatively, the effect of temporary disturbance on benthic ecology is therefore considered **minor**, and **Not Significant**.

**Increased SSC in subtidal habitats**

305. Construction activities, such as ploughing and jet trenching, associated with the proposed Project, and likely those projects listed in the short list (**Table 19-17**) have the potential to temporarily increase SSC. This can create sediment plumes in the water column which can travel away from the Offshore Development Area before depositing sediment elsewhere on the seabed. Increased SSC because of proposed Project activities alone has been assessed as not significant (**Section 19.8**).

306. The projects listed on the short list (**Table 19-17**) all fall within the distance at which their mean tidal excursion, and thus plumes of SSC have the potential to overlap with the proposed Project. However, this would only be the case if activities were conducted for the proposed

Project and the short list projects simultaneously, which at present only includes Llŷr 2 Floating Offshore Wind Project and Valorous (Blue Gem Wind), which both have construction planned for 2027/2028. It should be noted, that although the Valorous scoping report noted this construction timeline, the project has been delayed by the Crown Estate's Round 5 leasing process and therefore the construction timelines are expected to be several years later than this.

307. It should be considered that SSC and depositional loads will vary between the projects shortlisted (**Table 19-17**), depending upon the local environmental conditions at the site of their activities. Furthermore, a cumulative effect would only apply to the finer fragments of the particulate matter, as the largest sediment plumes and highest levels of increased SSC are associated with the disturbance of sediments which have a high proportion of fine particulate matter, such as muds and clays. These fine sediments remain in suspension for longer and therefore travel the furthest distance from the source of disturbance, settling to the seabed more slowly.

308. Considering most of the sediment in the OfECC and the Array Area is dominated by sand and gravel particles, which are expected to have deposited in tens of centimetres thickness on the seabed between 50 m – 500 m away of the source of disturbance, the likelihood of plumes overlapping is therefore reduced significantly. Thus, should the works be temporally separated between projects, it is considered there will be sufficient time to allow any localised increases in SSC to disperse and dilute.

309. The magnitude of this impact has been assessed as **negligible**, and the sensitivity of the benthic ecological receptors is considered **low** to **medium** in line with **Section 19.8.1**. This, coupled with the natural dispersal of sediment by water movements in the nearshore area, incorporation of measures into the proposed Project design for cabling, and likely high tolerance of benthic assemblages to some increased SSC, mean there is no potential for this effect to accumulate sufficiently and the cumulative effect of SSC is considered **minor** and **Not Significant**.

**Changes to water quality**

310. As outlined in **Chapter 18: Marine Water and Sediment Quality**, the extent of any changes to water quality from all identified potential impacts during construction will be limited to the extent of the Study Area and not significant at the waterbody scale. Outside of this, there will be no measurable change above existing baseline levels of drilling fluids, or pollutants that might be spilt.

311. All short-listed projects will require the use of marine vessels and will overlap temporally for construction, creating the possibility for two pollution events to occur at the same time which could lead to cumulative effects. Potential impacts from accidental spills can be temporary and short-term or more long-term, with the potential for contaminants to be present in the water column and settle into sediment, remaining there for prolonged periods of time.

312. However, the construction periods of the proposed Project, Llŷr 2 and Valorous are the only projects on the short-list with concurring construction timelines, reducing the potential for any cumulative effect to occur and the duration within which it would occur. Given this, and that both projects have suitable mitigation in place to prevent pollution events occurring, the magnitude of effect is therefore considered to be **negligible**.

313. The sensitivity of receptors is considered **medium** – **high**. The benthic ecology likely to be in the vicinity of any HDD fluid release is considered medium, reflecting epifaunal species on bedrock. The sensitivity of benthic ecology to any leaks or spills is considered high since toxicity and smothering could result in the mortality of species.

314. Based on the low likelihood, and very localised effects because of both HDD fluid release and accidental spills altering water quality, plus the mitigation measures available, the effect is considered **minor** and therefore **Not Significant**.

**INNS from vessels**

315. With embedded mitigation and best practice measures in place (see **Appendix 04B - Invasive Non-Native Species Management Plan**), the introduction and subsequent risk of INNS from the proposed Project is considered unlikely. The adoption of best practice measures identified in this Plan are industry standard and all other projects are required to commit to these measures. As a result, any cumulative effects are assessed as having a negligible magnitude and whilst many marine habitats and species have high sensitivity to INNS any impacts are much more common in intertidal environments. The proposed Project and other identified habitats are species are subtidal and so are considered to have low sensitivity to the introduction of INNS. Thus, the effect of introduced INNS during decommissioning is assessed as **negligible** and **Not Significant.**

**Further mitigation and residual risk**

316. No significant effect was identified, and as a result no further mitigation is specified.

**Operation and Maintenance**

**Direct permanent habitat loss**

317. Introduction of hard substrate for cable and scour protection, in the form of rock berms or concrete mattresses, would replace the existing seabed, leading to the permanent loss of these existing benthic habitats and species. Indicative cable protection locations are available for Erebus in the ES chapters. The proposed Project has also provided an indication of where cable protection will be required. Whilst it is not yet known specifically where cable protection and/or scour protection will be required for all short-listed projects, it is assumed that each will undertake a Cable Burial Risk Assessment (CBRA) pre-construction (not at construction) which will detail exact cable protection locations.

318. Direct permanent habitat loss will only be associated with the footprint of each project, and for the proposed Project, berm width is assumed to be 5 m. The same assumptions can be made for Llŷr 2. The Erebus project export cable will have up to 7,580 m of rock berm with 11 m base width.

319. For the proposed Project, the majority of the cable protection for the OfECC is predicted to be required in the coarse sediment habitats of the nearshore area. There will also be a small area of protection (100 $m^2$) at the HDD punch-out point, and protection at four cable crossings (excludes Greenlink as HDD installation) (**Volume 1, Chapter 4: Project Description**).

320. In the Offshore Development Area, permanent habitat loss will occur for inter-array cable and scour protection, placement of clump weights for mooring lines, anchoring and subsea connectors. Whilst the amount of each will vary between the projects (the proposed Project, Llŷr 2, Valorous, and Erebus), it is anticipated that all will have similar required pathways for this impact.

321. Regardless of the habitat loss within the Offshore Development Area, or along their associated OfECCs, any effects of habitat loss are expected to be highly localised. The proposed Project has identified that it shall commit to no cable installation on Annex 1 reef and no cable protection, other than articulated iron pipe, in Annex I sandbanks, both of which are designating features of the Pembrokeshire Marine SAC. Although some projects may be consented with approval to apply cable protection in Annex I habitat (this has already been the case for Greenlink), cable burial design plans generally aim to minimise and mitigate the need for cable protection. Both the need for cable protection, and therefore the amount of it,

will be minimised via detailed route refinement and burial risk assessment studies, as the project designs develop.

322. The habitats which could be lost from the infrastructure detailed above are relatively homogenous, with sediments dominated by sand with varying compositions of gravel and small contributions of mud. Therefore, compared to the extent of this habitat in the wider area and Celtic Sea, the magnitude of the impact is assessed as **minor**.

323. Sands and gravels cover a large spatial range in the Celtic Sea and therefore the proportionate loss of this habitat is not considered to result in a considerable decline of the sediment types. Therefore, this receptor is considered to be of **low** sensitivity.

324. Cumulatively, the effect of direct permanent habitat loss on benthic ecology is therefore considered **minor** and **Not Significant**.

**Alteration to benthic habitats**

325. There are a range of disturbance effects, such as from on-going scour, changes in hydrodynamics, increased sedimentation and smothering, and abrasions from the movement of mooring chains, that could result in the alteration of benthic communities. Assessments for the proposed Project consider such effects to be of negligible magnitude because of the limited extent and the avoidance of particularly sensitive habitat features.

326. For project Erebus, noting this windfarm project will consist of both cables and turbines, there will be a direct long-term (25 years) habitat alteration due to placement of project infrastructure on the seabed. Under the worst-case scenario, according to the ES, this has been estimated to be 163,001 $m^2$ (0.16 $km^2$). The proposed Llŷr 2 project will be adopting use of the same OfECC as the proposed Project and therefore alteration of benthic habitat will be limited to the array area only.

327. The benthic habitat types potentially altered by the placement of infrastructure associated with Erebus and Llŷr 2 are relatively homogenous, with sediments dominated by sand with varying compositions of gravel and small contributions of mud. The proportionate alteration of this habitat is not considered to result in a considerable decline of the sediment types. Therefore, this receptor is considered to be of **low** sensitivity.

328. Cumulatively, the effect of alteration to benthic habitats is therefore considered **minor** and **Not Significant**.

**EMF emissions**

329. EMF will be emitted for the duration of operational life of the proposed Project, and other windfarm and electrical transmission projects on the short-list (Llŷr 2, Erebus and Valorous), from both their export and the inter-array cables. The effects of EMF reduce with distance from the cables, and the modelling for the proposed Project shows negligible emissions beyond 2 m if cables are buried at a depth of 1.2 m. Given the low level of EMF emissions predicted, if the burial depth is reduced to 0.8 m, any changes in EMF emissions are considered negligible and similar in effect to that provided in the modelling. Whilst it is acknowledged that at crossings with other power cables, the potential increase in EMF is higher, the area where cables cross and interact is very small and as EMF reduces with distance any increase is also expected to be highly localised.

330. There is little available information on the effect of EMF on invertebrates but some laboratory studies found exposure to 30 mT resulted in potential effects to reproduction and embryonic development in sea urchins (**Section 19.8.2**). Similarly, in a laboratory study with common rag worm (*Hediste diversicolor*) there was no evidence of avoidance or attraction behaviours at an EMF of 1 mT. However, both investigations used EMF at a much higher intensity than will the emitted by the export cables. Should any other power cables cross the OfECC a maximum magnetic field density of 70 µT is expected though this is also below the levels at which effects

have been observed. Therefore, benthic invertebrate species are considered to have a low sensitivity to EMF.

331. EMF emissions for the proposed Project alone, was assessed as resulting in no significant effects (See **Section 19.8.2**). Given the above, it is considered that there is no potential for this effect to accumulate sufficiently to result in a significant cumulative effect.

332. The magnitude of this impact is therefore considered to be **negligible**, and the benthic ecology has been assessed **low** sensitivity. Cumulatively, the effect of temporary disturbance on benthic ecology is therefore considered **minor** and **Not Significant**.

**Thermal emissions**

333. The operation of electricity cables generates heat due to resistance in the conductor components, which can warm the cable surface and adjacent sediments (**Section 19.8.2**). Thermal emissions from the operation of the proposed Project have been appraised as resulting in no significant effects. At crossings with other power cables, the potential increase in temperature within the sediments, is higher.

334. Sediment particle size composition has been found to influence heat transfer, with coarse silts experiencing the greatest temperature change, but to a shorter distance from the source, while fine and coarse sands had a lower temperature change but a greater affected distance (**Section 19.8.2**). The sediments in the vicinity of the proposed Project predominantly consist of sand with varying percentages of mud and gravels, and therefore, the effect of temperature change is only expected to vary slightly.

335. Given this, it is considered that there is no potential for this effect to accumulate sufficiently to result in a significant cumulative effect and the magnitude of this impact is therefore considered to be **negligible**. Sea water temperature in the Celtic Sea varies seasonally and therefore it is anticipated that small variations due to thermal emissions from the cables can be accommodated by benthic receptors. Therefore, benthic habitats and species are assessed as having a **low** sensitivity to the thermal effects of cables.

336. As the magnitude is assessed as negligible and the sensitivity of the receptor is assessed as low, the effect of thermal emissions from the proposed Project in combination with those projects on the short-list, on all benthic ecology, is assessed as **negligible** and therefore **Not Significant**.

**INNS from presence of infrastructure**

337. As assessed in the operation phase (**Section 19.8.2**) the risk of the spread of INNS is low. Studies show that INNS are more likely to colonise intertidal areas and the presence of non-native species on subsea infrastructure has been observed to be minimal, and mostly occurs in the intertidal region of those structures, such as on turbine columns only in the tidal range. In general, field studies indicate that where colonisation of new habitat occurs, it is by endemic, rather than invasive fauna (OSPAR, 2023). With embedded mitigation and best practice measures in place (see **Appendix 04B - Invasive Non-Native Species Management Plan**), and the low likelihood of colonisation by non-native species, the introduction and subsequent risk of INNS for the proposed Project, and other projects which are subtidal in nature, is considered unlikely. As a result, there is considered to be little potential for the spread of INNS due to the placement of material and structures on the seabed. The magnitude of the effect is **low** and sensitivity **negligible** and so the effect during decommissioning is therefore assessed as **negligible** and **Not Significant**.

**Further mitigation and residual risk**

338. No significant effect was identified, and as a result no further mitigation is specified.

**Decommissioning**

339. It has been assumed that all infrastructure from the proposed Project will be removed during decommissioning, and therefore the area of seabed impacted during decommissioning would be similar to the area impacted during construction. While there is potential for cumulative effects to occur in relation to temporary physical disturbance to benthic habitats and species, increased SSC and changes to water quality, the impacts of decommissioning activities are expected to be no greater than that associated with construction for the proposed Project.

340. Decommissioning activities for the proposed Project will take place after 30 years and therefore may overlap with the operational period of the closest project outside of the Offshore Development Area (Erebus project) when there would be limited scope for adverse impacts. However, there may also be potential for overlap with decommissioning of the other identified cumulative schemes although full details of the decommissioning timescales are unclear.

341. Aside from Erebus and Llŷr 2, the other short-listed projects outside of the Offshore Development Area are more than 5 km away from the proposed Project, and as such it is assumed less likely for cumulative effects to take place due to distance and the nature of the projects. Therefore, any resulting cumulative impact is considered to be **negligible** in magnitude.

342. The benthic ecology receptors have reasonable capacity to absorb change (e.g., temporary physical disturbance, increased SSC and minor pollution incidents). However, since toxicity from spills and smothering could result in the mortality of species, the sensitivity of benthic ecology is considered **high**.

343. Given any disturbance to the seabed and thus increased SSC will be short-term, combined with the low likelihood, and very localised effects, as any spills would be small, plus the mitigation measures available, the cumulative effect on benthic ecology is considered to be **minor** and therefore **Not Significant**.

344. Similarly, the risk of the spread of INNS from the proposed Project's decommissioning activities interacting with INNS from other developments is highly unlikely and any cumulative effects considered to be **Not Significant**.

**Further mitigation and residual risk**

345. No significant effect was identified, and as a result no further mitigation is specified.

## 19.12 Inter-related Effects of the proposed Project

346. The term 'Inter-related' takes into account the environmental interactions ('inter-relationships') with other receptors within the proposed Project. These are referred to in the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 and further described in **Chapter 31 – Inter-related Effect Assessment.**

347. As set out in PINS Annex to Advice Note 7 (PINS), 2017, *inter-related -project effects*, or 'interrelationships between topics', derive from combinations of different project specific impacts which, when acting together on the same receptor, could result in a new or different effect, or an effect of greater significance than the project effects, when considered in isolation.

348. Inter-related effects comprise the following:

- *Project lifetime effects*: effects that have the potential to occur during more than one phase of the proposed Project (i.e. construction, operation and maintenance and decommissioning) and also to interact in a way that could potentially create a more significant effect than if it was assessed in isolation; and

- *Receptor-led effects*: effects that have the potential to interact, spatially and temporally, to create inter-related effects on a receptor.

349. **Chapter 31: Inter-related Effects Assessment** details the approach to the inter-related effects assessment and includes a description of the likely inter-related effects that may occur as a result of proposed Project on benthic ecology.

### *19.12.4. Inter-related Project lifetime effects*

| Development Phase | Nature of inter-related effect | ES Reference | Inter-related effects assessment |
|---|---|---|---|
| Construction, Operation and Maintenance, and Decommissioning | Temporary physical disturbance to benthic habitats and species<br>Direct permanent habitat loss | **ES Chapter 18: Marine Water and Sediment Quality;**<br>**ES Chapter 19: Benthic Ecology** | The assessment concludes that these impacts across all phases of the proposed Project would be of **minor** adverse significance, which is **not significant** in EIA terms.<br>When habitat disturbance is considered additively across all three phases of development, the total area of habitat affected is larger than when considered in each phase individually. However, the disturbance is taking place within the same site and therefore this spatial area represents repeated, rather than, additional disturbance.<br><br>As a result, it is not expected that these impacts will result in inter-related effects of greater significance, through combined project phases, than those assessed in isolation. |
| Construction and Operation and Maintenance | Introduction or spread of marine Invasive and Non-Native Species (INNS) | | The assessment concludes that these impacts across all phases were of **negligible** adverse significance, which is **not significant** in EIA terms.<br>There is limited potential for inter-related effects to occur because of the presence of infrastructure and project vessels across the construction and operation phases, both due to the negligible significance associated with these impacts and the embedded mitigation and best practice measures in place (see **Appendix 04B - Invasive Non-Native Species Management Plan**). It is therefore not anticipated that there will be any inter-related effects of greater significance than those occurring in isolation. |

| Development Phase | Nature of inter-related effect | ES Reference | Inter-related effects assessment |
|---|---|---|---|
| Construction and Decommissioning | Increased SSC in subtidal habitats<br><br>Changes in water quality | | The assessment concludes that these impacts across all phases of the proposed Project would be of **minor** adverse significance, which is **not significant** in EIA terms.<br>Due to the very localised nature of the works which would occur predominantly in sand and gravel habitats, any physical disturbance to benthic habitats and species and local increases in SSC and sediment deposition will be short-term.<br>Changes in water quality could occur during any development phase due to pollution events, but these would be unplanned and standard control measures will be adhered to, to minimise risk. |

### *19.12.5. Inter-related receptor-led effects*

350. It is considered possible for spatial and temporal interactions to occur between the impacts identified for benthic ecology. The impacts were considered not significant as standalone, and although potential combined impacts may arise (i.e. spatial and temporal overlap of direct habitat disturbance from installation methods, sediment deposition and the presence of infrastructure), it is predicted that this will not be any more significant than the individual impacts in isolation.
351. The combined area of habitat potentially affected would be very limited, and the scale and recoverability of the receptors (i.e. the biotopes affected are widespread) and where disturbance occurs, recovery of the benthos is predicted to occur in the short to medium term.
352. Transboundary Effects
353. A transboundary effect refers to the impacts or effects of a project that extend beyond the boundaries of the United Kingdom and have the potential to affect the environment of other countries within the European Economic Area (EEA). These effects can occur either from the proposed Project on its own or when combined with the effects of other projects or activities in the wider geographical area.
354. In terms of the impacts on benthic ecology receptors, impacts will be localised to the extent of the benthic ecology Study Area. Given the intervening distance to neighbouring European Economic Area (EEA) states, there is no potential for transboundary impacts and resultant effects are highly unlikely to occur.

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