MarineSpace

Making Sense of the Marine Environment ™

Environmental Impact Assessment
Scoping Report

Simply Blue Energy

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Environmental Impact Assessment Scoping Report

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Acronyms and Abbreviations

AA	Appropriate Assessment
AEMP	Adaptive Environmental Management Plan
AEZ	Archaeological Exclusion Zone
AIS	Automatic Identification System
AONB	Area of Outstanding Natural Beauty
AoS	Area of Search
AQMA	Air Quality Management Area
AQT	Aquatera
ATC	Air Traffic Control
BGS	British Geological Survey
CAA	Civil Aviation Authority
CBRA	Cable Burial Risk Assessment
CCC	Committee on Climate Change
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CFO	Commercial Fisheries Organisations
CFP	Common Fisheries Policy
CFPO	Cornish Fish Producers Association
CIA	Cumulative Impact Assessment
CRM	Collision Risk Modelling
D&SIFCA	Devon and Severn Inshore Fisheries and Conservation Authority
DAS	Digital Aerial Surveys
DBA	Desk-based Assessment
DCO	Development Consent Order
Defra	Department for Environment, Food and Rural Affairs
ECC	Export Cable Corridor
EIA	Environmental Impact Assessment

EMF	Electromagnetic Frequency
ERCoP	Emergency Response Co-operation Plan
ES	Environmental Statement
ESAS	European Seabirds at Sea
FAME	Future of the Atlantic Marine Environment
FLO	Fisheries Liaison Officer
FLOW	Floating Offshore Wind
GEART	Guidelines for the Environmental Assessment of Road Traffic
GIS	Geographical Information System
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GVA	Gross Value Added
HRA	Habitats Regulations Authority
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IAQM	Institute of Air Quality Management
ICES	International Council for the Exploration of the Sea
IMO	International Maritime Organisation
IUCN Red List	The International Union for Conservation of Nature's Red List of Threatened Species
JNCC	Joint Nature Conservation Committee
LAQM	Local Air Quality Management
LCA	Landscape Character Areas
LDP	Local Development Plan
LPA	Local Planning Authority
LSE	Likely Significant Effect
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MCAA	Marine and Coastal Access Act (2009)

MCZ	Marine Conservation Zone
META	Marine Energy Test Area
MHPA	Milford Haven Port Authority
MMMU	Marine Mammal Management Units
MMO	Marine Management Organisation
MoD	Ministry of Defence
NATS	National Air Traffic Services
NDFA	North Devon Fishermen’s Association
NE	Natural England
NEAFC	North East Atlantic Fisheries Commission
NFFO	National Federation of Fisherman’s Organisations
NGT	National Grid Transmission
NNR	National Nature Reserve
NOAA	National Oceanic and Atmospheric Administration
NPL	National Physical Laboratory
NRA	Navigational Risk Assessment
NRW	Natural Resources Wales
NTM	Notice to Mariners
NTS	Non-Technical Summary
O&M	Operational and Maintenance
ONS	Office for National Statistics
ORE Catapult	Offshore Renewable Energy Catapult
ORPAD	Offshore Renewables Protocol for Archaeological Discoveries
OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic
PAD	Protocol for Archaeological Discoveries
PCC	Pembrokeshire County Council

PCNP	Pembrokeshire Coast National Park
PCNPA	Pembrokeshire Coast National Park Authority
PCRH	Potential Collision Risk Height
PDZ	Pembrokeshire Demonstration Zone
PEA	Preliminary Environmental Appraisal
PINS	Planning Inspectorate
PIZ	Primary Impact Zone
PPG	Pollution Prevention Guidelines
PPI	Principle Power Inc.
RNLI	Royal National Lifeboat Institute
ROV	Remote Operated Vehicle
RSPB	Royal Society for the Protection of Birds
RYA	Royal Yachting Association
S.36	Section 36 consent
SAC	Special Area of Conservation
SBE	Simply Blue Energy 1 Ltd
SCA	Seascape Character Areas
SCADA	Supervisory Control and Data Acquisition
SIZ	Secondary Impact Zone
SLVIA	Seascape, Landscape and Visual Impact Assessment
SNCB	Statutory Nature Conservation Body
SNH	Scottish National Heritage
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
STAR	Seabird Tracking and Research
STECF	Scientific, Technical and Economic Committee for Fisheries
SWFPO	South West Fish Producers Organisation

SWWFC	South and West Wales Fishing Communities
TCE	The Crown Estate
THLS	Trinity House Lighthouse Service
TNUoS	Transmission Network Use of System
TOPA	Airport Technical and Operational Assessment
TSS	Traffic Separation System
UKC	Under Keel Clearance
UKHO	UK Hydrographic Office
UXO	Unexploded Ordnance
VERs	Valued Ecological Receptors
VMS	Vessel Monitoring System
WCPS	West Coast Palaeolandscapes Survey
WEC	Wave Energy Converter
WFA	Welsh Fishermen's Association
WG	Welsh Government
WMFAG	Welsh Marine Fisheries Advisory Group
WNMP	Welsh National Marine Plan
WPD	Western Power Distribution
WSI	Written Scheme of Investigations
WTG	Wind Turbine Generators
WWSFA	West Wales Shell Fisherman's Association
ZoI	Zone of Influence
ZTV	Zone of Theoretical Visibility

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Contents

List of Tables

List of Figures

1. Introduction

1.1. Purpose of the Document

This Environmental Impact Assessment (EIA) Scoping Report has been prepared by MarineSpace Ltd on behalf of Simply Blue Energy 1 Ltd (SBE) in support of a formal request for an EIA Scoping Opinion for the proposed 'Project Erebus' Floating Offshore Wind (FLOW) development. A Scoping Opinion is requested from the following organisations under the EIA Regulations listed below:

- Natural Resources Wales (NRW) - Marine Works (EIA) Regulations 2007 (as amended); and
- Planning Inspectorate (acting on behalf of Welsh Ministers)[1] - The Electricity Works (EIA) (England and Wales) Regulations 2017.

This report has been prepared in accordance with the relevant legislation and guidance, and recent consultation with NRW, Welsh Government (WG) Planning Directorate, and the Planning Inspectorate (PINS). A description of the project along with SBE's proposed approach to the EIA is provided.

1.2. Project Overview

SBE is the developer and seabed leaseholder for Project Erebus, a proposed FLOW development in the Celtic Sea region. The project is located approximately 44 km southwest of the Pembrokeshire coastline, in an outline area of interest of approximately 43.5 km^2 – see Figure 1.1.

The key Project components are:

- Between 7 and 10 floating Wind Turbine Generators (WTGs), of total capacity up to 96 MW, as well as the associated semi-submersible platforms and mooring infrastructure;
- Inter-array cables and a single offshore export cable to landfall;
- Onshore cabling between landfall and the grid connection; and
- Onshore substation at the grid connection point.

1.3. The Developer

SBE is a Blue Economy project developer active in the FLOW, wave energy and aquaculture sectors.

[1] Regulation 39 of The Electricity Works (EIA) (England and Wales) Regulations 2017 (as amended) permits deferral of EIA considerations in respect of applications under S.36 of the Electricity Act 1989, from the Welsh Ministers to NRW. A formal request has been issued by SBE to the Welsh Ministers, via PINS, to invoke Reg.39. Therefore, it is expected that only a single Scoping Opinion will be issued by NRW covering all aspects of the proposed Project.

SBE's vision is "*to sustainably harvest resources from our oceans for a better world*", and its mission is to become a leading Blue Economy Developer in the UK and Ireland. The company has offices in Ireland, Cornwall, Pembrokeshire and Scotland, and currently has a team of 10 full time staff.

Since its foundation in 2011, SBE has focused on exploring opportunities in the Celtic Sea. The company has therefore gained a thorough understanding of the area and built key relationships and synergies within the local area.

SBE formed a relationship with the floating wind technology company, Principle Power Inc. (PPI) in 2016, and has an exclusive relationship in zones in the Celtic Sea for Wave Hub, the Pembrokeshire Demonstration Zone (PDZ), and the site discussed below.

1.4. Project Need

1.4.1. United Kingdom and Wales Carbon Emission Targets

The UK established a legally binding framework to cut carbon emissions via the Climate Change Act (2008). A recently published paper 'Net Zero – the UK's contribution to Global Warming', May 2019, by the Committee on Climate Change (CCC) commits the UK government by law to reduce emissions by at least 100% of 1990 levels by 2050 (CCC, 2019a).

Monitoring by the CCC, to identify if the UK is on track to meet this target, confirmed the first (2008-12) and second (2013-17) carbon budgets have been met, and the UK is on target to meet the third (2018-22). The UK is not, currently, on track to meet the fourth (2023-27) target and 2018 records show emissions being 44% below 1990 levels (CCC, 2019b).

As a devolved administration the Welsh Government (WG) has created a climate change policy, the Environment (Wales) Act 2016, which sets emission reduction targets for Wales. In response to the CCC May 2019 paper, Wales has accepted the recommendation for a 95% reduction in emissions by 2050, with an ambition to reach net-zero (CCC, 2019b).

1.4.2. United Kingdom and Wales Renewable Energy Targets

The UK has committed to producing 15% of energy demands from renewable sources by 2020 and the CCC considers there is scope for 30-45% of all energy consumption to be produced by renewable energy (DECC, 2011). In 2016, UK renewables generated 24.5% of the country's electricity (BEIS, 2017).

Wales is a significant net exporter of electricity, with approximately half of what it produces being exported to England, Ireland and the wider European network (WG, 2017). A review undertaken in 2017 by the WG found 22% of total electricity generated in Wales is from renewables, equivalent to 48% of Wales' consumption. 65% of the renewable electricity generated comes from wind, of which 30% is generated by offshore wind projects (WG, 2017).

Energy Wales – A Low Carbon Transition (WG, 2012) sets WG's commitment to renewable energy generation in Wales and recognises the potential for Wales to be a world leader in marine renewables. In 2017, WG announced a target of meeting 70% of Wales' electricity demand from Welsh renewable sources by 2030 (WG, 2017).

In March 2019, WG published ‘Prosperity for All: A Low Carbon Wales’ (WG, 2019) setting out 100 policies and proposals to meet the UK’s 2020 carbon emissions targets.

1.4.3. Draft Welsh National Marine Plan

The WG is currently developing the first marine plan for Welsh inshore and offshore waters, the Welsh National Marine Plan (WNMP), to ensure marine resources are used in a sustainable way in line with the high-level marine objectives. The final draft is due to be presented for Ministerial sign-off in autumn 2019, prior to being approved by the UK Government’s Secretary of State for the Department for Environment, Food and Rural Affairs (Defra).

The draft Plan acknowledges FLOW as a developing technology with potential in Welsh waters, and considers the marine renewable sector contributing significantly to the decarbonisation of the Welsh economy. The WG values the strategic need to develop marine renewable energy generation capacity and considers this will be achieved through the deployment of demonstration and commercial scale renewable technologies (WG, 2018a).

The supporting policy ‘ELC01: Low Carbon Energy (supporting)’ states:

“Proposals for all types of marine renewable energy generation (wind, tidal and wave energy) and associated infrastructure are strongly encouraged, especially:

a) in corresponding wave, tidal stream and any other defined renewable energy technology test and demonstration zones; and
b) in corresponding wave, tidal stream and tidal lagoon Strategic Resource Areas.

In order to understand future opportunities for offshore wind development, proposals are encouraged that support strategic planning for the sector. Relevant public authorities should, in liaison with the sector and other interested parties, collaborate to:

- *collect evidence to support understanding of environmental constraints and opportunities; and*
- *support understanding of the optimal siting of offshore wind developments across Wales (WG, 2018a).”*

1.4.4. Role of Simply Blue Energy Floating Offshore Wind Farm

As supported by the WG, SBE has adopted a plan-led approach to identifying projects and sites that are potentially suitable for development through demonstration and commercial scales technologies.

Project Erebus is a site that has arisen out of the site selection process, and the adopted ‘Stepping-Stone Strategy’. The purpose of Project Erebus will be:

- To demonstrate the deployment of FLOW at pre-commercial scale (96 MW of total capacity);
- To stimulate the development of an indigenous supply chain and Operation and Maintenance (O&M) services; and
- To progress investment toward commercial deployment of FLOW in the whole of Celtic Sea.

1.5. Site Selection and Project Development

1.5.1. Overview and Studies Completed

A wide range of studies have been undertaken to date by, and on behalf of, SBE, to identify the preferred offshore array area for the proposed Project. Final Project details, including type / configuration of WTGs, offshore cable routes, landfall location, onshore cable route, and onshore substation location will be informed by further surveys and assessment and plans will be finalised prior to the submission of the ES to the relevant authority.

Therefore, the following section provides a summary of previous and ongoing site selection work undertaken in relation to the proposed Project. This section is intended to demonstrate that a large amount of work has already been done to rule out alternative locations / routes. A full description of the site selection and consideration of alternatives process will be provided within the final Environmental Statement (ES), as per requirements within the updated 2017 EIA Regulations.

Specific studies that have been commissioned by SBE to inform the ongoing site selection process are detailed below:

- GIS-based constraint mapping and site selection review (Aquatera, 2018);
- Site Selection Review (MarineSpace, 2019a);
- Geological Desk Top Study, Erebus Stage 1 Floating Windfarm (Intertek, 2019);
- Phase 1 and Phase 2 Cable Route Assessments (JFMS, 2019);
- WindFloat Design for a generic 12+MW Wind Turbine (PPI, 2019a);
- WindFloat Supply Chain (PPI, 2019b); and
- Metocean Analysis Desk Study (Wave Venture, 2019).

1.5.2. Offshore Array

1.5.2.1. Initial GIS-based Site Selection (Aquatera)

The offshore array area where the floating WTGs will be deployed was identified following an extensive GIS-based constraints mapping exercise undertaken by Aquatera (AQT), on behalf of SBE (AQT, 2018). The initial Area of Search (AoS) was defined by SBE as the Southwest Approaches region of the UK. The Southwest Approaches region was selected as the AoS by SBE due to its work in this region since 2011, and its wish to build upon the "*Celtic Sea Alliance*" concept of knowledge sharing and development between Ireland, Wales and Cornwall.

AQT used its proprietary GIS-tool (RADMAPP) to undertake constraint mapping, with the following initial groups of constraints considered further in Table 1-1:

Table 1-1: Initial constraints considered in site selection

Issue Type	Constraint Considered
Technical	• Bathymetry; • Depth of quaternary sediments; • Current velocity; and • Average wave height.
Cost / Profitability Constraints	• Average wind velocity; • TNUoS (Transmission Network Use of System) grid access charging zones; and • Distance from off grid and upstream energy market locations.
Infrastructure Constraints	• Distance from service port; and • Distance to transmission system.
Licensing Constraints	• Shipping lanes; • Fishing areas; • Locations of key bird sensitivities; • Designated nature conservation areas; • Military exercise areas; and • Zone of Theoretical Visibility (ZTV).

The RADMAPP Model was used to assign a suitability score ranging from 1.0 to 0.0 to each parameter, based on its suitability for the development in question. A score of 1.0 meant that the parameter was completely suitable, and a score of 0.0 meant that the parameter was a barrier to development.

Due to the complexity and uncertainty of the information surrounding onshore substations and available grid capacity, three scenarios were run:

- Scenario 1: No distance from substation parameter;
- Scenario 2: Distance from 132 kV substation parameter included; and
- Scenario 3: Distance from substations believed to hold sufficient capacity for this project.

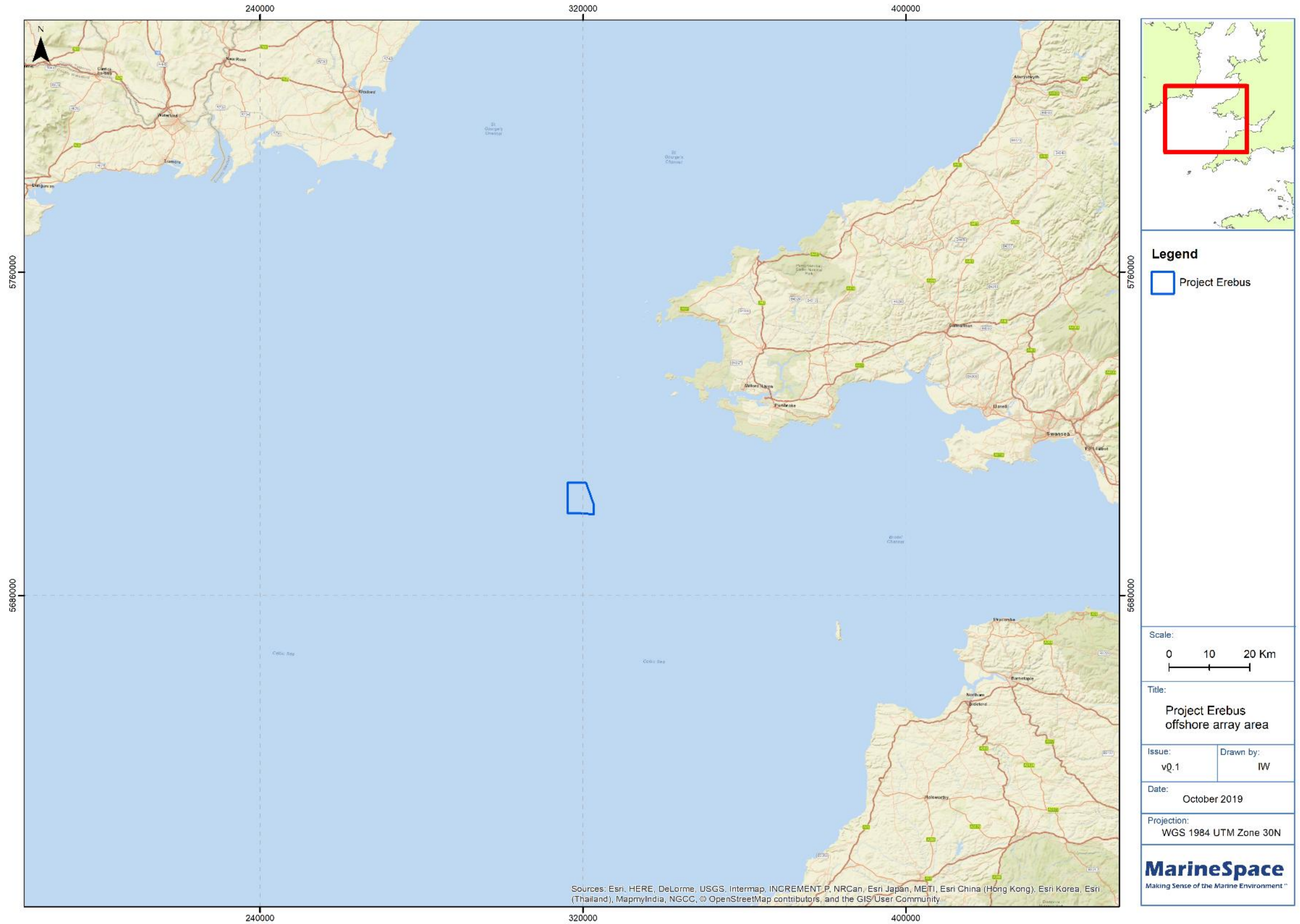
All three results were broadly comparable in terms of the most suitable locations.

Following completion of the first run of the Model, SBE provided greater input into the process, reviewing and editing suitability scores, as well as adding additional parameters into the Model.

Further runs of the Model were undertaken and a series of development polygons were identified around the most suitable areas identified by RADMAPP. Further analysis of each area was then carried out to compare and contrast the features within each area.

Following this final analysis and production of potential development area maps, SBE then engaged with The Crown Estate (TCE), presenting all the information from the suitability mapping and successive analysis. Subsequently, based on the discussions with TCE, SBE determined to take Site 2 forward for further investigation (the current offshore array area)

Figure 1.1: Proposed Offshore Array Area



1.5.2.2. Site Selection Review (MarineSpace)

Prior to the commencement of the formal EIA scoping process, SBE commissioned MarineSpace to undertake a review of all work done by AQT, to sense-check and validate the site selection process, and to ensure that more-suitable, alternative sites did not exist, prior to further studies commencing on the preferred site.

This review concluded that whilst the original GIS-based mapping work was robust and based on valid assumptions, there were certain datasets and additional information available, that could be input to RADMAPP to further inform the constraints mapping work.

A summary of key additional data identified, and added to the review process, is presented below:

- The seabird data used by AQT in the RADMAPP Model did not include records for Welsh waters. Therefore, no score was available to weight the dataset and the sensitivity of areas outwith the SPA and SAC boundaries. MarineSpace obtained open source Welsh seabird data from the RSPB and NRW, including European Seabirds at Sea (ESAS) and Thaxter *et al.* (2012) foraging area data;
- MarineSpace has established relationships with local stakeholders, specifically fishermen, via previous projects. Therefore, a chart was issued to local Welsh and north Devon fishing organisations showing the broad project area, requesting information on fishing activity in this area;
- MarineSpace also engaged with the Planning Inspectorate (Wales)(PINS), Welsh Government Planning Directorate, NRW Marine Licence Team, the Local Planning Authorities (LPA); Pembrokeshire County Council (PCC) and Pembrokeshire Coast National Park (PCNPA); the Maritime and Coastguard Agency (MCA) and the National Trust to inform the site location and feed into the site selection report;
- MarineSpace advised that rather than the original RADMAPP scoring re: MPAs be used, a more refined approach should be adopted, whereby increased distance from MPA's be scored to better define and understand risk to consent; and
- MarineSpace provided AQT with information and spatial data obtained from the Oil and Gas Authority, via the National Data Repository service, to ensure all data sets were complete and up to date.

Following the input of these additional datasets/stakeholder feedback, RADMAPP was re-run to assess whether the original Site 2 was still the most viable project location. This revised assessment confirmed that Site 2 is the optimal location for a <100MW FLOW demonstration project.

1.5.3. Grid Connections

An application for the Grid Connection at Pembroke Power Station has been submitted by SBE. The applicant has been in early discussions with Western Power Distribution (WPD) and National Grid Transmission (NGT), at this stage NGT is not proposing alternative connections for the proposed scheme.

1.5.4. Marine Export Cable

A range of potential marine export cable routes from the main array site to landfall have been considered as part of early-stage feasibility work. GIS-based constraints mapping was carried out, with the data sources outlined in Section 1.5.1 used to inform this work. Key constraints considered in the consideration of marine cable routes included large sand wave features, recorded wrecks, MoD firing areas, an explosive dumping ground and high-density shipping lanes.

A long-list of 24 offshore cable route options were identified, ranging from Broad Haven (North) to the north and Freshwater East to the south. These options were assessed against a series of technical, economic, environmental and other stakeholder (MoD; MHPA) criteria.

Following this assessment, the following export cable routes were identified as viable options and are presented within this report – see Figure 1.2:

1. West Angle Bay;
2. Angle Bay; and
3. Freshwater West Beach.

In addition to those sites identified above SBE are in discussions with Milford Haven Port Authority (MHPA) regarding a potential cable route within the Haven Waterway and landing point further east. This option is considered within the broad scope of the Study Areas set out for each section and if determined that bringing a cable route through the waterway is a viable option, this option will be considered further.

As part of ongoing project development, these potential routes will be assessed further so that a preferred option can be fixed prior to the main EIA commencing. Responses to this scoping report relevant to these route options will also be fully considered in the final route selection.

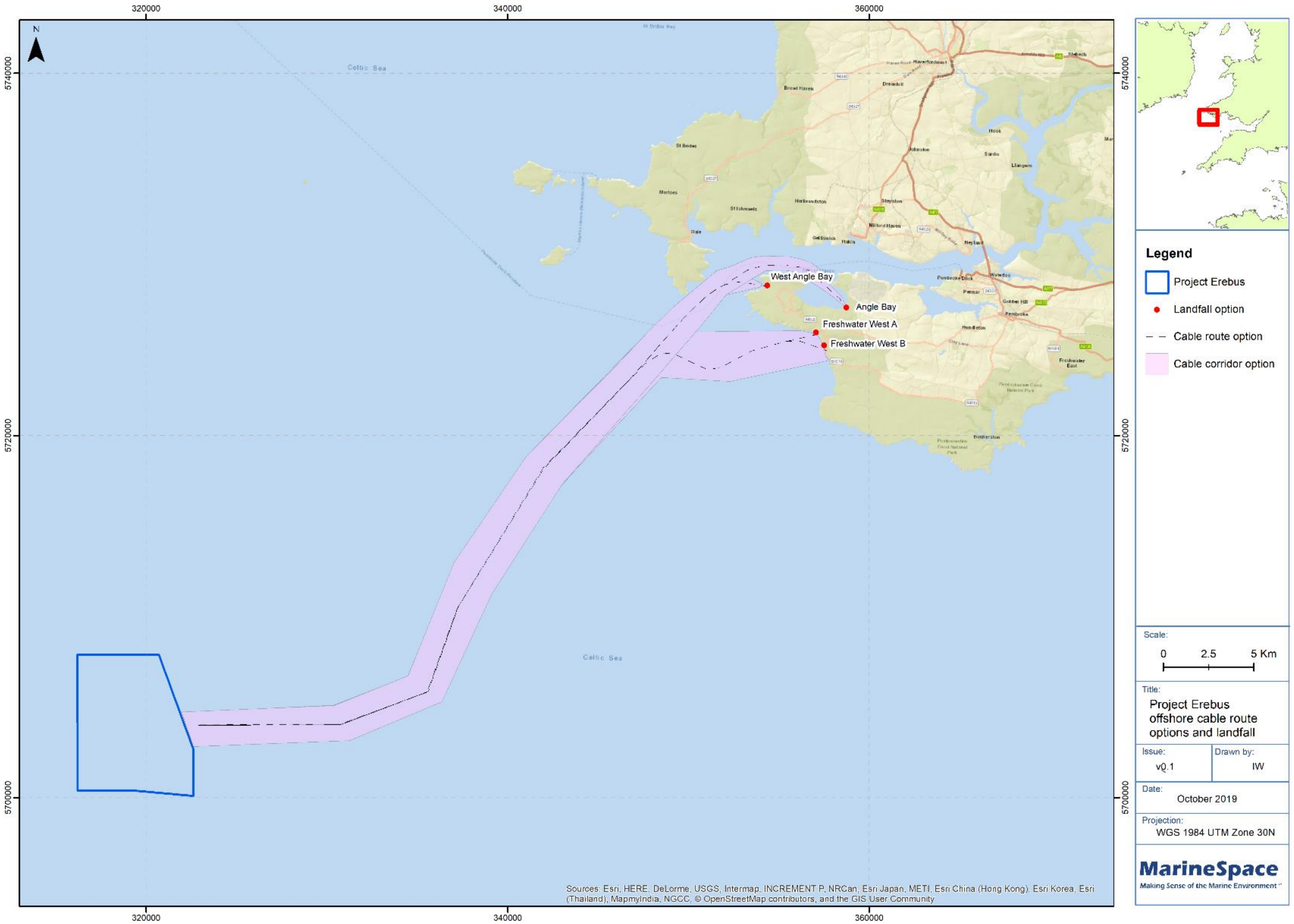
1.5.5. Marine Export Cable Landfall Sites

As per the approach detailed above for export cable routes, a range of potential landfall options have also been considered. GIS-based constraints mapping was again the key tool for site selection, complemented by local knowledge from MarineSpace staff who have worked on other projects in this area.

A long-list of 13 potential landfall locations were initially identified, covering the same broad geographic extent as the export cable routes. Assessment was carried out of each landfall option against the same criteria as for the export cable route selection. Certain landfall options were ruled out due to interaction with MoD land following discussions with this key stakeholder. Other options were ruled out due to subsequent excessive onshore cable routes – see below.

The current landfall options that are currently under consideration are the same locations as above for the export cable route (West Angle Bay; Angle Bay; Freshwater West Beach; and a potential site within the Haven Waterway) – see Figure 1.2 (below).

Figure 1.2: Short-listed Export Cable Routes and Landfall Options



1.5.6. Onshore Cable Routes

The potential onshore cable route options were intrinsically linked to the long-list of landfall options, thus resulting in a long-list of 13 potential onshore routes (the same number as for the landfall long-list). Similar assessment of constraints, including electrical design and landowner considerations, was undertaken to develop a shorter list of preferred options. These are shown in Figure 1.3. As with the export cable route and landfall, these potential route options will be further refined based on feedback from this scoping exercise and more detailed engineering, environmental and landowner assessments.

1.5.7. Onshore Substation

The options for the location of the onshore substation were intrinsically linked to the need to be close to the existing Pembroke Power Station so that the connecting cable circuit length was minimised. Following initial review of electrical, environmental and landowner constraints, 6 preliminary options were identified, each with different cost and risk profiles – see Figure 1.3. Site selection will be further refined based on feedback from stakeholders and the Scoping Opinion.

1.6. Consultation to Date

SBE engaged in pre-application discussions with regulatory and statutory bodies at an early stage of the process to review project feasibility and consider issues associated with the proposed development. Discussions have focused on consents required, baseline environmental and socio-economic data, project boundaries and grid connection.

A consultation log has been kept and further details are provided under Table 1-2.

Figure 1.3: Short-list of Onshore Cable Routes and Onshore Substation Locations

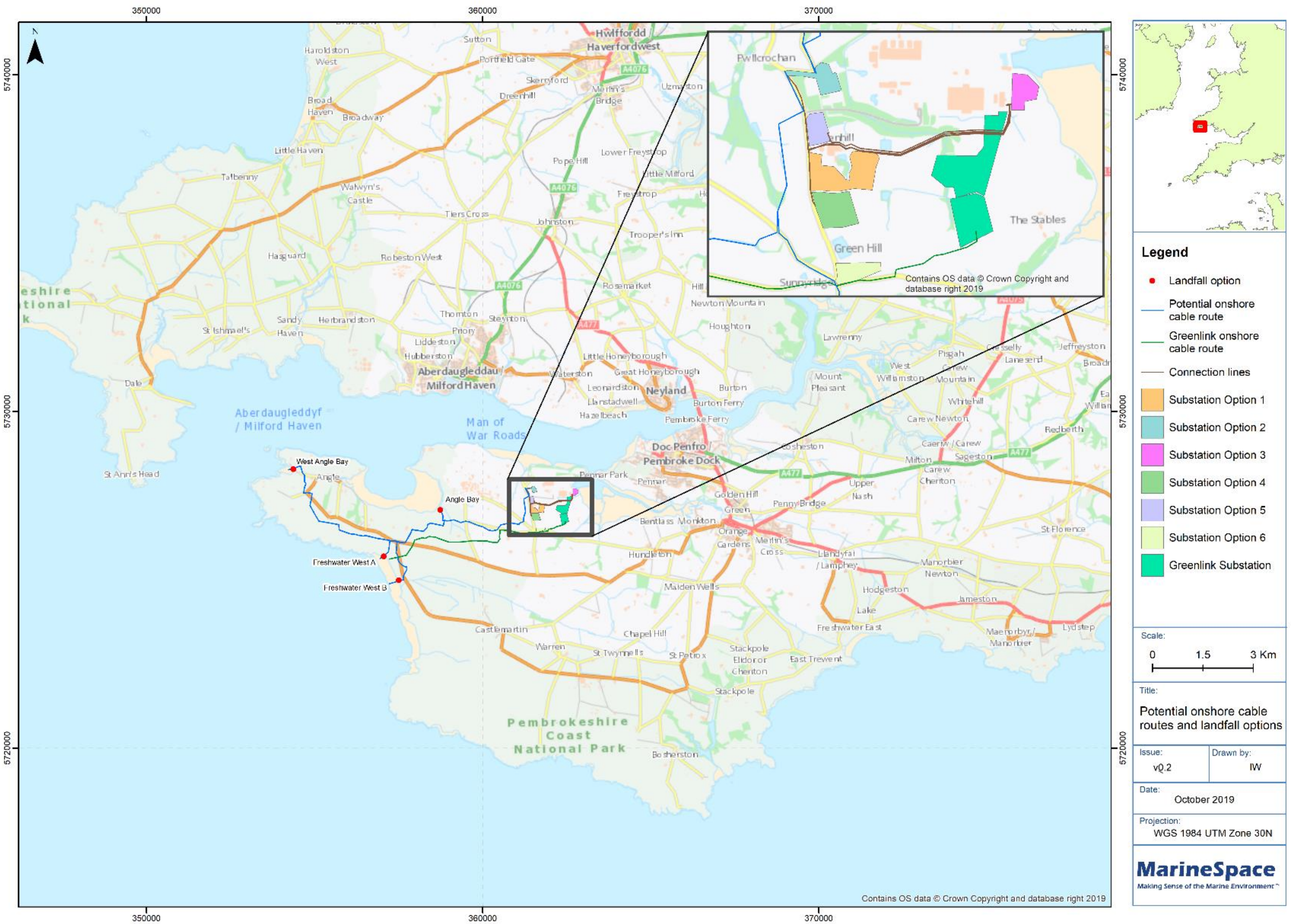


Table 1-2: Summary of Consultation to Date

Consultee	Dates	Purpose	Outcome
The Crown Estate	April / June / September 2019	Quarterly meetings to introduce project, update TCE on progress and progress the project's Offshore Wind Test and Demonstration Option Agreement application.	TCE supportive, clarified process and key requirements for application. Will review draft Option Agreement application prior to submission in October 2019. TCE considered that Erebus would be unlikely to trigger a plan level HRA alone.
Commercial Fisheries Organisations (various)	June / July / August 2019	Email to introduce project, understand areas of fishing activity, and risks to fishing sector	Where available, details of fishing activity were shared, including type and location. Agreement for continued consultation as project details refined.
JNCC	June / July 2019	Enquiring over access to seabird datasets to inform site selection.	JNCC was able to provide ESAS dataset for site area.
Maritime and Coastguard Agency (MCA)	July 2019	Telecon to introduce project and understand any significant issues or concerns from MCA about proposed development.	Nothing significant identified from discussion. It was confirmed a Navigational Risk Assessment would be required; MCA would like to be involved with future technical discussion (most likely joint with Trinity House); and MCA may attend Hazard Analysis Workshop.
Ministry of Defence	June / September 2019	Attendance at Castlemartin Steering Group meeting to introduce the project, clarify roles and contacts and review process. Email to follow up on proposed landfall locations and onshore cable route.	MoD supportive of further discussions regarding landfall and onshore cable route if necessary. Further meeting to follow with MoD in October / November

Consultee	Dates	Purpose	Outcome
National Grid Transmission	March 2019	To determine availability of and route to securing capacity at Pembroke Power Station GSP	National Grid, as of 1st April 2019 is splitting into to the National Grid Transmission asset Owner (NGTO) and the National Grid Electricity System Operator (NGESO). Any project connection contract will be with NGESO. National Grid own both 400kV and the 132kV sides of the substation so connection at either voltage is possible. Both 400kV and 132kV substations are indoor air insulated and can offer the capacity required. This capacity is reserved for wind and renewables projects only. National Grid were supportive and flexible in response to our outline plans. They are excited about potentially supporting the first FLOW project on their system. They recognised the fact that the project/technology is pre-commercial and were keen to help de-risk the process where possible. A competent grid connection application was submitted to NGESO in October 2019.
National Trust	September 2019	Meeting to introduce the project and discuss proposed landfall locations and onshore cable route.	National Trust did not identify any significant constraints and were supportive of further discussions regarding landfall and onshore routes.
NRW (Marine Licensing)	June / July / August 2019	Email to introduce project and request attendance at Inception meeting with PINs and Welsh Government.	See comments under PINS. NRW confirmed it would process the Marine Licence under new powers transferring functions to the Welsh Government under the Wales Act 2017. No application would be necessary to the MMO.
NRW (Data	July / August	Submission of data request for	Limited response from Data Distribution team, other than reference to

Consultee	Dates	Purpose	Outcome
Distribution)	2019	seabirds and marine mammals to inform site selection.	standard guidance document. Specific requests for ESAS data in Welsh waters were directed to JNCC.
NRW (Marine Area Advice and Management Team)	July / August 2019	Arrangement of Discretionary Advice Service (DAS) and submission of survey specification for seabird and marine mammal surveys.	NRW reviewed the survey specification and provided comments on the seabird surveys and marine mammal surveys.
NRW (Terrestrial Teams)	August 2019	Call and email to introduce project.	Officer from the South Wales Planning Team was contacted to introduce the project, discuss timeframes and confirm that further pre-application discussions would be held on terrestrial elements into 2020.
OFGEM	April 2019	Confirm project status in relation to the OFTO regulations.	OFGEM were useful in clarifying the current status of the Project with respect to the regulations. If the nominal voltage of the export cable is over 132kV, a transmission licence could only be granted through the OFTO tender process. At 66kV export, the Project does not trigger the requirement for an OFTO. However, in terms of generation it could trigger the OFTO requirements. The guidance advises that: with regard to generation activities, the Department's policy has broadly been to only consider applications for generating stations of less than 100 MWs capacity. This is because such plants will generally have a low impact on the total electricity system and it is considered appropriate therefore that, subject to consultation, such stations be exempted from the same degree of system regulation (and costs) as imposed by standard licensing conditions. To confirm the project's status as OFTO exempt, an application will have to be submitted to the Secretary of State.

Consultee	Dates	Purpose	Outcome
Pembrokeshire County Council (PCC) – (Local Planning Authority (LPA))	July / August 2019	Joint pre-application meeting with PCC and PCNPA to introduce project, discuss consenting options and review further pre-application process.	Neither PCC nor PCNPA had an objection to the proposed S.36 consent with deemed planning permission; understood pre-application discussions would continue direct with each authority on specific issues such as landscape and ecology; and further engagement would be via the formal pre-application service. PCC main concern related to siting of substation and potential visual impacts from another building in proximity to power station.
Pembrokeshire Coast National Park Authority (PCNPA) – (LPA)	July / August 2019	As above	As above. PCNPA main concerns related to landscape, seascape and visual impacts from turbines from sensitive viewpoints along the coast. PCNP is the only coastal National Park and visual impacts a possibility. Suggested a sample photomontage be included as part of EIA scoping report.
PINS and Welsh Government Planning Directorate	June / July / August 2019	Arrangement of Inception Meeting with PINS, Welsh Government Planning Directorate and NRW Marine Licence Team to introduce project, review consenting strategy, process and programme.	PINS provided an overview of the new S.36 process, PINS to administer but application determined by Welsh Ministers. PINS suggested invoking Regulation 39 to formalise NRW leading on EIA. NRW suggested S.36 with Deemed Planning Permission to cover all offshore and onshore development under one consent. Discussion over programme and review of processing times.
RSPB	July / August 2019	Enquiry over access to seabird datasets to inform site selection.	Limited access to data for Welsh waters.
Western Power Distribution (WPD)	April 2019	To determine availability of and route to securing capacity at Pembroke Power Station GSP	WPD were helpful in discussing the constraints to a project application via the local Distribution Network Operator (DNO). They would consider application for up to 100MW but no more. Risk of impacts on local distribution network for Project were thought to be low.

Consultee	Dates	Purpose	Outcome
			As NG own the substation, WPD would effectively be submitting a ModApp on behalf of the Project and thus the Project becomes a third party to the process. This precludes the project having direct communication with NG and could extend the application period considerably. Following this consultation and constraints presented, application via DNO was not progressed further.

1.7. Scoping Opinion

It is requested that any correspondence relating to this Scoping Report and the request for a Scoping Opinion is directed to:

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1.8. References

BEIS (Department for Business, Energy and Industrial Strategy), 2017. UK Energy in Brief 2017. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/631146/UK_Energy_in_Brief_2017.pdf [Accessed August 2019]

Committee on Climate Change, 2019a. Carbon budgets: how we monitor emissions targets. Available online at: https://www.theccc.org.uk/tackling-climate-change/the-legal-landscape/the-climate-change-act/ [Accessed September August 2019]

Committee on Climate Change, 2019b. How the UK is progressing. Available online at: https://www.theccc.org.uk/tackling-climate-change/reducing-carbon-emissions/how-the-uk-is-progressing/ [Accessed August 2019]

DECC (Department of Energy and Climate Change), 2011. UK Renewable Energy Roadmap. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48128/2167-uk-renewable-energy-roadmap.pdf [Accessed August 2019]

MarineSpace, 2018. Greenlink Interconnector Commercial Fisheries Assessment. MarineSpace Ltd. February 2018.

MarineSpace Ltd, 2019b. Project Erebus WP1.1 Site Selection Review: Final.

MarineSpace Ltd, 2019c. Project Erebus WP1.2 Consenting Strategy.

MarineSpace Ltd, 2019d. Project Erebus WP1.4 Stakeholder Consultation Plan

MarineSpace, 2019e. Invitation to Tender; For The Provision Of Seabird And Marine Mammal Surveys For The Proposed Project Erebus Floating Offshore Wind Farm Site. MarineSpace Ltd. August 2019

Welsh Government, 2017d. Energy Generation in Wales. Available online at: https://gweddill.gov.wales/topics/environmentcountryside/energy/renewable/energy-generation-in-wales/?lang=en [Accessed August 2019]

Welsh Government, 2018a. Draft Welsh National Marine Plan. Available online at: https://gov.wales/draft-welsh-national-marine-plan [Accessed August 2019]

Welsh Government, 2018b. Planning Policy Wales. Chapter 6. Distinctive and Natural Places. Section 6.1 - The Historic Environment. Edition 10. December 2018. Available online at: https://gov.wales/sites/default/files/publications/2019-02/planning-policy-wales-edition-10.pdf [Accessed August 2019]

Welsh Government, 2012. Marine Energy. Available online at: https://gweddill.gov.wales/topics/environmentcountryside/energy/renewable/marine/?lang=en [Accessed August 2019]

Welsh Government, 2019a. WIMD Report and interactive tool. Available online at: http://wimd.wales.gov.uk/ [accessed August 2019]

2. Consents and Scoping

2.1. Introduction

The following section of the report provides details of the key project consents that will be required to construct and operate the proposed Project. Details are also provided of the key supporting documents needed to accompany any consent applications, including an Environmental Statement (ES), produced following the Environmental Impact Assessment (EIA) process.

2.2. Consents to Install and Operate an Offshore Energy Installation

2.2.1. Consents Required

The following primary consents are required for the proposed FLOW development:

- **Section 36 consent with deemed planning permission**, under the Electricity Act 1989, to construct and operate a generating station, with devolved powers under Section 39 of the Wales Act 2017; and
- **Marine Licence** under the Marine and Coastal Access Act 2009 (in force since 6 April 2011) to carry out certain activities in the marine environment, including construction works, depositing substances or articles, and dredging.

2.2.2. Consenting Authorities

2.2.2.1. Section 36 Consent with Deemed Planning Permission

Section 39 of the Wales Act 2017 devolves authority for the consenting of S.36 applications for offshore electricity generating stations of between 1-350 MW under the Electricity Act 1989 to Welsh Ministers. Projects of between 1-100 MW in Welsh waters were previously dealt with by the MMO, with projects >100 MW dealt with by PINS via the Development Consent Order (DCO) process under the Planning Act 2008. At the time of writing no application has yet been submitted to Welsh Ministers for a S.36 application.

S.36 applications will be administered by PINS and, following the appropriate consultation period (and hearings if necessary), the Inspector will submit their report to the Welsh Ministers for determination.

Planning permission can be deemed to be granted with a S.36 consent under Section 90(2) of the Town and Country Planning Act 1990 (as amended by S.21 of the Growth and Infrastructure Act 2013). This would result in a single consent being issued for the proposed project, plus the Marine Licence (issued by NRW). For this option, PINS (on behalf of Welsh Ministers) would administer the process, with the Local Planning Authority (LPA) Pembrokeshire County Council (PCC) and Pembrokeshire Coast National Park Authority (PCNPA) consulted. No separate application under the Town and Country Planning (Development Management Procedure) (Wales) Order would be submitted to PCC or PCNPA. Following consultation with PINS, WG, NRW Marine Licensing, PCC and PCNPA, SBE intend to submit a S.36 with deemed planning permission.

Following a request by SBE, the Welsh Ministers have invoked Regulation 39 of The Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2017 (as amended) via a written notice issued on 12 September 2019. This has resulted in the deferral of EIA considerations, in relation to the S.36 Electricity Act 1989 application, from PINS to NRW.

2.2.2.2. Marine Licence

NRW administers Marine Licence applications under the Marine and Coastal Access Act 2009 (MCAA) for licensable marine activity. Prior to April 2019, NRW administered marine licences for schemes up to 100 MW within 12 nautical miles (nm), however the Wales Act 2017 also transfers the function for marine licensing beyond the territorial limit of 12 nm, from the MMO to the WG, to be administered by NRW.

As set out below, NRW will lead on the EIA for the S.36 consent and Marine Licence.

2.3. Environmental Impact Assessment

The EIA Directive (2014/52/EU) requires that public and private projects that are likely to have significant effects on the environment, by virtue of their size, location or nature be made subject to an assessment prior to consent being given. The following regulations transpose the EIA Directive (2014/52/EU) into UK legislation and apply to Project Erebus:

- The Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2017 – applies to applications for Section 36 consent under the Electricity Act 1989; and
- The Marine Works (EIA) Regulations 2007 (as amended) – applies to applications for a Marine Licence under the Marine and Coastal Access Act 2009.

Under both regulations listed above, Project Erebus would be recognised as a Schedule 2 project; development to provide a generating station or installation for the production of electricity (not otherwise identified under Schedule 1). Schedule 2 developments require screening to identify if EIA is required, Schedule 1 developments always require EIA. A separate EIA Screening Request has not been submitted, however this submission is for Screening and Scoping Opinion. It is anticipated that EIA will be required following the inception meeting held with WG, PINS and NRW, where all parties agreed that Project Erebus would be EIA development due to the type, scale and location of the Project in relation to sensitive areas.

As noted above, SBE has invoked Regulation 39 of The Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2017 (as amended), thus deferring EIA considerations, in relation to the S.36 Electricity Act 1989 application, from PINS to NRW.

A copy of this Scoping Report has been submitted to PINS, for deferral to NRW for the S.36 consent, and a copy submitted to NRW Marine Licensing for the Marine Licence application.

Details of the proposed methodology for the EIA are provided in Section 3. This section also includes details of the 'project envelope' approach to assessment that will be adopted in the EIA. This approach, which is well-established for EIAs of offshore renewable projects, ensures that the worst-case scenario is assessed for each EIA topic.

With respect to relevant EIA guidance, the EIA that will be undertaken will take full account of key policies, legislation, guidance and advice, including but not limited to the following:

- Environmental Impact Assessment for Offshore Renewable Energy Projects – Guide, 2015. Report PD6900:2015. Prepared by ABPMer on behalf of The British Standard Institution (BSI). ISBN 978 0 580 87163 4
- Ministry for Housing, Communities and Local Government (MHCLG) “Guidance: Environmental Impact Assessment” (2017);
- Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU) (E European Union, 2017);
- Institute of Environmental Management & Assessment (IEMA) “Guidelines for Environmental Impact Assessment” (2017);
- Planning Policy Wales (2018);
- Draft Welsh National Marine Plan (2019);
- National Development Framework for Wales [currently in development]; and
- The Wildlife and Countryside Act 1981.

2.4. Habitats Directive and Habitats Regulation Assessment

The aims of the EC Habitats Directive (Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora) and Birds Directive (2009/147/EC) are to maintain or restore European protected habitats and species; contribute to a coherent European ecological network of protected sites by designating Special Areas of Conservation (SACs) and Special Protection Areas (SPAs); and ensure appropriate assessment of plans and Projects likely to have a significant effect on the integrity of an SAC.

The UK has transposed the Directives into law through a series of regulations. Those relevant to Project Erebus are:

- The Conservation of Habitats and Species Regulations 2010 (apply to terrestrial and offshore waters out to 12 nm); and
- Offshore Marine Conservation (Natural Habitats & c.) Regulations 2007 (as amended) (apply to UK offshore waters (i.e. from 12 nm from the coast, out to 200 nm, or to the limit of the UK Continental Shelf Designated Area).

Due to the proximity of European Sites to the Project Erebus site, an HRA will be required to assess whether the project will have a likely significant effect on the interest features of the European site, either individually or in combination with other plans or projects. Where a significant effect is likely an Appropriate Assessment will be required to assess the implications on the site’s conservation objectives.

This assessment is required under the Regulations noted above and it is the developer’s responsibility to provide the competent authority with such information as may reasonably be required “*for the purposes of the assessment*” or “*to enable them to determine whether an* *appropriate assessment is required*". The relevant competent authorities are NRW for the Marine Licence and the Welsh Ministers, administered by PINS, for the S.36 consent.

Further details of the proposed approach to the HRA process are provided in Section 3.11.

2.5. Additional Approvals

The following secondary consents may be required, depending on siting, proposed timing and method of works;

- European Protected Species Derogation Licence issued under the Conservation of Habitats and Species Regulations 2017 to undertake works that may cause harm to European Protected Sites; and
- SSSI Consent for works that may cause harm to a SSSI.

In addition to the primary and secondary consents listed above, the following additional consents / approvals may be required:

- Electricity Generation Licence from Ofgem;
- Electricity Transmission Licence from Ofgem;
- Grid connection agreement with either Western Power Distribution or National Grid Transmission;
- Operational agreements with MoD or other relevant landowner;
- Offshore safety zone around or adjacent to the Project Erebus site;
- Wayleave and / or Deed (land transfers, leases or easements) agreements with landowners to install, replace and maintain equipment;
- Notification procedure under the New Roads and Street Works Act 1991, with the relevant highway authority; and
- Environmental Permits, e.g. for flood risk activities.

2.6. Co-ordination of Consenting

It is the intention of SBE to twin track the submission of the S.36 Consent with Deemed Planning Permission, with the Marine Licence. Both submissions will be supported by one Environmental Statement, covering offshore and inshore marine and the coastal and terrestrial environments.

It is already understood that a submission will be made to PINS for the S.36 and NRW for the Marine Licence. Each will be accompanied by the ES, although NRW will lead on the processing of the EIA. Each submission will also be accompanied by sufficient information for both competent authorities to undertake an HRA.

The ES will include sufficient information to meet the requirement of the following:

- EC Habitats Directive: Recognising any impacts arising from the proposed development on European Protected Species and requirement for derogation licences;
- Marine and Coastal Access Act 2009: In respect of a Marine Licence and potential impacts on Marine Conservation Zones;

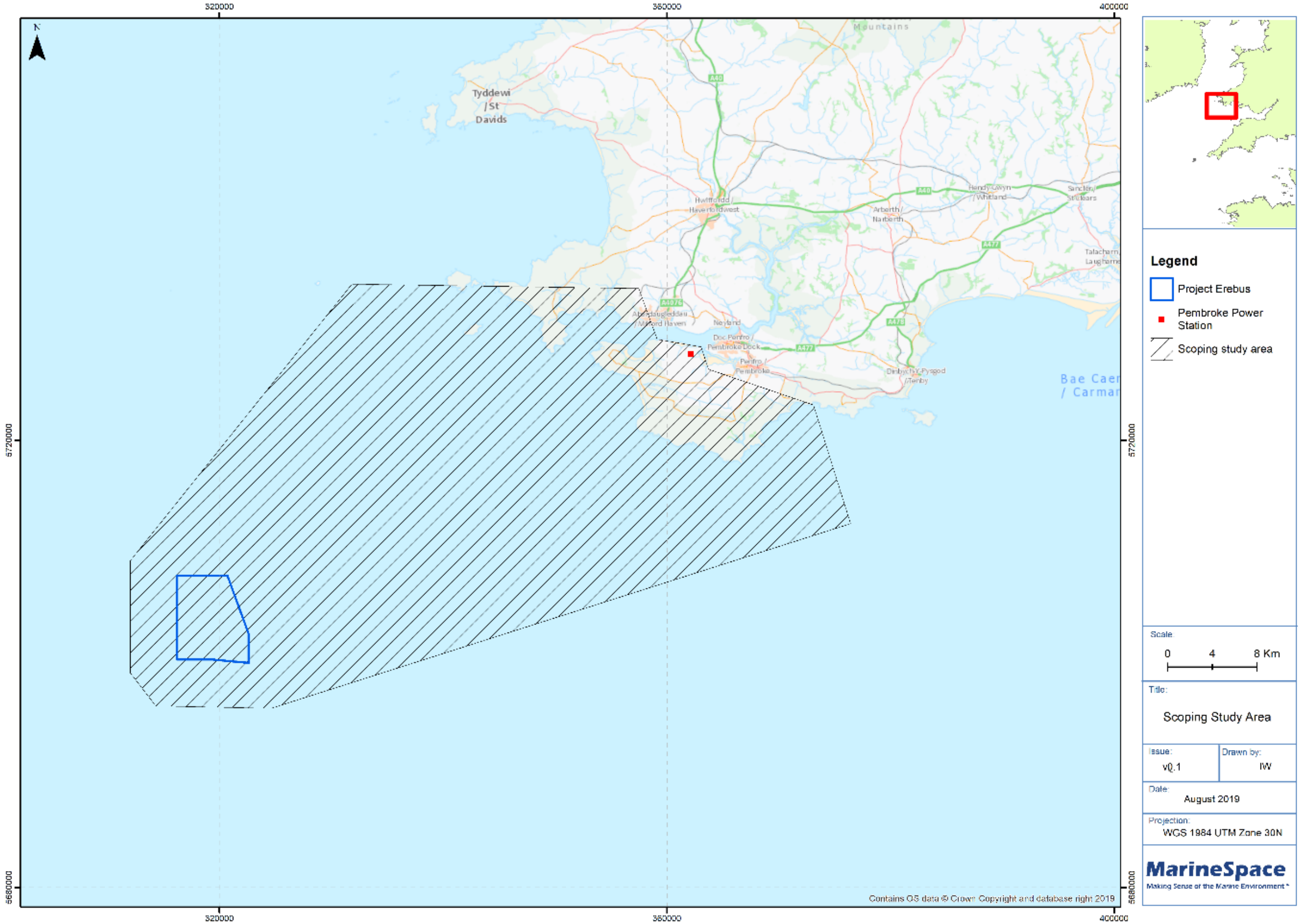
- The Well-being of Future Generations (Wales) Act 2015: To provide a framework for the consideration of social, economic, environmental and cultural impacts on the well-being of Wales, climate change being integral to those goals;
- The Environment (Wales) Act 2016: Recognition of policy and area statements to reflect the priorities and opportunities for Wales' natural resources;
- Planning Policy Wales: Recognition of current planning policy set out in PPW 10;
- Draft Welsh National Marine Plan (WNMP): It is anticipated the WNMP will be adopted within the next 2 years and any subsequent submission will be in accordance with the policies to ensure marine resources are used in a sustainable way in line with the high-level marine objectives;
- Local Development Plans (LDPs): Pembrokeshire County Council Local Development Plan - PCC Local Development Plan, 2013 will be referred to for any terrestrial elements of the proposed scheme, within PCCs jurisdiction; and
- Pembrokeshire Coast National Park Local Development Plan - It is expected that LDP 2 will be adopted by the time of submission; and works, within the jurisdiction of PCNPA, will be in accordance with the relevant LDP policies.

2.7. Scoping Study Area

Figure 2.1 shows the overarching study area upon which this Scoping Report is based. This area includes the area of interest of the FLOW development, including a 4 km seaward buffer to the south and west. The offshore area extends beyond the scope of the proposed offshore cable routes to encompass a large search area that has been applied in screening alternative cable routes and landfall sites. The offshore area also reflects the geological study area used in early feasibility studies.

For certain EIA topics, the EIA Scoping Study Area is different to that shown below. Where this is the case, the extents of these scoping Study Areas are provided in each section of the report.

Figure 2.1: EIA Scoping Study Area



2.8. References

BSI, 2017. Environmental Impact Assessment for Offshore Renewable Energy Projects. Available: http://shop.bsigroup.com/upload/271276/PD%206900.pdf [accessed September 2019]

European Union, 2017. Guidance on the preparation of the EIA Report (Directive 2011/92/EU as amended by 2014/52/EU). Available: https://ec.europa.eu/environment/eia/pdf/EIA_guidance_EIA_report_final.pdf [Accessed September 2019]

Infrastructure Planning Commission, 2011. *Habitats Regulations Assessment for Nationally Significant Infrastructure Projects*. IPC.

Institute of Environmental Management & Assessment (IEMA), 2017. Guidelines for Environmental Impact Assessment" (2017)

Ministry for Housing, Communities and Local Government (MHCLG), 2017. "Guidance: Environmental Impact Assessment" (2017)

PINS, 2017. EIA: Process, Preliminary Environmental Information, and Environmental Statements. Available: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2017/12/Advice-note-7.pdf [accessed September 2019]

Welsh Government, 2018. Planning Policy Wales, 2018. Available at: https://gov.wales/sites/default/files/publications/2019-02/planning-policy-wales-edition-10.pdf [accessed September 2019]

3. Proposed Approach to Environmental Impact Assessment

3.1. Introduction

This section sets out the general approach and methodology to the EIA process for the proposed Project. It draws on key relevant EIA guidelines and best practice (e.g. BSI, 2015; IEMA, 2016; EU, 2017; NRW, 2017; CIEEM, 2018). The proposed approach is intended to ensure the EIA and the final ES is fit-for-purpose (focused, proportionate and effective) as a tool to aid the consent decision-making process. This includes the approach that will be used to identify, evaluate and mitigate the environmental effects of the proposed Project, as well as ensuring that the EIA core findings are clearly presented in the ES. This will enable the Regulatory bodies to come to reasoned conclusions on the likely significant effects of the proposed Project as part of their decision-making processes. A list (albeit not exhaustive) of relevant EIA guidance that will be used throughout the EIA process is provided in Section 2.3 (above).

Amendments to the Marine Works EIA Regulations in May 2017 have placed a greater emphasis on the identification of the 'likely significant effects' of proposed projects at the earliest possible stage, so that the EIA can take a focused approach. The underlying tenet of the Regulations is to streamline assessments and limit their scope to those aspects of the environment that are likely to be significantly affected. To streamline the EIA and ES for the proposed Project, they will be based on a series of principles, as follows:

- Only environmental information that is relevant, necessary and material to the decision or to address issues raised by stakeholders will be provided in the ES;
- Whilst the ES will provide a full factual description of the proposed development and its effects, the emphasis will be on the main or significant environmental effects to which the Project is likely to give rise;
- Impacts which have little or no significance will have only a very brief treatment to indicate that their possible relevance has been considered; and
- Conclusions about significant or non-significant effects in the ES will be supported by reasoning and evidence. The depth of this evidence will vary across issues and receptors.

3.2. Project Phases

The EIA will consider the activities carried out within the three distinct phases of the proposed Project:

1. **Construction**: Offshore construction includes installation of WTGs and foundations / moorings, offshore electrical infrastructure including inter-array cables and a single export cable. Onshore construction includes cable landfall, the onshore cable, and an onshore substation near Pembroke Power Station;
2. **Operation**: Presence and operation of floating offshore WTGs and associated infrastructure, including maintenance activities; and
3. **Decommissioning**: Decommissioning and removal of WTGs and on- and offshore infrastructure. In some cases, it may be less environmentally damaging, or a preferred

option, to leave some infrastructure *in situ* rather than removing entirely. The most appropriate approach to Project decommissioning will be decided nearer the end of the Project lifetime, to ensure approaches are based on best practice and best available evidence.

3.3. EIA Process

This EIA Scoping Report presents the conclusions of the preliminary scoping exercise, or Preliminary Environmental Appraisal (PEA) for the proposed Project. It sets out those environmental issues that will be considered in the EIA, the assessment approach and the likely depth of evidence required to inform the assessment of each of the identified effects. This report also identifies those environmental effects for which it is suggested that no further consideration is necessary, either because they are unlikely, or because they are not likely to be of significance in their magnitude, duration or impact (i.e. no likely significant effects can be determined at the scoping stage). Further consideration is given to assessing significance and the distinction between significant and non-significant effects in Section 8.7.

The impact assessment itself will be an iterative process, featuring scoping as a core ongoing activity, refining understanding for the proposed Project's likely significant effects, and defining what information is of relevance and value. This iterative process will 'scope down / out' or 'retire' issues that are not likely to result in significant environmental effects and ensure that the EIA process identifies and focuses on the issues that may result in significant effects. It will also ensure that the ES presents an appropriate and proportionate depth of evidence on the environmental effects of the Project in a format that is accessible.

Table 3-1: Components of the Proposed Iterative EIA for the Proposed Project.

Component	Detail
Regulator and Stakeholder Consultation	Clear and focussed consultation with various parties, at key stages in the assessment process to address key concerns and identify key data gaps.
Scoping	Initial scoping study to identify the potentially significant direct and indirect likely effects of the Project and Cumulative Impact Assessment (CIA). Initial assessment of the depth of evidence required for EIA topics and, where relevant, need and scope of additional project-specific surveys.
Evidence Collection and Collation	Required to characterise the existing environment and gather appropriate data to enable an assessment of the environmental effects of the Project. EIA evidence collection and collation will include review and use of existing data and evidence, as well as project-specific survey activity to gather additional information or data, if necessary. This will likely also include project-specific specialist studies to provide further information on key parameters which may be affected by the project or on key impact pathways. These could include studies to predict changes to the physical environment as well as biological and human receptors.

Component	Detail
	Nature and depth of evidence to assess the environmental effects of the Project are indicated in Chapters 4-7 but will be part of the iterative EIA process. This review will be based on the findings of initial baseline studies, the assessment of effects and consultation with regulatory authorities and other stakeholders
Impact Assessment	Evaluation of the existing environment, definition of receptors (including their sensitivity – tolerance, adaptability and recoverability). Evaluation and prediction of the potential positive and negative impacts of the Project on the receiving environment plus assessment of the likely significance of the effects. The impact assessment will consider interactions between the project and existing activities and interactions between environmental topics. It will also identify any monitoring programs needed to verify the predicted effects and the effectiveness of mitigation measures to allow an Adaptive Environmental Management Process (AEMP) to be followed where appropriate.
Mitigation and Optimisation including Project Design Refinement	Where significant adverse effects are identified, mitigation measures will be proposed, designed to eliminate or ameliorate these effects to acceptable levels. Any required design changes and / or practical mitigation measures to avoid, reduce or offset likely significant effects will be considered and fed back into the Project Design Envelope (i.e. through an Adaptive Environmental Management Plan (AEMP) process). The EIA will also identify proposed monitoring procedures to keep under systematic review any significant adverse effects on the environment resulting from the construction and operation of the Project, as well as to identify unforeseen significant adverse effects, in order to be able to undertake appropriate remedial action where required.
Determination of Residual Effects	The likely significance of effects that remain after implementation of design optimisation and mitigation measures will be assessed (residual effects). The level of certainty associated with proposed mitigation measures both in terms of delivery and effectiveness will be considered as part of this stage.
Cumulative Impact Assessment	The potential for the effects of the project to interact cumulatively with those of other planned projects to result in likely significant effects will be assessed. If necessary additional optimisation mitigation or monitoring would be identified to avoid or reduce potentially significant cumulative effects.
Inter-Related Effects	An assessment will be made of the potential for individual effects to interact together to create likely significant effects.
Production of Environmental Statement	An ES will be produced to document the findings of the EIA as a tool to inform decision-making, in a format that is accessible to stakeholders. The ES will include a Non-Technical Summary (NTS).

As well as being iterative, the EIA process will be outcome led, whereby:

- The ES will be based around a clear narrative, setting out the key conclusions and messages of the EIA, backed up by a clear evidence-based rationale;
- Topic assessments will focus on delivering clarity and confidence in the key messages they need to deliver via the EIA process and ES presentation;
- Any likely significant effects identified are reliable and backed up by the right compelling evidence for the topic or subtopic's key stakeholders;
- Any mitigation is clearly explained as to why it is capable and sufficient to manage the identified likely significant effects;
- Other impacts are clearly and concisely presented, aside from any likely significant effects; and
- The assessment provides all interested stakeholders with confidence that any mitigating actions will be delivered.

3.4. Project Envelope

At this stage there are uncertainties associated with the final Project description and parameters. The EIA will address this uncertainty, such that a key aspect of the EIA process will be ensuring that for each EIA topic, the 'realistic worst-case' scenario is identified and used as the basis of all assessments. The ES will provide a clear explanation of the potential impact of each of the different scenarios. This approach aligns with NRW guidance on project design envelopes for marine renewable energy projects (NRW, 2019) by ensuring that the scenario that would have the greatest impact (e.g. largest footprint of project infrastructure on seabed; highest blade tip height / diameter of WTGs etc.), is fully assessed for each EIA topic. Adopting this approach enables an assumption to then be made, that if impacts from the worst-case scenarios were acceptable (in EIA terms), then any impacts from scenarios with lesser / lower values would also be acceptable.

Scoping, and the ongoing process throughout EIA of refining the evidence base on the likely significant effects of the Project, will inform understanding for those parameters of the design envelope most likely to influence the magnitude of the significant impacts of the Project. It is likely that some design parameters will need to be tightly defined, where the potential for impacts on sensitive receptors is significant. Other Project parameters may be more benign in their potential to cause significant effects, such that greater flexibility in the design envelope may be retained.

The worst-case scenarios for each EIA topic will be presented at the start of each chapter of the ES, so that the basis of the assessment is clear. An overall Project Design Envelope (PDE) spreadsheet will be developed and populated with all key parameters and values. This will form the basis for determining the worst-case values for each chapter and for identifying any relationship between impact pathways, envelope parameters and worst-case scenarios, to ensure a holistic assessment. In order to future-proof the assessment, the PDE will contain values for technologies that may not yet be fully developed but are expected to potentially form part of the proposed Project infrastructure by the time of construction.

This approach is particularly advantageous for developments, including OWF, where it is not possible to identify the exact components to be used within the final development; as it provides for flexibility in design and construction within maximum extents and ranges assessed within the EIA. Therefore, the consent permits the use of any components so long they are within the maxima assessed, rather than limiting the development to existing technology at the time of assessment, which may not be economically viable or available at the point of construction.

3.5. Approach to Assessing Interactions with Existing Activities

The potential for interactions between the effects of the proposed Project and existing pressures and activities on sensitive receptors will be considered in the EIA. Current activities form part of the baseline environment. Their effect on the current status of a receptor (e.g. the conservation status of a habitat or species, or the economic status of an existing sector or industry) will be described in the baseline sections of the relevant topic chapters. The sources of baseline information and evidence of relevance to existing activities and receptors, have been summarised in Sections 5-7 of this document.

3.6. Approach to Interactions between Environmental Topics

The impact assessment will consider how effects on individual environmental receptors may interact to generate new effects or alter the magnitude of effects. The EIA will first consider the potential effects of the proposed Project on environmental receptors individually, before identifying, evaluating and assessing any linkages and relationships. The effect of any interactions on likely significance of effects will be considered, along with possible need for additional mitigation measures and any resultant residual effects. The final assessment of effects will take account of the identified interactions.

3.7. Transboundary Assessment

The EIA will consider all areas and receptors that could be directly or indirectly affected by the Project, irrespective of administrative boundaries. Potential effects on transboundary receptors will therefore be an integral component of the relevant topics for the environmental assessment.

The Zone of Influence (ZoI) for the Project, and therefore the geographical scope of the impact assessment including any necessary transboundary assessment, will vary across receptors. The potential ZoI of the Project is likely to be greatest for wide-ranging mobile or migratory species (e.g. some species of seabirds and marine mammals) as well as shipping and commercial fisheries. The ZoI and the spatial scale of assessment for receptors, including transboundary assessment, is considered in Sections 4-6 of this report.

3.8. Assessing Significance

The determination of significance is fundamental to determining the requirement, breadth and scope of EIA, and is the primary method for communicating information related to environmental effects. However, significance is a subjective judgement without legal definition or relevant guidelines. It will be important to have consistency and transparency in the process by which the significance of effects is assessed in the EIA and that this is clearly and effectively documented within the ES.

To date, guidance has not been produced by the UK and Welsh Governments on defining ‘likely significant effects’ particularly in the context of the amendments to the EIA regulations in 2017. A series of principles has therefore been developed, drawing on recognized EIA guidance and technical guidelines (BSI, 2015; IEMA, 2016; EU, 2017; CIEEM, 2018) and further informed by discussions relating to the development of a proportionate EIA strategy for the UK (IEMA, 2017).

These principles provide the framework around which judgements on 'likely significant effects' will be based throughout the EIA process for the proposed Project:

- The assessment of significance will take account of the regulatory context, environmental consequences, and stakeholder expectations in determining the overall consequences of effects;
- A likely significant effect is a potential effect that may be a reasonably predicted consequence of the project;
- A likely significant effect may be positive or negative in its consequences for a receptor;
- Trivial or inconsequential effects are not significant;
- The assessment of significance of effects will consider the extent, magnitude, duration and reversibility of the effects and the sensitivity of the receptor (as determined through the interactions of receptor's tolerance, adaptability and recoverability to each effect);
- A significant ecological effect is one that either supports or undermines biodiversity conservation objectives for 'important ecological features'; and
- The assessment of likely significance of effects will consider mitigation measures (i.e. residual significance of effects).

The EIA process will use a combination of approaches to use the best available evidence to assess the significance of effects. This is likely to include use of traditional significance ranking matrices, such as the approach presented in Table 3-2a-c, (based on approaches set out in CIEEM, 2018 and SNH,2018), as well as narratives based on organised reasoning and expert judgement[2].

Table 3-2 a-c: Example of a Traditional Matrix-Based Approach to Assessing the Significance of Effects in Environmental Impact Assessment, Combining Receptor Sensitivity with Impact Magnitude (CIEEM, 2018; SNH,2018)

a. Sensitivity Levels for Environmental Receptors.

Sensitivity	Description
High	Receptor has very limited capacity to avoid, adapt to, accommodate or recover from the anticipated impact.
Medium	Receptor has limited capacity to avoid, adapt to, accommodate or recover from the anticipated impact.

[2] Regulation 12(2) of the Marine Works Regulations (as amended 2017) explicitly requires developers to use 'competent persons' to undertake the EIA.

Low	Receptor has some tolerance to avoid, adapt to, accommodate or recover from the anticipated impact.
Negligible	Receptor is generally tolerant to and can accommodate or recover from the anticipated impact.

b. Guidelines for Determining Magnitude Levels for Environmental Effects.

Magnitude	Description
High	Loss of resource, but not affecting integrity of the resource; partial loss of or damage to key characteristics, features or elements (adverse). Permanent / irreplaceable change, which is likely to occur. Improvement to, or addition of, key characteristics, features or elements of the resource; improvement of attribute quality (beneficial).
Medium	Minor loss of, or alteration to, one (or maybe more) key characteristics, features or elements; measurable change in attributes, quality or vulnerability (adverse). Long-term though reversible change, which is likely to occur. Minor improvement to, or addition of, one (maybe more) key characteristics, features or elements of the resource; minor improvement to attribute quality (beneficial).
Low	Very minor loss of, or alteration to, one (or maybe more) key characteristics, features or elements; noticeable change in attributes, quality or vulnerability (adverse). Short to medium though reversible change, could possibly occur. Very minor improvement to, or addition of, one (maybe more) key characteristic, feature or element; very minor improvement to attribute quality (beneficial).
Negligible	Temporary or intermittent very minor loss of, or alteration to, one (or maybe more) characteristic, feature or element; possible change in attributes, quality or vulnerability (adverse). Short-term, intermittent and reversible change, which is unlikely to occur. Possible very minor improvement to, or addition of, one (maybe more) characteristic or element; possible improvement to attribute quality (beneficial).

c. Impact Assessment Matrix, Combining Receptor Sensitivity with Effect Magnitude.

		Negative Magnitude				Beneficial Magnitude			
		High	**Medium**	**Low**	**Negligible**	**Negligible**	**Low**	**Medium**	**High**
Sensitivity	**High**	Major	Major	Moderate	Minor	Minor	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Minor	Minor	Minor	Moderate	Major
	Low	Moderate	Minor	Minor	Negligible	Negligible	Minor	Minor	Moderate
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

Where a traditional matrix-based approach is deemed appropriate for assessing the significance of environmental effects within the EIA, the above definitions will be used. Where more bespoke approaches to defining receptor sensitivity and environmental effect magnitude are required, Modified versions of the above will be used. Full details of the topic-specific assessment methodology will be set out in each individual ES chapter.

3.9. Mitigation and Monitoring

Where an impact assessment identifies that an aspect of the project is likely to give rise to significant environmental impacts, mitigation measures will be proposed, in order to avoid impacts or reduce them to acceptable levels.

Mitigation will take place in the following hierarchy, where the first is not feasible due to constraints, including, engineering, technology or geology, the next measure will be engaged.

1. The proposed Project design will aim to avoid placing permanent infrastructure or having temporary working areas within protected sites, where possible;
2. If avoidance of protected sites is not possible, best endeavors will be made to design the proposed Project to avoid direct impact on the specified features of interest within protected sites via specific construction and decommissioning methods, where possible;
3. Where the feature is not static, the design of the infrastructure of the proposed Project must, where practicable, minimise impact on mobile species, therefore reducing the interaction and harm; and
4. Where avoidance of features of interest are not possible, mitigation measure will be developed for construction, operation and decommissioning to minimise effects, such as work schedule, techniques and working areas, and agree reinstatement of temporary works with regulatory authorities, offsetting or enhancement measures; and

It is important to note that the mitigation measures applied should be proportionate to the scale of the impact predicted. Appropriate mitigation measures will be discussed and agreed, where possible, with the relevant regulatory authorities and stakeholders.

In some cases, in order to ensure that the mitigation measures are successful or where there is significant uncertainty with respect to important receptors, monitoring may be appropriate. Monitoring programmes are most commonly required during and shortly after construction but can also be prior to and during operations. The nature of any monitoring will be dependent on the nature of the effect or mitigation measure under inspection.

3.10. Structure of the Environment Statement

The structure and format of the ES will be finalised during the EIA, to ensure that it adds value to the consenting process[3]. The final format of the ES will be such that it provides stakeholders with clear accessible information on the likely effects of the Project that is relevant, necessary and material to the decision, or where it is required to address issues raised by stakeholders throughout the consultation process.

Table 3-3: Proposed Structure for the Project Environmental Statement

ES component / section	Detail of chapters
Non-Technical Summary	• Single NTS covering the entire Project.
Introductory chapters	• Introduction; • Overview of EIA methodology; • Site selection process; • Project description; and • Policy and legislation.
EIA Results	• Physical environment; o Marine and coastal processes; o Marine seabed and water quality; o Onshore geology, geomorphology and soils; o Onshore groundwater and hydrology; and o Water Framework Directive. • Designated sites and biological environment; o Designated sites; o Marine and coastal ecology; o Ornithology; o Terrestrial and coastal ecology; and o Terrestrial ecology. • Human environment; o Commercial fisheries; o Shipping and navigation; o Coastal and marine infrastructure and other users; o Aviation and radar;

[3] The ES structure will be compliant with the requirements of Regulation 21A.(2)(a)-(e)) of the Marine Works Regulations (as amended 2017)

ES component / section	Detail of chapters
EIA results	○ Archaeology and cultural heritage; ○ Land use; ○ Traffic and transport; ○ Landscape, seascape and visual impacts; ○ Underwater noise and vibration. ○ Air quality; ○ Tourism and recreation; ○ Military activity; ○ Socio-economics; ○ Population and human health • Cumulative effects
Information to inform Habitats Regulations Assessment	Information to inform the regulatory bodies' Habitats Regulations Assessments (including Appropriate Assessment, if required) of the effects of the Project on European Protected Sites.
Technical Appendices	Technical Appendices to supplement information in other volumes, as necessary.

Each topic chapter within the 'EIA results' section will describe the bespoke approach taken to impact assessment, including assessing significance. This will include an outline of consultation undertaken, evidence incorporated and the means of defining the area of search or ZoI for that topic. Any technical deficiencies or difficulties encountered in compiling the required information will be noted and commentary provided on how uncertainty may influence the impact assessment. The existing baseline conditions for the topic will be described and assessment will then be made of the nature, magnitude, duration and significance of the likely effects of the construction, operation maintenance and decommissioning of the proposed Project on the topic.

Mitigation measures to avoid, minimise, or remedy the predicted impact, where practical, will be outlined and assessment will be made of the significance of the likely residual effect following monitoring and mitigation.

3.11. Vulnerability to Climate Change Natural Disasters or Major Accidents

The 2017 amendments to the EIA Regulations require that the EIA considers the vulnerability of the proposed Project to climate change, natural disasters and major accidents. This assessment will be included within the EIA; either incorporated into topic chapters, or in a separate section. The scope of this assessment will be informed by NRW's advice on the nature and scope of natural disasters and major accidents it would advise are relevant the Project.

3.12. Approach to Habitats Regulations Assessment

3.12.1. The EC Habitats Directive and UK Regulations

The UK is bound by the terms of the EC Habitats Directive, the Birds Directive, and the Convention on Wetlands of International Importance, also known as the Ramsar Convention. The aim of the Habitats Directive is to conserve natural habitats and wild species across Europe by establishing a network of sites known as Natura 2000 sites (for the purpose of this Scoping Report, and as defined under the 2010 Habitats Regulations, these are referred to as European site(s), or European marine site(s) where the site exists below highest astronomical tide (HAT)).

Under Article 6(3) of the Habitats Directive, for any proposed plan or project, which is not directly connected or necessary to the management of the European marine site, competent authorities[4] should make an initial consideration, in consultation with Natural England, to establish whether the plan or project is likely to have a significant effect on the European marine site.

"Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to Appropriate Assessment of its implications for the site in view of the site's conservation objectives" - Article 6(3).

Article 6(3) has been interpreted as meaning that any project is to be subject to an appropriate assessment (AA) if it cannot be proven, beyond reasonable scientific doubt, that there is no likely significant effect on that site (a precautionary approach), either alone, or in combination with other plans or projects[5].

The protection given by the Habitats Directive is transposed into UK legislation through the 2010 Habitats Regulations (as amended)[6]. The 2010 Habitats Regulations (as amended) require the competent authority, before deciding to authorise a project which is likely to have a significant effect on a European site "*to make an Appropriate Assessment of the implications for that site in view of that site's conservation objectives*"[7].

In accordance with the 2010 Habitats Regulations (as amended) Regulation 61(2), anyone applying for consent must provide the competent authority with such information as may reasonably be

[4] "Competent Authority" as defined in the 2010 Habitats Regulations (as amended) Regulation 7(1), is a Minister, government office, statutory undertaker or public body, and is any such body with authority to give consent, or with authority to undertake projects themselves. The competent authority must ensure the requirements of the Regulations are met before undertaking or permitting any plan or project. Regulation 61 of the 2010 Habitats Regulations (as amended) and Regulation 25 of the Offshore Marine Regulations.

[5] Decision of the ECJ in Waddenzee (C-127/02) – determined that in light of Article 6(3) of the Habitats Directive, a probable risk of significant effect of a plan or project exists (in particular, in view of the precautionary principle) if such a risk cannot be excluded on the basis of objective information that the plan or project will have significant effects on the site concerned.

[6] The Conservation of Habitats and Species Regulations 2010. Statutory Instrument 2010/490.

[7] Regulation 61 of the 2010 Habitats Regulations (as amended) and Regulation 25 of the Offshore Marine Regulations.

required "*for the purposes of the assessment*" or "*to enable them to determine whether an Appropriate Assessment is required*"[8].

Sites of Community Importance, afforded protection under the 2010 Habitats Regulations (as amended), are designated in the UK as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). As a matter of policy, the devolved Governments also apply the procedures described below to Ramsar sites, possible SACs, candidate SACs and potential SPAs.

3.12.2. The Role and Requirements of the Competent Authority

Although the 2010 Habitats Regulations (as amended) do not specify the methodology for carrying out an HRA, they do specify the obligations of the competent authority, the MMO in this respect, and the applicant. The role of the competent authority is to determine if there are likely significant effects and carry out the AA[9], if required, before a decision is made. The competent authority is also required to consult with the relevant statutory nature conservation bodies (SNCBs), NRW and JNCC in this case (and the public, if considered appropriate), before deciding to give consent; and where adverse effects remain, they must undertake further assessments on alternatives and prepare a justification statement for Imperative Reasons of Overriding Public Interest (IROPI).

It is the responsibility of the applicant to include 'sufficient information' with the ability to identify the European sites, including European marine sites, and to enable an AA to be made if required[10]. That is the rationale for a report to inform an AA (RIAA).

3.12.3. The Habitats Regulations Assessment Approach

The approach to the Habitats Regulations Assessment (HRA) process has followed that set out in '*Planning Circular 06/2005 on Biodiversity and Geological Conservation – Statutory obligations and their Impact within the Planning System*' produced by the Office of the Deputy Prime Minister (ODPM). It has also taken account of a range of other guidance material including that produced by the Infrastructure Planning Commission (IPC) (2011) and the European Commission (EC) (2007; 2002, 2000).

3.12.4. Overview of the Habitats Regulations Assessment Process

The HRA process comprises four main stages as shown in the bullet points below (extracted from Circular 06/2005 produced by the Office of the Deputy Prime Minister (ODPM)). The stages are:

- **Stage 1 Screening** to identify the likely impacts of a project on a European site and consider whether the impacts are likely to be significant;

[8] Regulation 61(2) of the 2010 Habitats Regulations, Regulation, and Regulation 25(2) of the Offshore Marine Regulations,

[9]The 2010 Habitats Regulations (as amended) 61(1)

[10]The 2010 Habitats Regulations (as amended) 61(2)

- **Stage 2 AA** to determine whether the integrity of the European site will be adversely affected by the project;
- **Stage 3 Assessment of Alternative Solutions** to establish if there are any that will result in a lesser effect on the European site; and
- **Stage 4 Imperative Reasons of Overriding Public Interest (IROPI) and Compensatory Measures** to establish whether it is necessary for the project to proceed despite the effects on the European site, and to confirm that necessary compensatory measures are in place to maintain the coherence of the Natura 2000 network.

All four stages of the process are referred to collectively as the HRA, to clearly distinguish the whole process from the step within it referred to as the 'Appropriate Assessment' (i.e. Stage 2 AA). The stages are discussed in more detail in **Appendix A**.

3.13. Marine and Coastal Access Act (2009) / Marine Conservation Zones

Under the Marine and Coastal Access Act (MCAA) (2009) a series of Marine Conservation Zones (MCZs) have been designated around the UK. It is considered good practice to make consideration of MCZs in line with any assessment of European sites.

MCZs have been designated in three tranches; the first tranche was designated in 2013, the second in 2016 and, recently, the third tranche in 2019 (JNCC) 2019). There are currently 91 MCZs designated.

MCZs aim to conserve areas of our seas, protecting rare, threatened and representative habitats and species in English inshore and English, Welsh and Northern Irish offshore waters (JNCC, 2010).

The MCZ process specifically takes into account the socio-economic data, alongside the ecological data, during the designation process; also taking into account the views and interests of sea users and interest groups. Details of the MCZ risk assessment process are provided in **Appendix A.**

3.14. References

BSI (British Standards Institute) Ltd,2015. PD6900: Environmental Impact Assessment for offshore renewable energy projects – Guide. Available online at: http://shop.bsigroup.com/upload/271276/PD%206900.pdf [accessed August 2019].

CIEEM, 2018. *Guideliens for EcIA in the UK and Ireland.* Available at: https://cieem.net/wp-content/uploads/2019/02/Combined-EcIA-guidelines-2018-compressed.pdf [accessed August 2019].

European Commission, 1999. Habitats Regulations Guidance Note 3. The Determination of Likely Significant Effect under The Conservation (Natural Habitats &c) Regulations 1994.

European Commission, 2007. Guidance Document on Article 6(4) of the Habitats Directive 92/43/EEC.

European Commission, 2002. Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites. Methodological Guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC.

European Commission, 2000. Managing Natura 2000 Sites - The Provisions of Article 6 of the 'Habitats' Directive 92/43/CEE.

EU (European Union), 2017. Environmental Impact Assessment of Projects. Guidance on the preparation of an Environmental Impact Assessment Report. Available online at: https://ec.europa.eu/environment/eia/pdf/EIA_guidance_EIA_report_final.pdf [accessed August 2019].

IEMA, 2016. *EIA Guide to Delivering Quality Development.* Available at: https://www.iema.net/assets/newbuild/documents/Delivering%20Quality%20Development.pdf [accessed August 2019].

IPC (Infrastructure Planning Commission), 2011. *Habitats Regulations Assessment for Nationally Significant Infrastructure Projects*. IPC.

JNCC (Joint Nature Conservation Committee), 2019. *Marine Protected Area network completed.* Available online at: https://jncc.gov.uk/news/tranche-3-mcz-designation-announcement/ [Accessed August 2019].

JNCC (Joint Nature Conservation Committee), 2010. *Marine Conservation Zones*. Available online at: http://archive.jncc.gov.uk/default.aspx?page=5545 [Accessed August 2019].

NRW (Natural Resources Wales), 2017. Guidance Note 13: Scoping an Environmental Impact Assessment for Marine Developments. Guidance for developers and NRW staff. Available online at: https://cdn.naturalresources.wales/media/684594/gn13-scoping-an-environmental-impact-assessment-for-marine-developments.pdf [Accessed August 2019].

SNH (Scottish Natural Heritage), 2018. Environmental Impact Assessment Handbook. Available online at: https://www.nature.scot/sites/default/files/2018-05/Publication%202018%20-%20Environmental%20Impact%20Assessment%20Handbook%20V5.pdf. [Accessed August 2019].

4. Project Description

4.1. Overview of Technology

Fixed bottom technology faces significant challenges in deep waters as a result of installation, O&M and costs associated with foundations, however, FLOW has the potential to circumvent these challenges and unlock deeper offshore sites. The technology is still to be tested at large scale but sites such as Kincardine, 15 km off the Scottish North Sea coast, have achieved first power and once fully operational in 2020, at 50 MW could be the world's largest FLOW development (Pilot Renewables, 2019). Currently the 30 MW Hywind site off the coast of Scotland is the world's largest FLOW farm.

The WTGs proposed for installation at the Project are 9-12 MW. The WTGs will be mounted on the WindFloat offshore platform (see Section 4-2). The main characteristics and specifications of this type of WTG are shown below, Table 4.1.

Table 4.1: Proposed Project Wind Turbine Generator Parameters (12+ MW)

Parameter	Value	Parameter	Value
Rated Power	12 MW	**Tower type**	Tubular Steel
Swept Area	38,000 m^2	**Hub Height (from sea level)**	Approx. 132 m
Max. Blade Tip Height (from sea level)	Approx. 242 m	**Rotor Diameter**	220 m

4.2. SBE Floating Offshore Wind Farm Infrastructure

Each proposed individual WTG will be mounted on the WindFloat offshore platform which is a unique semi-submersible type, platform with water-entrapment plates and an asymmetric mooring system. The WindFloat platform has been designed to achieve high stability levels. Three columns provide buoyancy to support the WTG and are laid out in a triangle shape to counteract the large wind-induced overturning moment.

The three columns are inter-connected with a truss structure composed of main beams, connecting columns and bracings. Secondary structures include a boat landing on one of the columns, deck space and railings (for personnel access) and associated equipment (onboard davit crane, array cable hang-off etc.). Dimensions and an image of the WindFloat platform are provided in Figure 4.1 and Table 4.2 respectively.

Figure 4.1: WindFloat Platform (Side, Front, Top View) (source: PPI, 2019a)

Table 4.2: WindFloat Parameters

Parameter	Value
Number of columns	3
Column diameter	11-18 m
Column centre to centre distance	60-80 m
Column height	Approx. 25 m
Operating Draft (distance from keel to sea level)	13-15 m
Maximum footprint (per platform)	95 m x 85 m (8,075 m^2)

4.3. Array Layout Description

Three indicative layouts for the WindFloat platforms within the Erebus option area are shown below.

- 9.5MW WTGs, all turbines north of existing SOLAS cable, shown in **Error! Reference source not found.**;
- 9.5 MW WTGs, across existing SOLAS cable, shown in **Error! Reference source not found.**; and
- 12MW WTGs, across existing SOLAS cable, shown in **Error! Reference source not found.**.

Figure 4.2: 9.5MW WTGs on WindFloat Platforms - North of Communications Cable Only

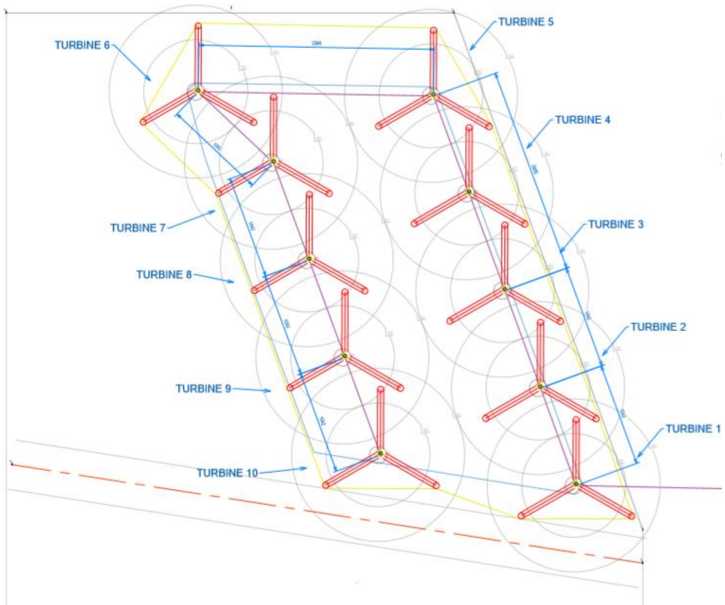


Figure 4.3: 9.5MW WTGs on WindFloat Platforms - Crossing Communications Cable

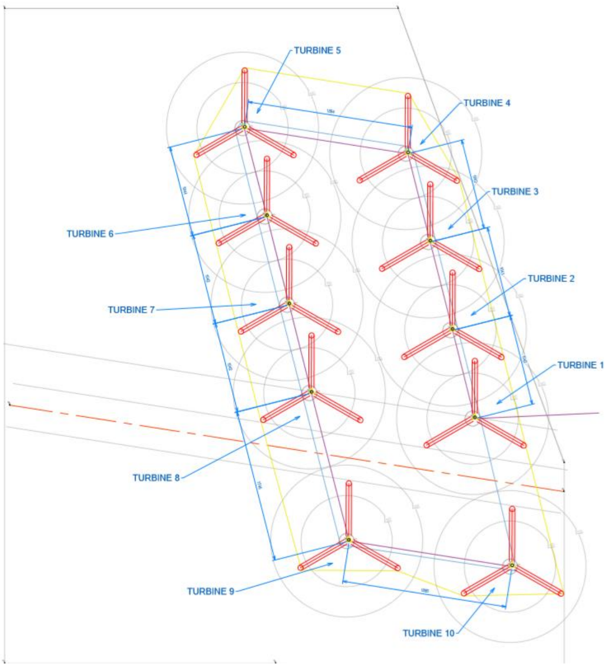
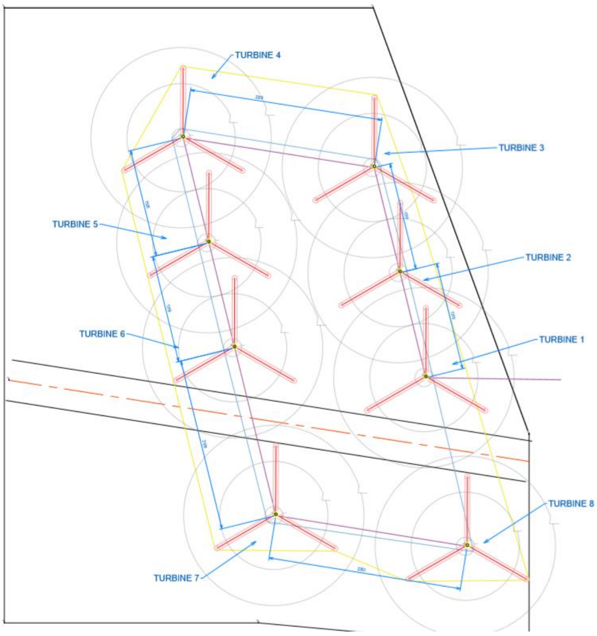


Figure 4.4 12MW WTGs on WindFloat Platforms - Crossing Communications Cable



4.4. Mooring Requirements

It is proposed that three mooring lines are arranged in an asymmetrical fashion to provide a mooring system with low pretension requirements (see Figure 4.4). In extremely exposed sites a fourth mooring line may be specified. The mooring system is designed to address station-keeping issues (it does not need to contribute to the platform's stability) and enables simple connection-disconnection procedures that can be performed by widely available tug vessels.

The proposed catenary mooring system mirrors the system widely used in the offshore O&G industry and consists of drag-embedment anchors, ground chain, synthetic ropes, as well as various shackles and connectors. Concrete or steel clump weights may be used to reduce the size of the mooring lines. Drag embedment anchors can address a large spectrum of seabed characteristics, ranging from gravel to sand to mud. This type of anchor (see Figure 4.6), will be adapted to the conditions found at the proposed Project site following analysis of the results of the geophysical and geotechnical campaign. The detailed arrangement of the mooring system is determined by extreme sea-states, water depth, survey results and structural system modelling and optimisation. Based on the preliminary assessment for the proposed Project, the drag-embedment anchors are likely to be approximately 15-20 tonnes per anchor and the estimated length of each mooring line is up to 800 m.

Figure 4.5: Indicative Mooring Layout (source: PPI, 2019a)

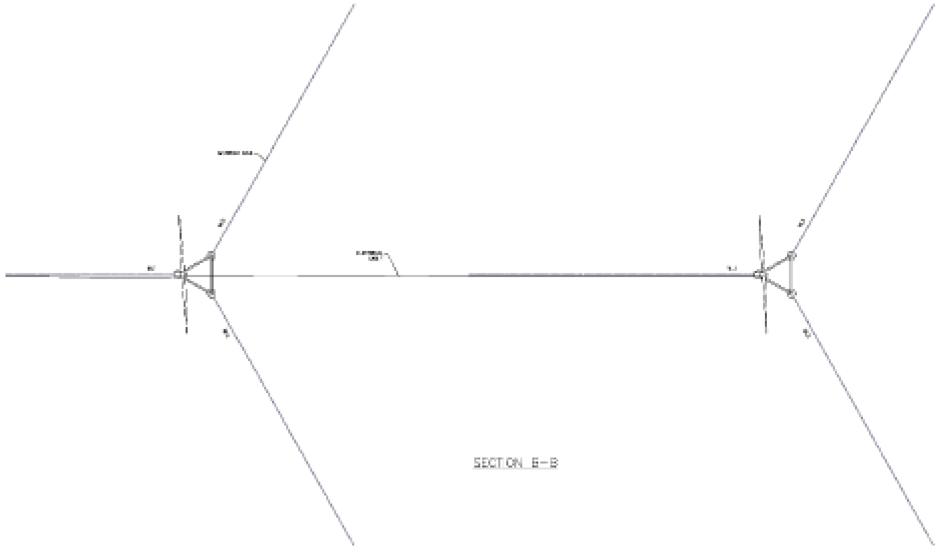


Figure 4.6: Example Drag-Embedment Anchor

4.5. Navigational Markers

During the operational phase of the proposed Project, the offshore array will be marked with appropriate navigational marker buoys to provide the necessary warning to mariners of the presence of the site. The exact type and configuration of any navigational markers will be determined via consultation with the MCA and Trinity House Lighthouse Service (THLS) and will also be informed by the outputs of the project-specific Navigational Risk Assessment (NRA). Consideration will be given to use of virtual aids to navigation as well as buoyage. The site will be marked on the UK hydrographic charts and through Kingfisher Information Service - Offshore Renewable & Cable Awareness (KIS-ORCA) to manage fisheries awareness.

The individual navigational structures will also be marked with appropriate navigation lights and signage in accordance with relevant MCA guidance (MGN543) and IALA Recommendation O-139 on The Marking of Man-Made Offshore Structures (Edition 2, December 2013). This will include identification panels for individual WTG structures. The array layout will be determined via consultation with the MCA to ensure Search and Rescue (SAR) requirements are met.

Consideration may also be given to the provision of fog signals where appropriate, taking into account the prevailing visibility, topography and vessel traffic conditions. The range of such a fog signal should not be less than two 2 nm.

The actual WTGs will also be marked in accordance with relevant aviation requirements and via consultation with key organisations (MCA, Civil Aviation Authority (CAA)). CAA Policy and Guidelines on Wind Turbines CAP 764 (CAA, 2016) will be referenced.

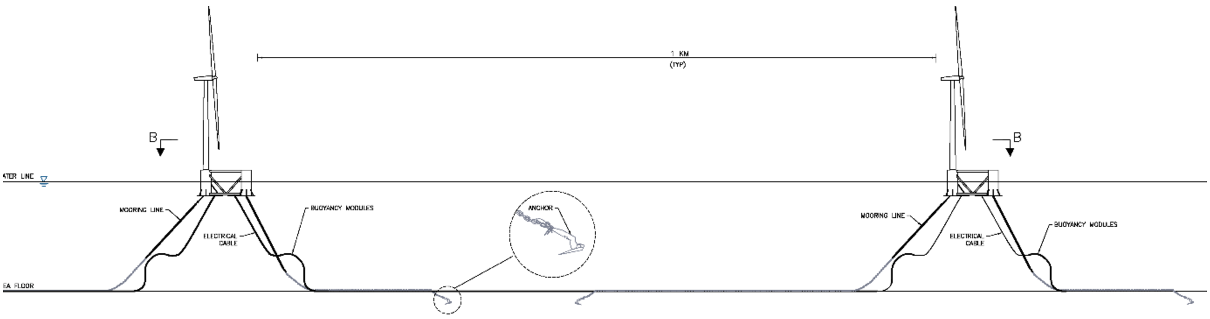
Figure 4.7: Typical Marine Aids to Navigation

(a) Special mark **(b) Cardinal buoy**

4.6. Offshore Inter-Array and Export Cables

An indicative inter-array electrical cable configuration between the units is shown in Figure 4.8. The inter-array cable between the units is anticipated to have a lazy-wave configuration, laying on the seabed between units. The proposed cable will be a 3-core, dynamic design, HVAC subsea cable rated at 66 kV.

Figure 4.8: Inter-Array Electrical Cable Configuration (source: PPI, 2019a)



The inter-array cable system will also include the cable hang-off, bend stiffener, buoyance modules and touchdown point protection.

If spatial constraints dictate that some array cables need to be longer than others, then there is an incentive to position the longer cables closer (electrically) to the 'Lead Turbine' rather than out at the far end of the string, to reduce the impact of the longer cables on Reactive Power Compensation requirements.

4.7. Marine Export Cable

The proposed export cable is expected to be between 45 km and 50 km long, depending on the final cable route engineered. The export cable will be a single, static design, 3-core, armoured, subsea cable rated at 66kV. The export cable diameter will be approximately 180mm and, depending on the permissible spooling length will likely have between 2 and 4 joints along its length. Short-listed potential export cable routes are shown in Figure 1.2.

4.8. Cable Landfall and Transition Pit

Potential landfall sites (see Figure 1.2 and Figure 1.3) include:

- West Angle Beach
- Angle Bay
- Freshwater West Beach
- Potential site within the Haven Waterway

Installation is proposed via trenching or Horizontal Directional Drilling (HDD), see 4.12.3 for further information. A beach transition joint chamber would be required as close to the shoreline as is practicable, however avoiding inundation with water (i.e. above the spring high water mark). This chamber will typically be concrete with likely maximum dimensions of 8 m x 3 m x 2 m. The depth of burial will be dependent on ground conditions and location. It usually has provision for access for maintenance checks, testing and repairs.

4.9. Onshore Cables

The onshore export cable is expected to be between 4 km and 15 km long, depending on the final landfall location and cable route engineering work (see Figure 1.3) The onshore export cable will comprise three single core HVAC cables, rated at 66kV. For the cable route (<2 km) from the Erebus substation to the National Grid Pembroke 132kV Substation, the cable will be rated at 132kV. Each of the three 66kV onshore single core cables will be approximately 80mm diameter and the three cables will be bundled together either flat or in trefoil. Where ducts are utilised, each cable will have its own duct with approximate diameter 160 mm to 210 mm. These ducts will then either be laid flat or in trefoil. The trench width will typically be 600 mm and the cables will be installed in accordance with the regulations, at depths typically between 1000 mm and 1400 mm with a depth of cover that varies between 900 mm and 1200 mm.

Depending on the permissible spooling length, the onshore cables will likely have concrete, buried joint chambers (measuring approximately 5 m x 3 m x 2 m) every 500 m to 2000 m along the route. Link box chambers (buried steel inspection chambers) will be required every 2000 m alongside a joint chamber.

It is proposed that the onshore cable be buried along public highway routes (in-road or verge) and through agricultural land (on headlands or adjacent hedgerows where possible). HDD will be used for infrastructure, ditch, water and major road crossings.

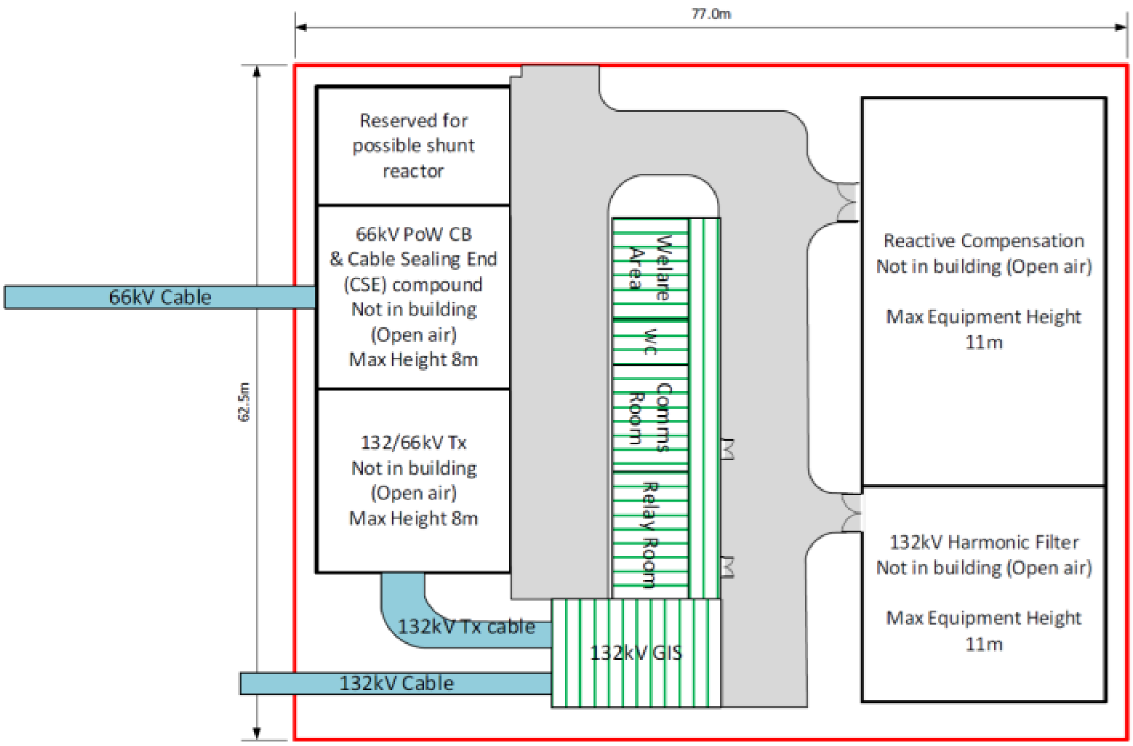
4.10. Grid Connection and Project Substation

The proposed substation will connect the offshore generation to the onshore network and the UK National Grid. It will house the main transformer, HV switchgear, protection and control interface, and power quality management equipment. For electrical design reasons, it is important that this substation is located within 2 km of the point of grid connection. The closer the substation is to the point of connection, the lower the demands are in terms of reactive compensation. Multiple locations have been identified (see Figure 1.3) and discussions with relevant landowners are being progressed.

The indicative dimensions of the proposed substation are approximately 77 m x 63 m with a maximum infrastructure height of 11m, see Figure 4.9. The substation compound will comprise:

- 66 kV Point-on-Wave (POW) Switchgear;
- Harmonic Filters;
- Reactive Compensation;
- 132/66 kV Transformer;
- 132 kV Switchgear;
- Control and protection building;
- Welfare building;
- Compound lighting;
- Perimeter security; and
- Access road.

Figure 4.9: Indicative Substation Layout (source: JFMS, 2019)



The proposed point of grid connection is at the National Grid operated Pembroke 132kV Substation at the Pembroke Power Station. There is currently 150MW of headroom allocated to renewable generation at this location. The proposed Project has applied to National Grid for connection capacity (up to 96MW).

4.11. Construction Phase

4.11.1. Wind Turbine Generator Platforms

4.11.1.1. Port

It is proposed that the WTGs will be installed and commissioned on the WindFloat platform at a local port facility (likely Pembroke Dock). This work will be completed alongside, using land-based cranes. It is also possible that the final stages of the WindFloat assembly are also undertaken at this local port, if facilities are determined sufficient to support this work.

The following activities will be undertaken when integrating the WTG to the WindFloat Platform, see also Figure 4.10:

1. Mobilisation and erection of high-capacity land-based crane;
2. Unloading in-bound WTG components from supply vessel;
3. Laying down of WTG components;
4. Unload WindFloat hulls from supply vessel (or barge), and wet store/moor WindFloat hulls at quayside;
5. Prepare turbine components for assembly (nacelles, rotors and/or towers); and
6. Assembly of WTG onto WindFloat platform moored at quayside.

Each WindFloat unit would arrive at the turbine installation site pre-ballasted and in an even keel position. A spacer barge or fenders may be used to separate the WindFloat unit from the side of the quay. Mooring and spring lines would keep the unit in a stable position at quayside. While the unit is floating and moored quayside, turbine components will be mounted and secured, one by one, onto the hull. Sequentially, the turbine components will be lifted and secured to the unit in the following order (7 lifts):

- Tower section 1;
- Tower section 2;
- Tower section 3;
- Nacelle and hub together;
- Blade 1;
- Blade 2; and
- Blade 3.

The WindFloat unit will remain even keel during the whole operation by adding or removing ballast water to/from the different compartments, as the weight of each wind turbine component is being transferred from the crane onto the unit.

7. Pre-commissioning of fully assembled WindFloat unit at quayside; and

8. Towing out of WindFloat unit to offshore array site (via tugs at between 2 and 4 knots), see Figure 4.11. The target WindFloat delivery rate is up to two units per week.

Figure 4.10: Assembly of Wind Turbine Generator onto WindFloat Platform Moored at Quayside (source: PPI, 2019b)

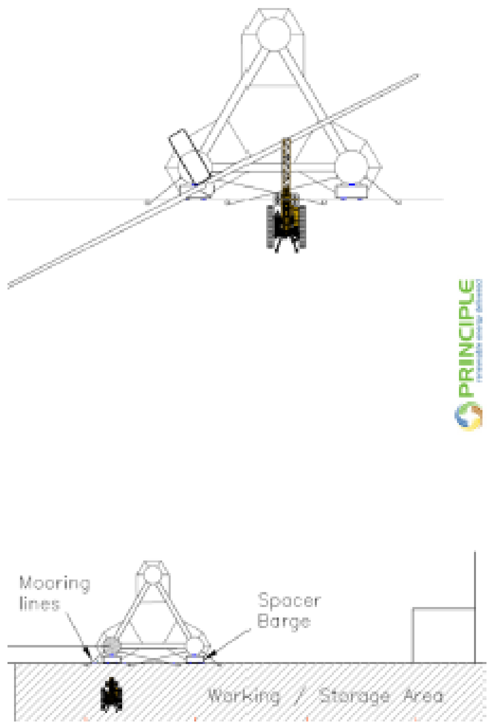
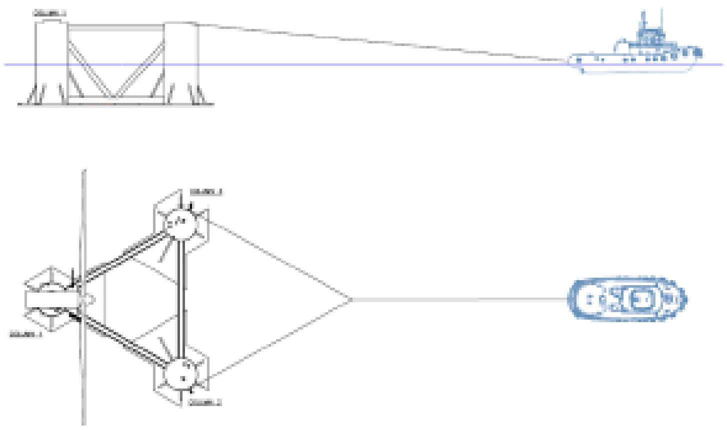


Figure 4.11: Towing out of WindFloat Unit to Offshore Array Site (source: PPI, 2019b)



4.11.1.2. Offshore

The proposed offshore installation works would involve the following sequence:

1. Pre-installation survey;
2. Export cable installation, stabilisation and testing;

3. Mooring System Pre-Lay: this pre-lay operation requires Anchor Handling Tug Supply (AHTS) vessels. One vessel must have sufficient bollard pull to perform the proof-load test of the anchors. Mooring lines will be laid one after another for each unit. After their deployment, the anchors will be proof load tested to a level of tension specified during the engineering phase. Except for the anchor and anchor chain, no other part of the permanent mooring system will be connected during proof-load testing. In order to verify the correct positioning of the anchors after the test, the mooring lines will be equipped with transponders, or similar systems;
4. Offshore Tow and Mooring Hook-Up: the tow would be timed when weather forecasts indicate a suitable weather window for the planned hook-up works as well as the tow. The mooring hook-up requires the use of the onboard winch to pull in the mooring line itself. Thus, an offshore team will be working from the unit to operate the winch; and
5. Inter-Array Dynamic Cable Post-Lay: installation of the inter-array cable will begin once the unit mooring hook-up is completed. The cable will be spooled from a suitable cable handling spread mobilised to an installation vessel. The winch onboard the WindFloat platform will be used to pull-in the dynamic cable to the point of connection. Once the dynamic cables, hang-offs, bend stiffeners, buoyancy modules and touchdown point abrasion protection equipment has been installed, the cables will be stabilised with rock bags or mattresses.

4.11.2. Marine Export Cable

The proposed offshore export cable route will avoid non-mobile features such as sudden seabed level changes or wrecks. However, prior to deployment, the cable corridor will need to be cleared from any recorded mobile features such as suspected UXOs and boulders. Specific survey extents will form the basis of such clearance operations to ensure that all risks within the surrounding environment are minimised to an acceptable level. Once the corridor is prepared, different cable installation and protection techniques will enable reliable and safe operation within the marine environment for the proposed project lifetime.

Submarine cable burial in sediment rich zones can be completed using a number of different methods: submarine ploughing; dredging; mechanical excavation; water jetting excavation; and tracked ROV. Cable trenching with plough is proposed where possible to minimise seabed disturbance. The plough itself runs on skids with a contact width less than 5m. The trench itself would typically be less than 1m in width and less than or equal to 2m in depth.

Where cable burial is not possible due to hard substrates, it is proposed the cable will be surface laid and then stabilised using various solutions such as concrete mattresses and/or rock bags. These artificial cable protection solutions would require a vessel with a crane in order to lift the cable stabilising product and to lower it onto the cable at the required locations, determined during the engineering cable stability assessment. The locations are determined to both stabilise and protect the cable.

4.11.3. Landfall

Cable installation may be trench and/or Horizontal Directional Drilling (HDD):

1. Trenching: The beach landing usually consists of a trench in which the cable is laid and then buried. This avoids any unwanted cable displacement, keeping it out of the surf zone, hence reducing risk of damage. The operation is carried out with a cable plough which buries the cable into a trench as it travels. When the export cable is successfully landed, it can then be safely laid to the offshore site and the lead turbine.
2. HDD: Sometimes the beach landing described above is not suitable, this could be for one of a number of reasons - example constrains are: if the minimum burial depth requirements cannot be fulfilled; if the beach is too narrow; if there is a high cliff. A solution to these problems is the use of HDD. The HDD is drilled from the acceptable point of cable emergence onshore to the point of safe cable exposure offshore. This is generally away from the cliff and deep enough not to be exposed due to erosion or contribute to the natural erosion rates. This operation requires a special drilling tool capable of drilling horizontally and with the flexibility to change height as it drills to gradually curve from the entry point to the eventual exit height. The diameter of an HDD would be approximately 350mm - 400mm.

4.11.4. Onshore Works

In general, it is proposed that the cables will be installed at a minimum depth of 910mm to the top of the cable or duct. This may increase to 1200mm or more where necessary (such as in arable land). These depths are in accordance with National Joint Utilities Group (NJUG) guidance. Ideally, the cable will be direct buried where there is sufficient time to open a trench, install the cable, and cover the trench again. In most cases in roads and tracks this method is not possible due to the requirements to have a trench of up to 500m to be open before the 500m cable on the drum is installed. In this case, it would be proposed that ducts are installed in 20-50m sections and closed over; cables are then pulled in every 500m or so and jointed. Installing short sections of duct on road crossing and access points is mandatory. Where possible, the number of sizes of cable will be limited to 2 or 3 as a maximum. Larger cable sizes will be used in the deeper sections, small sizes in the shallow direct buried sections.

Once the proposed substation is built and the equipment checked, safety rules will be developed prior to connecting the proposed Project substation to the grid connection point at 132kV. At this point the substation can be commissioned and connected to the 132kV network. Once the onshore cable is installed to the landing point and the substation is commissioned and connected, the offshore works can commence. The programme below targets completion of onshore works to coincide with the most favourable weather months (May-August) for the commencement and execution of the offshore works.

4.12. Operation and Maintenance Phase

A major return to port asset repair or service event is expected once during the 25-year service life. Once again, major work will utilise a local port and land-based cranes and plant in support. Return to port will require the disconnection and later reconnection of the WindFloat platform. This done by first disconnecting and over boarding the cable hang-off assembly. This is designed to float on location as a buoy whilst repairs are underway and is held in position by the attached dynamic cables. This assembly also allows the continued operation of the wind farm whilst a single unit is removed from service. Following electrical disconnection, the moorings are disconnected and the

WindFloat platform may then be towed to port. Once repairs are completed and the unit is recommissioned, it may be towed back to site where moorings are re-installed and then the cable hang off assembly re-attached to the Platform and electrical connections restored. These offshore disconnection and hook-up operations are accomplished using the onboard winch and davit crane.

Planned minor offshore maintenance is aligned with the WTG manufacturer maintenance recommendations. These are typically scheduled at: 6month – 1year – 2year – 5year – 10year – 15year – 20year.

Inspections of the moorings and sub-structure are also required periodically. These will, where possible, be undertaken using ROVs to avoid the use of commercial diving activity. ROV inspections may be planned for: 6 month, 2.5 year, 7.5 year, 12.5 year, 17.5year, 22.5year, 24.5year (assessment for decommissioning or extension), 25year (decommissioning). However, the programme will vary depending on findings and the need to monitor condition in a responsible and proactive manner.

4.13. Decommissioning

Decommissioning will comprise the reversal of the installation process, with Platforms and moorings removed from the Project area and returned to local ports for disassembly and disposal. Cable will be left *in situ* as far as is possible from a technical and environmental perspective.

4.14. Indicative Timescales

Table 4.3: Indicative Development Programme

Activity	Indicative Date
Engineering and EIA Surveys Completed	Q4 2021
FEED Completed	Q4 2021
Planning Application Submitted	Q1 2022
Planning Consent Determined	Q1 2023
Detailed Design Finalised	Q4 2024
Pre-Construction Planning Compliance	Q1 2026
Additional Consents	Q1 2026
Construction Started (Onshore)	Q2 2026
Construction started (Offshore)	Q2 2027
Substation Connection Date	Q2 2027
Construction Complete/Commissioning	Q4 2027

4.15. References

Pilot Renewables, 2019. Kincardine Offshore Windfarm project. Available online at: http://pilot-renewables.com/ [Accessed August 2019].

JFMS, 2019. Phase 1 and Phase 2 Cable Route Assessments.

PPI, 2019a. WindFloat Design for a generic 12+MW Wind Turbine.

PPI, 2019b. WindFloat Supply Chain.

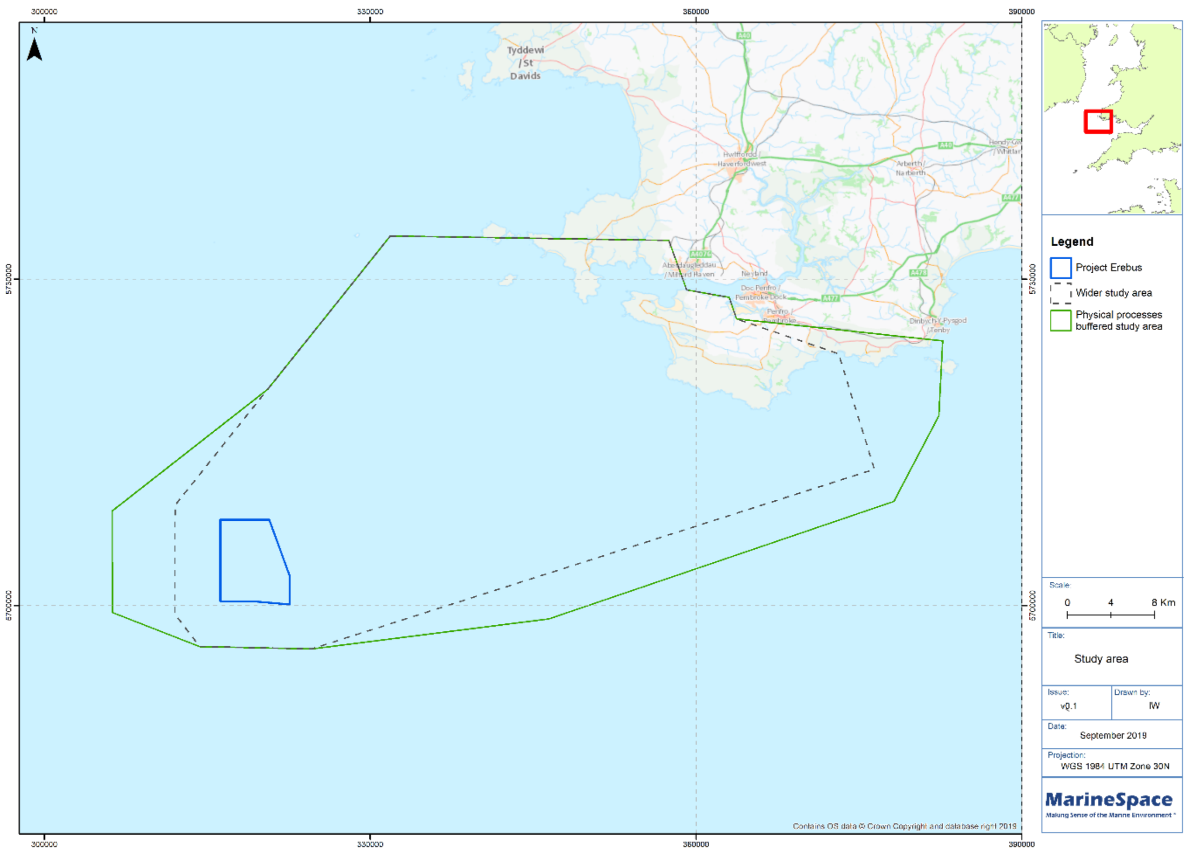
5. Physical Environment

5.1. Marine Coastal Processes (Geology and Geomorphology, Metocean, and Sedimentary Processes)

5.1.1. Study Area

Because of the potential local and regional effects on hydrodynamics and sedimentary process, the Study Area for this section of the Scoping Report comprises a portion of St George's Channel and the northwestern Bristol Channel running into the southwestern coast of Pembrokeshire. Recent NRW advice on a marine aggregates Plan-level HRA indicates that a potential tide-parallel Secondary Impact Zone (SIZ) of up to 10 km in each direction should be considered. Figure 5.1, therefore, shows the Wider Study Area, buffered by an additional tide-parallel 10 km around the proposed project site and potential cable route (where appropriate).

Figure 5.1: Proposed Study Area for Physical Environment



5.1.2. Baseline Data

A range of baseline data sources has been used to compile this section of the Scoping Report, including:

- ABPmer, 2019. Atlas of UK Marine Renewable Energy – information of wind, waves and tides;

- British Geological Survey (BGS), 2017a; 2017b – geological units, Quaternary deposits and seabed sediments;
- Cefas, 2019. WaveNet – real time data from the SEACAMS PDZ WaveRider buoy;
- DTI, 2007. Offshore Oil and Gas Strategic Environment Assessment (SEA) 8 Overall Report and associated specialist reports;
- EMODnet – Bedrock Geology and seabed sediment information;
- Intertek Ltd, 2018. Greenlink Interconnector Environmental Scoping Report – UK Marine Route. Rev 2;
- Intertek, 2019. Erebus Stage 1 Floating Windfarm Geological Desk Top Study;
- Mackie *et al.*, 2006. The Outer Bristol Channel Marine Habitat Study;
- RPS Energy, 2018. Marine Energy Test Area (META) Environmental Impact Assessment Scoping Report;
- UKHO and Admiralty Charts – bathymetry and Tidal Diamond data; and
- Wave Hub Ltd, 2018. Pembrokeshire Demonstration Zone Feasibility Study Environmental Scoping Report.

5.1.3. Geological and Geomorphological Baseline

5.1.3.1. Bathymetry

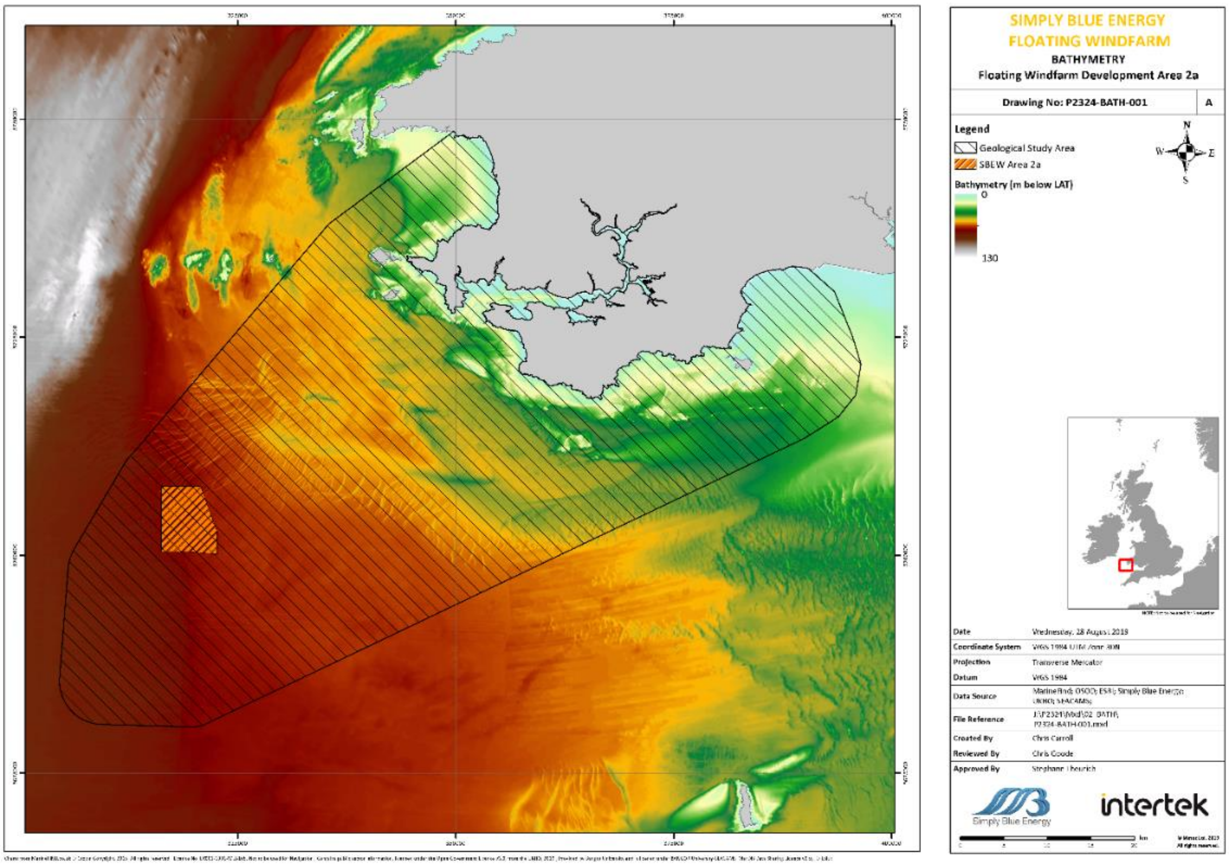
The dominant bathymetric feature of the region is the wide trough along the length of St George's Channel, where maximum depths are in excess of 100m. In general, bathymetries shallow to the east, into the Bristol Channel, and further shallow into the Severn Estuary.

Intertek (2019) summarises bathymetric data from a range of sources, including UKHO bathymetric data available from EMODnet, as well as data available from a series of high-resolution bathymetric surveys. Intertek (2019) reports that water depths over the greater study are range from 0-85 m below Lowest Astronomical Tide (LAT), while the water depths in the vicinity of the Project site ranges from 70-75 m below LAT (Figure 5.2).

5.1.3.2. Bedrock Geology

Southern Britain, including the area which includes the Outer Bristol Channel into St George's Channel, has been subject to sedimentation and major tectonic episodes over hundreds of millions of years. Regionally, underlying bedrock geology of varying age is reported, comprising Palaeozoic rock (541 – 252.17 million years ago) overlain by Permian (252.17 – 298.9 million years ago), Mesozoic (252.17 – 66 million years ago) and Tertiary strata (66 – 2.58 million years ago). Overlying Quaternary sediments locally exceed 300m in depth (Tappin *et al.*, 2007). The central Celtic Sea comprises Upper Cretaceous (100.5 – 66 million years ago) and Paleogene sedimentary rock (66 – 23.03 million years ago), with Devonian to Carboniferous rock extending along the coast of southern Ireland (Tappin *et al.*, 2007).

Figure 5.2: Bathymetry in the Vicinity of the Proposed Project Site and Wider Study Area (From: Intertek, 2019)



The Bristol Channel is floored by Jurassic and Triassic rocks with Palaeozoic rocks on the coastal margins. Westward, these are overstepped by the Cretaceous Chalk that, in turn, is buried beneath Tertiary strata. The central floor of the Bristol Channel comprises a submarine valley system, extending up into the Severn Estuary, which was incised during the late-Tertiary – early Quaternary (Evans 1982; Mackie *et al.*, 2006). Mackie *et al.* (2006) report that the form and morphology of the present-day seabed includes elements directly related to the erosion and deposition associated with the formation of the submarine valley, e.g. rock platforms.

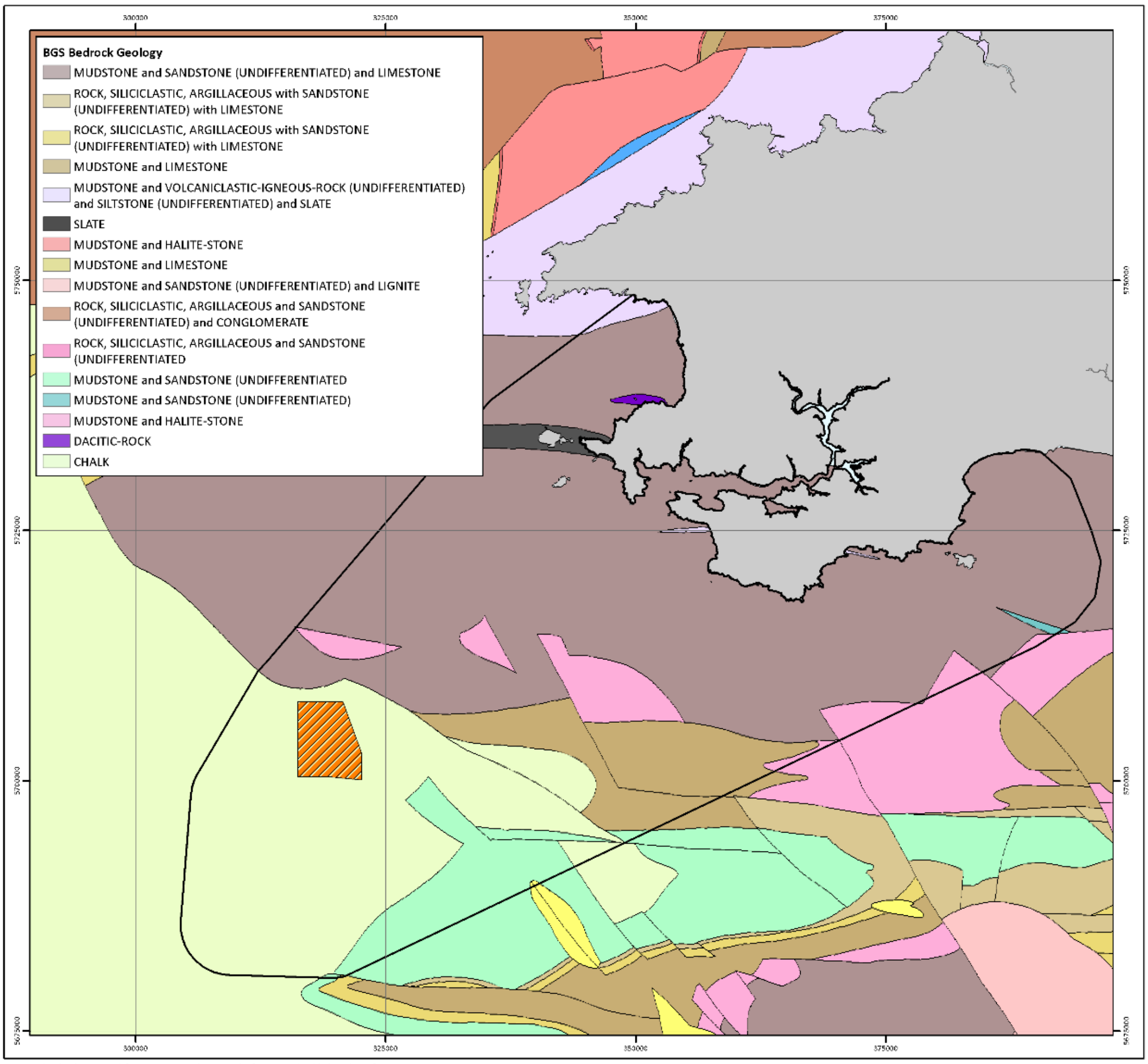
Intertek (2019) indicates that the dominant bedrock types are identified in the vicinity of the proposed Project site and potential cable routes to shore (

Figure 5.3) are:

1. Chalk over the main offshore array site;
2. Mudstone and sandstone to the southeast of the main offshore array site;
3. Mudstone, sandstone and limestone on the northeastern half of the wider study area;
4. Mudstone and halite in isolated areas; and

5. Mudstone and limestone in the middle southeastern part of the wider study area.

Figure 5.3: Bedrock Geology in the Vicinity of the Proposed Project Site and Wider Study Area (From: Intertek, 2019)



5.1.3.3. Quaternary Geology

Quaternary deposits are those laid down during the Quaternary Period (2.6 Ma to Recent). During the Quaternary, glacial and interglacial events shaped the environment of this part of northern Europe. During glacial periods regional sea levels were lower than the present time (low stands), while during the interglacials sea levels were comparable to their current level (high stands).

St George's Channel lies in the middle of the Irish and Celtic Sea and was subject to extensive glaciation over the past 25,000 years (Tappin *et al*., 1994). During the Pleistocene the Irish Sea

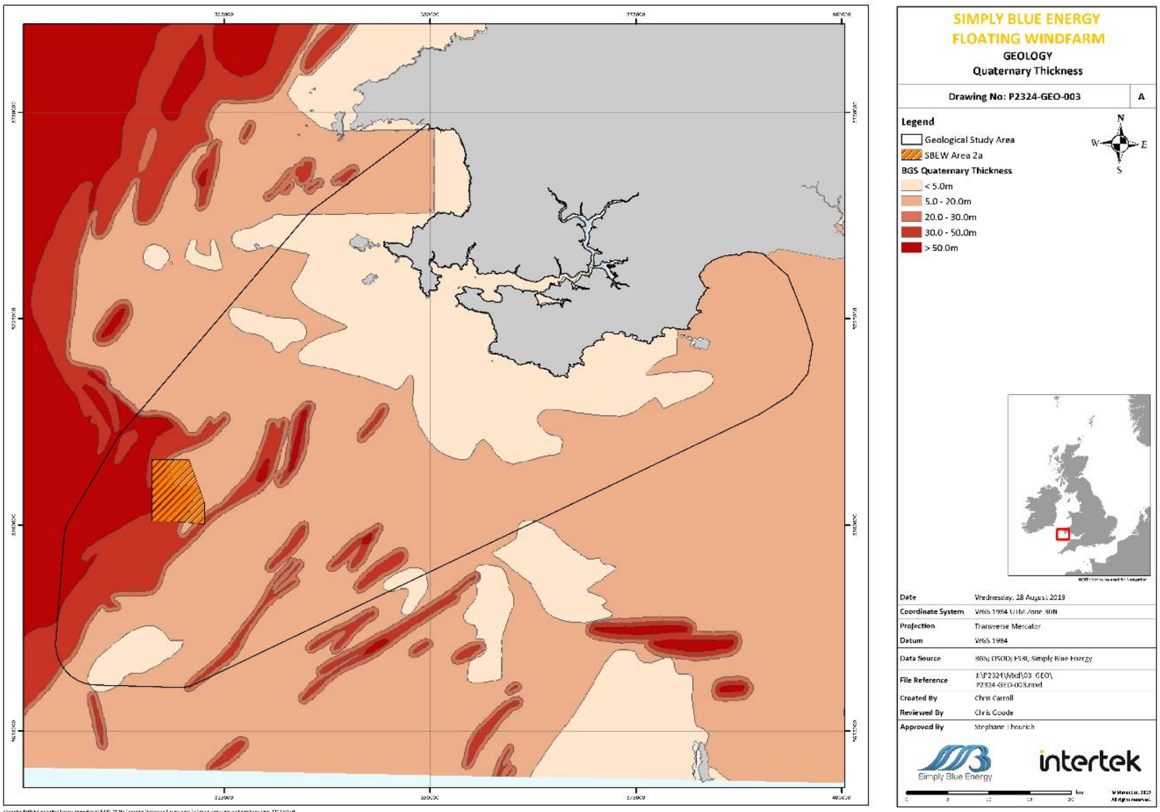
Glacier flowed southwards, on more than one occasion, through St George's Channel and into the northern Celtic Sea, transporting and depositing the Quaternary sediments present today.

Intertek (2019) summarises the Quaternary Formations present in the Irish Sea and St George's Channel as consisting of the following (youngest to oldest):

- Western Irish Sea Formation;
- Cardigan Bay Formation;
- St Georges Channel Formation; and
- Caernarfon Bay Formation.

Intertek (2019) indicates that the Cardigan Bay Formation makes up most of the Quaternary seabed deposits underlying St George's Channel and Cardigan Bay. The Cardigan Bay Formation is a till deposit, consisting of a stiff to hard clay containing varying amounts of sand, gravel, shell, cobbles and bounders. The Quaternary Formations in the vicinity of the proposed Project site are thickest to the west and northwest of the project site, reaching in excess of 50 m thickness. In general, the Quaternary deposits become thinner to the northeast, towards the coast (Figure 5.4).

Figure 5.4: Thickness of Quaternary Deposits in the Vicinity of the Proposed Project Site and Wider Study Area (From: Intertek, 2019)



5.1.3.4. Recent Seabed Sediments

Recent seabed sediments are those deposited during the Holocene (approximately the last 15,000 years) and influenced by the rising sea levels since the most recent (Late Devensian) glaciation.

Seabed sediments off the west coast of Wales predominantly consist of sandy gravel with nearshore areas of sand (DECC, 2016). The inshore seabed around the south Pembrokeshire coast is characterised by rocky reef, shoals and sandbanks. BGS seabed sediment data, summarised in Intertek (2019; Figure 5.5) shows the seabed in the vicinity of the proposed offshore array to primarily consist of sand, with increased amounts of gravel in sediments closer to the coast. Very fine muds are present in sheltered areas of the Milford Haven waterway.

Figure 5.5: Seabed sediments in the Vicinity of the Proposed Project Site and Wider Study Area (From: Intertek, 2019)

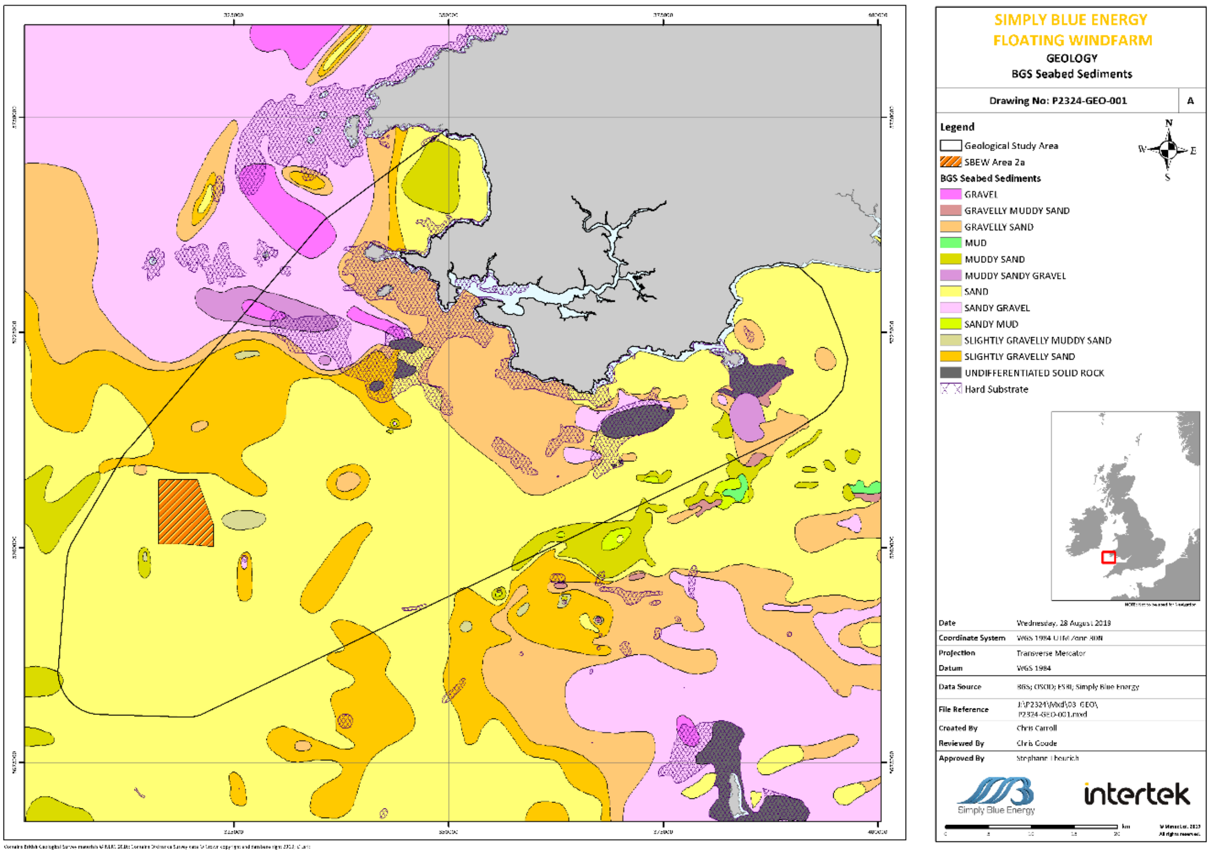


Figure 5.5 indicates that the unconsolidated sediment of much of the seabed inshore of the proposed offshore array is formed into bedform fields comprising subaqueous dunes with crests typically oriented southwest-northeast. Further east, to the south of Carmarthen Bay, there is an extensive sand wave field (Mackie *et al.*, 2006) and areas of subaqueous dunes as well as larger banks are relatively common.

5.1.4. Metocean Baseline

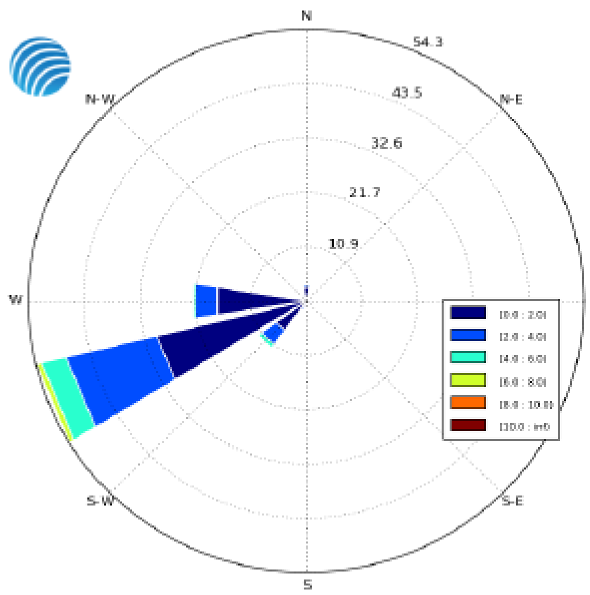
5.1.4.1. Waves

The following information is taken from a desk-based review of wider literature sources and also a project-specific desk-based metocean assessment prepared by Wave Venture Ltd on behalf of SBE (Wave Venture, 2019).

Waves within the Bristol Channel are driven by the wind regime, with the largest waves being driven by winds from the longest fetch direction from the southwest. Exposure to largest waves is more pronounced on coasts and submarine shoals facing the longest fetch. Uncles and Stephens (2007) report that parts of the coast of this region are among the windiest in the UK and that mean hourly coastal wind speeds exceed approximately 3.5 m/s for 75% of the time and exceed 19 m/s for approximately 0.1% of the time. Uncles and Stephens (2007) also indicate that dominant southwesterly winds blow for approximately 20% of the time, whereas winds from the east blow for about 9% of the time. Uncles and Stephens (2007) conclude that the significant wave height in the outer reaches of the Bristol Channel and St George's Channel is greater than about 3 m for 10% of the year (compared with a predicted 50-year extreme of 18 m).

Outputs of the project-specific metocean study indicate that long term significant mean wave height is 1.91 m and most frequent significant wave height is 1.0 m. Dominant wave direction was 247^{o} (south-westerly).

Figure 5.6: Wave Rose of Long-Term Wave Directions and Significant Wave Heights (Wave Venture, 2019)



These values are supported by data available from the UK Renewable Atlas (ABPmer, 2019), and shown in

Figure 5.7, which suggest that both the proposed offshore array site and the wider Study Area lie in a zone where significant wave heights are in the range of 1.5-2 m.

5.1.4.2. Tides

Tides in the region flow from the west-northwest to east-southeast on the flood and reverse in direction on the ebb. They are semi-diurnal (i.e. there are two low waters and two high waters each day) and are predominantly rectilinear (i.e. there is little movement at right angles to the main flow direction).

Figure 5.8 indicates that at the proposed offshore array site, peak mean spring tidal current speeds are in the region of generally exceeding 0.61-0.92 m/s at springs, with peak mean current speeds increasing closer to shore. Figure 5.9 shows the peak mean neap tidal current speeds at the proposed site are in the region of 0.32-0.50 m/s, with the peak mean current speeds again increasing closer to shore. Uncles and Stephens (2007) indicate a potential tidal excursion distance of up to 25 km during a flood or ebb tide.

The mean spring-tide tidal range along the region's coastlines is generally high, ranging from more than 8 m in the northeastern parts of the Bristol Channel, to about 4 m, or less, northeast of the St George's Channel. The mean spring tidal range at Freshwater West is approximately 7 m. The mean spring tidal range at the proposed site is between 4.27-5.58 m.

Mean spring and neap astronomical tidal current velocities in areas close to the proposed project site are available from Tidal Diamond data on UK Hydrographic Office Admiralty Charts. The closest Tidal Diamond to the proposed project site is Tidal Diamond P, 23 km to the southwest. Table 5-1 shows the current speeds and directions for Tidal Diamond P.

Figure 5.7: Significant Wave Heights in the Vicinity of the Proposed Project Site and Wider Study Area

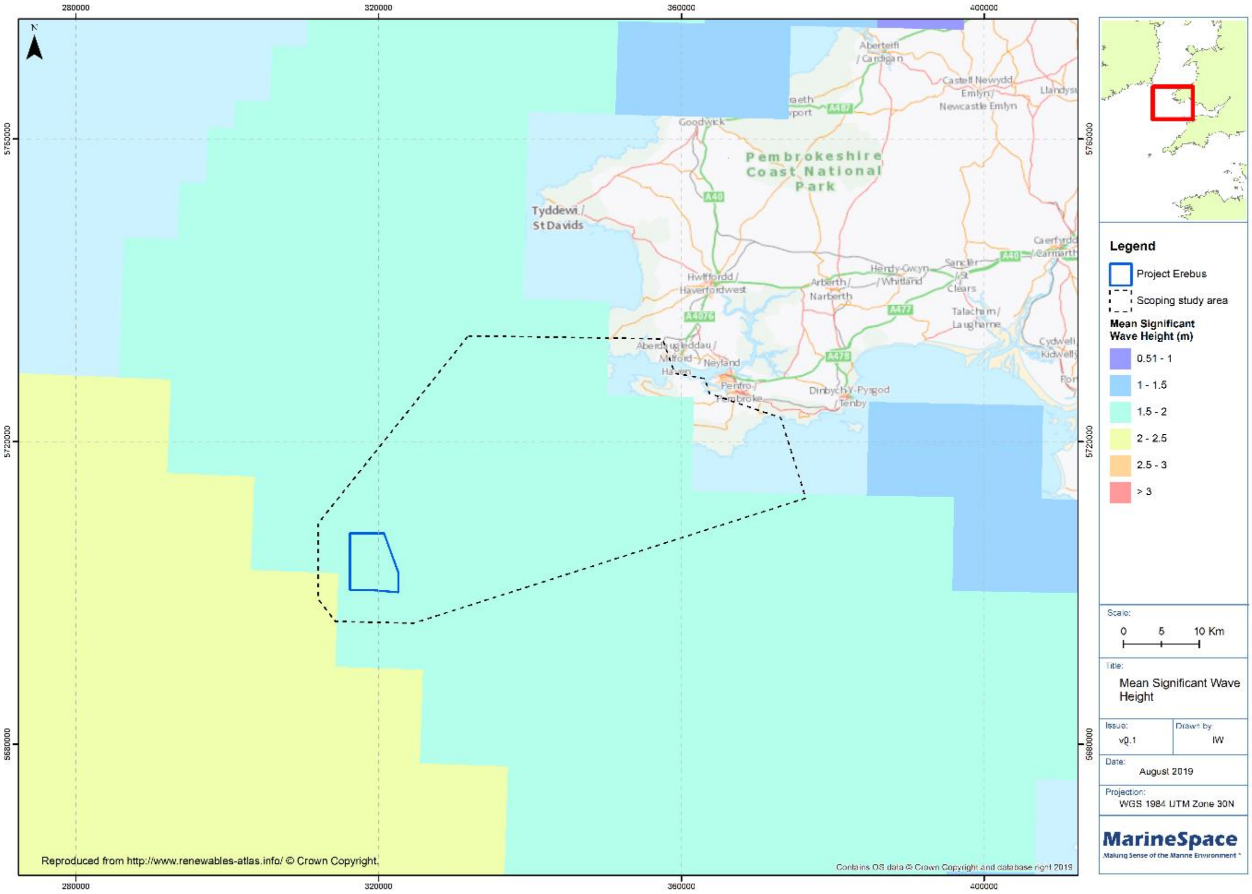


Figure 5.8: Peak Mean Spring Tide Current Speed in the Vicinity of the Proposed Project Site and Wider Study Area

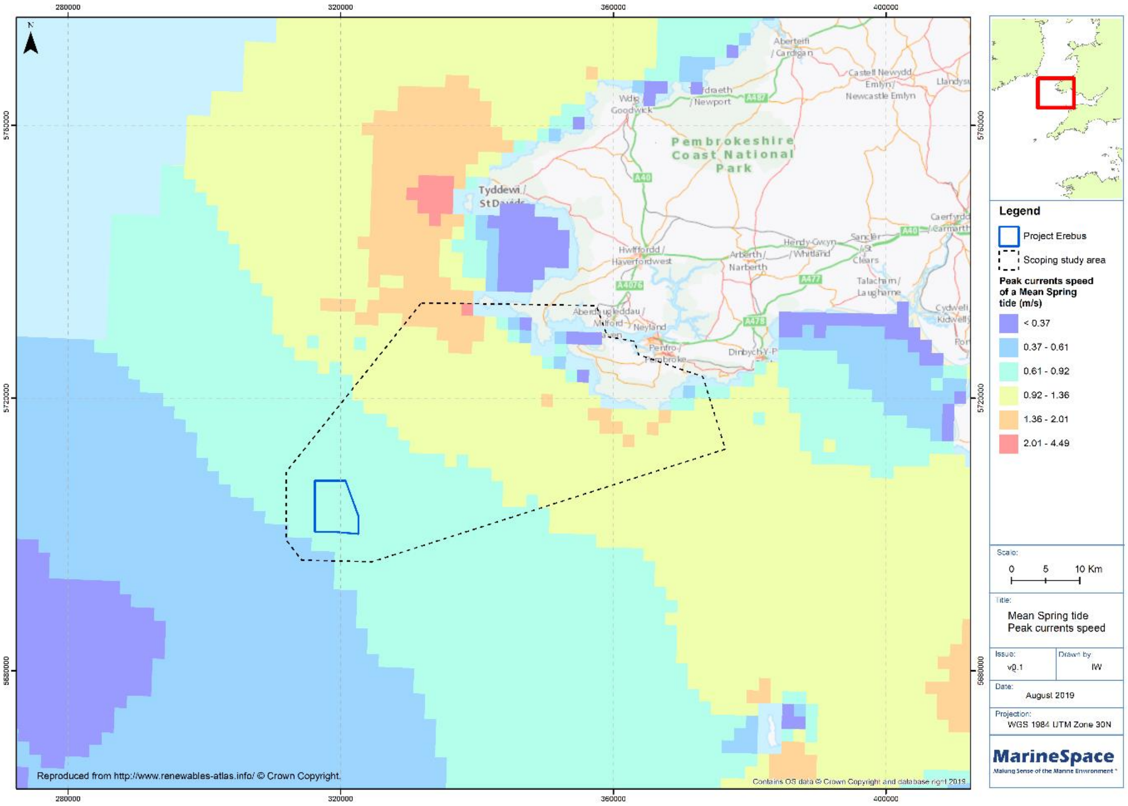


Figure 5.9: Peak Mean Neap Tide Current Speed in the Vicinity of the Proposed Project Site and Wider Study Area

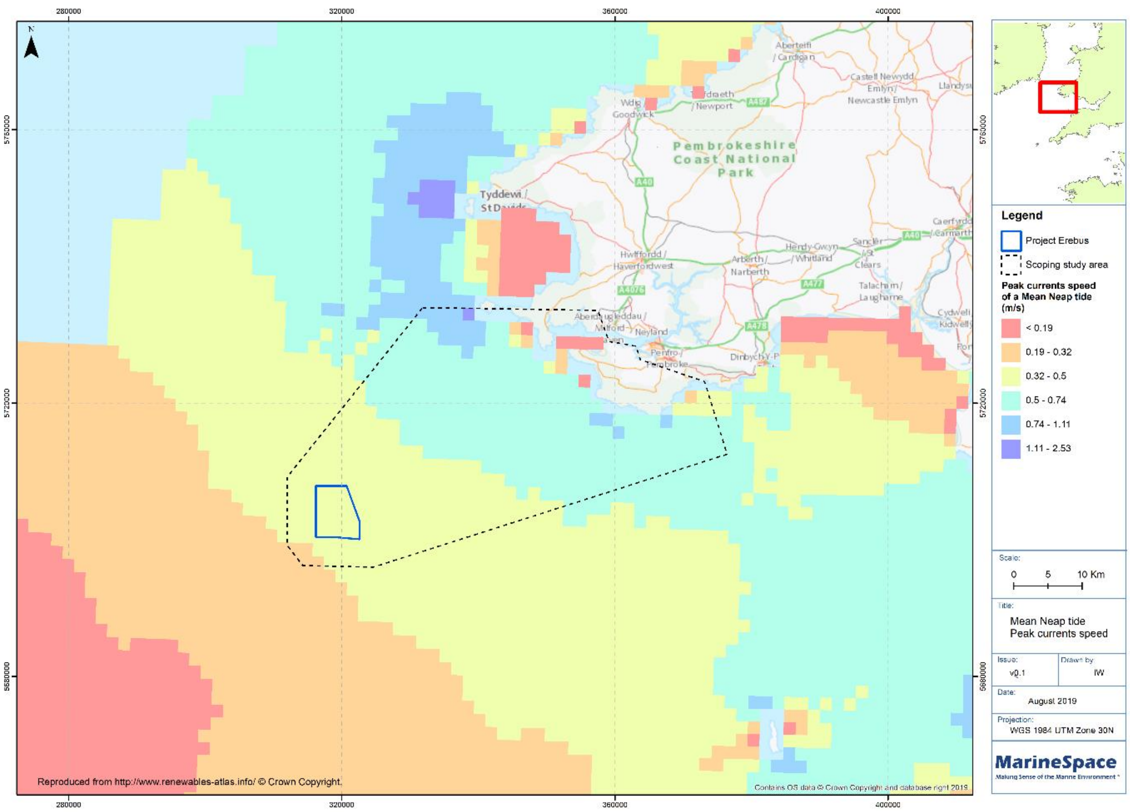


Table 5-1: Current Speeds and Directions for Tidal Diamond P, 23 km to the Southwest of the Proposed Offshore Array Site

Time relative to High Water (hrs)	Current Direction (°)	Spring current speed (m/s)	Neap current speed (m/s)
-6	040	0.31	0.15
-5	007	0.31	0.15
-4	326	0.31	0.15
-3	304	0.36	0.15
-2	283	0.36	0.15
-1	258	0.31	0.15
0	215	0.31	0.15
1	179	0.36	0.15
2	148	0.31	0.15
3	123	0.31	0.15
4	102	0.31	0.15
5	079	0.26	0.15
6	049	0.26	0.15

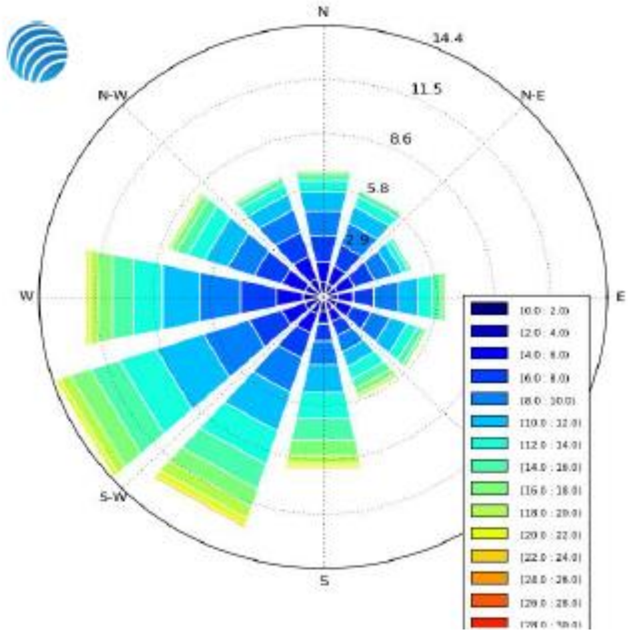
Tidal water levels can be Modified by storm surges, which occur when deep atmospheric depressions move through the area. Uncles and Stephens (2007) suggest that these may increase water levels by over 1.5 m as an extreme value during a 50-year period.

5.1.4.3. Wind

A desk-based assessment of metocean conditions in the offshore array area reached the following conclusions with respect to wind conditions (all values presented as for 110 m above sea level, i.e. reference hub height):

- Mean wind speed: 9.78 m/s (standard deviation: 4.59); and
- Long term wind direction (by wind energy): 204° (SSW).

Figure 5.10: Wind Rose of Long-Term Wind Direction and Speed (Hub Height)



5.1.5. Sedimentary Processes Baseline

Unconsolidated sediments in the vicinity of the proposed project site may be mobilised and transported by the prevailing local hydrodynamics (waves and / or tidal currents). Information in SEA8 Technical Report – Hydrography (Uncles & Stephens, 2007) suggests that detailed sediment transport processes in St George's Channel are poorly understood but are dominated by tidal currents, rather than waves (DTI, 2007). DTI (2007) also indicates that strong tidal currents present around the Pembrokeshire coast suspend high levels of seabed particles in the water column.

Collins (1987) concluded that, within the Bristol Channel, sediment transport occurs in an upstream direction along the coast (i.e. it is flood dominated) while sediment movement is seawards within the central part of the Channel (i.e. ebb dominated). DTI (2007) reports that this results in a scoured central region, with exposed bedrock in much of the central section of the Bristol Channel; with sediment thickness increasing to either side but, especially to the north.

The Outer Bristol Channel Habitat Study (Mackie *et al.*, 2006) also confirms the Collins (1987) hypothesis, proving a northward change in sediment type and bedforms from Lundy Island northward. West of Lundy Island, the seabed sediment is coarse grained, gravelly sand and sandy gravel with sand patches, ribbons and waves and isolated sand waves on outcropping bedrock. Northward there is sand that forms sand waves up to 10 m high.

Intertek (2019) summarises the high-resolution bathymetry data available in the vicinity of the proposed offshore array site, and within a wider Study Area inshore of the proposed Project site. Figure 5.5 shows the presence of significant areas of subaqueous dunes to the north of the proposed array. The crests of these bedform features are, typically, oriented southwest-northeast or south-north and their asymmetry would suggest an easterly movement of sediment. Intertek (2019) indicates that these subaqueous dunes have heights of between 10-15 m and wavelengths of several

100s of meters. Further east, in deeper water to the south of Carmarthen Bay, there is an extensive sand wave field (Mackie *et al.*, 2007). The asymmetries of these bedforms also suggest an easterly sediment transport in this part of the Bristol Channel.

The EIA Scoping Report for the Greenlink cable (Intertek, 2018) indicates active sediment transport close to the beaches of the area, with tidal and longshore sediment movement covering and exposing a fossil forest on the beach at Freshwater West. Due to the presence of a sandbank off the beach at Freshwater West, Intertek (2018) also speculates that there may be a sediment transport pathway between the beach and the sandbank. The Scoping Report for the META project (RPS Energy, 2018) indicates that sediment transport along the frontage of the south shore of the Milford Haven waterway is generally from west to east.

5.1.6. Identification of Key Sensitivities and Potential Impacts

Table 5-2 provides a summary of the potential impacts arising from the project on physical process receptors.

5.1.7. Potential Mitigation Measures

It is expected that any impacts on the offshore physical and sedimentary processes will be of small spatial and temporal scale (localised and temporary). Therefore, no additional mitigation measures are expected.

5.1.8. Proposed Approach to Environmental Assessment

Assessment of potential impacts on physical processes from the proposed Project will be undertaken via the steps detailed below:

- Review of existing relevant baseline data and information (to include Shoreline Management Plans; Regional Marine Processes data/reports);
- Acquisition of additional project-specific data to fill any gaps (see Table 5-3 below);
- Formulation of a conceptual understanding of baseline conditions;
- Consultation and agreement with the regulators regarding proposed assessment approaches;
- Determination of the worst-case scenarios based on the agreed Project Design Envelope;
- Consideration of embedded mitigation measures; and
- Assessment of effects using data analysis and expert-based judgements by the EIA consultant team. Note that it is currently <u>not proposed</u> to develop a project-specific numerical model due to the expected lack of significant physical process impacts;

Table 5-2: Key Sensitivities and Potential Impacts

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rational for Impact Scoped In/Out
Sediment Transport Hydrodynamics	Changes to sediment transport system by changes in wave and current climate.	Construction Operational Decommissioning	Yes	Changes in metocean conditions are possible as a result of construction and / or presence of structures within the proposed project site. However, it is not expected that there would be a significant change from baseline hydrodynamic conditions and, thus, little effect on baseline sediment transport. This will be confirmed through the EIA.
Coastal Erosion	Potential changes in sediment transport at the coast.	Construction Operational Decommissioning	Yes	Changes to local hydrodynamic regime, for example, changes to tidal energy and wave directions may result in changes to the coastal erosive regime. While this is unlikely, due to the importance of the receptor this will be scoped in to the EIA.
Seabed Morphology	There is potential to Modify the morphology of the seabed as a result of anchoring structures at the site.	Construction Operational	Yes	Placement of anchoring on the seabed may have the potentially to locally alter hydrodynamics, potentially causing scour and associated alterations to seabed morphology. It is not expected that there will be a significant change to baseline conditions, however this will be confirmed during EIA.
Sediment Transport	Drilling of anchors into hard rock seabed, or their removal during decommissioning, may produce additional suspended particles which may become part of the local sediment transport regime.	Construction Decommissioning	Yes	Levels of additional sediment generated as part of the construction or decommissioning are expected to be negligible when compared with the baseline local and regional sediment transport, and of a temporary duration.

- Consideration of the potential impacts of the proposed Project will be carried out over the following spatial scales:
    - Near-field: the area within the immediate vicinity (tens or hundreds of meters) of the proposed Project and along the offshore cable corridor; and
    - Far-field: the wider area that might also be affected indirectly by the proposed Project (e.g. due to disruption of waves, tidal currents or sediment pathways).
- Potential impacts will be divided into and presented as two main categories:
    - Those that directly affect receptors which possess their own intrinsic morphological value, e.g. change in local sandwave features and subsequent effect on sediment transport;
    - Those that result in effects (or changes) in the baseline metocean conditions and coastal processes which then manifest as impacts upon other (i.e. ecological) receptor, e.g. increased suspended sediment loads leading to impact on shellfish.
- Three main phases of development are considered, in conjunction with the present-day baseline, over the life-cycle of the Project. These are:
    - Construction phase;
    - Operation and maintenance phase; and
    - Decommissioning phase.

Table 5-3 summarises the proposed surveys that would be undertaken to inform the physical processes assessment.

Table 5-3: Proposed Surveys to Inform the Physical Process Assessment

Survey Type	Proposed Spatial Extent	Proposed Timing	Objective
Geophysical (MBES; SSS; Sub-Bottom Profiler, Magnetometer). **Will include grab samples for PSA and potentially DDV to ground-truth SSS data.**	Minimum 100% coverage of the offshore array site plus proposed 1km buffer. Minimum 100% coverage of export cable corridor up to landfall.	Summer 2020	To gather site-specific data on bathymetry, seabed sediments, morphology/bedforms, sub-bottom geology and potential UXO. Data will be used to inform EIA process, in particular the following topic areas: • Marine Physical Processes; • Marine Ecology; • Marine Archaeology; and • UXO / Other Marine Users.

5.2. Marine Sediment and Water Quality

5.2.1. Study Area

Due to the potential local and regional effects on marine sediment and water quality, the Study Area for this section of the Scoping Report comprises a portion of St George's Channel and the northwestern Bristol Channel running into the southwestern coast of Pembrokeshire. The recent NRW advice on a marine aggregates Plan-level HRA indicating a potential tide-parallel Secondary Impact Zone (SIZ) of up to 10 km in each direction is relevant for marine sediment and the Study Area shown in Figure 5.1 is also relevant for this receptor.

5.2.2. Baseline Data

A range of baseline data sources have been used to compile this Section of the Scoping Report, including

- ABPmer, 2019. Atlas of UK Marine Renewable Energy – information of wind, waves and tides;
- British Geological Survey (BGS), 2017a; 2017b - geological units, Quaternary deposits and seabed sediments;
- Cefas, 2019. WaveNet - real time data from the SEACAMS PDZ WaveRider buoy;
- DTI, 2007. Offshore Oil and Gas Strategic Environment Assessment (SEA) 8 Overall Report and associated specialist reports;
- EMODnet - Bedrock Geology and seabed sediment information;
- Intertek Ltd, 2018. Greenlink Interconnector Environmental Scoping Report - UK Marine Route. Rev 2;
- Intertek, 2019. Erebus Stage 1 Floating Windfarm Geological Desk Top Study;
- Mackie *et al.*, 2006. The Outer Bristol Channel Marine Habitat Study;
- NRW, 2017a. Water Framework Directive (WFD) online information;
- RPS Energy, 2018. Marine Energy Test Area (META) Environmental Impact Assessment Scoping Report;
- UKHO and Admiralty Charts - bathymetry and Tidal Diamond data; and
- Wave Hub Ltd, 2018. Pembrokeshire Demonstration Zone Feasibility Study Environmental Scoping Report.

5.2.3. Existing Baseline

5.2.3.1. Marine Sediment Quality

Seabed sediments off the west coast of Wales predominantly consist of sandy gravel with nearshore areas of sand (DECC 2016). The inshore seabed around the south Pembrokeshire coast is characterised by rocky reef, shoals and sandbanks. BGS seabed sediment data, summarised in Intertek (2019), and shown in Figure 5.5, shows the seabed in the vicinity of the of the proposed offshore array site to primarily consist of sand, with increased amounts of gravel in sediments closer to the coast. The physical properties of the sediments are important because fine muddy sediments have a higher risk of containing / taking up contaminants (due to a relatively large surface area and greater cation exchange capacity) than coarser sediments, such as sand and gravel.

The ES for the Atlantic Array Offshore Wind Farm (RWE, 2013) reported on sediment quality data collected to inform the EIA. Due to the higher potential for fine-grained sediments to be contaminated, the Atlantic Array sampling and testing concentrated on areas of fine sediment within their site, as well as inshore sections of their proposed cable route. Results indicated that chemical contaminant concentrations were low; and no samples exceeded the Cefas Action Level values for metal contamination used in the assessment. In addition, Total Hydrocarbon Content (THC) results indicated no levels of THC contamination above Cefas Action Level 1. Concentrations of hydrocarbons such as polycyclic aromatic hydrocarbons (PAH) in offshore samples and from the south coast of Pembrokeshire do not exceed their maximum allowable concentrations (MACs) (Intertek, 2018).

Intertek (2018) also indicates that polychlorinated biphenyls (PCBs) concentrations are decreasing across the Celtic and Irish Sea but are highest in industrialised regions such as harbours. Tributyltin (TBT) is a widespread contaminant of coastal waters and sediments due to its use an antifoulant on marine structures and shipping. OSPAR (2010) reports suggest that levels of TBT are acceptable across the Celtic Sea but there are still areas of high concentrations such as harbours and shipping lanes (UKMMAS 2010).

5.2.3.2. Marine Water Quality

There is no site-specific information on water quality, however the offshore Study Area has a dynamic hydrological regime with a varied wave regime and a strong tidal regime that provides the site with high levels of mixing and dispersal. It is anticipated that water quality offshore will be good.

The EU Marine Strategy Framework Directive adopted in 2008 requires that the UK takes "*the necessary measures to achieve or maintain Good Environmental Status in the marine environment by the year 2020 at the latest*" (UKMMAS 2010). There is a requirement for monitoring of near-shore waters under the EU Water Framework Directive (WFD) with a requirement to report on the 'ecological status' of surface and ground water in coastal waters (out to 1 nm from the baseline) and 'chemical status' of surface and ground waters in territorial waters (out to 12 nm from the baseline). The offshore Study Area overlaps with the Western Wales River Basin District.

Water quality, defined in terms of bacterial concentration, is monitored in Bathing Waters designated under the revised Bathing Water Directive (2007/7/EC) and many of the beaches within offshore Study Area have been assessed as having excellent water quality for the last four years (NRW, 2019). Water quality is also monitored for shellfish waters designated under the Shellfish Waters Directive 79/923/EEC. Currently, the nearest shellfish water to the proposed Project area is to the northeast at the Milford Haven Cleddau.

Intertek (2018), in the Scoping Report for the Greenlink interconnector, reports that dissolved contaminants in the Celtic Sea, and off the Pembrokeshire coast, are low or below the level of detection for current analytical tools. Coastal waters contain the highest concentrations of contaminants as they are within close proximity to run off from industry, however contamination along the south Pembrokeshire coast does not exceed environmental quality standards (EQSs) for metals and MACs for alkylphenolic chemicals.

5.2.4. Identification of Key Sensitivities and Potential Impacts

Table 5-4 provides a summary of the potential impacts arising from the project on the marine sediment and water quality.

5.2.5. Potential Mitigation

Mitigation measures dealing with the risk of accidental spills are suggested, with risks managed through the implementation of industry standard best practice guidelines, for example, appropriate use of chemicals, spill response, marine pollution contingency plans and pollution prevention guidelines (PPGs). Using these mitigation measures means the risk of pollution is not deemed to be significant.

Project vessels will comply with the International Maritime Organisation (IMO) International Convention for the Prevention of Pollution from Ships (MARPOL) standards.

No further mitigation is suggested at this stage.

5.2.6. Proposed Approach to Environmental Assessment

The assessment of impacts on marine water and sediment quality will follow the general methodology as set out in Section 5.1. The first stage in the assessment of potential impacts on marine water and sediment quality will be to determine the baseline conditions of the marine water (i.e. the naturally occurring levels of contamination and concentrations of suspended sediments) and the sediments (in terms of physical properties and contamination). The physical properties of the sediments are important because fine muddy sediments have a higher risk of containing / taking up contaminants (due to a relatively large surface area and greater cation exchange capacity) than coarser sediments, such as sand and gravel.

Potential effects on marine water and sediment will then be compared against existing baseline conditions and potential impacts will be assessed against natural variation, the Study Area characteristics, spatial and temporal scales.

The assessment to consider the potential effects of the resuspension of sediment as a result of hydrodynamic changes or as a result of direct resuspension through operations will use the outputs of the additional data collection proposed to be undertaken to inform the Marine Coastal Processes chapter of the EIA. Due to the low risk of contamination of the coarse-grained offshore sediments, no additional marine sediment and water quality data collection is proposed.

Table 5-4: Key Sensitivities and Potential Impacts

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rational for Impact Scoped In/Out
Water Quality (Suspended Sediment)	Drilling of anchors into hard rock seabed, or their removal during decommissioning, may produce additional suspended particles which may become part of the local sediment transport regime.	Construction Decommissioning	Yes	Increased suspended sediments leading to smothering of surrounding habitats or a release of contaminated sediments is very unlikely in a strongly tidal area. If an increase in suspended sediments does occur, this will be rapidly dispersed due to tidal flows. The tidal flows will also reduce any smothering potential due to increased dilution and dispersion rates.
Water Quality (Suspended Sediment)	Changes to sediment transport system caused by changes in wave and current climate.	Construction Operational Decommissioning	Yes	Increased suspended sediments leading to smothering of surrounding habitats, or a release of contaminated sediments as a result of changes in hydrodynamics, is very unlikely in a strongly tidal area. If an increase in suspended sediments does occur, this will be rapidly dispersed due to tidal flows. The tidal flows will also reduce any smothering potential due to increased dilution and dispersion rates.
Water Quality (Chemical Contamination)	There is the potential for accidental release of fluids into the environment through construction, operational and decommissioning phases.	Construction Operational Decommissioning	Yes	The risk of this is managed through the implementation of industry standard best practice guidelines, for example, appropriate use of chemicals, spill response, marine pollution contingency plans and pollution prevention guidelines (PPGs); therefore, the risk of pollution is not deemed to be significant.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rational for Impact Scoped In/Out
Sediment Quality (Contamination of Marine Sediments)	There is the potential for accidental release of fluids into the environment through construction, operational and decommissioning phases.	Construction Operational Decommissioning	Yes	Industry standard best practice guidelines will be followed at all times, for example, appropriate use of chemicals, spill response, marine pollution contingency plans and PPGs, (in particular PPG1 and PPG5); therefore, risk of contamination is not deemed to be significant.

5.3. Intertidal / Onshore Geology, Geomorphology and Soils

5.3.1. Study Area

The proposed Project will include a single marine export cable which will make landfall at a location to be determined. Therefore, the Study Area for the intertidal / onshore geology, geomorphology and soils encompasses all potential landfall locations in the Castlemartin peninsula, from the Milford Haven waterway in the north to Bosherston in the south.

5.3.2. Baseline Data

A range of baseline data sources has been used to compile this section of the Scoping Report, including:

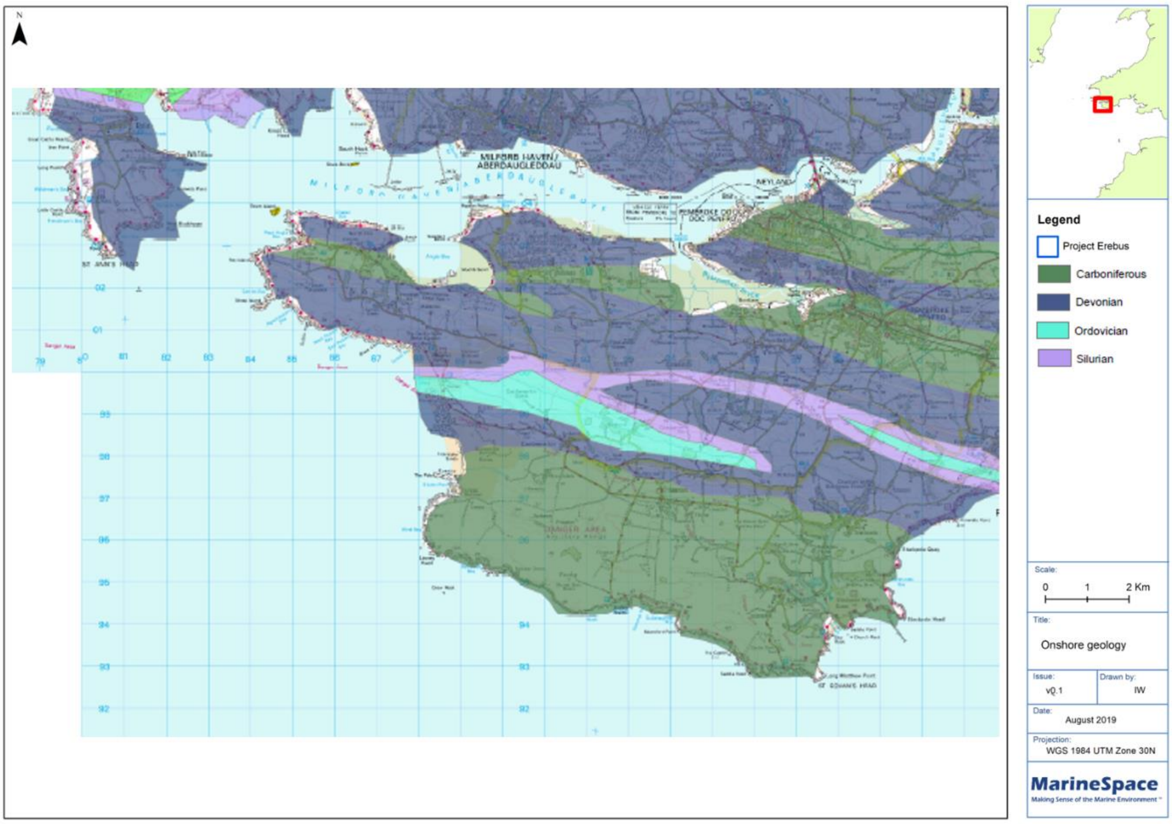
- British Geological Survey (BGS), 2017a; 2017b - geological units, and Quaternary deposits;
- Halcrow, 2012. South Wales Shoreline Management Plan;
- Intertek Ltd, 2018. Greenlink Interconnector Environmental Scoping Report - UK Marine Route. Rev 2;
- RPS Energy, 2018. Marine Energy Test Area (META) Environmental Impact Assessment Scoping Report; and
- Wave Hub Ltd, 2018. Pembrokeshire Demonstration Zone Feasibility Study Environmental Scoping Report.

5.3.3. Existing Baseline

The region around St Govan's Head is primarily comprised of sedimentary bedrock formed approximately 326 to 359 million years ago in the Carboniferous Period, although to the north of St Govan's Head, Ordovician, Silurian, and Devonian-age rocks all make up elements of the south Pembrokeshire geology (Figure 5.11).

The coastline between Giltar Point and St Govan's Head is largely undeveloped, and characterised by rocky cliffs fronted by narrow rocky platforms with a series of indented sheltered embayments, or pocket beaches, within which sediment tends to accumulate. In places, these beaches are backed by dunes, such as at Freshwater East, Barafundle Bay and Stackpole Warren (Halcrow, 2012) and much of the landscape is designated. Halcrow (2012) indicates that the key policy driver for this frontage is to enable the natural evolution of the coastline, to preserve its environmental interest and the tourist economy it supports, and while along the undeveloped sections of the coast the policy is no active intervention, a policy of managed realignment will be adopted for the dune system at Freshwater East to enable natural functioning.

Figure 5.11: Onshore Bedrock Geology in the Region of St Govan's Head, Showing the Extensive Carboniferous Deposits at the South of Peninsula. (From: Halcrow, 2012)



The St Govan's Head to Thorn Island frontage is characterised by limestone cliffs to the south and sandstone cliffs to the north, separated by the dunes at Frainslake Sands and Freshwater West. The shoreline is important for the landscape and habitats it supports, being within the Limestone Coast of South West Wales SAC and Castlemartin Coast SPA, as well as a number of SSSIs. West Angle Bay is a defended frontage, with a short length of seawall reducing the risk of coastal erosion and flooding and the recommended policy along much of this frontage is no active intervention to allow the coastline to evolve naturally and preserve the environmental interest. Halcrow (2012) indicates that within the dune systems at Frainslake Sands and Freshwater West a policy of managed realignment is in place to allow the dunes to function naturally, whilst allowing dune management to be undertaken as required.

The Thorn Island to Cleddau Bridge frontage comprises the southern bank of Milford Haven and includes Angle Bay and Pembroke river upstream to the barrage. Milford Haven is constrained by the resistant geology which provides the main influence on its structure and shape. The area is important for conservation and is part of the Pembrokeshire Marine SAC, as well as encompassing a number of SSSIs. The western (outer) section of the frontage is largely undeveloped, consisting of sandstone cliffs fronted by rocky foreshores, and is within the Pembrokeshire Coast National Park. The policy for the undeveloped frontage is to allow natural evolution of the coastline to continue through no active intervention. The Shoreline Management Plan policy of hold the line is in place between Llanreath (Martello Tower) eastwards to Cleddau Bridge to reduce coastal erosion and flood risk by maintaining and upgrading existing defences (Halcrow, 2012).

West Angle Bay, Angle Bay, Bullslaughter Bay, New Quay, Broadhaven South, and Barafundle Bay are all underlain by Dinantian (Lower Carboniferous) rocks (approximately 331-359 million years old). These rocks are limestones with some interbedded sandstones and argillaceous rocks. The Carboniferous limestones and sandstones were formed in warm shallow seas with carbonates being laid down on platform, shelf and slope areas; often rich in corals and shelly faunas.

Pembroke Dock is underlain by Lower Devonian rocks, approximately 393 to 419 million years old. The Lower Devonian generally comprises an upward coarsening sequence of mudstones, sandstones and conglomerates laid down on an alluvial plain as distal fluvial sediments.

Freshwater West is located in an area of rocks of Ludlow (Silurian) age, approximately 419 to 423 million years old. These rocks are mudstones, siltstones and sandstones and run in a band between Freshwater West and Freshwater East. The depositional environment was different to the Carboniferous limestones, being primarily fluvial, with detrital sand and gravel being deposited in channels, forming river terrace deposits. Some units are likely derived from fine silt and clay from overbank floods forming floodplain alluvium, and ancient peat bogs.

5.3.4. Identification of Key Sensitivities and Potential Impacts

Table 5-5 provides a summary of the potential impacts arising from the project on the intertidal / onshore geology, geomorphology and soils.

5.3.5. Potential Mitigation

Construction practices will comply with a Code of Construction Practice (CoCP) to ensure appropriate Pollution Prevention Guidelines (PPG) and good practice guidelines are followed. Potential mitigation measures for the onshore cable construction works will also include avoidance of impact through engineering techniques (e.g. trenchless techniques at sensitive points) where sensitive habitats and receptors are present.

5.3.6. Proposed Approach to Environmental Assessment

The assessment of impacts on intertidal / onshore geology, geomorphology and soils will follow the general methodology as set out in Section 5.1. The first stage in the assessment of potential impacts will be to determine the baseline conditions of these receptors.

In order to inform the EIA baseline, additional data gathering will focus on site-specific description of soils. It is likely that this would be undertaken through a combination of desk review, site visits and walk over survey investigations, although use of a UAV is also possible (Table 5-6). Should any additional geophysical and / or geotechnical data be collected for engineering purposes, these would also be incorporated into the appraisal.

Potential effects on intertidal/onshore geology, geomorphology and soils will then be compared against existing baseline conditions and potential impacts will be assessed against natural variation, the study area characteristics, spatial and temporal scales.

Table 5-5: Key Sensitivities and Potential Impacts

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Geological Features	Damage or disturbance of geological features of interest (including national and regional designated sites).	Construction Decommissioning	Yes	As the exact cable route is currently unknown, there is potential for disturbance of geological features of interest and is therefore scoped in for assessment. It is not anticipated, however, that there will be an impact on geological features from the onshore works. With the exception of the landfall, no significant excavation into the underlying geology would be expected, with any excavations being within surface soils. Landfall installation would either require open trenching or HDD drilling through rock.
Geomorphology / Soils	Damage or removal of geomorphological (topographical) and / or soil features.	Construction Decommissioning	Yes	Excavation of the onshore cable route and groundworks for the substation are expected to be predominantly within areas that are already Modified. As cable will be buried, it is not anticipated that there would be permanent changes to geomorphology or topography, although there may be temporary disturbance during construction and possibly decommissioning phases. Once buried, the ground level of the cable route would be returned to near baseline conditions. Therefore, it is not anticipated that there would be an impact on geomorphology or topography.
Soil	Compaction and degradation of soils.	Construction Decommissioning	Yes	Excavation works during installation of the onshore cable route is likely to disturb surface soils. This can result in compaction and degradation of excavated soils, particularly topsoil. The extent of significance would be influenced by the final locations and construction methodology used. In addition, construction plant activities may also cause compaction of soils in the surrounding working area. Installation in areas of made ground are less likely to result in impacts to surface soils.

Table 5-6: Proposed Surveys to Inform the Intertidal / Onshore Geology Assessment

Survey Type	Proposed Spatial Extent	Proposed Timing	Objective
Topographic / UAV Survey	Selected landfall location (MLWS to MHWS).	Summer 2020	To gather topographic data from the proposed landfall location to inform EIA work.

5.4. Onshore Groundwater and Hydrology

5.4.1. Study Area

The project will include a single marine export cable. The exact location of landfall is not yet determined, therefore the Study Area for the onshore groundwater and hydrology assessment encompasses all potential landfall locations and the southwestern part of the Castlemartin peninsula, from the Milford Haven waterway in the north to Bosherston in the south.

5.4.2. Baseline Data

A range of baseline data sources has been used to compile this section of the Scoping Report, including:

- Halcrow, 2012. South Wales Shoreline Management Plan;
- Intertek Ltd, 2018. Greenlink Interconnector Environmental Scoping Report - UK Marine Route. Rev 2;
- NRW, 2016. Pembrokeshire Catchment Summary;
- RPS Energy, 2018. Marine Energy Test Area (META) Environmental Impact Assessment Scoping Report; and
- Wave Hub Ltd, 2018. Pembrokeshire Demonstration Zone Feasibility Study Environmental Scoping Report.

5.4.3. Existing Baseline

The Study Area is underlain by the Pembrokeshire Carboniferous Limestone groundwater body. Halcrow (2012) indicates that this has a Good Status for saline intrusion and Good Status overall. Wave Hub Ltd (2018) indicates that the Pembrokeshire Carboniferous Limestone water body has good water quality and availability. Wave Hub Ltd (2018) also indicates that the southern part of the area is underlain by a bedrock Principal aquifer.

NRW (2016) reports that Dŵr Cymru Welsh Water (DCWW) supplies the area with potable water and also raw water to some industry, and that its major abstractions are at Canaston on the Eastern Cleddau, which provides water for most of South Pembrokeshire, and Crow Hill on the Western Cleddau.

NRW (2016) also notes that Llys y Fran reservoir on the Syfynwy (a tributary of the Eastern Cleddau) is used to regulate flows in the Eastern Cleddau to enable abstraction at Canaston at times of low river flows.

The Study Area contains a number of River Water Bodies:

- Freshwater East Stream – headwaters to tidal limit;
- Bosherston Lily Ponds – headwaters to tidal limit;
- Fraislake Stream - – headwaters to tidal limit;
- Castlemartin Corse – headwaters to tidal limit;
- Angle Stream South – headwaters to tidal limit;
- Angle Stream North – headwaters to tidal limit; and
- Martin’s Haven Pill – headwaters to tidal limit.

Wave Hub Ltd (2018) indicates that Castlemartin Corse is the largest waterway in the Study Area, and that it begins as a series of springs to the west of St Petrox, and flows northwesterly, until it reaches the sea at Freshwater West.

Wave Hub Ltd (2018) also indicates the presence of small lakes in the Study Area, with the largest being formed by three flooded valleys at Bosherston, each fed by a small freshwater stream, which make up the Lily Ponds.

NRW flood risk data (2019) shows that flooding risk due to surface runoff is low, and confined to valley floors, while flood risk from fluvial and coastal flooding is also generally low.

5.4.4. Identification of Key Sensitivities and Potential Impacts

Table 5-7 (below) provides a summary of the potential impacts arising from the project on the onshore groundwater and hydrology.

5.4.5. Potential Mitigation

Mitigation measures to maintain surface water flows during cable installation should be put in place to prevent direct impacts on the hydrology and geomorphology of surface watercourses.

In order to mitigate the effects of sediment entering water courses standard sediment management measures could be used, if appropriate; e.g. settlement ponds, covering stockpiles to prevent runoff, silt curtains in water courses etc.

Mitigation measures dealing with the risk of accidental spills or contaminants are also suggested, with risks managed through the implementation of industry standard best practice guidelines, for example, appropriate use of chemicals, spill response, pollution contingency plans and pollution prevention guidelines (PPGs).

Table 5-7: Key Sensitivities and Potential Impacts

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Hydrology	Changes to hydrology (including private water supplies).	Construction Operational Decommissioning	Yes	The cable route may need to cross hydrological features such as streams or drainage channels. The impacts of this will be dependent on construction methodology, location and nature of hydrological features in the development area.
Surface Water Bodies	Sediment suspended as a result of construction or decommissioning activities may enter surface water bodies.	Construction Decommissioning	Yes	Increased sediment supply could result in localised increases in turbidity and alter sediment deposition patterns and locations downstream of the source point.
Surface Water Bodies and Groundwater	Release of contaminants to surface waters and groundwater.	Construction Decommissioning	Yes	Onshore activities associated with construction and decommissioning works have the potential for accidental release of contaminants which could directly enter surface water bodies or enter the groundwater.
Flood Risk	Alteration to flood risk as a result of onshore works.	Construction Operational Decommissioning	Yes	The onshore works may be located within areas at risk from river, tidal or coastal flooding. The impacts of this will be dependent on construction methodology, location and nature of hydrological features and flood risk zones in the area of works, which is currently unknown. Flood risk (including sea level rise associated with climate change) should therefore be considered further as part of the EIA.

5.4.6. Proposed Approach to Environmental Assessment

In order to inform the EIA baseline, data gathering will focus on:

- Site specific description of soils. It is likely that this would be undertaken through a combination of desk review, and site visits / walk-over survey. Where additional geophysical and / or geotechnical data may be collected for engineering investigations, these would also inform the risk assessment process; and
- Desk-based review of information regarding hydrological features that may be impacted by the Project, including private water supplies. This would include ground water flow, surface water flow, drainage and flood risk zones.

5.5. Water Framework Directive

5.5.1. Study Area

The Study Area for the WFD assessment includes the southwestern part of the Pembrokeshire peninsula, from the Milford Haven waterway in the north to Bosherston in the south.

5.5.2. Baseline Data

A range of baseline data sources have been used to compile this Section of the Scoping Report, including

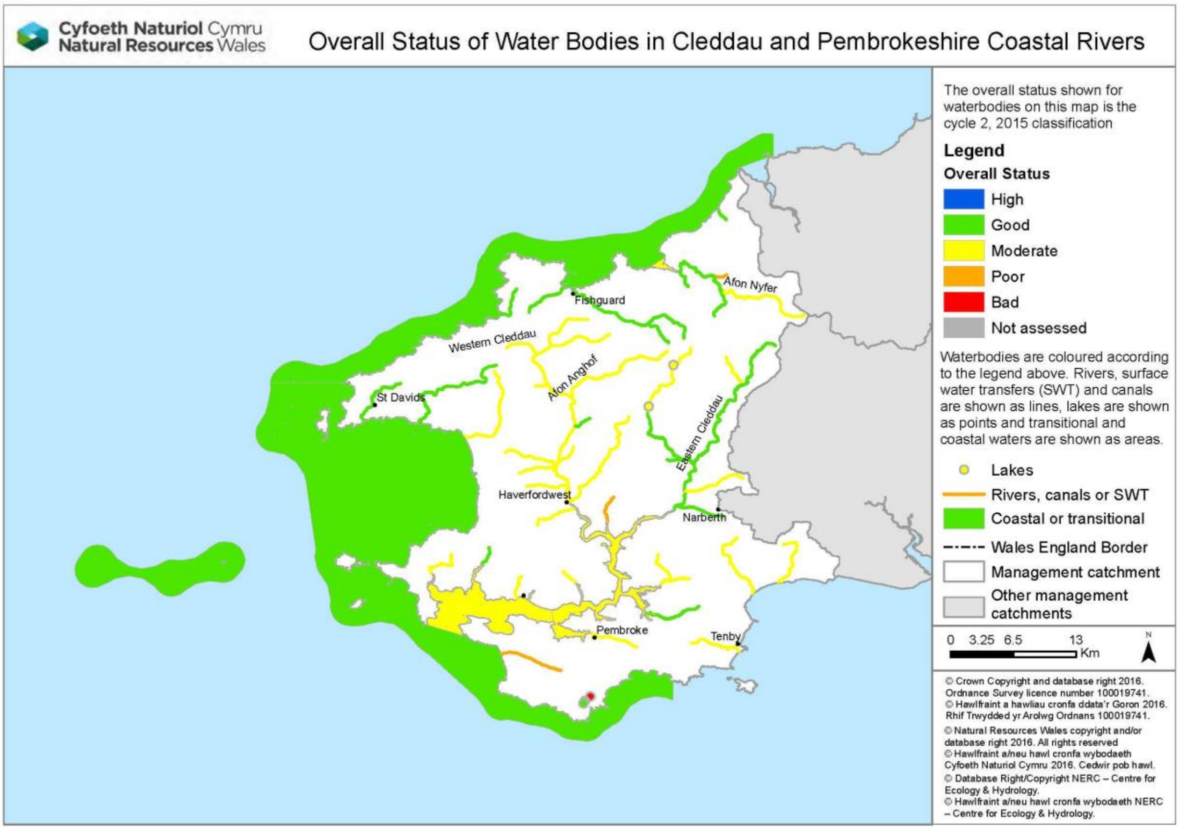
- Halcrow, 2012. South Wales Shoreline Management Plan;
- NRW (Natural Resources Wales), 2016. Pembrokeshire Catchment Summary; and
- NRW (Natural Resources Wales), 2019. Online information for WFD waterbodies and associated Protected Areas.

5.5.3. Existing Baseline

NRW (2016) indicates that within the overall Pembrokeshire catchment, 42% of surface water bodies are at good overall classification status, 51% at Moderate, 5% at poor and 2% at bad overall status. There are no water bodies at high overall status (Figure 5.12). NRW (2016) states that the Milford Haven water bodies are sensitive to nutrient pollution.

The proposed offshore array site is not located within a WFD water body, however the potential marine export cable routes and landfalls may pass through coastal and transitional water bodies, as designated under the WFD, and shown in Figure 5.12.

Figure 5.12: Overall Status of Water Bodies in Cleddau and Pembrokeshire Coastal Rivers. (From NRW, 2016)



WFD water bodies relevant to the proposed Project are:

- Milford Haven Inner transitional water body (GB531006114100), which is at Moderate Ecological Status because of and high concentrations of mercury and mercury-containing compounds, Tributyltin (TBT), Brominated Diphenylether (BDPE) and dissolved inorganic nitrogen;
- Milford Haven Outer coastal water body (GB641008220000), which is at Moderate Ecological Status because of high concentrations of dissolved inorganic nitrogen, mercury, and mercury-containing compounds; and
- Pembrokeshire South coastal water body (GB611008590003), which is at Good Ecological Status.

The potential cable routes and landfalls will also pass through the Pembrokeshire Carboniferous Limestone groundwater body (GB41002G206000), designated under the WFD groundwater body. This is currently at Good Quantitative Status and Good Chemical Status.

In addition, and by comparison with information presented by Wave Hub Ltd (2018), any potential cable routes and landfalls also have the potential to pass through or close to the catchments of the following river and lake water bodies:

- Castlemartin Corse river water body (GB110061025000) which, because of low dissolved oxygen concentrations and related pressures on macrophytes and macroinvertebrates, is at Poor Ecological Status;
- Bosherston Lily Ponds (Eastern Arm) lake water body (GB31047013) which, because of high total phosphorus concentrations and pressure on macrophytes, phytobenthos and diatom communities, is at Bad Ecological Status;
- Bosherston Lily Ponds (Central Arm) lake waterbody (GB31047014), which is at Good Ecological Status; and
- Bosherston Lily Ponds (Western Arm and Central) lake water body (GB31047015), which is at Good Ecological Status.

5.5.4. Identification of Key Sensitivities and Potential Impacts

Table 5-8 provides a summary of the potential impacts arising from the project on the WFD.

5.5.5. Potential Mitigation

In order to mitigate the effects of sediment entering water courses standard sediment management measures could be used, if appropriate; e.g. settlement ponds, covering stockpiles to prevent runoff, silt curtains in water courses etc.

Mitigation measures dealing with the risk of accidental spills or contaminants are also suggested, with risks managed through the implementation of industry standard best practice guidelines, for example, appropriate use of chemicals, spill response, pollution contingency plans and pollution prevention guidelines (PPGs).

5.5.6. Proposed Approach to Environmental Assessment

The overall requirement of the WFD is that all waterbodies must achieve Good Ecological Status by 2027, with interim targets in 2015 and 2021. It also requires that environmental objectives be set for all waterbodies to either maintain Good Status, or to move towards Good Status if a waterbody is currently failing its target. Under all conditions, it requires that there should be no deterioration in status. The WFD assessment will, therefore, consider whether there is potential for the proposed Project to cause deterioration in the status of river, lake, transitional, coastal and groundwater bodies in the Study Area.

In order to inform the EIA baseline and WFD assessment, data gathering will focus on a review of potential impacts in terms of the WFD, considering morphological, ecological and chemical aspects of onshore water receptors and coastal receptors within 1 nm of the coastline. The potential requirement for a WFD Compliance Assessment and requirements under the WFD will also be reviewed.

Table 5-8: Key Sensitivities and Potential Impacts

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped in/Out
WFD Designated Water Bodies	There is the potential that sediments could be suspended into the water column during construction and decommissioning (installation of cables and during landfall activities).	Construction Decommissioning	Yes	Increased suspended sediments, sufficient to lead to deterioration in status is very unlikely in the tidal coastal area. If an increase in suspended sediments does occur, this will be rapidly dispersed due to tidal flows. Increased sediment supply as a result of onshore activities could potentially result in localised increases in turbidity in river, lake, and groundwater water bodies.
WFD Designated Water Bodies	There is the potential that contaminated sediments could be suspended into the water column during construction and decommissioning, and contaminants adsorbed onto particles could be released to designated water bodies.	Construction Decommissioning	Yes	Onshore activities associated with construction and decommissioning works have the potential for accidental release of contaminants which could directly enter surface water bodies or enter the groundwater.
WFD Designated Water Bodies	Accidental release of contaminants from vessels and plant.	Construction Decommissioning	Yes	Onshore activities associated with construction and decommissioning works have the potential for accidental release of contaminants which could directly enter surface water bodies or enter the groundwater.
WFD Designated Water Bodies	Installation of permanent project infrastructure (cable protection) within boundary of WFD water body.	Operational	Yes	The potential impacts caused by rock armour protection are essentially permanent impacts and if they are located in a WFD water body, they will directly impact on the waterbody hydromorphology and biological elements and have the potential to affect waterbody status.

A WFD assessment comprises up to 3 stages, all of which may not be required depending on what is found at each stage. The stages are:

- Screening – excludes any activities that do not need to go through the scoping or impact assessment stages;
- Scoping – identifies the receptors that are potentially at risk from the proposed activity and need impact assessment; and
- Impact assessment – considers the potential impacts of the proposed activity, identifies ways to avoid or minimise impacts, and shows if the proposed activity may cause deterioration or jeopardise the water body achieving good status.

The WFD assessment will consider all operations performed as part of the project; and the water body the activity will occur in and all water bodies that could be affected. If any specific activities are identified that have the potential to cause a non-temporary deterioration within a WFD water body that cannot be mitigated, derogation under Article 4.7 will need to be sought. If the WFD assessment identifies any potential instances of this, then these will be immediately raised with the Environment Agency for discussion.

No project-specific surveys are proposed to inform the WFD assessment.

5.6. References

ABPmer, 2019. Atlas of UK Marine Renewable Energy Resources. Available online at: http://www.abpmer.co.uk/experience/renewable-energy-experience/atlas-of-uk-marine-renewable-energy-resources/ [Accessed September 2019].

BGS (British Geological Survey), 2017a. View Maps. Available online at: http://www.bgs.ac.uk/data/mapViewers/home.html [Accessed September 2019].

BGS (British Geological Survey), 2017b. The BGS Lexicon of Named Rock Units. Available online at: http://www.bgs.ac.uk/lexicon/ [Accessed September 2019].

Cefas, 2019. WaveNet. Available online at: https://www.cefas.co.uk/cefas-data-hub/wavenet/ [Accessed September 2019].

Collins MB, 1987. Sediment transport in the Bristol Channel: A review. Proceedings of the Geologists' Association, 98, 367-383.

DECC (Department of Energy and Climate Change), 2016. Offshore Energy Strategic Environmental Assessment (SEA): An overview of the SEA process. Available online at: https://www.gov.uk/guidance/offshore-energy-strategic-environmental-assessment-sea-an-overview-of-the-sea-process [Accessed September 2019].

DTI, 2007. Impact assessment Strategic Environmental Assessment 8: supporting documents. Available online at: https://www.gov.uk/government/publications/strategic-environmental-assessment-8-supporting-documents [Accessed September 2019].

Efron B, and Tibshirani RJ, 1993. An introduction to the bootstrap. Monographs on Statistics and Applied Probability 57. Pp 430. Chapman and Hall. ISBN: 0-412-04231-2.

EMODnet, 2019a. EUSeaMap (92019) Broad-Scale Predictive Habitat Map. Available online at: https://www.eMoDnet-seabedhabitats.eu/access-data/launch-map-viewer/?zoom=4&center=-3.508,52.305&layerIds=1&baseLayerId=-3 [Accessed August 2019].

EMODnet, 2019b. Seabed Habitats - Unlocking seabed habitat data in Europe. Available online at: http://www.eMoDnet-seabedhabitats.eu [Accessed September 2019].

Evans CDR, 1982. The geology and superficial sediments of the inner Bristol Channel and Severn Estuary. In: Severn Barrage, pp. 35-42. Thomas Telford, London.

Halcrow, 2012. Lavernock Point to St Ann’s Head Shoreline Management Plan SMP2. Available online at: http://www.southwalescoast.org/content.asp?id=58 [Accessed September 2019].

Intertek Ltd, 2018. Greenlink Interconnector Environmental Scoping Report – UK Marine Route. Rev 2. 105pp.

Intertek, 2019. Simply Blue Energy Ltd Erebus Stage 1 Floating Windfarm Geological Desk Top Study. Report Reference P2324_R4791_Rev0. 44pp.

Mackie ASY, James JWC, Rees EIS, Darbyshire T, Philpott SL, Mortimer K, Jenkins GO, and Morando A, 2006. The Outer Bristol Channel Marine Habitat Study. Studies in Marine Biodiversity and Systematics from the National Museum of Wales. 249 pp.

NRW (Natural Resources Wales), 2016. Cleddau and Pembrokeshire Coastal Rivers Management Catchment Summary. 22pp. Available online at: https://naturalresources.wales/media/679390/2016-updated-pembrokeshire_catchment_summary_nrw.pdf [Accessed September 2016].

NRW (Natural Resources Wales), 2019. River Basin Management Plans Published 2015 – 2021. Available online at: https://naturalresources.wales/evidence-and-data/research-and-reports/water-reports/river-basin-management-plans/river-basin-management-plans-published/?lang=en [Accessed September 2019].

OSPAR (OSPAR Commission), 2010. Quality Status Report 2000. OSPAR Commission, London. 108 pp. Available online at: https://qsr2010.ospar.org/media/assessments/QSR_2000.pdf [Accessed September 2019].

RPS Energy, 2018. Marine Energy Test Area (META) Environmental Impact Assessment Scoping Report. 208pp.

RWE, 2013. Atlantic Array Offshore Wind Farm Environmental Statement Volume 3: Offshore Annexes.

Tappin DR, Chadwick RA, Jackson AA, Wingfield RTR, Smith NJP, 1994. United Kingdom offshore regional report: The Geology of Cardigan Bay and the Bristol Channel. British Geological Survey, Nottingham. 107pp.

UKMMAS (UK Marine Monitoring and Assessment Strategy), 2010. Charting Progress 2. Feeder Report: Productive Seas. Defra, London. 472pp.

Uncles RJ, and Stephens JA, 2007. SEA8 Technical Report – Hydrography. 105pp.

Wave Hub Ltd, 2018. Pembrokeshire Demonstration Zone Feasibility Study Environmental Scoping Report. 293pp.

Wave Venture, 2019. Project Erebus Metocean Analysis Desk-Study. Prepared on behalf of SBE Ltd.

6. Biological Environment and Nature Conservation

6.1. Nature Conservation (Designated Sites)

6.1.1. Study Area

Differing scales of Study Area have been used depending on the type and nature of the designated sites presented in this Section. Table 6-1 lists these Study Areas, which are displayed in Figure 6.1.

For EU designated sites, including Special Protection Areas (SPAs) and Special Areas of Conservation (SACs), all sites within the defined Study Area have been identified and scoped in at the time of writing. This represents a precautionary approach at this time. A Habitats Regulation Assessment (HRA) will be undertaken separately to any EIA and, as part of the HRA process, a formal HRA screening exercise will be undertaken – see Section 2.4. The outputs of this screening exercise will present the evidence base for which EU designated sites will be subject to HRA and will be presented to NRW at a later date (i.e. post this EIA Scoping Report), for consideration and agreement.

For non-EU sites, including SSSIs and MCZs, some sites within the defined Study Area (up to 100 km from Project area) have been scoped out at this stage due to no predicted spatial overlap / pathway for impacts with the interest features of these sites.

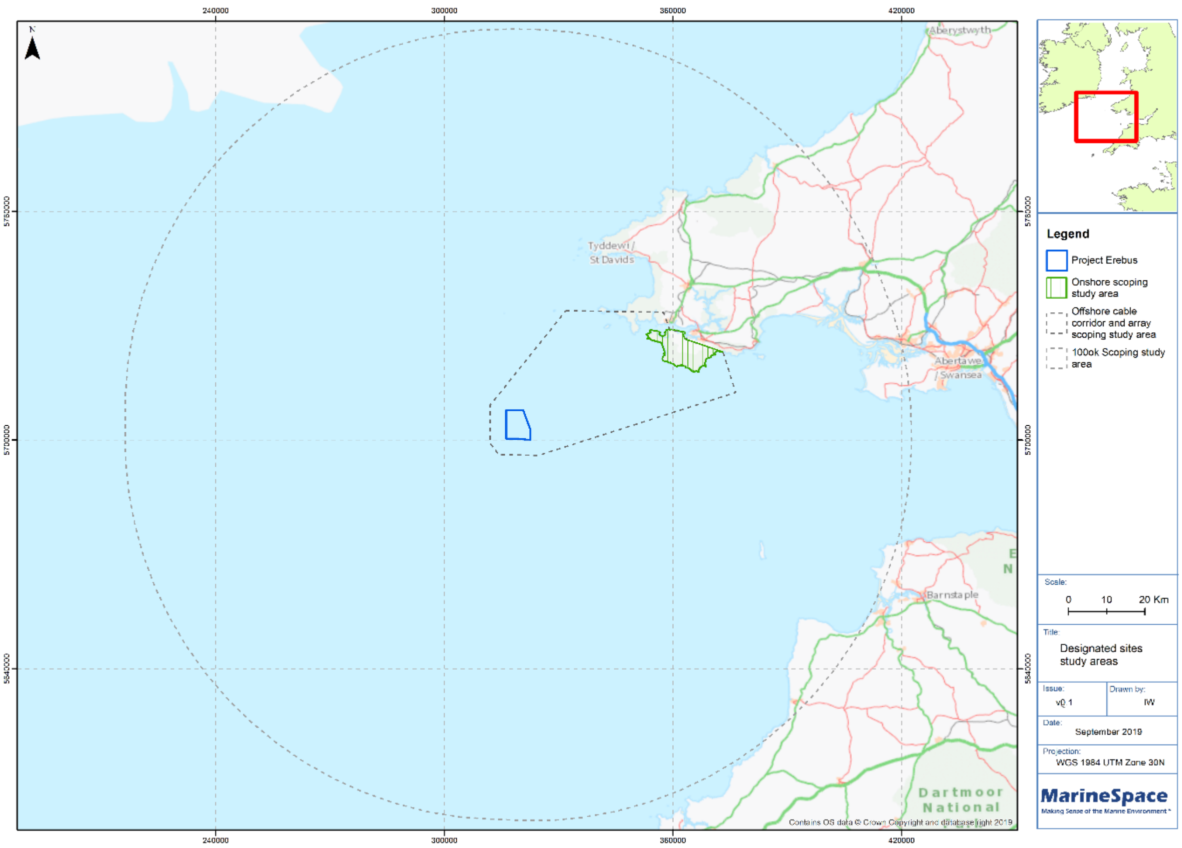
The proposed Project falls within Pembrokeshire Coast National Park, with much of the coast designated as SSSI or SACs. The Pembrokeshire Coast National Park has not been included within this section, however the relevant designations within this area have been included.

Table 6-1: Designated Sites Study Area Definition and Rationale

Designated Site Type	Study Area	Rationale
Terrestrial designated sites that overlap and are in close proximity to proposed onshore works.	Entire Castlemartin Peninsula, covering all potential landfall options, onshore cable routes and onshore substation location.	Ensures that all terrestrial designated sites, including those that may not overlap with proposed onshore Project infrastructure, are considered within the EIA / HRA. Inclusion of wider area also enables potential mobile components of terrestrial sites (bats) to be fully considered.
Marine / Coastal designated sites that overlap with or are in close proximity to proposed offshore works.	Offshore cable corridor and offshore array (plus 4 km buffer around array site).	Ensures that all marine designated sites, including those that may not directly overlap with any actual offshore project infrastructure, are considered within the EIA / HRA. Inclusion of a wider area also enables assessment of potential impacts on designated sites via sediment plumes / change in hydrodynamic regime.

Designated Site Type	Study Area	Rationale
Marine / Coastal designated sites that contain mobile interest / qualifying features (migratory fish; birds).	Offshore cable corridor and offshore array plus 100 km buffer. Extended buffer area for selected species (gannet; Manx shearwater).	Ensures that EIA / HRA takes full account of: (a) typical foraging ranges by birds that are part of designated site (SPA) populations; (b) movement of migratory birds through the offshore array area and (c) the movement of migratory fish that may pass through the site to SAC rivers. An expanded Study Area was also used to search for sites that support breeding bird species such as gannet and Manx shearwater, which may forage over distances ranging from 230 km to 300 km from their breeding colonies (Thaxter *et al.*, 2012).

Figure 6.1: Designated Sites Study Area



6.1.2. Baseline Data

The following key sources of information have been used to identify designated sites in and around the proposed Project:

- MAGIC online geographical information system (MAGIC, 2018);
- Lle - Welsh Marine Planning Portal (Welsh Government, 2019);
- Wildlife Trust of South and West Wales website;
- Royal Society for the Protection of Birds (RSPB) website;
- Natura 2000 standard data forms published by the Joint Nature Conservation Committee (JNCC); and
- Site Management Plans published by Natural Resources Wales (NRW).

6.1.3. Baseline Environment

The following section provides details of designated sites that have the potential to be impacted by the proposed Project. The sites are presented in line with the categories of designated sites set out in Table 6-1 (above). Figure 6.2 and Figure 6.3 summarise the sites listed in the tables below.

6.1.3.1. Terrestrial Designated Sites

Table 6-2 lists the designated sites for the terrestrial study area in close proximity to proposed onshore works within the Castlemartin Peninsula.

Table 6-2: Terrestrial Designated Sites that Overlap with or are in Close Proximity to Proposed Onshore Works

Site Code	Name	Location	Reason for Consideration
Special Area of Conservation (SAC)			
UK0014793	Pembrokeshire Bat Sites and Bosherston Lakes SAC	Overlaps with the Study Area (possible cable route); approx. 46 km from offshore array.	Within the Study Area, noted for inland water bodies, greater and lesser horseshoe bats and otter.
UK0014787	Limestone Coast of South West Wales SAC	Overlaps with the Study Area (possible cable route); approx. 39 km from offshore array.	Within the Study Area, noted for cliffs and caves, cliff top heath, grassland and dunes and associated plant species and greater horseshoe bat.
Special Protection Area (SPA)			
UK9014061	Castlemartin Coast SPA	Overlaps with the Study Area (possible cable route); approx. 40 km from offshore array.	Within the Study Area, noted for breeding coastal birds (chough).
Site of Special Scientific Interest (SSSI)			
SSSI_923 (32WWH)	Angle Peninsula Coast SSSI	Overlaps with the Study Area (possible cable route); approx. 37 km from offshore array.	Within the Study Area, noted for geology, coastal habitats, fish spawning and chough and peregrine falcon presence.

Site Code	Name	Location	Reason for Consideration
SSSI_1136 (32WVY)	Broomhill Burrows SSSI	Overlaps with the Study Area (possible cable route); approx. 40 km from offshore array.	Within the Study Area, noted for geology, the dune habitats and species, and breeding chough.
SSSI_242 (32WFD)	Castlemartin Corse SSSI	Overlaps with the Study Area (possible cable route); approx. 41 km from offshore array.	Within the Study Area, noted for swamp and fen habitats and species.
Code not known	Castlemartin Cliffs and Dunes SSSI	Overlaps with the Study Area (possible cable route); approx. 41 km from offshore array.	Within the Study Area, noted maritime grassland fronting maritime heath and gorse scrub, chough, sand dune habitats and strand-line beetle.
SSSI_140 (32WQ3)	Castlemartin Range SSSI	Overlaps with the Study Area (possible cable route); approx. 39 km from offshore array.	Within the Study Area, noted for geology and coastal, cliff, maritime grassland and heath habitats and species.
SSSI_1379 (32WUS)	Freshwater East Cliffs to Skrinkle Haven SSSI	Overlaps with the Study Area (possible cable route); approx. 52 km from offshore array.	Within the Study Area, noted for coastal habitats and species.
Code not known	Gweunydd Somerton Meadows SSSI	Overlaps with the Study Area (possible cable route).	Within Study Area, noted for grassland fungi.
SSSI_2549 (32WKQ)	Orielton Stable Block and Cellars SSSI	Overlaps with the Study Area (possible cable route); approx. 47 km from offshore array	Within the Study Area, noted for greater and lesser horseshoe bats and other bat species.
SSSI_24 (32WQ4)	Stackpole SSSI	Overlaps with the Study Area (possible cable route); approx. 47 km from offshore array.	Within the Study Area, noted for coastal habitats and species, freshwater habitats and species, greater and lesser horseshoe bats and otter.
SSSI_113 (32WQ5)	Stackpole Quay to Trewent Point SSSI	Overlaps with the Study Area (possible cable route); approx. 47 km from offshore array.	Within the Study Area, noted geology and coastal and cliff habitats and species (linked to SAC / SPA).

Site Code	Name	Location	Reason for Consideration
SSSI_615 (32WEX)	Stackpole Courtyard Flats and Walled Garden SSSI	Overlaps with the Study Area (possible cable route); approx. 46 km from offshore array.	Within the Study Area, noted breeding horseshoe bats (linked to SAC).
Code not known	St Margaret's Island SSSI	Adjacent to the Study Area; approx. 62 km from offshore array.	Adjacent to the Study Area, noted guillemot, razorbill and kittiwake.
SSSI_1440 (32WPU)	Park House Outbuildings, Stackpole SSSI	Overlaps with the Study Area (possible cable route); approx. 48 km from offshore array.	Within the Study Area, noted for breeding horseshoe bats (linked to SAC).
National Nature Reserve (NNR)			
00062	Stackpole NNR	Overlaps with the Study Area (possible cable route); approx. 47 km from offshore array.	Within the Study Area, noted for geology, landscapes, habitats and species.
Regionally Important Geological Site (RIGS)			
453	East Pickard Bay RIGS	Overlaps with the Study Area (possible cable route); approx. 39 km from offshore array.	Within the Study Area, noted for stratigraphy (igneous, Devonian).
483	Sawdern Point RIGS	Overlaps with the Study Area (possible cable route); approx. 42 km from offshore array.	Within the Study Area, noted for stratigraphy (Devonian).
488	West Angle Bay RIGS	Overlaps with the Study Area (possible cable route); approx. 39 km from offshore array.	Within the Study Area, noted for stratigraphy and structure (Carboniferous; Variscan).
501	Caled Quarry Bosherston RIGS	Overlaps with the Study Area (possible cable route); approx. 46 km from offshore array.	Within the Study Area, noted for stratigraphy and structure (Lower Carboniferous).
519	Longstone Down RIGS	Overlaps with the Study Area (possible cable route); approx. 42 km from offshore array.	Within the Study Area, noted for Quaternary geomorphology and Holocene geomorphology.

Site Code	Name	Location	Reason for Consideration
520	Bullslaughter Bay RIGS	Overlaps with the Study Area (possible cable route); approx. 44 km from offshore array.	Within the Study Area, noted for stratigraphy, Quaternary geomorphology and structure (Carboniferous, possible Triassic and Variscan).
529	New Quay RIGS	Overlaps with the Study Area (possible cable route); approx. 46 km from offshore array.	Within the Study Area, noted for Quaternary geomorphology and Holocene geomorphology.
555	Middle Cove RIGS	Overlaps with the Study Area (possible cable route); approx. 49 km from offshore array.	Within the Study Area, noted for stratigraphy (Carboniferous).
556	Stackpole Head RIGS	Overlaps with the Study Area (possible cable route); approx. 48 km from offshore array.	Within the Study Area, noted for geomorphology (karst).
561	Angle Bay RIGS	Overlaps with the Study Area (possible cable route); approx. 41 km from offshore array.	Within the Study Area, noted for stratigraphy (Carboniferous).
Geological Conservation Review (GCR)			
1759	Blucks Pool - Bullslaughter Bay GCR	Overlaps with the Study Area (possible cable route); approx. 39 km from offshore array at closest point.	Within the Study Area, noted for Dinantian geology.
43	Freshwater East (northeast) GCR	Overlaps with the Study Area (possible cable route); approx. 53 km from offshore array.	Within the Study Area, noted for Palaeozoic palaeobotany.
954	Freshwater East (southwest) GCR	Overlaps with the Study Area (possible cable route); approx. 52 km from offshore array.	Within the Study Area, noted for Wenlock geology.
1657	Freshwater East (north) GCR	Overlaps with the Study Area (possible cable route); approx. 53 km from offshore array.	Within the Study Area, noted for Variscan structures.

Site Code	Name	Location	Reason for Consideration
0	Freshwater West GCR	Overlaps with the Study Area (possible cable route); approx. 40 km from offshore array.	Within the Study Area, noted for non-marine Devonian geology.
1663	Freshwater West (North) GCR	Overlaps with the Study Area (possible cable route); approx. 40 km from offshore array.	Within the Study Area, noted for Variscan structures.
1666	Freshwater West (South) GCR	Overlaps with the Study Area (possible cable route); approx. 40 km from offshore array.	Within the Study Area, noted for Variscan structures.
1913	South Pembroke Cliffs GCR	Overlaps with the Study Area (possible cable route); approx. 42 km from offshore array.	Within the Study Area, noted for coastal geomorphology.
1656	Stackpole Quay GCR	Overlaps with the Study Area (possible cable route); approx. 49 km from offshore array.	Within the Study Area, noted for Variscan structures.
1735	Tenby Cliffs GCR	Overlaps with the Study Area (possible cable route); approx. 53 km from offshore array.	Within the Study Area, noted for non-marine Devonian geology.
1458	West Angle Bay GCR	Overlaps with the Study Area (possible cable route), approx. 39 km from offshore array.	Within the Study Area, noted for Quaternary geology.
1733	West Angle Bay (North) GCR	Overlaps with the Study Area (possible cable route); approx. 39 km from offshore array.	Within the Study Area, noted for non-marine Devonian geology.
Local Nature Reserve (LNR)			
Local Nature Reserve	Freshwater East LNR	Overlaps with the Study Area (possible cable route); approx. 52 km from offshore array.	Within the Study Area, noted for environment.

6.1.3.2. Marine and Coastal Designated Sites within Close Proximity to Proposed Offshore Works

Table 6-3 lists the marine and coastal designated sites that overlap or are within 4 km of the cable corridor and offshore array.

Table 6-3: Marine / Coastal Designated Sites that Overlap with or are in Close Proximity to Proposed Offshore Works

Site Code	Name	Location	Reason for Consideration
Special Protection Areas (SPA)			
UK9014051	Skomer, Skokholm and the Seas off Pembrokeshire SPA	Overlaps with the proposed offshore works and Study Area.	Within the Study Area, with noted breeding seabirds and coastal birds (including, puffins and chough).
UK9014061	Castlemartin Coast SPA	Overlaps with the Study Area (possible cable route); approx. 40 km from offshore array.	Within the Study Area, noted for breeding coastal birds (chough).
Special Areas of Conservation (SAC)			
UK0030396	Bristol Channel Approaches SAC	Overlaps with the Study Area (possible cable route); approx. 50 km from offshore array (closest point 26 km).	Within the Study Area, noted for marine mammals (harbour porpoise).
UK0030397	West Wales Marine SAC	Overlaps with the Study Area (possible cable route); approx. 10 km from offshore array.	Within the Study Area, noted for marine mammals (harbour porpoise).
UK0013116	Pembrokeshire Marine SAC	Overlaps with the Study Area (possible cable route); approx. 16 km from offshore array.	Within the Study Area, noted for marine and coastal habitats, marine mammals (grey seal), migratory fish and otter.
UK0014787	Limestone Coast of South West Wales SAC	Overlaps with the Study Area (possible cable route); approx. 39 km from offshore array.	Within the Study Area, noted for cliffs and caves, cliff top heath, grassland and dunes and associated plant species and greater horseshoe bat.
Marine Conservation Zone (MCZ)			

Site Code	Name	Location	Reason for Consideration
MCZ	Skomer MCZ	Overlaps with the Study Area (possible cable route); approx. 33 km from offshore array.	Within the Study Area, with noted marine mammals (grey seal).
Site of Special Scientific Interest (SSSI)			
SSSI_585 (32WTB)	Dale and South Marloes Coast SSSI	Overlaps with the Study Area (possible cable route); approx. 35 km from offshore array.	Within the Study Area, noted for geology, coastal and cliff habitats and species and marine mammals (grey seal).
SSSI_342 (32WHS)	St Bridges Bay South SSSI	Overlaps with the Study Area (possible cable route); approx. 36 km from offshore array.	Within the Study Area, noted for geology, coastal and cliff habitats and marine mammals (grey seal) (linked to SAC).
SSSI_282 (32WP3)	Milford Haven Waterway SSSI	Overlaps with the Study Area (possible cable route); approx. 37 km from offshore array.	Within the Study Area, noted for geology, estuarine, coastal and wetland habitats and species (incl. otter), ancient woodland and horseshoe bats.
SSSI_953 (32WAG)	Skomer Island and Middleholm SSSI	Overlaps with the Study Area (possible cable route); approx. 33 km from offshore array.	Within the Study Area, noted for breeding seabirds, breeding chough and marine mammals (grey seal).
SSSI_297 (32WTL)	Skokholm SSSI	Overlaps with the Study Area (possible cable route); approx. 30 km from offshore array.	Within the Study Area, noted for breeding seabirds (incl. chough) and marine mammals (grey seal).
SSSI_464 (32WHF)	Marloes Mere SSSI	Overlaps with the Study Area (possible cable route); approx. 36 km from offshore array.	Within the Study Area, noted for wet acidic habitat and species.
National Nature Reserve (NNR)			
00112	Skokholm NNR	Overlaps with the Study Area (possible cable route); approx. 33 km from offshore array.	Within the Study Area, noted for geology, coastal habitats and species, marine mammals (grey seal), seabirds and chough.
00061	Skomer Island NNR	Overlaps with the Study Area (possible cable	Within the Study Area, noted for geology, coastal

Site Code	Name	Location	Reason for Consideration
		route); approx. 33 km from offshore array.	habitats and species, marine mammals (grey seal), seabirds and chough.
Heritage Coast			
NLCA47	South Pembrokeshire Heritage Coast	Overlaps with the Study Area (possible cable route); approx. 37 km from offshore array.	Within the Study Area, noted for geology, coastal habitats, landscapes and land use.
-	Marloes and Dale Heritage Coast	Overlaps with the Study Area (possible cable route); approx. 29 km from offshore array.	Within the Study Area, noted for landscapes.

6.1.3.3. Marine and Coastal Designated Sites that Contain Mobile and Qualifying Features

Table 6-4 lists the marine and coastal designated sites that are located within 100 km of the offshore array and which contain mobile interest/qualifying features (marine mammals, birds, fish).

Table 6-4: Marine / Coastal Designated Sites that Contain Mobile Interest / Qualifying Features

Site Code	Name	Location	Reason for Consideration
SPA			
UK9014051	Skomer, Skokholm and the Seas off Pembrokeshire (SPA	Overlaps with the proposed offshore works and Study Area.	Within the Study Area, with noted breeding seabirds and coastal birds (including, puffins, chough and short-eared owl).
UK9014091	Carmarthen Bay SPA	Within 100 km of proposed offshore works (approx. 64 km).	Within the Study Area, noted for wintering water birds (common scoter).
UK9015011	Burry Inlet SPA	Within 100 km of proposed offshore works (approx. 92 km).	Within the Study Area, noted for wintering water birds (various species).
UK9014041	Grassholm SPA	Within 100 km of proposed offshore works (approx. 25 km).	Within the Study Area, noted for breeding seabirds (gannet).
UK9014062	Ramsey and St David`s Peninsula	Within 100 km of proposed offshore	Within the Study Area, noted for breeding coastal

	Coast SPA	works (approx. 42 km).	birds (chough).
004002 (IRE)	Saltee Islands SPA	Within 100 km of proposed offshore works (approx. 96 km).	Within the Study Area, noted for breeding seabirds (various species).
004092 (IRE)	Tacumshin Lake SPA	Within 100 km of proposed offshore works (approx. 95 km).	Within the Study Area, noted for breeding and wintering water birds (various species).
004009 (IRE)	Lady's Island Lake SPA	Within 100 km of proposed offshore works (approx. 92 km).	Within the Study Area, noted for breeding and wintering water birds (various species).
UK9020327	Northern Cardigan Bay SPA	Potential migratory species (approx. 133 km from proposed offshore array).	Noted for wintering water birds (red-throated diver).
UK9015022	Severn Estuary SPA	Potential migratory species (approx. 164 km from proposed offshore array).	Noted for wintering and migratory water birds (various species).
SAC			
UK0020020	Carmarthen Bay and Estuaries SAC	Within 100 km of proposed offshore works (approx. 61 km).	Noted for migratory fish (various) and otter.
UK0030074	Cleddau River SAC	Within 100 km of proposed offshore works (approx. 64 km).	Noted for migratory fish species (various) and otter.
UK0013114	Lundy SAC	Within 100 km of proposed offshore works (approx. 63 km).	Noted for marine mammals (grey seal).
UK0012712	Cardigan Bay SAC	Within 100 km of proposed offshore works (approx. 88 km).	Noted for marine mammals (bottlenose dolphin and grey seal) and migratory fish (lamprey).
UK0013010	River Tywi SAC	Within 100 km of proposed offshore works (approx. 97 km).	Noted for migratory fish (various) and otter.
UK0012670	River Teifi SAC	Within 100 km of proposed offshore	Noted for migratory fish (lamprey) and otter.

		works (approx. 91 km (>100 km around coast).	
IE0000704	Lady's Island Lake SAC	Within 100 km of proposed offshore works (approx. 92 km).	Noted for breeding and wintering water birds (various).
IE0000696	Ballyteige Burrow SAC	Within 100 km of proposed offshore works (approx. 100 km).	Noted for wintering water birds (various).
IE0000707	Saltee Islands SAC	Within 100 km of proposed offshore works (approx. 87 km).	Noted for wintering and breeding water birds and marine mammals (grey seal).
IE0000709	Tacumshin Lake SAC	Within 100 km of proposed offshore works (approx. 94 km).	Noted for wintering water birds.
Marine Conservation Zone (MCZ)			
MCZ	North West of Lundy MCZ	Within 100 km of proposed offshore works (approx. 43 km).	Noted for geology and sediments.
MCZ	Lundy MCZ	Within 100 km of proposed offshore works (approx. 43 km).	Noted for geology and sediments.
MCZ	Morte Platform MCZ	Within 100 km of proposed offshore works (approx. 86 km).	Noted for geology and sediments.
MCZ	Bideford to Foreland Point MCZ	Within 100 km of proposed offshore works (approx. 96 km).	Noted for geology, sediments and marine species (incl. spiny lobster and sponges).
MCZ	Hartland Point to Tintagel MCZ	Within 100 km of proposed offshore works (approx. 84 km).	Noted for geology, sediments and marine species (incl. sea fans and sponges).
MCZ	South of Celtic Deep MCZ	Within 100 km of proposed offshore works (approx. 67 km).	Noted for spiny lobster.
MCZ	South West Approaches to the Bristol Channel MCZ	Within 100 km of proposed offshore works (approx. 54 km).	Noted for geology and sediments.

MCZ	Padstow Bay and Surrounds MCZ	Within 100 km of proposed offshore work (approx. 99 km).	Noted for geology, sediments and marine species (incl. spiny lobster and sea fans).
Ramsar			
UK14001	Burry Inlet	Within 100 km of proposed offshore works (approx. 91 km).	Noted for wetland habitat and species, breeding and wintering water birds (various), fish and otter.
National Nature Reserve (NNR)			
00038	Grassholm Island NNR	Within 100 km of proposed offshore works (approx. 26 km).	Noted for breeding seabirds.
00040	Ramsey Island NNR	Within 100 km of proposed offshore works (approx. 43 km).	Noted for breeding and wintering sea and coastal birds and marine mammals (grey seal).
00041	Gower Coast NNR	Within 100 km of proposed offshore works (approx. 87 km).	Noted for breeding seabirds.
00042	Oxwich NNR	Within 100 km of proposed offshore works (approx. 87 km).	Noted for migratory and wintering water birds and bats.
00043	Whiteford NNR	Within 100 km of proposed offshore works (approx. 90 km).	Noted for migratory and wintering water birds.

Figure 6.2: Location of National (UK) Designated Sites

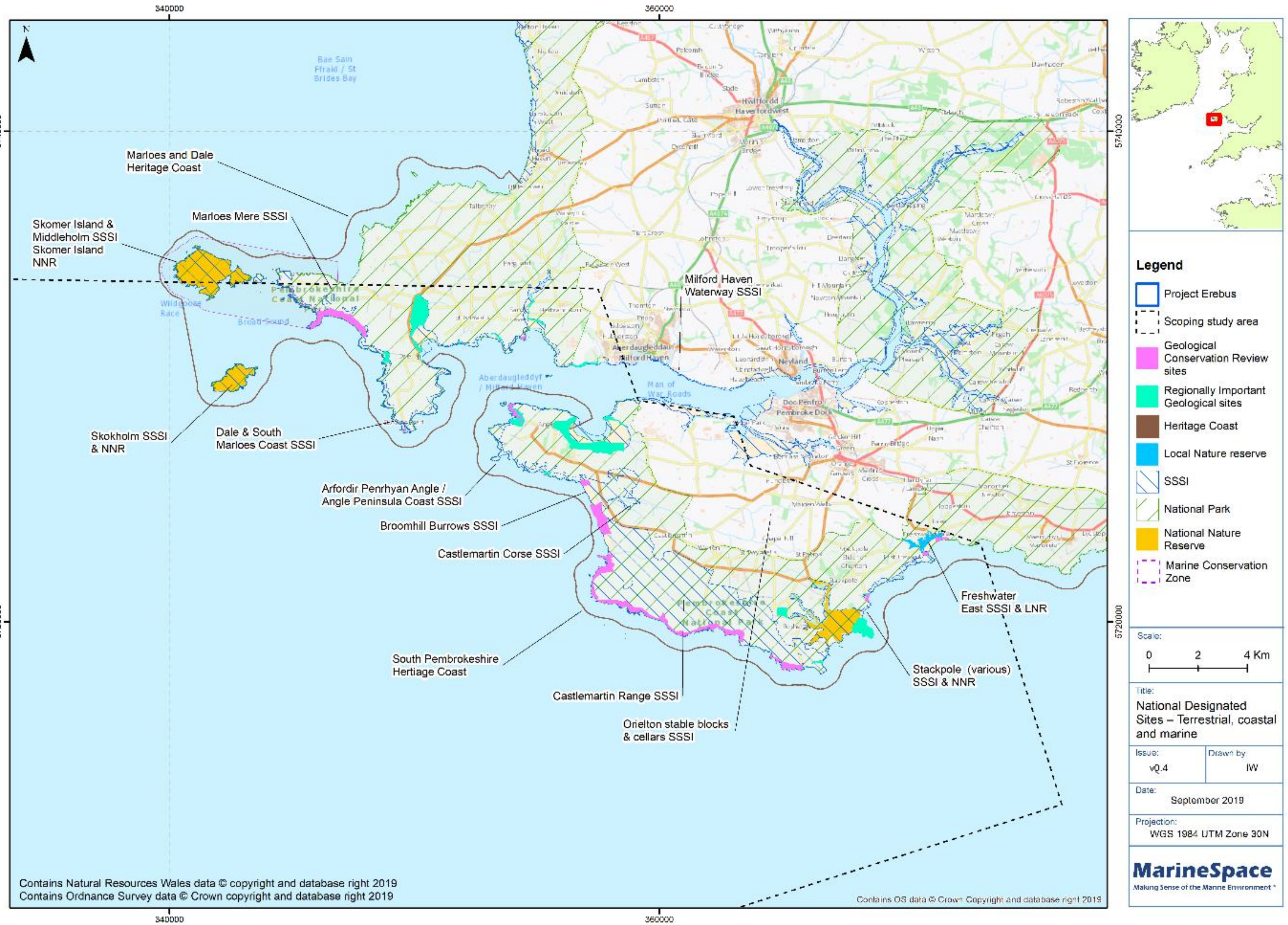
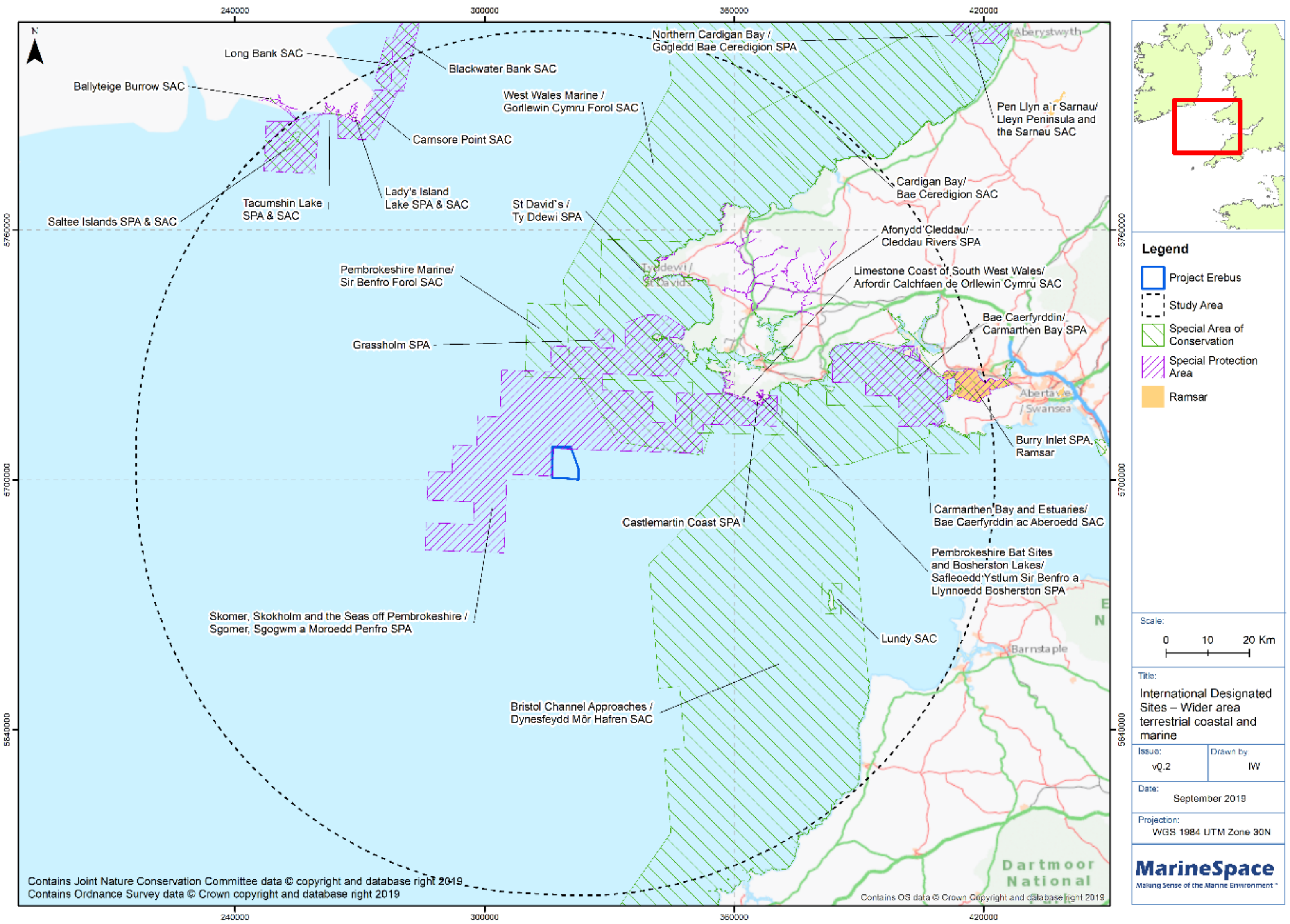


Figure 6.3: Location of International Designated Sites



6.1.4. Identification of Key Sensitivities and Potential Impacts

For each type of site identified in Section 6.1.3, an assessment of potential impacts arising from changes in the environment and the effects as a consequence, is listed by Study Area in Table 6-5,

Table 6-6 and Table 6-7. As detailed in the introductory section, a separate HRA screening exercise will be undertaken post-scoping which will list all EU designated sites that will need to be subject to Appropriate Assessment.

6.1.5. Potential Mitigation

Potential effects to, and proposed mitigation measures for species and habitats of nature conservation significance will be addressed in Section 6.2 (Benthic Subtidal and Intertidal Ecology), Section 6.3 (Fish and Shellfish Ecology), Section 6.4 (Marine Mammals and Reptiles Ecology), Section 6.5 (Ornithology) and Section 6.6 (Terrestrial Ecology).

Mitigation will take place in the hierarchy set out in Section 3.9.

6.1.6. Proposed Approach to Environmental Assessment

The EIA approach for species and habitats of nature conservation significance will be addressed in Section 6.2 (Benthic Subtidal and Intertidal Ecology), Section 0 (Fish and Shellfish Ecology), Section 6.4 (Marine Mammals and Reptiles Ecology), Section 6.5 (Ornithology) and Section 6.5 (Terrestrial Ecology). Data from these chapters and relevant sources, including local regulators, will be used to assess the effects of the proposed Project on designated and protected sites.

EU designated sites (SAC / SPA) will be subject to the HRA process. Details of the proposed approach to HRA are provided in Section 3.12.

SBE will liaise with statutory authorities throughout the EIA process, to ensure project survey designs are robust and sufficient to assess potential impacts to designated sites, species and habitats.

Table 6-5: Key Sensitivities and Potential Impacts to Designated Sites within the Terrestrial Study Area

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Special Areas of Conservation				
Pembrokeshire Bat Sites and Bosherston Lakes Limestone Coast South West Wales	Installation / removal of infrastructure, associated construction activities and operation of the substation has the potential to cause disturbance through noise, vibration and lighting, severance and loss of foraging habitat and commuting corridors.	Construction Operational Decommissioning	Yes	Potential damage and loss of habitats; Reduction in foraging success; Behavioral changes and injury to individuals and potential stress to protected species (bats).
Special Protection Areas				
Castlemartin Coast	Installation / removal of infrastructure and construction has the potential to disturb breeding habitat and result in the loss of foraging habitats.	Construction Decommissioning	Yes	Reduction in foraging success; Behavioral changes and injury to individuals and potential stress to protected species (birds).

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Sites of Specific Scientific Interest				
Angle Peninsula Coast Broomhill Burrows Castlemartin Corse Castlemartin Cliffs and Dunes Castlemartin Range Freshwater East Cliffs to Skrinkle Haven Gweunydd Somerton Meadows Orielton Stable Block and Cellars Stackpole Stackpole Quay to Trewent Point Stackpole Courtyard Flats and Walled Garden Park House Outbuildings, Stackpole	Installation / removal of infrastructure, associated construction activities and operation of the substation has the potential to cause disturbance through noise, vibration and lighting, severance and loss of foraging habitat, and commuting corridors.	Construction Operational Decommissioning	Yes	Potential damage and loss of habitats; Reduction in foraging success (bats, fish and birds); Behavioral changes and injury to individuals and potential stress to protected species (bats, fish, birds, otters).

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
National Nature Reserves				
Stackpole	Installation / removal of infrastructure and associated construction activities have the potential to cause disturbance to species and habitats, loss of habitat and severance of connectivity.	Construction Decommissioning	Yes	Potential damage and loss of habitats; Reduction in foraging success; Behavioral changes and injury to individuals and potential stress to protected species (bats).
Regionally Important Geological Site				
East Pickard Bay Sawdern Point West Angle Bay Caled Quarry Bosherston Longstone Down Bullslaughter Bay New Quay Middle Cove Stackpole Head Angle Bay	Installation / removal of infrastructure and associated construction activities directly impacting features.	Construction Decommissioning	Yes	Potential damage and loss of features.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Geological Conservation Review				
Blucks Pool - Bullslaughter Bay Freshwater East (northeast, southwest and north) Freshwater West (general, north and south) South Pembroke Stackpole Quay Tenby Cliffs West Angle Bay (general and north)	Installation / removal of infrastructure and associated construction activities directly impacting features.	Construction Decommissioning	Yes	Potential damage and loss of features.
Local Nature Reserves				
Freshwater East	Installation / removal of infrastructure and associated construction activities has the potential to cause noise disturbance and loss of habitat.	Construction Decommissioning	Yes	Potential damage and loss of habitats.

Table 6-6: Key Sensitivities and Potential Impacts to Designated Sites within the Marine and Coastal Study Area

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)[11]	Rationale for Impact Scoped In/Out
Special Protection Areas				
Skomer, Skokholm and the Seas off Pembrokeshire Castlemartin Coast	Surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance and loss of habitat leading to reduced prey availability and impacts to foraging seabirds (indirect). Potential disturbance and risk of pollution incidences impacting habitats and species near export cable landfall.	Construction Operational Decommissioning	Yes	Potential damage and loss of habitats and features; Potential mortality of key species due to collision risk; Create alteration in migratory routes; Reduction in foraging success; Behavioral changes and injury to individuals and potential stress to protected species (birds).

[11] Future HRA screening exercise will provide definitive basis for inclusion/further assessment of SACs/SPAs in EIA/HRA

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in) [11]	Rationale for Impact Scoped In/Out
Special Areas of Conservation				
Bristol Channel Approaches West Wales Marine Pembrokeshire Marine Limestone Coast of South West Wales	Installation and removal of surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance and loss of habitat leading to reduced prey availability and impacts to foraging seabirds (indirect). Potential disturbance and risk of pollution incidences impacting habitats and species near export cable landfall.	Construction Operational Decommissioning	Yes	Potential damage and loss of habitats and features; Create alteration in migratory routes; Reduction in foraging success (bats, fish and birds); Behavioral changes and injury to individuals and potential stress to protected species (bats, fish, birds, otters and marine mammals (grey seals and harbour porpoise)).
Marine Conservation Zone				
Skomer	Installation and removal of surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance and loss of habitat leading to reduced prey availability	Construction Decommissioning	Yes	Potential damage and loss of habitats and features; Reduction in foraging success; Behavioral changes and injury to individuals and potential stress to protected species (marine mammals (grey seals)).

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in) [11]	Rationale for Impact Scoped In/Out
	(indirect). Potential disturbance and risk of pollution incidences impacting habitats and species near export cable landfall.			
Sites of Specific Scientific Interest				
Dale and South Marloes Coast St Bridges Bay South Milford Haven Waterway Skomer Island and Middleholm Skokholm Marloes Mere	Installation and removal of surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance and loss of habitat leading to reduced prey availability and impacts to foraging seabirds (indirect). Potential disturbance and risk of pollution incidences impacting habitats and species near export cable landfall.	Construction Operational Decommissioning	Yes	Potential damage and loss of habitats and features; Reduction in recruitment and spawning success; Create alteration in migratory routes; Reduction in foraging success (bats, fish and birds); Behavioral changes and injury to individuals and potential stress to protected species (bats, fish, birds, otters and marine mammals (grey seals)).

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in) [11]	Rationale for Impact Scoped In/Out
National Nature Reserves				
Skokholm Skomer Island	Installation and removal of surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance and loss of habitat leading to reduced prey availability and impacts to foraging seabirds (indirect). Potential disturbance to habitats and species near export cable landfall.	Construction Operational Decommissioning	Yes	Potential damage and loss of habitats; Create alteration in migratory routes; Reduction in foraging success (bats, fish and birds); Potential collision risk; Behavioral changes and injury to individuals and potential stress to protected species (birds, otters and marine mammals (grey seals)).
Heritage Coast				
South Pembrokeshire Marloes and Dale	Installation and removal of infrastructure directly impacting features	Construction Operational Decommissioning	Yes	Potential damage and loss of features.

Table 6-7: Key Sensitivities and Potential Impacts to Designated Sites that Contain Mobile or Qualifying Features within the Marine and Coastal Study Area (100 km)

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in) [12]	Rational for impact scoped in/out
Special Protection Areas				
Carmarthen Bay Burry Inlet Grassholm Ramsey and St David`s Peninsula Coast Saltee Islands Tacumshin Lake Lady's Island Lake Northern Cardigan Bay Severn Estuary	Installation and removal of surface and subsea infrastructure has the potential to cause noise disturbance with additional effects from collision hazards, and loss of habitat leading to reduced prey availability and impacts to foraging seabirds (indirect). Potential disturbance and risk of pollution incidences impacting habitats and species near export cable landfall.	Construction Operational Decommissioning	Yes	Create alteration in migratory routes; Reduction in foraging success; Behavioral changes and injury to individuals and potential stress to protected species (birds).

[12] Future HRA screening exercise will provide definitive basis for inclusion/further assessment of SACs/SPAs in EIA/HRA

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in) [12]	Rational for impact scoped in/out
Special Areas of Conservation				
Carmarthen Bay and Estuaries Cleddau Rivers Lundy Cardigan Bay River Tywi River Teifi Lady's Island Lake Ballyteige Burrow Saltee Islands Tacumshin Lake Llyn Peninsula and the Sarnau Severn Estuary	Installation and removal of surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance and loss of habitat leading to reduced prey availability and impacts to foraging seabirds (indirect). Potential disturbance to habitats and species near export cable landfall.	Construction Operational Decommissioning	Yes	Create alteration in migratory routes; Reduction in foraging success; Behavioral changes and injury to individuals and potential stress to protected species (fish, birds, otters and marine mammals (grey seals, bottlenose dolphin and harbour porpoise)).

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in) [12]	Rational for impact scoped in/out
Marine Conservation Zone				
North West of Lundy Lundy Morte Platform Bideford to Foreland Point Hartland Point to Tintagel South of Celtic Deep South West Approaches to the Bristol Channel Padstow Bay and Surrounds	No effects predicted on features, habitat and species identified.	NA	No	Proposed Project does not encroach into features or habitats identified by MCZs (geology and sediments) Species identified by MCZs are not directly impacted (including, spiny lobster, sponges and sea fans).
Ramsar				
Burry Inlet Severn Estuary	Installation and removal of surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance and loss of habitat leading to reduced prey availability and impacts to foraging seabirds (indirect).	Construction Decommissioning	Yes	Potential damage and loss of habitats; Create alteration in migratory routes; Reduction in foraging success (fish and birds); Behavioral changes and injury to individuals and potential stress to protected species (birds, fish and otters).

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in) [12]	Rational for impact scoped in/out
National Nature Reserve				
Grassholm Island Ramsey Island Gower Coast Oxwich Whiteford	Installation and removal of surface and subsea infrastructure has the potential to cause collision hazards, noise disturbance and loss of habitat leading to reduced prey availability and impacts to foraging seabirds (indirect).	Construction Operational Decommissioning	Yes	Potential damage and loss of habitats; Create alteration in migratory routes; Reduction in foraging success (fish and birds); Behavioral changes and injury to individuals and potential stress to protected species (bats, birds and marine mammals (grey seal)).

6.2. Benthic Subtidal and Intertidal Ecology

6.2.1. Study Area

The Study Area covers all areas currently under consideration for placement of marine project infrastructure, including the offshore array area, potential marine export cable routes and landfall options (see Figure 2.1). The proposed offshore array area covers a seabed area of approximately 43.5 km^2 and is situated approximately 44 km off the southwest coast of Pembrokeshire. The marine export cable route is not yet finalised however potential landfall options include West Angle Bay, Angle Bay or Freshwater West beach. The Study Area encompasses water depths of 0-80 m.

6.2.2. Baseline Data

This report has been informed using the available baseline data for the area. No project-specific surveys have been undertaken to date to inform this report.

Key documents consulted in compiling this Section comprise:

- Marine Information Network (MarLIN);
- Lle (Marine Planning Portal for Wales);
- National Biodiversity Network (NBN) Gateway;
- EMODnet (2019);
- Greenlink cable EIA Scoping Report (Intertek, 2018); and
- Pembrokeshire Demonstration Zone EIA Scoping Report (Wave Hub, 2018).

6.2.3. Existing Baseline

The waters off Pembrokeshire support a diverse range of intertidal and subtidal habitats. The broadscale predictive habitat data as part of EUSeaMap (2019) are available on EMODnet and have been displayed for the Study Area in Figure 6.4.

Based on the data presented on EMODnet (Figure 6.4) and also Lle, the marine Study Area comprises a highly varied nearshore environment and a more uniform offshore environment within which the offshore array lies. The offshore array site is located wholly within an area of EUNIS habitat A5.27 Deep circalittoral sand, with areas of A5.37 Deep circalittoral mud and A5.15 Deep circalittoral coarse sediment also nearby, but outside of the offshore array itself. Most of the coastline in the Study Area comprises intertidal sand with Moderate-high energy intertidal rocks, with known biogenic habitats (e.g. biogenic reefs, seagrass beds, saltmarsh) in only a few sheltered locations in Milford Haven, such as around Dale, Angle Bay and West Angle Bay.

Many of these habitats are listed under nature conservation designations, such as Annex I of the EC Habitats Directive, OSPAR List of Threatened and / or Declining Species and Habitats, and Habitats of Principal Importance (as designated under Section 7 of the Environment (Wales) Act (2016)). The Annex I habitats in the Study Area include:

- Estuaries;
- Submerged or partially submerged marine caves;
- Reefs (intertidal and subtidal);

- Large shallow inlets and bays;
- Mudflats and sandflats not covered by seawater at low tide;
- Coastal lagoons;
- Saltmarsh / Atlantic salt meadows *(Glauco-Puccinellietalie maritimae)*;
- Sandbanks which are slightly covered by sea water all the time; and
- Sea caves.

All these habitats are designated features of the Pembrokeshire Marine SAC which overlaps the Study Area (as displayed in Figure 6.1). The location of these habitats within the Pembrokeshire Marine SAC is displayed within Figure 6.5.

Potential landfall options include West Angle Bay, Angle Bay and Freshwater West beach. West Angle Bay is located on the mouth of Milford Haven. It contains high energy circalittoral and infralittoral seabed, and low energy circalittoral seabed, with the more offshore areas in the estuary comprising A5.14 circalittoral coarse sediment with small patches of A5.13 infralittoral coarse sediment. Freshwater West and Bullslaughter Bay are located on the southwest Pembrokeshire coastline known as Castlemartin Ranges. The Castlemartin Ranges is characterized as A3.1 Atlantic and Mediterranean high energy infralittoral rock in the nearshore, with A5.14 circalittoral coarse sediment, and A4.2 Atlantic and Mediterranean Moderate energy circalittoral rock (Figure 6.4). Freshwater West also contains areas of A5.13 Infralittoral coarse sediment.

The landfall site options have been investigated for the presence of any designated features. All potential landfall options lie within the Pembrokeshire Marine SAC. The final management plan of the Pembrokeshire Marine SAC (Pembrokeshire Marine SAC, 2006) shows the indicative distribution of the qualifying features, as displayed in Figure 6.5. Sea caves and areas of reef overlap Bullslaughter Bay and West Angle Bay, though Freshwater West does not contain either of these features. Intertidal mud and sand flats are present at Freshwater West, Angle Bay and West Angle Bay. An area of subtidal sandbanks is located offshore of Freshwater West. West Angle Bay and Angle Bay lie within the designated large shallow inlets and bays feature and the marine inlet (ria). Atlantic salt meadow is not present at any of the cable landfall options.

The location of protected habitats is displayed in Figure 6.4 and Figure 6.5. As inferred from Lle, there are no known Environment (Wales) Act Section 7 and OSPAR Marine Habitats in Bullslaughter Bay, Freshwater West, West Angle Bay or Angle Bay. Also presented on Figure 6.6 are Article 17 Habitats, including Annex I subtidal sandbanks, in the benthic Study Area. Both West Angle Bay and Bullslaughter Bay lie within an area of possible subtidal reef, with rocky subtidal reef also nearby to these two locations.

Figure 6.4: Marine Habitats in the Study Area (Source: EUSeaMap (2019). Data Available on EMODnet (2019)).

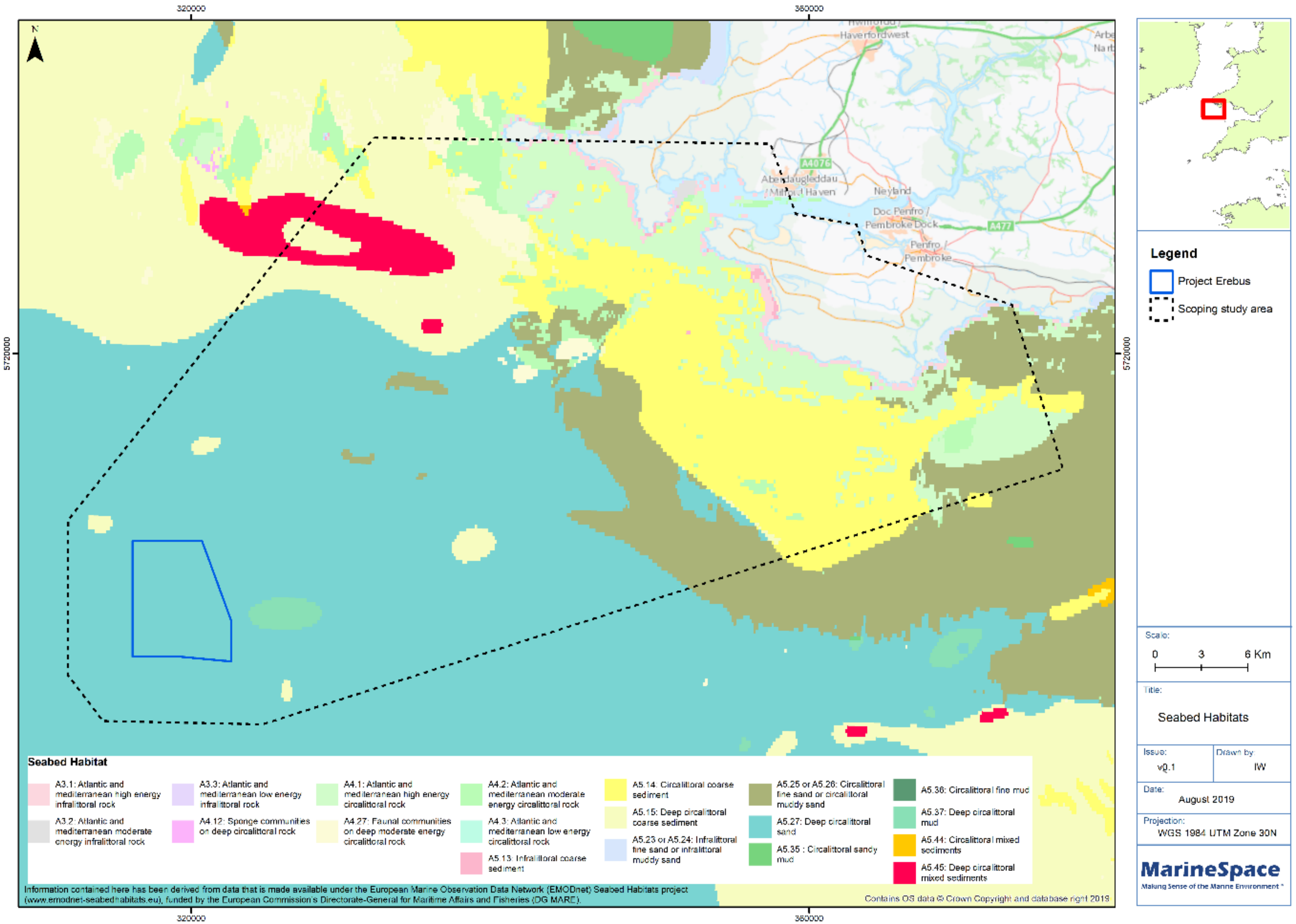
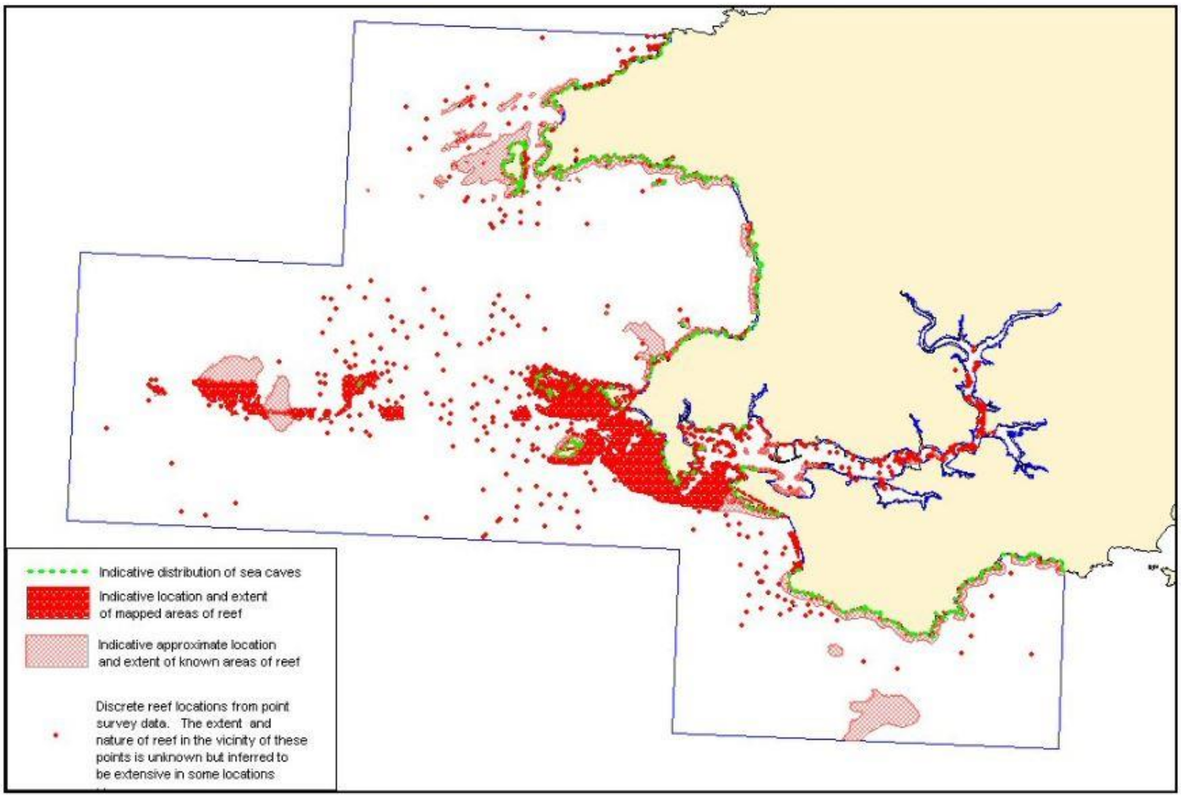
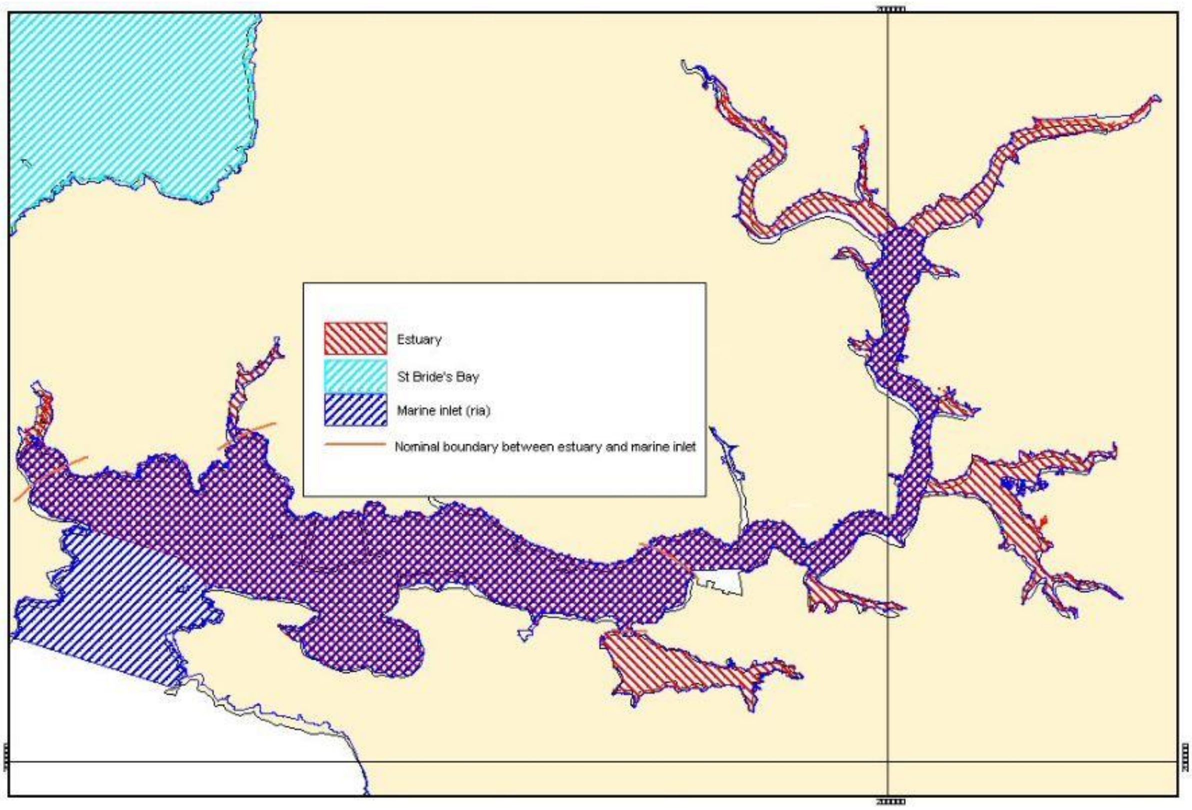


Figure 6.5: Location of Annex I Features within Pembrokeshire Marine SAC (Source: Pembrokeshire Marine SAC, 2006)

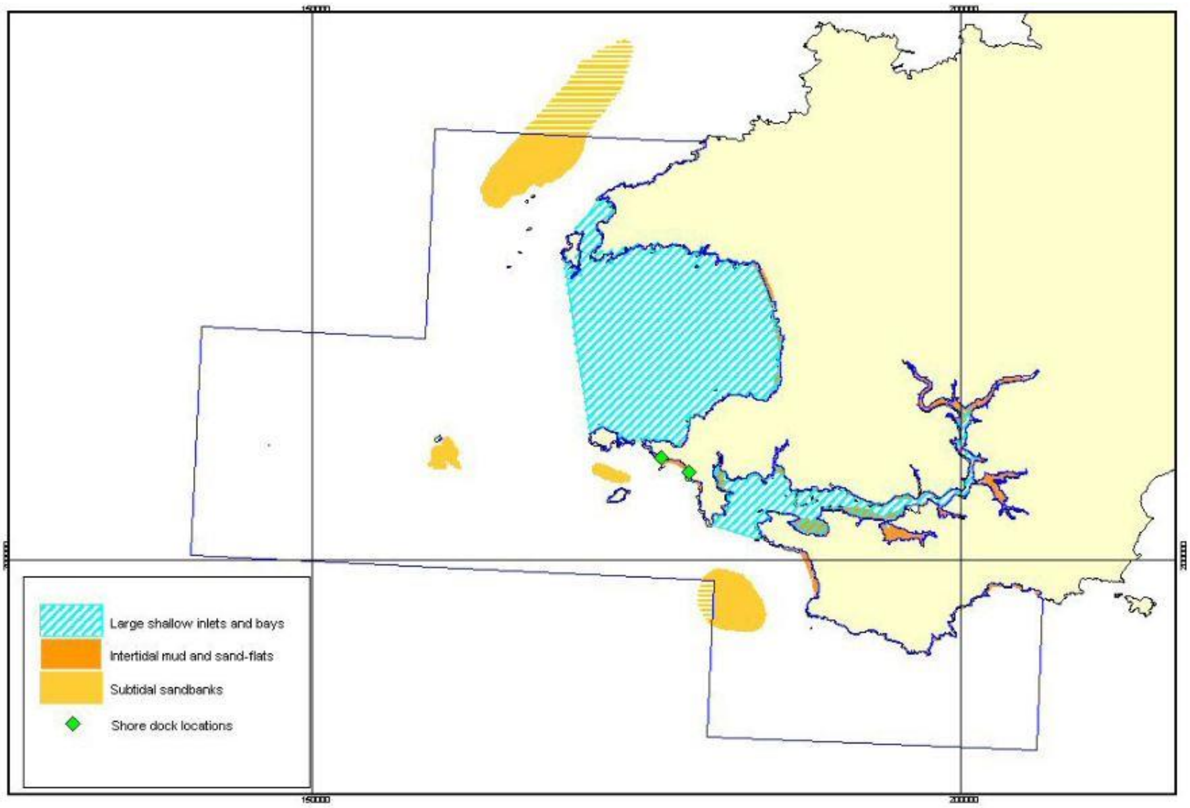
(a) sea caves



(b) Estuary



(c) large shallow inlets and bays; intertidal mud and sand-flats; subtidal sandbanks



(d) Atlantic salt meadows

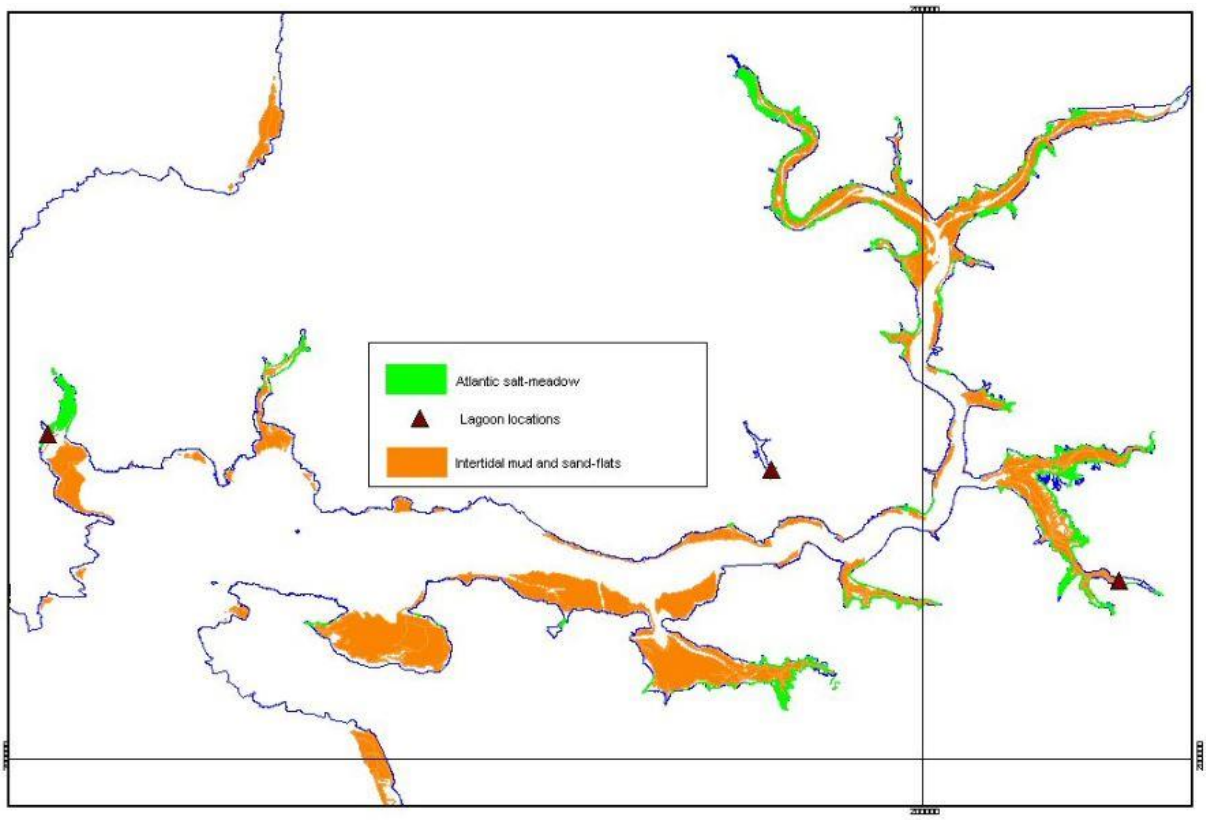


Figure 6.6: Location of Habitats Listed as Habitats of Principal Importance under the Environment (Wales) Act Section 7 and as Threatened and / or Declining under OSPAR in the Vicinity of the Study Area.

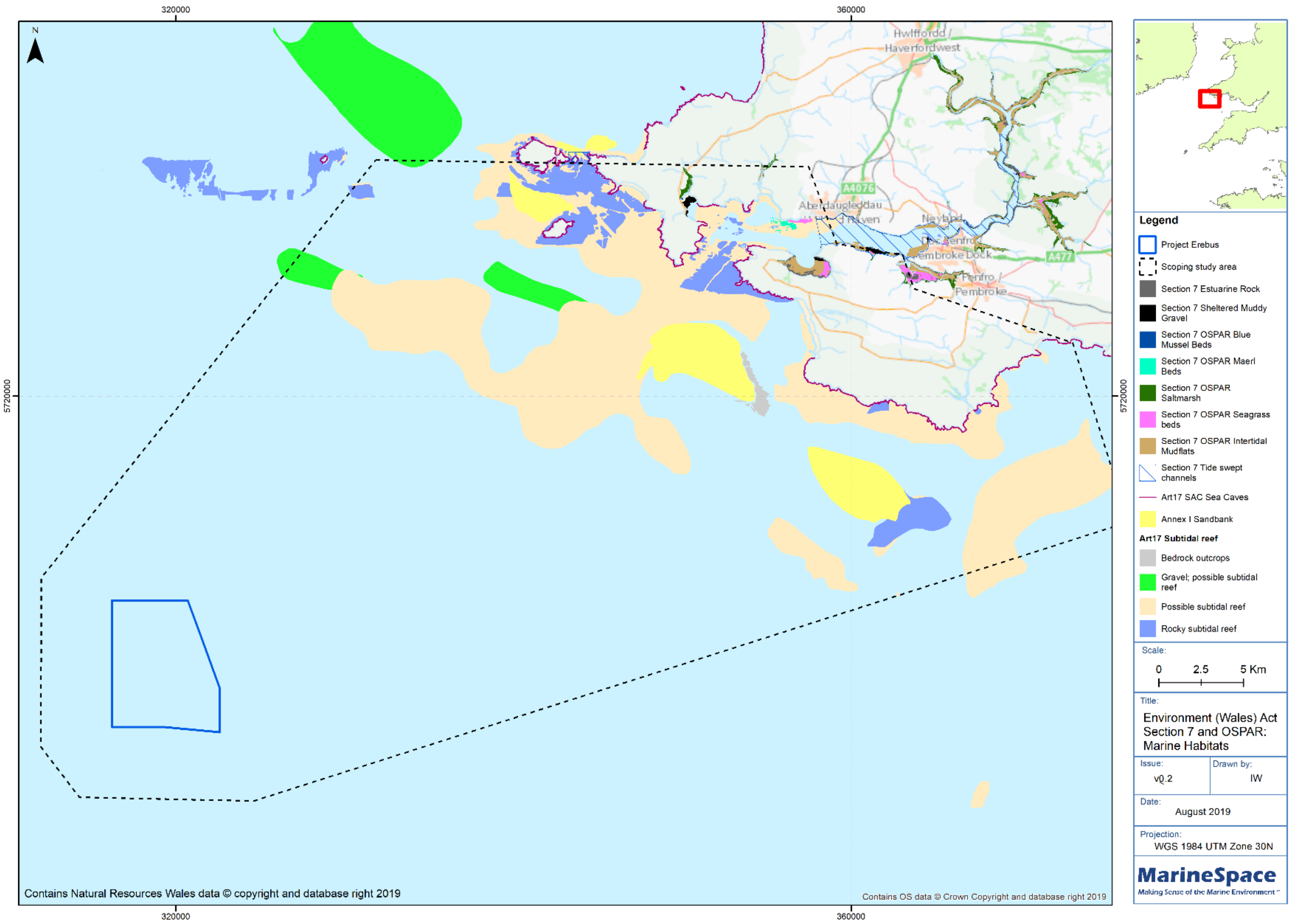


Table 6-8: Habitat Types, Description and Protection Status in the Benthic Study Area

Habitat types	Description	Protection Status
Submerged or partially submerged caves (H8330)	Caves situated under the sea or opened to it, at least at high tide, including partially submerged sea caves. The bottom and sides of these caves support communities of marine invertebrates and algae. Such features occur within the boundary of the benthic Study Area. Sea caves occur specifically around the Angle peninsula, along the Castlemartin coast, and along the northern coast of Milford Haven (not including the inner estuary). Proposed Project infrastructure may overlap the indicative location of sea caves if the landfall option of West Angle Bay is selected.	Annex I habitat. Listed as a designated feature of: Pembrokeshire Marine SAC.
Reefs (intertidal and subtidal) (H1170)	Submarine, or exposed at low tide, rocky substrates and biogenic concretions, which arise from the sea floor in the sublittoral zone but may extend into the littoral zone where there is an uninterrupted zonation of plant and animal communities. These reefs generally support a zonation of benthic communities of algae and animal species including concretions, encrustations and corallogenic concretions. Such features occur within the boundary of the benthic Study Area. Reefs are widespread throughout the coastal portion of the Study Area. Bullslaughter Bay lies within an area of indicative approximate reef location, with a small indicative patch of reef offshore of its location. Freshwater West is not predicted to contain reef although there are discrete reef locations offshore of its location that could potentially overlap with cable route, should the landfall option of Freshwater West be selected. There are areas of indicative mapped areas of reef in the inshore area of West Angle Bay and also throughout the mouth of Milford Haven.	Annex I habitat. Listed as a designated feature of: Pembrokeshire Marine SAC. OSPAR List of Threatened and / or Declining Species and Habitats (specifically reefs of *Mytilus edulis*, *Lophelia pertusa*, maerl, *Modiolus Modiolus*, *Ostrea edulis, Sabellaria spinulosa)*

Habitat types	Description	Protection Status
Large shallow inlets and bays (H1160)	Large indentations of the coast where, in contrast to estuaries, the influence of freshwater is generally limited. These shallow indentations are generally sheltered from wave action and contain a great diversity of sediments and substrates with a well-developed zonation of benthic communities. These communities have generally a high biodiversity. The limit of shallow water is sometimes defined by the distribution of the *Zostera* spp. and *Potamegeton* spp. associations. Several physiographic types may be included under this category providing the water is shallow over a major part of the area: embayments, fjards, rias, and voes. Such features occur within the boundary of the benthic Study Area. The large shallow inlet extends through Milford Haven to a line drawn between the two heads at the entrance to the estuary. This designated feature would be overlapped by proposed Project infrastructure should the cable landfall be at West Angle Bay or Angle Bay.	Annex I habitat. Listed as a designated feature of: Pembrokeshire Marine SAC. OSPAR List of Threatened and / or Declining Species and Habitats (specifically *Zostera* beds)
Mudflats and sandflats not covered by seawater at low tide (H1140)	Sands and muds of the coasts of the oceans, their connected seas and associated lagoons, not covered by sea water at low tide, devoid of vascular plants, usually coated by blue algae and diatoms. They are of particular importance as feeding grounds for wildfowl and waders. Note: Eelgrass communities (Palaearctic 11.3) are included in this habitat type. Such features occur within the boundary of the benthic Study Area. The proposed Project infrastructure may overlap this designated feature if the cable landfall option of Freshwater West, West Angle Bay or Angle Bay is selected.	Annex I habitat. Listed as a designated feature of: Pembrokeshire Marine SAC. OSPAR List of Threatened and / or Declining Species and Habitats (specifically Intertidal mudflats).
Coastal lagoons (H1150)	Lagoons are expanses of shallow coastal saltwater, of varying salinity and water volume, wholly or partially separated from the sea by sand banks or shingle, or, less frequently, by rocks. Salinity may vary from brackish water to hypersalinity depending on rainfall, evaporation and through the addition of fresh seawater from storms, temporary flooding of the sea in winter or tidal exchange. With or without vegetation from *Ruppia maritima*, *Potamegeton* spp., *Zostera* spp. or *Chara* spp. (CORINE91: 23.21 or 23.22). Such features occur within the boundary of the benthic Study Area, specifically at one location off Dale, which is not overlapped by the proposed Project infrastructure.	Annex I habitat. Listed as a designated feature of: Pembrokeshire Marine SAC. OSPAR List of Threatened and / or Declining Species and Habitats (specifically Saline lagoons).

Habitat types	Description	Protection Status
Atlantic salt meadows *(Glauco-Puccinellietalie maritimae)* (H1330)	Salt meadows of Baltic, North Sea, English Channel and Atlantic shores. *Aster tripolium* can be present or abundant in most subdivisions. Such features occur within the boundary of the benthic Study Area, although only within Angle Bay therefore the designated feature would be overlapped if landfall is proposed at Angle Bay.	Annex I habitat. Listed as a designated feature of: Pembrokeshire Marine SAC.
Sandbanks which are slightly covered by sea water all the time (H1110)	Sublittoral sandbanks, permanently submerged. Water depth is seldom more than 20 m below Chart Datum. Non-vegetated sandbanks or sandbanks with vegetation belonging to the *Zostera marina* and *Cymodoceion nodosa*. Such features occur within the boundary of the benthic Study Area. Within Pembrokeshire Marine SAC there is a designated subtidal sandbank approximately 4 km off Freshwater West. Annex I sandbanks are also located at approximately 4 km off the Castlemartin coast. There is the potential overlap between these protected features and proposed Project infrastructure (specifically the cable route).	Annex I habitat. Listed as a designated feature of: Pembrokeshire Marine SAC.
Estuaries (H1130)	Downstream part of a river valley, subject to the tide and extending from the limit of brackish waters. River estuaries are coastal inlets where, unlike 'large shallow inlets and bays' there is generally a substantial freshwater influence. The mixing of freshwater and sea water and the reduced current flows in the shelter of the estuary lead to deposition of fine sediments, often forming extensive intertidal sand and mud flats. Where the tidal currents are faster than flood tides, most sediments deposit to form a delta at the mouth of the estuary. Such features occur within the boundary of the benthic Study Area. The entrance to Milford Haven if designated as a marine inlet (ria), with the additional designated estuary commencing approximately 2.5 km into the Milford Haven. The proposed Project infrastructure may overlap the marine inlet (ria) designated feature if West Angle Bay or Angle Bay is selected as the cable landfall location.	Annex I habitat. Listed as a designated feature of: Pembrokeshire Marine SAC.
A5.37 Deep circalittoral mud	In mud and cohesive sandy mud in the offshore circalittoral zone, typically below 50-70 m, a variety of faunal communities may develop, depending upon the level of silt / clay and organic matter in the sediment. Communities are typically dominated by polychaetes but often with high numbers of bivalves such as *Thyasira* spp., echinoderms and foraminifera.	None

Habitat types	Description	Protection Status
A5.27 Deep circalittoral sand	Offshore (deep) circalittoral habitats with fine sands or non-cohesive muddy sands. Very little data are available on these habitats however they are likely to be more stable than their shallower counterparts and characterised by a diverse range of polychaetes, amphipods, bivalves and echinoderms	None
A5.15 Deep circalittoral coarse sand	Offshore (deep) circalittoral habitats with coarse sands and gravel or shell. This habitat may cover large areas of the offshore continental shelf although there is relatively little quantitative data available. Such habitats are quite diverse compared to shallower versions of this habitat and generally characterised by robust infaunal polychaete and bivalve species. Animal communities in this habitat are closely related to offshore mixed sediments and, in some areas, settlement of *Modiolus Modiolus* larvae may occur and consequently these habitats may occasionally have large numbers of juvenile *M. Modiolus*. In areas where the mussels reach maturity their byssus threads bind the sediment together, increasing stability and allowing an increased deposition of silt leading to the development of the biotope A5.622.	None

6.2.4. Identification of Key Sensitivities and Potential Impacts

Table 6-9: Key Sensitivities and Potential Impacts to the Benthic Receptors in the Study Area.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Habitats and associated species (as listed in Table 6-8) in the offshore array	Installation, maintenance, and removal, of project infrastructure, specifically anchor mooring, cable laying (including laying of cable protection) and installation of cable landfall, can cause physical disturbance to habitats and species and habitat loss / displacement. The sensitivity of the habitats will depend on the species present, as determined during survey. The extent of this effect will be limited to the Project infrastructure footprint. Habitat loss may be temporary, such as through vessel anchoring, or long term (i.e. for the duration of the Project) if it is due to footprint of infrastructure installation.	Construction Operational Decommissioning	Yes	No piling or drilling to install infrastructure within the Project site is anticipated at this stage. The offshore site is not known to contain any *Modiolus Modiolus* beds as can be associated with the A5.27 EUNIS habitat type. It is likely to contain mostly robust fauna that has limited sensitivity and a wide area of A5.27 available. There are no known Annex I habitats in the project site. However, as the species present are not known this impact will be taken forward to the EIA.
Habitats and associated species (as listed in Table 6-8) along the marine export cable route and landfall options		Construction Operational Decommissioning	Yes	No piling or drilling is anticipated at this stage for cable installation, though it may be that horizontal directional drilling (HDD) is required. The inshore area has known Annex I habitats and features that are designated as part of the Pembrokeshire Marine SAC, such as sea caves, subtidal sandbanks, intertidal mud and sand flats, and reefs. These may be highly localised and support significant biodiversity. This impact will be assessed under the EIA. Mitigation measures can be undertaken to reduce these impacts.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
All habitats and associated species along the cable marine export cable route	Increased suspended sediment concentration and sediment deposition may arise during activities associated with cable laying and protection, which can affect benthic habitats through smothering or decreases in water quality.	Construction Decommissioning	Yes	The amount of resuspended sediment is expected to be minimal, as is the footprint of any such sediment plume that will be detectable above background conditions (though this will depend on hydrodynamic conditions at the time). The majority of the project footprint is in an area of coarse sediment (i.e. sand) or rock, further reducing the likelihood for notable sediment resuspension, though there are areas of fine / muddy sand. The species present (aside from Annex I habitats) are not well known, therefore it is not possible to determine their sensitivity to this effect, and as such it is scoped into the EIA.
All habitats and associated species	Pollution of water and sediment through accidental release of pollutants or chemicals from vessels, which could affect benthic and intertidal ecology throughout the project area accessed by vessels.	Construction Operational Decommissioning	No	Although accidental release has the potential to negatively impact benthic communities, the likelihood of this impact is extremely low given the industry standard mitigation measures that are expected to be put in place (see Section 6.2.5).
All habitats and associated species	Potential introduction and spread of Invasive Non-native Species (INNS) through transporting of organisms from other regions via vessel hull or ballast water, which could displace local fauna.	Construction Operational Decommissioning	Yes	Vessels used during the project may inadvertently transport INNS. This can have significant impacts on local fauna through displacement, and the effects may not be restricted to the immediate area as any INNS could spread rapidly.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
				It is expected that infrastructure will be brought into and out of the nearby Pembroke Dock, which may reduce the likelihood for INNS to be introduced. Nevertheless, this impact will be assessed in the EIA.
All habitats and associated species	Project infrastructure can cause changes in hydrodynamic regime, which can in turn impact the benthic ecology through inter-related effects.	Operational	No	There is expected to be minimal subsea infrastructure due to the semisubmersible nature of the Project. The changes to hydrodynamics are anticipated to be negligible, therefore it has been scoped out of the EIA.
All habitats and associated species	Introduction of new habitat in the form of project infrastructure, including cable protection, may affect the established environment by providing new habitat / ecosystem function.	Operational	Yes	This could be a potential benefit to the environment as it may increase presence of species that are known to use hard structures for protection or species that attach to similar hard substructures.

6.2.5. Potential Mitigation

The design and development of the proposed Project is not yet finalised. As part of the ongoing process mitigation measures can be introduced and reviewed. Mitigation measures for the marine benthic and coastal ecology will potentially comprise:

- Avoidance of key sensitive habitats, where known, through pre-construction surveys and micro-siting of proposed Project infrastructure;
- Minimisation of the total footprint of the proposed Project;
- Discussion with the regulatory authorities and stakeholders on methods to reduce impact;
- With regards to accidental events:
    - Develop an Emergency Response Plan in accordance with standard protocols;
    - Compliance with International Maritime Organisation (IMO) / Marine and Coastguard Agency (MCA) codes for prevention of oil pollution and any vessels over 400 Gross Tonnage will have on board Ship Oil Pollution Emergency Plans;
    - All vessels to carry onboard oil and chemical spill mop up kits; and
- Compliance with guidelines on mitigating the introduction and spread of INNS.

6.2.6. Proposed Approach to Environmental Assessment

The approach to assessing impacts on benthic receptors will be based on the following stages:

- Review of existing relevant data and information;
- Acquisition of additional project-specific data to fill any gaps (see Table 6-10 below);
- Formulation of a conceptual understanding of baseline conditions;
- Consultation and agreement with the regulators regarding proposed assessment approaches;
- Determination of the worst-case scenarios;
- Consideration of embedded mitigation measures; and
- Assessment of effects using data analysis, numerical Modelling outputs, and expert-based judgements by the EIA team.

The assessment of effects on subtidal and intertidal ecology will be predicated on a Source-Pathway-Receptor (S-P-R) conceptual Model, whereby the source is the initiator event, the pathway is the link between the source and the receptor impacted by the effect, and the receptor is the receiving entity.

An example of the S-P-R conceptual Model is provided by marine export cable installation which disturbs sediment on the seabed (source). This sediment is then transported by tidal currents until it settles back to the seabed (pathway). The deposited sediment could smother and have an effect on the species on this area of the seabed (receptor).

Consideration of the potential effects of the Project will be carried out over the following spatial scales:

- Near-field: the area within the immediate vicinity (tens or hundreds of metres) of the offshore array site and along the offshore export cable corridor (ECC); and
- Far-field: the wider area that might also be affected indirectly by the project (e.g. due to disruption of waves, tidal currents or sediment pathways).

Potential impacts from the following three main phases of development will be considered:

1. Construction phase;
2. Operation and maintenance phase; and
3. Decommissioning phase.

For ease of assessment and presentation, not every single benthic habitat will be assessed. Instead, similar types of habitats in terms of their sensitivity to potential impacts will be grouped to form Valued Ecological Receptors (VERs). The process and rationale of developing these VERs will be checked with NRW prior to the impact assessment work commencing so that all parties are in agreement on the key receptor groups.

Outputs from the physical process assessment, i.e. increased suspended sediment concentration, changes in sediment transport etc., will provide the basis of the benthic impact assessment, along with quantified values of temporary habitat disturbance and habitat loss derived from the final project design envelope.

Table 6-10: Proposed Benthic Surveys to Inform the Environmental Impact Assessment

Survey Type	Proposed Spatial Extent	Proposed Timing	Objective
Desktop Study	Benthic Study Area (offshore; nearshore; intertidal)	Spring 2020	1. To characterise the baseline in terms of occurrence within the Study Area. This will help identify any gaps in the existing data, to inform survey needs. 2. To assess the potential level pressure pathways and receptor sensitivity information to be referenced / used. Also, to identify cumulative effects with existing activities. 3. All outputs will be used to inform the EIA and HRA.
Project-Specific Benthic Survey **Sub-Tidal: SSS; DDV; Grab** **Intertidal: UAV survey**	Offshore Array; Export Cable Corridor; Intertidal region	Summer 2020	1. To gain a thorough understanding of the baseline subtidal and intertidal benthic environment, particularly the distribution of benthic habitats and species within the offshore array site and along the export cable corridor / landfall. 2. Data will be used to inform the EIA and HRA.

6.3. Fish and Shellfish Ecology

6.3.1. Study Area

For the majority of fish and shellfish species, the study area is focused on the offshore elements of the main EIA scoping area. For certain migratory species, the study area is larger, to account for the mobile nature of these species.

6.3.2. Baseline Data

Data on fish and shellfish ecology in the study area has been collated from the following sources:

- Marine Information Network (MarLIN);
- Lle (Marine Planning Portal for Wales);
- National Biodiversity Network (NBN) Gateway;
- EMODnet (2019);
- Greenlink cable EIA Scoping Report (Intertek, 2019); and
- Pembrokeshire Demonstration Zone EIA Scoping Report (Wave Hub, 2018).

6.3.3. Existing Baseline

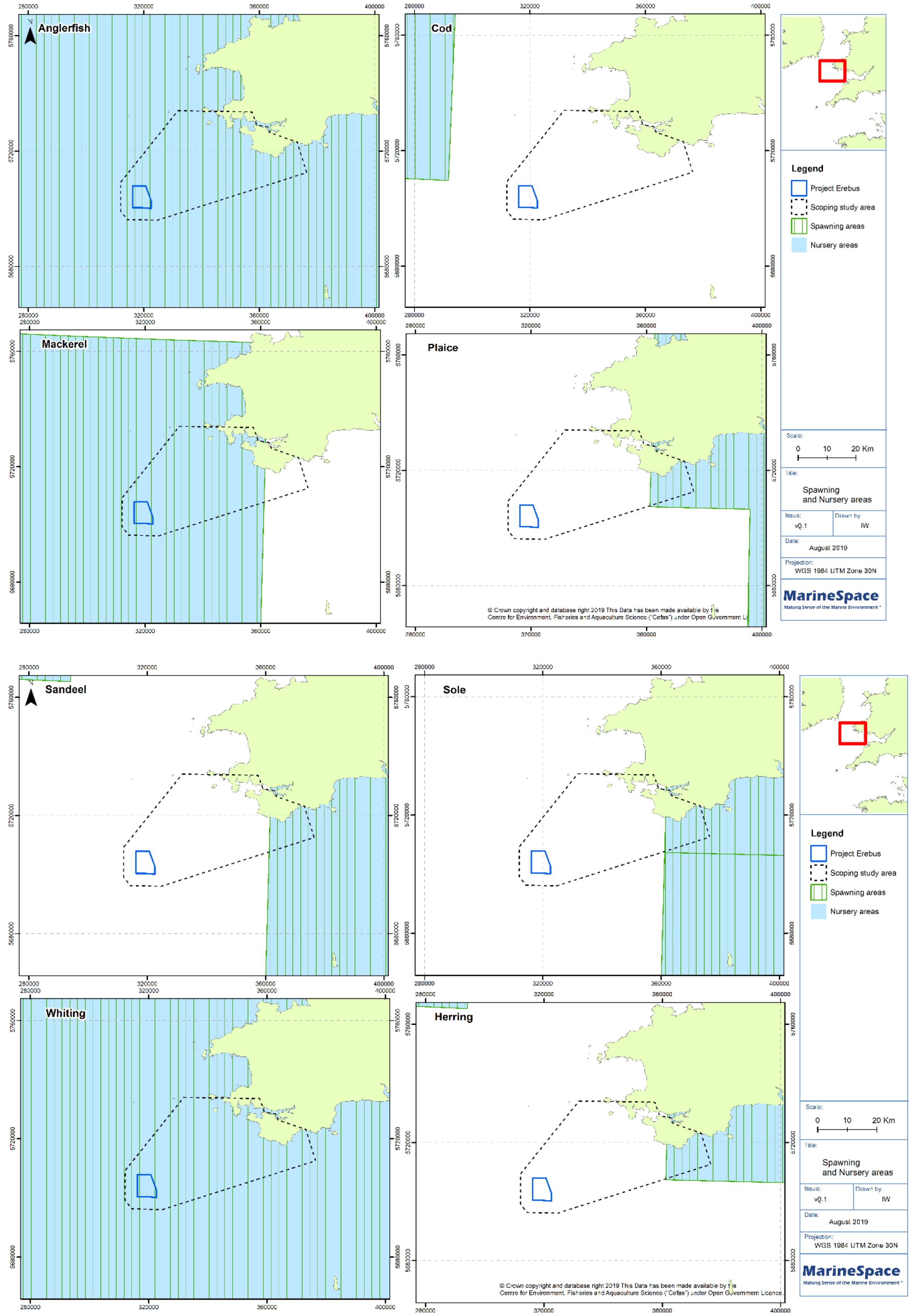
The variable seabed conditions across the southwestern coasts of England and Wales support a wide variety of fish species, with distinct assemblages associated with particular seabed conditions. Sandy inshore areas support large numbers of juvenile flatfish and sand eel, with seasonal populations of sprat and herring (Intertek, 2018), while areas where the underlying bedrock is exposed are characterised by small species such as wrasse, gobies and blennies, as well as juvenile pollock. A number of demersal (bottom dwelling) fish spawn and have nursery grounds in the offshore and nearshore area, whilst pelagic (free swimming) fish such as mackerel and herring range widely within the region, migrating between summer feeding grounds and overwintering grounds (Cefas 2005).The fish communities present can be broadly categorised as migratory (which encompasses diadromous species), demersal, pelagic, and benthopelagic.

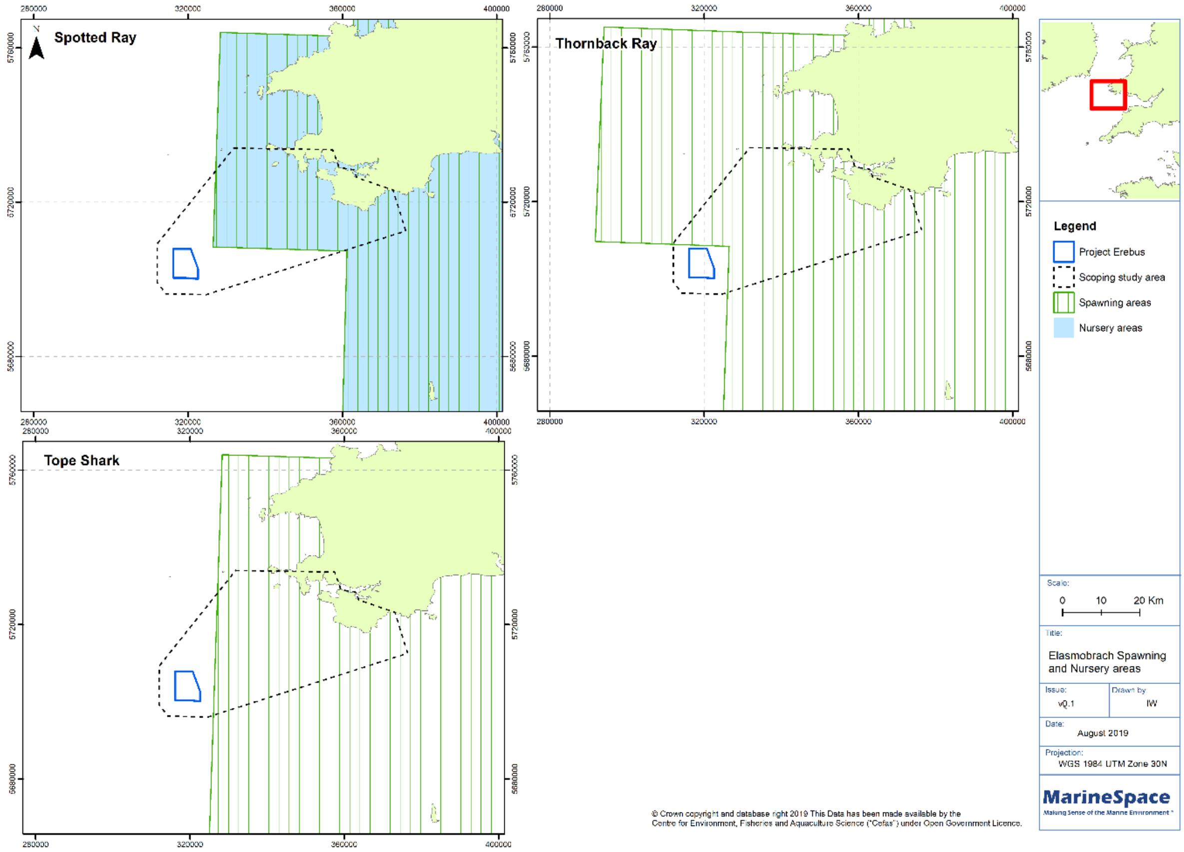
Information presented in the Pembrokeshire Demonstration Zone EIA Scoping Report (Wave Hub Ltd, 2018) indicates that commonly occurring and notable demersal species in this region include cod *Gadus morhua*, plaice *Pleuronectes platessa*, sole *Solea solea*, lemon sole *Microstomus kitt*, and several species of ray *Raja* spp. All these species also have spawning and / or nursery grounds within the region. Data derived from Coull *et al.* (1998); and Ellis *et al.* (2012) are presented in Intertek (2018) and provide further information on fish spawning and nursery areas for fish-stocks in the region. Data indicate that there are spawning grounds for nine commercially important fish species in the region, and a nursery for eleven commercially important fish species (Figure 6.7 and Table 6-11).

Additional information is presented with respect to the <u>potential</u> for herring and sand eel spawning grounds in this region. Both these species produce demersal eggs (eggs laid onto or into seabed sediments) and are, therefore, particularly susceptible to impacts from offshore projects.

The spawning habitat potential has been determined using a methodology developed by MarineSpace for use in the EIA process for the marine aggregate industry (Figure 6.8).

Figure 6.7: Spawning Grounds within Proposed Project Area (Ellis *et al*, 2012)





Spotted Ray
Thornback Ray
Tope Shark
Legend
Project Erebus
Scoping study area
Spawning areas
Nursery areas
Scale:
0
10
20 Km
Title:
Elasmobrach Spawning and Nursery areas
Issue:
v0.1
Drawn by
IW
Date:
August 2019
Projection:
WGS 1984 UTM Zone 30N
MarineSpace
© Crown copyright and database right 2019 This Data has been made available by the Centre for Environment, Fisheries and Aquaculture Science ('Cefas') under Open Government Licence.

Figure 6.8: Herring and Sand eel Spawning Potential in Study Area (MarineSpace, 2019)

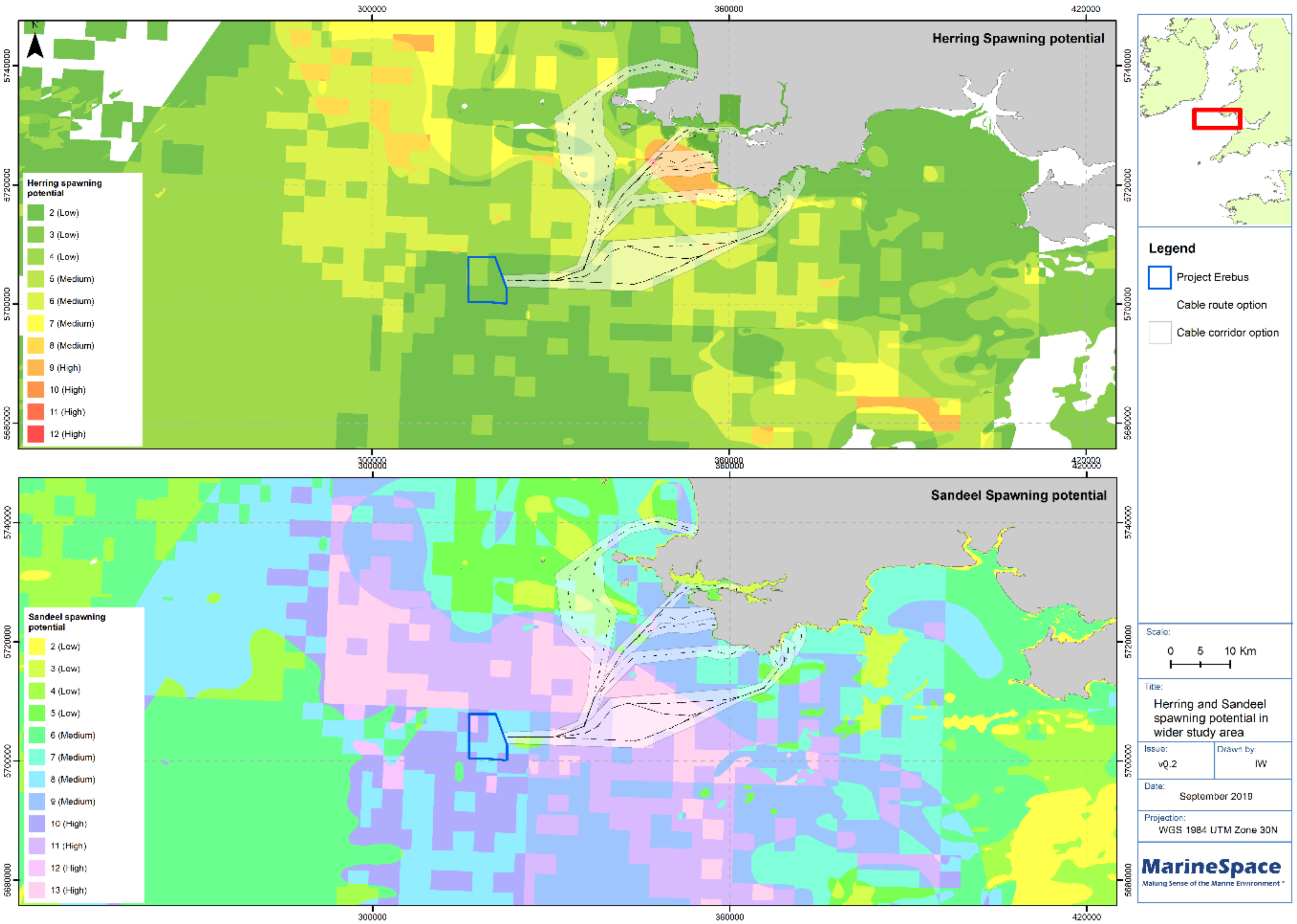


Table 6-11: Summary of Spawning and Nursery Areas for Commercially Important Species in the Bristol Channel and Celtic Sea. (From: Intertek, 2018)

Species	Spawning period	Nursery period	Spawning aquatic zone
Atlantic cod *Gadus morhua*	-	Jan – Jun	Demersal
Mackerel *Scomber scrombrus*	-	Mar - Sep	Pelagic
Lemon sole *Microstomus kitt*	Apr - Sep	Apr - Nov	Demersal
Norway lobster *Nephrops norvegicus*	Gravid females and juveniles can be found all year round		Demersal
Whiting *Merlangius merlangus*	-	Feb - Aug	Demersal
Tope *Galeorhinus galeus*	Viviparous species (gravid females can be found all year).		Demersal
Sprat *Sprattus sprattus*	May - Aug (Peak May - Jun)	-	Pelagic
Atlantic herring *Clupea harengus*	Jan - Apr	-	Demersal
Anglerfish *Lophius piscatorius*	-	Jan – Aug	Demersal
Blue whiting *Micromesistius poutassou*	-	Apr - Aug	Pelagic
Ling *Molva molva*	Feb - May	Feb - Jul	Pelagic
Thornback ray *Raja clavate*	Feb - Nov*	Feb - Nov	Demersal
European hake *Merluccius merluccius*	-	Jan – Aug	Demersal
Sand eel *Ammodytidae*	Nov - Feb	-	Demersal
Sole *Solea solea*	Mar - May (Peak spawning April)	-	Demersal

Intertek (2018) also highlights the importance of sea bass *Dicentrarchus labrax* around the coast of south Wales, with areas around the coast likely to form sea bass nursery areas. Welsh Government and the MMO has implemented fishing regulations to protect juvenile stocks of sea bass and this species has also been placed under special protection measures, following an increase in the fishing pressure and a reduction in reproduction (Intertek, 2018).

Of the demersal species present in the area, sand eel *Ammodytes* sp. and Atlantic herring *Clupea harengus* are particularly sensitive to seabed disturbance, such as that which may arise via construction activities associated with this proposed Project.

Sand eel

Sand eel exhibit diurnal and seasonal habits, burying themselves overnight, and over-winter, around 4-6 cm below the surface of sandy sediments (Holland *et al.*, 2005). During the spring and summer sand eel also exhibit diurnal habits, leaving the sediment habitat during daylight to feed on phytoplankton and zooplankton, and returning to bury themselves in the sediment during the periods of darkness.

Sand eel are an umbrella species in the marine ecosystem linking primary production at the base of the food chain associated with plankton to apex predators at the top, such as pinniped seals and seabirds. During the late 1980s and early 1990s overfishing and adverse environmental conditions led to dramatically reduced levels of juvenile sand eel recruitment resulting in catastrophic impacts on the numerous seabird populations which relied upon them as food.

A study by Holland *et al.* (2005) showed that areas which contained a high proportion of medium and coarse sand (particle size 0.25 to 2.0 mm) were preferred seabed habitats for sand eel, however the fine sediment content (<63 µm) is also critical, such that a high percentage of sand eel habitat has a fines content below 2%, and above 4% fines the occupancy and density of sand eel is extremely low. Sand eel may display a high level of site fidelity making them potentially vulnerable at a sub-population level to direct habitat loss (removal).

Atlantic herring

Atlantic herring is an umbrella species, occupying an important part of the trophic network, and providing key ecosystem services. It is a critical prey species for many apex predators both as adults and as juveniles, colloquially referred to as whitebait. There are three southwest Ireland sub-stock population areas for Atlantic herring and, for most of the year, the different populations mix. However, during the spawning season, they migrate to separate spawning areas.

Atlantic herring has a specific habitat preference which limits the spatial extent of their spawning grounds. Sediment suitability for potential spawning grounds has been seen to range from Gravel through sandy Gravel to gravelly Sand on the Folk (1954) scale (Reach *et al.*, 2013). Whilst potential Atlantic herring spawning grounds appear to have a relatively wide range of suitable seabed habitat, their distribution is likely to be restricted within potential spawning grounds to discrete spawning beds found at a local scale (O'Sullivan *et al.*, 2013). This is because besides sediment type, they also require broader environmental characteristics and parameters such as oxygenation of sediments, near bed flow rates and micro-scale seabed morphological features e.g. ripples and ridges. This is further complicated as spawning beds may be used sporadically, laying unused for several years at a time, before being re-used. All suitable areas of herring spawning habitat are, therefore, important to maintain a resilient herring population.

Migratory fish

The Celtic Sea is an important migration route for migratory fish such as lamprey, salmonids and European eel *Anguilla anguilla*. Intertek (2018) reports that the sea lamprey *Petromyzon marinus* and river lamprey *Lampetra fluviatilis* are both listed on Annex II of the EC Habitats Directive and are a qualifying feature for the Pembrokeshire Marine / Sir Benfro Forol SAC, which the potential marine export cable routes will cross.

Adult river lamprey migrate through the SAC entering freshwater between October and December to spawn, while juveniles generally migrate downstream into estuaries and inshore waters in spring, though autumn migrations have also been recorded. Adult sea lamprey migrate through the SAC between March and June to spawn while juvenile sea lamprey migrate downstream between December and June (Intertek, 2018)

Twaite shad *Alosa fallax* and Allis shad *Alosa alosa* are both Annex II species on the EC Habitats Directive and are qualifying features of the Pembrokeshire Marine / Sir Benfro Forol SAC. In addition, they are also listed as UK BAP priority fish species. Shad spend most of their adult lives in the sea but spawn in rivers (or, occasionally, in the upper reaches of estuaries) in early summer.

The Atlantic salmon *Salmo salar* and sea trout *Salmo trutta* may also be found in this region, and Atlantic salmon is listed on Annex II on the EC Habitats Directive. The European eel is also listed on Annex II of the EC Habitats Directive and is a UK BAP species.

Elasmobranchs (sharks, rays and skates)

Thornback ray *Raja clavata*, cuckoo ray *Leucoraja naevus*, small eyed ray *Raja microocellata* and spotted ray *Raja montagui* are all found in the region (DECC 2016). The thornback ray has both nursing and spawning grounds in the area and is therefore is vulnerable to cable activities (Ellis *et al.*, 2012).

Intertek (2018) indicates that basking shark *Cetorhinus maximus* is commonly seen at the surface in the summer months, particularly around the western coasts of the UK. The species is listed on the UK BAP as a priority marine species. The lesser spotted dogfish *Scyliorhinus canicula* and greater spotted dogfish *Scyliorhinus stellaris* is very abundant, and oceanic sharks such as blue sharks *Prionace glauca*, thresher shark *Alopias vulpinus* and mako sharks *Isurus oxyrinchus* may also make rare visits to the region (Intertek, 2018).

Shellfish

Brown crab *Cancer pagurus*, green crab *Carcinus maenas*, velvet crab *Necora puber*, spider crab *Maja squinado*, and lobster *Homarus gammarus* are all abundant in the region (Intertek, 2018). Catch statistics for Wales, reported by Intertek (2018) indicate that five known species of shellfish were landed into Wales between 2013-2017, crab, lobster, nephrops *Norvegicus norvegicus*, scallops *Pecten maximus* and whelks *Buccinum undatum*. Scallops are abundant on sandy sediments along the coasts of south Wales (DECC 2016).

6.3.4. Identification of Key Sensitivities and Potential Impacts

Table 6-12: Key Sensitivities and Potential Impacts to the Fish and Shellfish Receptors in the Study Area.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Demersal fish (spawning and nursery areas)	Habitat Loss / Disturbance Activities that have the potential to cause habitat loss and / or disturbance to spawning and nursery areas, including installation of moorings; marine export cable installation; cable protection.	Construction Operational Decommissioning	Yes	Species that lay their eggs on specific seabed types, such as herring, or species that live in specific sediments, such as sand eel, may be affected by activities that have the potential to disturb, alter or remove seabed sediments e.g. cable trenching. The significance of the impact would be dependent on methods, project design and location.
Demersal fish and shellfish	Increases in sediment or water temperature as a result of subsea cable operation	Operational	No	The exact amount of heating depends on cable specification and surrounding sediment characteristics; however, heat will dissipate quickly, and any heating will only be marginally above baseline conditions. Based on monitoring data collected from numerous operational UK OWF projects, no impacts are expected to demersal fish species and shellfish in close contact with the seabed via increased water temperatures.
All fish species (including migratory species)	Underwater Noise Impacts on fish species from underwater noise	Construction Operational Decommissioning	Yes	Underwater noise from operations has the potential to displace migratory fish from their migration routes if this passes through the offshore scoping area during construction. During the operational period, noise levels are expected to be significantly lower than those during construction. The sensitivity of fish to underwater noise is not well documented and pathways of migratory fish are not well understood once individuals leave rivers

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Shellfish	Loss of shellfish habitat	Construction Operational	Yes	Loss of habitat through placement of devices and swept area of mooring cables has the potential to remove habitat for shellfish. The significance of this would be dependent on the final project design and the importance of the area for shellfish.
Fish and shellfish (including migratory fish)	Increased Suspended Sediment Concentrations Impacts on fish and shellfish through a decrease in water quality	Construction Decommissioning	Yes	Construction methods that create sediment plumes also have the potential to release contaminants (if present) into the water column. This could result in decreased water quality that could impact on the health of fish and shellfish populations and potentially impact on the quality of commercial species. The significance of the impact will depend on the construction methodology, the presence of contaminants and the abundance of species in the offshore scoping area.
Fish and shellfish	Loss of Habitat Reduced resource availability	Construction Operational Decommissioning	Yes	The loss or alteration of habitats within the development have the potential to impact on resource availability and prey distribution within the offshore scoping area. The significance of the impact will be influenced by the extent of any change to benthic habitats and the importance of those areas as a resource.
Migratory fish	EMF as a barrier to migratory fish	Operational	No	Potential EMF effects on fish species has been investigated and there is no clear evidence of any adverse impacts as demonstrated in previously assessed and consented Offshore Wind Farms (OWF). Post-construction monitoring of fish in operational OWF projects around the UK has shown no absence of electro-sensitive species (rays;

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
				dogfish) in these areas, indicating that installed subsea cables have no impact on these species.
All fish species (including migratory species)	Ghost fishing from lost fishing gear, entangled in the mooring system could pose an entanglement risk to fish.	Operational	Yes	There is a risk that fish using the area may become entangled with derelict fishing gear, though the likelihood of this is poorly understood. For previous FLOW projects in Scottish waters, Marine Science Scotland stated that they consider that the effects of “ghost fishing”, whereby derelict fishing gear becomes entangled on the mooring lines and has the potential to then entangle fish, as very difficult to quantify at this stage.

6.3.5. Potential Mitigation

The specific requirements for mitigation depend on the assessed significance of the effects on fish and shellfish ecology. Mitigation measures will be developed as part of the proposed Project development and EIA as an iterative process; however some key considerations are likely to include:

- Temporal mitigation – consideration of the timing of operations to avoid periods of high importance e.g. spawning times for demersal spawners; migration periods for key migratory species;
- Spatial mitigation – develop an understanding of key sediment types, particularly with regards Atlantic herring and sand eel in order to potentially mitigate effects through spatial zonation and / or siting of moorings / cable etc.; and
- Discussion with statutory consultees on the monitoring of mooring and cabling for ghost fishing gear to minimize entanglement.

6.3.6. Proposed Approach to Environmental Assessment

The proposed approach to the assessment of potential impacts on fish and shellfish is detailed below:

- Natural fish populations within the Study Area will be characterised via a review of existing literature and, existing environmental data such as bathymetric data and fish landings data from the MMO;
- No project-specific surveys on fish and shellfish populations are proposed;
- Feedback gathered from commercial fishermen on key target species via the commercial fisheries assessment will also be used to characterise the Study Area;
- Key receptor groups will be defined and used as the basis of the assessment, with the sensitivity of each receptor group clearly explained within the ES. There will be particular focus to Atlantic herring and sand eel with regards impact assessment of seabed disturbance to inform final cable route and proposed Project infrastructure locations and also migratory fish, from both an EIA and HRA perspective;
- Footprints of potential habitat loss/disturbance will be calculated and used as the basis of many of the impact assessments;
- Outputs of the physical processes assessment will also provide the basis of impact assessments related to increased suspended sediments;
- Due to the lack of significant subsea noise emissions (no piling proposed), a project-specific subsea noise Model is not proposed to be developed. Potential impacts via subsea noise will be assessed via a desk-based review of previous subsea noise Models produced for other OWF projects;
- Reference will be made within the assessment to Models produced by the National Physical Laboratory (NPL) and also published response thresholds (Popper *et al.*, 2003; Hawkins *et al.*, 2014); and
- The subsea noise assessment on fish will also take full account of conclusions of EIA for previous FLOW projects (HyWind; Kincardine; Dounreay Tri) where impacts on fish and shellfish ecology were concluded to be non-significant.

6.4. Marine Mammal and Marine Reptile Ecology

6.4.1. Study Area

The study area for marine mammals is focused on the offshore elements of the main EIA scoping area although consideration is given to more wide-ranging species in the region.

6.4.2. Baseline Data

Data on marine mammals in the study area has been collated from the following sources:

- Marine Information Network (MarLIN);
- Lle (Marine Planning Portal for Wales);
- National Biodiversity Network (NBN) Gateway;
- EMODnet (2019);
- Greenlink cable EIA Scoping Report (Intertek, 2019); and
- Pembrokeshire Demonstration Zone EIA Scoping Report (Wave Hub, 2018).

6.4.3. Existing Environment

A range of marine mammals, including cetaceans (whale, dolphins and porpoises) and pinnipeds (seals) are likely to occur within the marine Study Area. Marine turtles are the only species of reptile that may potentially be present. An overview of the key species in the Study Area is provided below and in Table 6-13. The location of designated sites for marine mammals in the vicinity of the project site are displayed in Figure 6.1.

More than 28 cetacean species have been recorded in UK waters; of these, 11 have regular presence. Approximately 15 species have been recorded in the Irish and Celtic Sea (Wave Hub Limited, 2018). Three of these species are seen regularly in the Study Area; the harbour porpoise *Phocoena phocoena*, common bottlenose dolphin *Tursiops truncatus*, and shortbeaked common dolphin *Delphinus delphis* (Baines and Evans, 2012; Wave Hub Limited, 2018). Seen less frequently is the Risso's dolphin *Grampus griseus* and minke whale *Balaenoptera acutotostrata* (Baines and Evans, 2012).

Species with rare occurrence in the area are fin whale *Balaenoptera physalus*, sei whale *Balaenoptera borealis*, northern bottlenose whale *Hyperoodon ampullatus*, striped dolphin *Stenella coeruleoalba*, Atlantic white-sided dolphin *Lagenorhynchus acutus*, killer whale *Orcinus orca*, and long-finned pilot whale *Globicephala melas* (National Biodiversity Network (NBN) Atlas, 2019; Reid *et al.*, 2003). Even though these species with rare occurrence are not likely to be present in the Study Area, it is recognised that there are records of minke whale in this region, as well as an increase in sightings of humpback whales off the southwest Wales coast. Further comment in respect of these species and potential entanglement risk, is provided below.

Two species of pinniped are resident to the UK; the grey seal *Halichoerus grypus* and harbour seal *Phoca vitulina*. Both have known haul out sites along the coastline of the UK and will forage in surrounding waters. Grey seals typically forage at greater distances from haul out sites than harbour seals (135 km and 120 km, respectively; SCOS, 2018).

Grey seals are present throughout Welsh waters and have many haul out sites and breeding sites around the coast, some of which are designated. Conversely, harbour seals do not have any designated sites in the Study Area and are only rarely recorded in the Study Area, therefore they have been scoped out of the assessment.

Five species of marine turtle have been recorded in the UK but the majority of these are vagrants and are not sighted regularly. The only species thought to be resident is the leatherback turtle *Dermochelys coriacea*. Leatherback turtles migrate through the Irish Sea whilst on passage between the southwest of Ireland through to Northern Ireland and the west coast of Scotland (Intertek, 2016), and as such pass through the Study Area.

6.4.4. Identification of Key Sensitivities and Potential Impacts

Marine mammals may be directly or indirectly impacted during all phases of the proposed Project. Table 6-14 details the key sensitivities and potential impacts on marine mammals during the construction, operation and decommissioning of the proposed Project, and whether the impact is scoped in or out of the EIA. It should be noted that although the topic / receptor group may be generalised (e.g. 'All marine mammals'), it may be that only certain species within the broader group will be significantly impacted by the proposed Project; this will be investigated further during the EIA.

Overall it is anticipated that the impacts to marine mammals are likely to be minor / negligible based on the sensitivities of the features and (estimated) low temporal and spatial scale and magnitude of the activities. This reasoning is based on review of the EIAs and Scottish Government decision letters/consents for other FLOW floating wind projects around the UK (Kincardine; HyWind; Dounreay Tri).

6.4.5. Potential Mitigation

The level of mitigation required during the proposed Project will be proportionate to the anticipated level of impact on marine mammal and reptile species. The approach to mitigation will be discussed with the statutory consultees throughout the EIA process. The proposed Project design and development has not been finalised and mitigation measures can be incorporated and reviewed in an iterative process. It is expected that the key mitigation measures will comprise:

- Pre-construction characterisation studies will be conducted in accordance with the advice provided by the statutory consultees;
- Discussion with statutory consultees on the design of mooring and cabling to minimize entanglement and also routine monitoring of the mooring lines to inspect for fishing debris and, where possible, removal;
- The method of construction will aim to reduce noise output where possible;
- Adhering to the JNCC Guidelines on marine mammals and underwater noise, with regards to visual and acoustic monitoring and operational mitigation requirements;
- Vessels will travel at speeds below the threshold to cause injury to marine mammal species; and
- Nearshore operations will be timed to minimise overlap with key periods for seals (breeding, moulting).

Table 6-13: Species, Description and Protection Status in the Marine Mammal and Reptile Study Area

Species	Description	Protection Status
Harbour porpoise *Phocoena phocoena*	Found throughout the Study Area and around southwest Wales, in the Bristol Channel, throughout the Irish Sea and present but with lower densities in the Celtic Sea (Hammond *et al.,* 2017; Paxton *et al.,* 2016). Distribution is typically restricted to 200 m depth. The species is widespread throughout the West Wales Marine SAC and wider Study Area during summer; the winter range constricts to a smaller area in Cardigan Bay (JNCC, 2019a). Similarly, the Bristol Channel Approaches SAC is a key area during winter (JNCC, 2019b). Harbour porpoise density varies from <0.1 to 5 / 10 km in the offshore waters, with higher densities recorded inshore (from 5 to >10 / 10 km) (as derived from the Kriging interpolated maps; Baines and Evans, 2012).	Annex II and IV species Habitats Directive; Wildlife and Countryside Act 1981; CITES, OSPAR List of Threatened and / or Declining Habitats and Species; Section 7 Environment (Wales) Act (2016); Convention on Migratory Species. Listed as Vulnerable on the IUCN Red List (European population).
Common bottlenose dolphin *Tursiops truncatus*	Observed in the Irish Sea, particularly in Welsh coastal waters, though in lower numbers than harbour porpoise (Hammond *et al.,* 2017; MarLin, 2019). Due to predominantly coastal distribution they are unlikely to occur in the project site in high numbers. There is a semi--resident but wide--ranging population in Cardigan Bay, comprising a core ~125 individuals (Cardigan Bay SAC, 2019; JNCC, 2019c; Paxton *et al.,* 2016). Numbers here increase through the summer and peak in late September / October (Cardigan Bay SAC, 2019). Numbers of sightings in the project site are low (0-0.1 / 10 km), with considerably higher densities in Cardigan Bay (>0.1 / 10 km), and a small patch of slightly higher density (0.02-0.1 / 10 km) in Carmarthen Bay to the east (Baines and Evans, 2012). Breeding occurs year-round (Baines and Evans, 2012).	Annex II and IV species, Habitats Directive; Wildlife and Countryside Act 1981; CITES, Section 7 Environment (Wales) Act (2016); Convention on Migratory Species. Listed as Least Concern on the IUCN Red List (Global Population).
Short beaked common dolphin *Delphinus delphis*	The species is observed offshore in the Bristol Channel and down through the southwest approaches and Celtic Sea; it is rarer in the Irish Sea (Baines and Evans, 2012; Hammond *et al.,* 2017; MarLin, 2019; Paxton *et al.,* 2016). Density of common dolphin in the area is highly variable and can vary from <0.1 to >20 / 10 km, with densities of 1-10 / 10 km specifically in the project site. It is mainly a summer visitor though can be seen further offshore in deeper waters through to November (Baines and Evans, 2012).	Annex IV species, Habitats Directive; Wildlife and Countryside Act 1981; CITES; Section 7Environment (Wales) Act (2016); Convention on Migratory Species. Listed as Least Concern on the IUCN Red List (Global Population).

Species	Description	Protection Status
Risso's dolphin *Grampus griseus*	The species has a localised distribution around the coasts of the Irish Sea, including west Pembrokeshire (Baines and Evans, 2012). It is mainly seen in summer and autumn, with peak numbers in July to September. Densities are typically low in the area (<0.01 / 10 km), inclusive of the project site, with the exception of small patches where it can exceed 5 / 10 km (Baines and Evans, 2012).	Annex IV species, Habitats Directive; Wildlife and Countryside Act 1981; CITES, Section 7 Environment (Wales) Act (2016); Convention on Migratory Species. Listed as Least Concern on the IUCN Red List (Global Population).
Minke whale *Balaenoptera acutotostrata*	A largely offshore distribution, most common in the deeper waters of the Celtic Deep though also frequents the Irish Sea, particularly around southwest Wales and the Isle of Man (Paxton *et al.,* 2016). It is a summer visitor (Baines and Evans, 2012). Densities are typically low in the area (<0.001 / 10 km), inclusive of the project site, though there are more patches of higher density (>0.1 / 10 km) with increasing water depth over the Celtic Deep (Baines and Evans, 2012).	Annex IV species, Habitats Directive; Wildlife and Countryside Act 1981; CITES; Section 7 under Environment (Wales) Act (2016). Listed as Least Concern on the IUCN Red List (Global Population).
Grey seal *Halichoerus grypus*	Grey seals are present near the proposed Project site, though not directly in it (MarLIN, 2019). They have colonies that are designated as qualifying features of the Pembrokeshire Marine, Lundy Island, Cardigan Bay and Llŷn Peninsula and the Sarnau SACs. A breeding colony is also present on Skomer Island (Büche and Stubbings, 2018). The west Wales population of seals that use these sites are an isolated breeding population of approximately 5,000 individuals (Pembrokeshire Marine SAC, 2019). Grey seal annual pup production on the west coast of Pembrokeshire is high, with 300-400 pups produced per year around Skomer Island and the same amount, in 1994 and 2001, around other nearby islands (Baines and Evans, 2012). There are also numerous haul out sites around the Pembrokeshire peninsula, mainly off the coast of St David's, with 50 to 150 non-breeding haul out counts between 1990 and 2007 (Baines and Evans, 2012).	Annex II species, Habitats Directive; Wildlife and Countryside Act 1981; Convention on Migratory Species. Listed as Least Concern on the IUCN Red List (Global Population).
Leatherback turtle *Dermochelys coriacea*	Leatherback turtles make extensive migrations and enter UK waters in the summer months, following swarms of their favourite prey, jellyfish. WaveHub Ltd (2018) reported that high numbers were sighted in the wider area between July-September 2000. There are no nesting beaches in the UK.	Wildlife and Countryside Act 1981; CITES; OSPAR; Section 7 Environment (Wales) Act (2016); Convention on Migratory Species. Vulnerable on the IUCN Red List (Global).

Table 6-14: Key Sensitivities and Potential Impacts for Marine Mammals

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
All marine mammals	Operations associated with the Project, such as vessel movements and installation of moorings, will produce underwater noise, which has the potential to affect marine mammal species.	Construction Operational Decommissioning	Yes	Marine mammals are sensitive to underwater noise. They use underwater noise for prey detection, predator avoidance, communication, navigation etc. Increases in underwater noise can lead to physical and auditory injury, behavioral changes or masking. The amount of noise from the Project is expected to be limited; no piling or drilling is predicted, therefore there is a much-reduced likelihood of a significant impact. Noise levels are not expected to exceed injury levels, though disturbance by vessel noise, trenching, or cable and cable protection laying is possible. An assessment of the noise impact from the Project alone and in-combination will be undertaken in the EIA.
Marine reptiles	Operations associated with the Project, such as vessel movements and installation of moorings will produce underwater noise, which has the potential to affect marine reptiles.	Construction Decommissioning	Yes	Little is known about the sensitivity of marine turtles to underwater noise, however recent research indicates that they are sensitivity to low frequencies (peak hearing for leatherback turtles is 100-400 kHz) such as those produced during project operations (Piniak *et al.,* 2012). This impact is therefore scoped in for further assessment.
All marine mammals and reptiles	There is potential for UXOs to be present in the area; if this is the case, their controlled detonation can cause injury to marine mammals and reptiles	Construction	Yes	The area is close to the Castlemartin firing range and so may contain UXOs. Controlled UXO detonation, if required, can cause lethal and sub-lethal injuries to marine mammals and reptiles, with the severity of injury decreasing with distance from the explosion. Though it is not certain that UXOs will be discovered, the impact has been scoped in due to its potential severity.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
All marine mammals and reptiles	There is increased collision risk from the vessels to be used during the Project, which may cause harm to marine mammal and reptile species.	Construction Operational Decommissioning	Yes	Both marine mammals and turtles have been known to be impacted by ship strikes, large cetaceans in particular. The likelihood of injury depends on the vessel speed. An assessment of the collision risk from the Project alone and in-combination with other projects and existing vessel traffic will be undertaken in the EIA.
All marine mammals and reptiles	Accidental and unplanned release of chemicals and pollutants from vessels used during the Project has the potential to cause harm to marine mammals and turtles.	Construction Operational Decommissioning	No	The risk of accidental and unplanned release of chemicals and pollutants from vessels is considered extremely low. An Environmental Management Plan (EMP) will be created, with procedures that will minimise the risk of such events and contain measures to minimise the impacts should they occur. This interaction is scoped out of the EIA.
All marine mammals and reptiles	Operations associated with the Project may cause sediment resuspension and so changes in water quality, which may impact the visual behaviour of marine mammals and reptiles.	Construction Decommissioning	No	The marine mammal species common to the project site inhabit coastal waters that are often turbid, and so they will have a natural level of adaptation to increased sediment suspension. In addition, there is minimal suspended sediment expected to be generated due to the semi-submersible nature of the project, and the great water depth will restrict the effects to a small fraction of the water column near the seabed.
All marine mammals and reptiles	Infrastructure associated with the Project may cause barrier effects from the mooring lines, which could disrupt the passage of marine mammals and turtles.	Operational	Yes	The configuration of the WTGs and moorings is currently unknown. This interaction has been scoped in as a precautionary measure however it is not expected to be significant and is likely to be scoped out upon further assessment.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
All marine mammals and reptiles	Mooring lines and cabling between the platform and the anchors used during the project could pose an entanglement risk to marine mammals and reptiles.	Operational	Yes	There is a risk that cetaceans, pinnipeds and turtles using the area may get tangled in mooring lines. Large cetaceans (such as minke whales) are considered at greatest risk to this impact. The mooring lines may also become entangled with derelict fishing gear, which may further increase the chance of marine mammal entanglement, though the likelihood of this is poorly understood. For previous FLOW projects in Scottish waters, Marine Science Scotland agreed that the risk of entanglement for marine mammals in any vertical mooring lines was very small, as was similar risk from catenary lines. MSS also stated that they consider that the effects of “ghost fishing”, whereby derelict fishing gear becomes entangled on the mooring lines and has the potential to then entangle marine mammals, as very difficult to quantify at this stage. This impact is scoped in; however, it is not judged to be significant and will likely be scoped out upon further assessment.
Pinnipeds	The presence of vessels close to the coast could lead to the disturbance of coastal and onshore habitats used by seals e.g. haul-out sites, breeding and foraging areas.	Construction Operational Decommissioning	Yes	Seals that are present at their coastal sites for breeding, moulting, and nearshore foraging could be affected by vessels in this way. The level of disturbance is correlated with the distance from the vessel; at <900 m seals can exhibit a fleeing response, at 900-1,500 m the vessels is detectable, and at 1,500 m the vessel is not detectable. This impact will be further considered in the EIA.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
All marine mammals and reptiles	Subsea cables for the Project will emit electromagnetic frequency (EMF), which can impact the navigation of marine mammal and turtle species.	Operational	No	Many marine mammal and turtle species make long-distance migrations and are thought to use the Earth's magnetic fields for navigation. There is no evidence of subsea cables associated with OWF project affecting these migrations, even with > 25 operational UK OWF projects. Therefore, this impact is proposed to be scoped out of the EIA.
All marine mammals and reptiles	The Project operations have the potential to cause indirect effects to marine mammal and turtle species through impacts to their prey.	Construction Operational Decommissioning	Yes	All marine mammal and turtle species could be affected by changes to their prey as a result of the Project. An assessment of this will be undertaken in the EIA, taking into account the assessment of impacts to key prey species in the benthic ecology and fish and shellfish ecology chapters. This may include impacts that have been scoped out as a direct risk to marine mammals and reptiles, such as sedimentation.

6.4.6. Proposed Approach to Environmental Assessment

The potential impacts on marine mammals listed above will be assessed using the general EIA methodology set out within Section 3 (EIA Methodology). Each potential impact will be properly defined and agreed using expert judgement and through consultation with NRW.

A key part of the impact assessment for marine mammals will be agreeing the exact approach with NRW. We are aware that currently there is potentially conflicting advice from SNCB's concerning assessment for harbour porpoise. NE and JNCC advise that harbour porpoise should be assessed using the appropriate SAC boundary and relevant buffer distances for underwater sound and pressure emissions. However, NRW currently advises that potential impacts on harbour porpoise (and bottlenose dolphin) should be assessed at the population scale using the appropriate Marine Mammal Management Units (MMMUs). MMMUs are regional sea-scale areas known to support populations / meta-populations of marine mammals. This results in a much larger area of sea requiring assessment than an appropriately buffered SAC boundary.

Following agreement on approach and receptor definition, an assessment of significance will then be undertaken based on the sensitivity and value of the receptor and the magnitude of effect.

Provisional definitions of different impact significance on marine mammals is provided below:

- Major: Very large or large changes (either adverse or beneficial) to a receptor (or receptor group), which is important at a population (national or international) level because of the contribution to achieving national or regional objectives, or, a change expected to result in exceedance of statutory objectives and / or breaches of legislation;
- Moderate: Intermediate or large changes (either adverse or beneficial) to a receptor (or receptor group), which may be an important consideration at national or regional population level. Potential to result in exceedance of statutory objectives and / or breaches of legislation;
- Minor: Small changes (either adverse or beneficial) to a receptor (or receptor group), which may be raised as local issues but is unlikely to be important at a regional population level; and
- Negligible: No discernible change in receptor (or receptor group).

Due to the predicted lack of significant subsea noise emissions via this proposed Project (due to no proposed piling), a project-specific subsea noise Model is not proposed to be developed. Potential impacts via subsea noise will be assessed via a desk-based review of previous subsea noise Models produced for other OWF projects.

Reference will be made within the assessment to Models produced by the National Physical Laboratory (NPL) and also published response thresholds (Popper et al., Hawkins et al., 2014). The subsea noise assessment on fish will also take full account of conclusions of EIA for previous FLOW projects (HyWind; Kincardine; Dounreay Tri) where impacts on marine mammals were concluded to be non-significant. Table 6-15 summarises the addition data collection proposed for the Project, in relation to marine mammals and reptiles.

Table 6-15: Proposed Additional Data Collection for Marine Mammals and Reptiles

Data requirement	Method	Justification
Desktop study		
Marine mammal baseline data including sightings, distribution, abundance, sensitive periods and areas.	Request information from named consultees and statutory scientific advisors (e.g. MMO, NRW, JNCC and Sea Mammal Research Unit). In addition to data from the Atlas of Marine Mammals of Wales (Baines and Evans 2012), and MarLIN 2018 data, additional information will be collated from SCANS-III1 data (Hammond *et al.,* 2017).and revised Phase III analysis of the Joint Cetacean Protocol (JCP) (Paxton *et al.,* 2016).	To characterise the baseline in terms of spatiotemporal occurrence, density, and key periods. This will help identify any gaps in the existing data, to inform survey needs. To inform the EIA and HRA
Sensitivity of marine mammals to underwater noise and potential noise impact assessment	Desktop review of existing information, including noise produced by other floating wind operations and also other activities (bottom-fixed offshore wind, aggregates, fishing etc.). Noise impact assessment, if required, should be undertaken using a recognised acoustic Model (NPL, 2014) and established thresholds (e.g. NMFS, 2018; Southall *et al.,* 2019). Review of the observed responses to underwater noise.	To assess the potential level of underwater noise that will be produced during the different construction activities and identify any gaps in the literature. Also to identify cumulative effects with existing activities.
Surveys		
Marine mammal and reptile presence, distribution and abundance in the project site to fill in any gaps identified during the desktop study and consultation.	A project-specific bird and marine mammal survey scope is currently under consultation with NRW. The final survey design is likely to comprise Digital Aerial Surveys (DAS) and imagery collection, which will be used to detect presence of marine mammals and reptiles.	To gain a thorough understanding of the baseline environment, particularly the most frequently occurring species and how they utilise the area, the key sensitivities. To inform the Project Envelope To inform the final cable route To inform the EIA and HRA

6.5. Ornithology

6.5.1. Study Area

The offshore ornithological Study Area covers all areas currently under consideration for installation of Project infrastructure (see Figure 2.1) plus a buffer of 100 km.

The buffer of 100 km has been selected as it captures the extent of localised and medium-range effect envelopes and encompasses the majority of species-specific foraging ranges. The far-ranging species with a mean max foraging range + 1 Standard Deviation (SD) that is greater than 100 km are listed in Table 6-16, (as derived from Thaxter *et al.* (2012)).

Table 6-16: Mean Max Foraging Range plus 1 Standard Deviation (SD) for Species that have a Foraging Range Greater than 100 km (Source: Thaxter *et al.*, 2012)

Species	Mean max foraging range plus 1 SD (km)
Northern fulmar	400 ± 245.8
Manx shearwater	>330
Leach's storm petrel	91.7 ± 27.5
Lesser black-backed gull	141.0 ± 50.8
Common guillemot	84.2 ± 50.1
Atlantic puffin	105.4 ± 46.0

More recent Future of the Atlantic Marine Environment (FAME) / Seabird Tracking and Research (STAR) tracking data from the RSPB (as presented in Wakefield *et al.,* 2013) have also been reviewed. The greatest predicted foraging range of the two sources has been used in the scoping exercise (applying the precautionary approach), to scope in the maximum number of SPAs that could potentially be affected. FAME and / or STAR data are only available for the following species:

- European shag;
- Black-legged kittiwake;
- Common guillemot; and
- Atlantic razorbill.

These data show that colonies of these four species fall within the area of interest, although it should be noted that only razorbill use the area in any great intensity.

It should be noted that although northern gannet have a mean max foraging range + 1 SD that is greater than 100 km (specifically 229.4 ± 124.3 km; Thaxter *et al.,* 2012), more recent data suggest that they show density-dependent competition and colony segregation (Wakefield *et al.,* 2013). Using this evidence-based approach, the breeding colony at Grassholm is the only colony scoped into assessment and it is predicted that the colony's foraging range is captured within the 100 km buffer.

The proposed Project area of interest is in water depths of approximately 70 m and lies approximately 44 km to the southwest of the Pembrokeshire coastline. The offshore study area also covers the area within which the offshore cable will be routed. The offshore cable route has yet to be finalised but is likely to pass through water depths of 0-80 m.

A number of potential cable landfall sites have been identified with the final site yet to be selected. Potential sites under consideration are West Angle Bay, Angle Bay and Freshwater West all on the south Pembrokeshire coast.

The onshore ornithological Study Area covers all areas in which onshore project infrastructure could be located. The precise location of the onshore cable routes and onshore substation is not yet known. The onshore cable routes will extend from the landfall to an onshore substation which is expected to be within 2 km of the Pembroke Power Station.

6.5.2. Baseline Data

The baseline environment section has been informed using the following key data sources:

- Bird Atlas 2007 – 2011 Mapstore (BTO, 2019);
- Analyses of European Seabirds at Sea (ESAS) data by Kober *et al.*, 2010);
- Birds of Conservation Concern (BoCC) 4 the Red list for birds (Eaton *et al.,* 2015);
- JNCC (2019d) Seabird Monitoring Programme online database (available at: http://archive.jncc.gov.uk/smp/);
- State of Birds in Wales 2018 (Bladwell *et al.,* 2018);
- Birdlife International's Seabird Tracking Database (available at: http://seabirdtracking.org);
- FAME and STAR data (Wakefield *et al.,* 2013 / RSPB);
- Mean maximum foraging ranges + 1 standard deviation (Thaxter *et al.*, 2012);
- Wetland Bird Surveys counts (WeBS) (BTO, 2019)
- NBN Gateway; and
- MAGIC Interactive map (available at: https://magic.defra.gov.uk/MagicMap.aspx).

6.5.3. Baseline Environment

The primary legislation under which birds are protected in Wales is:

- The European Council Directive (2009/147/EC) on the Conservation of Wild Birds (the 'Birds Directive');
- The Wildlife and Countryside Act (WCA), 1981, as amended;
- The Conservation (Natural Habitats & c.) Regulations, as amended ('The Habitats Regulations'); and,
- Species listed under Section 7 of The Environment Act (Wales) 2016.

A desk-based study of available data has been undertaken to identify which protected species or species of conservation concern are likely to be present in the offshore and onshore study areas using available data.

6.5.3.1. Offshore

Ornithological interests within the offshore Study Area include seabirds, auks, divers, grebes, wildfowl, gulls and terns that may use the area for foraging or other essential behaviours such as preening, displaying, bathing and loafing / resting at sea.

There are several SPAs designated for internationally important breeding seabird populations within the offshore ornithological Study Area. A list of these sites and the species for which they are designated is presented in Table 6-17, and their location is displayed in Figure 6.1. The designated features of the listed SPAs have the potential to interact with the proposed Project. In addition, there are several species for which SPAs at greater distances than 100 km are scoped in due to their far-ranging foraging behaviour (see Table 6-16 for the foraging ranges used to screen). The additional sites for these species are listed in Table 6-18.

Table 6-17: SPAs and Relevant Designated Features that Occur within the Offshore Ornithological Study Area

Site code	Site name	Designated features
UK		
UK9014051	Skomer, Skokholm and the Seas off Pembrokeshire / Sgomer, Sgogwm a Moroedd Penfro	Atlantic puffin, European storm-petrel, lesser black-backed gull, Manx shearwater, chough. Seabird assemblage including razorbill, guillemot, kittiwake, puffin, lesser black-backed gull, Manx shearwater, and European storm-petrel.
UK9014091	Bae Caerfyrddin / Carmarthen Bay	Common scoter.
UK9015011	Burry Inlet	Pintail, northern shoveler, Eurasian teal, Eurasian wigeon, turnstone, dunlin, red knot, Eurasian oystercatcher, Eurasian curlew, grey plover, common shelduck, redshank. Waterbird assemblage (of the aforementioned designated bird features).
UK9014041	Grassholm	Gannet.
Ireland		
IE0004002	Saltee Islands SPA	Razorbill, peregrine falcon, puffin, fulmar, lesser black-backed gull, great cormorant, Manx shearwater, chough, black-legged kittiwake, gannet, common guillemot.
IE0004092	Tacumshin Lake SPA	Reed warbler, pintail, northern shoveler, Eurasian teal, Eurasian wigeon, mallard , garganey, gadwall, white-fronted goose, pochard, tufted duck, brent goose, dunlin, curlew, sandpiper, little stint, marsh harrier, Bewick's swan, mute swan, coot, lesser black-backed gull, black-headed gull, black-tailed godwit, curlew, ruff, golden plover, grey plover, shelduck, spotted redshank, wood sandpiper, greenshank, green sandpiper, redshank, lapwing.

Site code	Site name	Designated features
IE0004009	Lady's Island Lake SPA	Pintail, northern shoveler, Eurasian teal, Eurasian wigeon, garganey, gadwall, pochard, tufted duck, scaup, curlew, sandpiper, little stint, marsh harrier, mute swan, coot, Eurasian oystercatcher, Mediterranean gull, black-headed gull, black-tailed godwit, red-breasted merganser, curlew, ruff, golden plover, roseate tern, common tern, Arctic tern, Sandwich tern, spotted redshank, wood sandpiper, greenshank, green sandpiper, redshank, lapwing.

Table 6-18: Additional SPAs Screened in for Far-ranging Species, Based on the Mean Max Foraging Range + 1 Standard Deviation (SD) Presented in Thaxter *et al.* (2012).

Species	Additional SPAs screened in
Northern fulmar	Baie de Seine occidentale, Bancs des Flandres, Camaret, Cap d'Erquy-Cap Fréhel, Cap Gris-Nez, Cap Sizun, Côte de Granit Rose-Sept Iles, Falaise du Bessin Occidental, Forth Islands SPA (as part of seabird assemblage), Lambay Island SPA, Littoral seino-marin, Mingulay and Berneray SPA, Old Head of Kinsale SPA, Ouessant-Molène, Rathlin Island SPA (as part of seabird assemblage), Skerries Islands SPA, Tregor Goëlo.
Manx shearwater	Copeland Islands SPA, Côte de Granit Rose-Sept Iles, Glannau Aberdaron ac Ynys Enlli/ Aberdaron Coast and Bardsey Island SPA, Lambay Island SPA, Ouessant-Molène.
Leach's storm-petrel	No additional sites screened in.
Lesser black-backed gull	No additional sites screened in.
Common guillemot	No additional sites screened in.
Atlantic puffin	No additional sites screened in.

European Seabirds at Sea (ESAS) data for the area show that survey effort in the area is rather poor, however an analysis of available data for the period 1980 to 2004 indicates that in the breeding season, the region is of key importance for breeding Manx shearwater *Puffinus puffinus*, northern gannet *Morus bassanus* and black-legged kittiwake *Rissa tridactyla* (May-September) and Atlantic puffin *Fratercula arctica* (April-June) (Kober *et al.*, 2010). In the winter months, the area is of particular importance for common guillemot *Uria aalge* (October-April) and an extensive area further offshore to the southwest of the proposed Project area of interest is used by large numbers of wintering lesser black-backed gull *Larus fuscus* (September to April) (Kober *et al.*, 2010).

Seabird tagging data for the offshore Study Area show that lesser-black backed gulls tagged at Skokholm island use the Study Area and wider area extensively (Thaxter *et al.*, 2015). The data presented on the Seabird Tracking Database (BirdLife International, 2019) show that the offshore Study Area and wider area is also used extensively by razorbill *Alca torda* and is frequented by

Atlantic puffin *Fratercula arctica* which have a very widespread distribution in the offshore Study Area and surrounding area.

The inshore coastal waters provide foraging habitat for European shag *Phalacrocorax aristotelis* which feed on a wide range of small fish that are caught on or near the seabed (Bladwell *et al.*, 2018).

Tern species that could be present in the Study Area during the breeding season are Arctic tern *Sterna paradisaea*, Sandwich tern *Sterna sandvicensis*, common tern *Sterna hirundo* and roseate tern *Sterna dougalii* which breed within the Anglesey Terns / Morwenoliaid Ynys Môn SPA (JNCC, 2019e), 193 km to the north of the Study Area.

All tern species are considered passage migrants through Pembrokeshire, primarily in autumn (scarcely in spring), with Arctic and Sandwich tern being the most commonly sighted (Pembrokeshire Bird Group, 2019).

In winter, the coastal waters provide important habitat for wintering wildfowl, divers and grebes. Common scoter *Melanitta nigra* is a common winter visitor to Pembrokeshire and is a designated feature of Carmarthen Bay SPA which is located 64 km to the west of the study area. Few common scoters have been recorded outside of Carmarthen Bay (Pembrokeshire Bird Group, 2019).

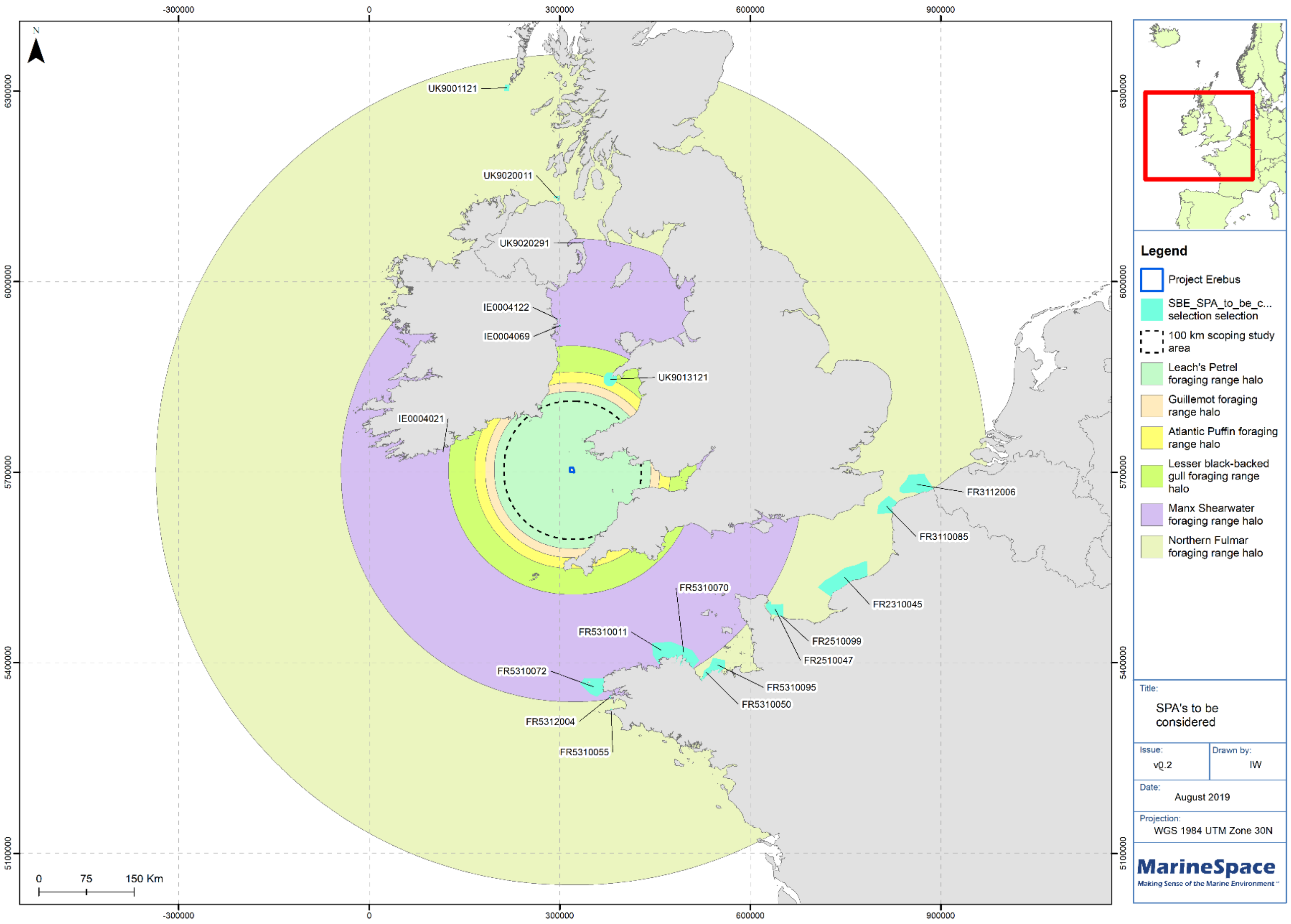
The other seaduck species (velvet scoter *Melanitta fusca*, long-tailed duck *Clangula hyemalis,* scaup *Aythya marila* and pochard *Aythya ferina*) are scarce winter visitors to Pembrokeshire (Pembrokeshire Bird Group, 2019). Red-throated diver *Gavia stellata* commonly frequent the inshore coastal waters during the winter months in small numbers (typically 1-10 individuals per locality), and Milford Haven is considered a hotspot in Pembrokeshire (Pembrokeshire Avifauna, 2019). They are also passage migrants in spring and autumn. Great northern diver *Gavia immer* and black-throated diver *Gavia arctica* are also regular winter visitors to the coastal waters of Pembrokeshire, though the main sighting locations are outside the study area (Pembrokeshire Avifauna, 2019). All of the grebe species listed are uncommon winter visitors to Pembrokeshire (Pembrokeshire Bird Group, 2019).

Mediterranean gull *Larus melanocephalus* was first recorded in Pembrokeshire in 1968 and, since then, the species presence has grown and it is now considered a regular winter visitor in small numbers (<10) (Pembrokeshire Avifauna, 2019). They are typically recorded in the Cleddau estuary, feeding inland during the day, but are rarely recorded in south Pembrokeshire (Donovan and Rees, 1994; The Wildlife Trust South and West Wales, 2017).

A wide range of other species that migrate to and from the UK may also pass through the offshore study area including seabirds, wildfowl, waders, passerines and raptors.

A summary of the protected species and other species of conservation importance that may be present or pass through the offshore study area is shown in **Table A.1 (Appendix B).**

Figure 6.9: Additional SPAs Screened in as Part of the Environmental Impact Assessment Scoping Process due to Designated Far-ranging Ornithological Features



6.5.3.2. Onshore

Ornithological interests present within the onshore Study Area include coastal and terrestrial bird species that may breed, roost or forage within the area. There are a number of designated sites with ornithological interests within the area including SPAs and Sites of Special Scientific Interest (SSSIs) (see Section 6.1).

The location of the cable landfall has yet to be confirmed however potential locations include Angle Bay, West Angle Bay and Freshwater West beach.

Freshwater West and Bullslaughter Bay are within the Castlemartin Coast SPA, which is designated for breeding and wintering populations of chough (JNCC, 2001). This SPA provides important nesting and foraging habitat for 12 pairs of chough during the breeding season, and provides important foraging habitat for 24 pairs during the winter months. Other areas within the study area that hold important habitat for chough include the Skomer, Skokholm and the Seas off Pembrokeshire SPA and Angle Peninsula Coast SSSI both designated for breeding chough (JNCC, 2017), and The Dale and South Marloes Coast SSSI which holds important breeding and wintering habitat for chough (NRW, 2002a).

The cliffs along the Castlemartin coastline, including Castlemartin Cliffs and Dunes SSSI, support the largest concentration of breeding seabirds on the Pembrokeshire mainland including common guillemot, razorbill, northern fulmar, European shag, black-legged kittiwake, herring gull and great black-backed gull (JNCC, 2019d). There are also a few records of lesser black-backed gull and Atlantic puffin. Broomhill Burrows SSSI is of importance for breeding lapwing *Vanellus vanellus*.

The onshore Study Area also holds important breeding habitat for a number of passerines; the key species in terms of conservation importance are listed in Table A.2 (Appendix B). Many species such as starling *Sturnus vulgaris*, marsh tit *Poecile palustris*, skylark *Alauda arvensis*, spotted flycatcher *Muscicapa striata*, yellowhammer *Emberiza citronella* and linnet *Linaria cannabina* still breed in south Pembrokeshire, though declines have been recorded elsewhere (Pembrokeshire Avifauna, 2019). Increases in numbers and distribution have been reported for other species such as grasshopper warbler *Locustella naevia* and reed bunting *Emberiza schoeniclus*, with known breeding sites in the Study Area (Pembrokeshire Avifauna, 2019).

Common residents that breed throughout Pembrokeshire (including the Study Area) include bullfinch *Pyrrhula pyrrhula*, house sparrow *Passer domesticus*, dunnock *Prunella Modularis*, song thrush *Turdus philomelos* and mistle thrush *T. viscivorus* (Pembrokeshire Avifauna, 2019). Species considered unlikely to breed in the Study Area due to a decline in numbers and subsequent range retraction, include cuckoo *Cuculus canorus*, willow tit *Poecile montanus*, grey wagtail *Motacilla cinerea*, tree pipit *Anthus trivialis*, and lesser redpoll *Acanthis cabaret* (Pembrokeshire Avifauna, 2019).

The Study Area is also of importance for wintering waterbirds; Milford Haven supports an aggregation of 20,000-30,000 waterbirds each year (The Wetland Bird Survey (WeBS), 2019). The mudflats and saltmarshes of Milford Haven Waterway SSSI, including Angle Bay, support significant numbers of over wintering wildfowl and waders (NRW, 2002b).

Species of special interest include little grebe *Tachybaptus ruficollis*, shelduck *Tadorna tadorna*, wigeon *Anas penelope*, teal *Anas crecca*, dunlin *Calidris alpina* and curlew *Numenius arquata*. The most numerous wintering waders include curlew, with an average mid-winter population of approximately 3,000 birds, concentrated in northern Pembrokeshire. The most numerous wildlfowl is wigeon, with approximately 8,000 wintering in Milford Haven Waterway SSSI every year.

Large flocks of golden plover *Pluvialis apricaria* numbering several thousand birds are present at the Castlemartin ranges. Lapwing is found across farmland and coastal habitats in large flocks up to a few thousand birds. Passage migrants in spring and autumn include whimbrel *Numenius phaeopus*, black-tailed godwit *Limosa limosa* and bar-tailed godwit *Limosa lapponica*, seen in estuaries and coastal habitats in the study area. Only a few ruff *Philomanchus pugnax* are seen in the area in winter and spring. Woodcock *Scolopax rusticola* is a common winter visitor (tens of individuals) but does not breed in the area.

Brent geese *Branta bernicla*, Greenland white-fronted goose *Anser albifrons flavirostris*, and Bewick's swan *Cygnus columbianus bewickii* are scarce winter visitors and passage migrants to Pembrokeshire (Pembrokeshire Avifauna, 2019). All species are typically present in low numbers though larger aggregations (10+) can occur during cold weather periods. The main location that Brent geese are found is in Angle Bay where up to nine birds have been recorded on occasion (Pembrokeshire Avifauna, 2019).

Raptors of conservation importance likely to be present in the onshore study area are listed in Table A.2 (Appendix B). Peregrine falcon *Falco peregrinus,* a scarce resident to Pembrokeshire, has been recorded breeding within the Study Area with nesting sites distributed along the coastline and also present in man-made structures, natural inland sites, and quarries (Pembrokeshire Avifauna, 2019; Wilson *et al.,* 2017). The Angle Peninsula Coast SSSI provides important breeding and foraging habitat for peregrine (NRW, 2003). Peregrines hunt widely across the whole of Pembrokeshire during the winter, particularly favouring the estuaries (Pembrokeshire Avifauna, 2019). Red kite *Milvus milvus* is a common resident species with an increasing population in Pembrokeshire, present in both the winter and breeding seasons, though with only one possible breeding site within the onshore Study Area (BTO, 2019; Pembrokeshire Avifauna, 2019). Kestrel *Falco tinnunculus* is a scarce resident and passage migrant; with coastal breeding sites present in the study area (Pembrokeshire Avifauna, 2019).

Hen harrier *Circus cyaneus* is a regular but scarce winter visitor to Pembrokeshire, rarely ranging south of the Cleddau estuary and not thought as likely to occupy southwest Wales (Pembrokeshire Avifauna, 2019; Wotton *et al.,* 2016). Marsh harrier *Circus aeruginosus* is a scarce visitor, and is mostly recorded at or near the coast (only in the north of the Study Area) (Pembrokeshire Avifauna, 2019). Goshawk *Accipeter gentilis* is a resident and winter visitor to Pembrokeshire, though the main population lies to the east of the Study Area (Pembrokeshire Avifauna, 2019). Merlin *Falco columbarius* is a winter visitor and migrant species occurring in small numbers, most frequently seen in coastal areas, and less commonly across farmland (Pembrokeshire Avifauna, 2019).

The Skomer, Skokholm and the Seas off Pembrokeshire SPA is also designated for breeding short-eared owl *Asio flammeus* (JNCC, 2017). Short-eared owls are also frequently seen foraging over heaths and bogs during the winter months (Pembrokeshire Avifauna*,* 2019).

The Study Area may be used by large flocks of wintering passerines including fieldfare *Turdus pilaris*, redwing *Turdus iliacus* and also black redstart *Phoenicurus ochruros* (Pembrokeshire Avifauna, 2019).

A summary of the protected species and other species of conservation importance that may be present within the onshore study area is shown in **Table A.2 (Appendix B).**

Once the selection of locations for the onshore project infrastructure have been finalised, the need to gather further project-specific baseline characterisation data for each of these locations will be assessed (see Table 6-12).

6.5.4. Identification of Key Sensitivities and Potential Impacts

Given the preliminary nature of EIA Scoping, the potential impacts on ornithological receptors may only be broadly predicted, until completion of the project-specific baseline characterisation surveys and finalisation of the project description elements (e.g. offshore cable route, cable landfall site selection, substation location, onshore cable route and onward grid connection, etc.). The key sensitivities and potential impacts for offshore and onshore ornithological interests are presented in Table 6-19 and Table 6-20 respectively. These have been identified for each phase of the Project (construction, operation and maintenance and decommissioning).

6.5.5. Potential Mitigation

The findings of the project-specific surveys will inform the need for mitigation measures. Consultation with key ornithological stakeholders (NRW; RPSB) will include discussion of the need for mitigation and the feasibility of potential options.

Time-related restrictions to onshore construction activities may be considered as an option to avoid disturbance to breeding birds.

Table 6-19: Key Sensitivities and Potential Impacts for Offshore Ornithology

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
All seabirds (divers, grebes, cormorant / shag, seaducks, tubenoses, gannet, gulls, terns, and auks)	Direct loss of seabed habitat used by foraging birds due to placement of project infrastructure.	Construction Operational Decommissioning	Yes	Placement of offshore project infrastructure may result in the loss of benthic habitat within the project footprint. This is likely to be limited to the locations of the electrical infrastructure and drag embedment anchor locations. The area of habitat disturbed by the anchors is likely to be very small and the resulting loss of prey resource is likely to be negligible. The offshore bird surveys will provide data on the importance of these areas to foraging birds.
Diving birds (divers, grebes, cormorant / shag, seaducks, gannet, terns, and auks)	Disturbance (displacement) to birds due to noise from construction and decommissioning activities, including general vessel movements.	Construction Decommissioning	Yes	Data from construction and operational phases of OWF projects around the UK coast indicate that displacement of certain bird species can occur due to vessel movements during construction and operational works.
All seabirds (divers, grebes, cormorant / shag, seaducks, tubenoses, gannet, gulls, terns, and auks) and migratory birds (incl. waders and wildfowl)	Increased risk of mortality due to collision with WTGs.	Operational	Yes	Birds in flight are at risk of collision from WTGs. Key sensitivities include migrating birds and birds in transit between breeding sites and foraging areas. The offshore bird surveys will determine which species are present and the spatial and temporal distribution of flight activity through the wind farm area.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
All seabirds (divers, grebes, cormorant / shag, seaducks, tubenoses, gannet, gulls, terns, and auks) and migratory birds (incl. waders and wildfowl)	Barrier effect of WTGs to regular movements of birds to and from breeding colonies or on migration.	Operational	Yes	The introduction of WTGs may result in a barrier effect to birds. Those species that make regular movements through the wind farm area between breeding sites and foraging sites or birds on migration are most sensitive. The offshore bird surveys will determine which species are present and the spatial and temporal distribution of flight activity through the wind farm area.
All seabirds (divers, grebes, cormorant / shag, seaducks, tubenoses, gannet, gulls, terns, and auks)	Displacement of birds from foraging or loafing areas due to effective loss of habitat if birds avoid the wind farm and its surrounds due to the physical presence of project infrastructure and maintenance activities.	Operational	Yes	The presence of offshore WTGs and associated project infrastructure and maintenance activities has the potential to result in displacement of birds from the wind farm and surrounding area. The offshore bird surveys will provide information to inform which species are present in the area and the spatial and temporal distribution of species using the site.
Diving birds (divers, grebes, cormorant / shag, seaducks, gannet, terns, and auks)	Disturbance to foraging diving birds from underwater noise and vibration from operational floating WTGs.	Operational	Yes	Underwater noise and vibration from the operating WTGs may disrupt or interfere with the ability of diving birds to forage successfully. The offshore bird surveys will provide information to inform which diving species are present in the area.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Diving birds (divers, grebes, cormorant / shag, seaducks, gannet, terns, and auks)	Ghost fishing from lost fishing gear caught around mooring lines and cables could pose an entanglement risk to diving seabirds.	Operational	Yes	There is a risk that diving seabirds may become entangled with derelict fishing gear, though the likelihood of this is poorly understood. For previous FLOW projects in Scottish waters, Marine Science Scotland stated that they consider that the effects of "ghost fishing", whereby derelict fishing gear becomes entangled on the mooring lines and has the potential to then entangle diving seabirds, as very difficult to quantify at this stage.
Seabirds (cormorant / shag, gulls and terns)	Creation of roosting habitat for birds due to presence of floating platforms and associated infrastructure	Operational	Yes	The introduction of floating platforms and associated infrastructure presents the opportunity for new roosting habitat which may be utilised by foraging birds. The offshore bird surveys will provide information to inform which species are present in the area.
Seabirds (tubenoses)	Attraction of nocturnal seabirds (shearwaters and petrels) to lighting on project infrastructure	Operational	Yes	The potential for nocturnal species such as petrels and shearwaters to be negatively affected (attraction or disorientation) by lighting associated with project infrastructure is unknown and should be considered as part of the EIA process.
All coastal and terrestrial birds	Direct loss of breeding, roosting and foraging habitat due to the placement of project infrastructure	Construction Operational Decommissioning	Yes	The footprint of the onshore works may result in loss of breeding, foraging or roosting habitat. Onshore surveys will be required to determine which species and habitats are present and to inform placement and routing of infrastructure to minimise effects.

Table 6-20: Key Sensitivities and Potential Impacts for Onshore Ornithology

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact scoped In / Out
All coastal and terrestrial birds	Disturbance (noise and visual) to birds from installation and decommissioning activities	Construction Decommissioning	Yes	Construction activities for the onshore works may result in potential disturbance to breeding, foraging or roosting birds. Construction and decommissioning activities will be of limited duration and any disturbance effects will be temporary. Onshore surveys will be required to determine which species are present and to inform placement and routing of infrastructure to minimise effects.
All coastal and terrestrial birds	Displacement of birds from breeding, foraging or roosting areas due to effective loss of habitat if birds avoid the area due to the physical presence of project infrastructure and maintenance activities	Operational	Yes	The presence of the onshore substation and associated maintenance activities may result in the displacement of breeding, foraging or roosting birds within the surrounding area. Onshore surveys will be required to determine which species are present and to inform placement and routing of infrastructure to minimise effects.

6.5.6. Proposed Approach to Environmental Assessment

Key to ensuring that a robust impact assessment on ornithological receptors is carried out is making sure that robust data are available to inform the assessment. Based on current knowledge, a number of data gaps have been identified. Proposed approaches to gather these data to inform the EIA are outlined in Table 6-21.

A focus will be provided concerning the most likely significant effects which will be associated with risk of collision with the WTGs and also disturbance and displacement effects associated with the visual presence of the WTGs and, potentially, O&M vessels. The critical pressures will be informed by the proposed two-year ornithological survey, data from which will be used to develop and inform:

- Surface density plots and Models;
- Collision Risk Modelling (CRM); and
- Potential displacement Modelling.

The project-specific offshore ornithological survey programme data will be presented in an EIA characterisation technical report to focus on the individuals recorded within, and abundance estimates for, the offshore array only:

- Except for Manx shearwater, northern gannet, common guillemot, razorbill, and Atlantic puffin. Additional data from the 4 km buffer will be presented for these 5 species to permit the analysis of potentially displaced individuals;
- Raw counts will be divided by the number of images taken to give mean number of birds per image (i). Abundance estimates (N) for each survey month will then be generated by multiplying the mean number of birds per image by the total number of images required to cover the entire study area (A):

$$N = iA$$

- Dividing the monthly abundance estimates by the size of the study site or the 4 km buffer sites will then enable the calculation of density for any given species.

The project-specific offshore ornithological survey programme will also collect flight height data for each of the relevant species recorded within the proposed ornithological Study Area (area of the array plus a 4 km buffer). If the preferred data collection method of Digital Aerial Surveys (DAS) is used, this will be processed from the digital still images captured.

The Potential Collision Risk Height (PCH) will be determined (currently defined as between 22 m and 242 m), as this represents the minimum and maximum sweep of the proposed turbine blades. Collision risk Modelling can also be informed by relevant literature and Models, to supplement and further refine the data collected during surveys.

Displacement Modelling will follow the guidance note from UK SNCBs entitled '*Joint SNCB Interim Displacement Advice Note: Advice on how to present assessment information on the extent and potential consequences of seabird displacement from offshore wind farm developments.*'

By following this guidance, an estimate of percentage displacement from the disturbance zone and percentage mortality within displaced birds will be made.

Displacement can arise from the vessels involved throughout the proposed Project activities, and from the presence of WTGs in the operational phase, and lighting. The level of impact from vessels will be based on the vessel type, number, and duration at the location. Each species will be scored for its sensitivity to displacement, based on the available literature for offshore wind farms (e.g. Furness *et al.*, 2013; Furness and Wade, 2012).

The displacement Modelling will also be informed by the results of the site-specific surveys, as these will be used to assess the density of species within the proposed Project site (density surface Modelling). the survey has also been designed to allow for a statistically robust assessment of displacement (grid rather than transect surveys). In addition to displacement, disturbance at breeding sites will also be assessed. It may also be relevant to use the 'Mrsea' package from Marine Scotland, which can be used by developers to assess displacement effects.

Consideration and assessment of cumulative effects associated with collision and displacement will be made. Where practicable, the cumulative impact assessment will include data and assessments from other reasonably foreseeable plans and projects (such as the recent Plan-level HRA conducted by The Crown Estate concerning extensions to existing offshore wind farms). A list of potential plans and projects and other activities are considered within Section 8 of this scoping document.

European marine sites and their designated ornithological features will also be assessed as part of the Habitats Regulations Assessment (HRA) process. Stage 1 of the HRA process requires the identification of European sites and Ramsar sites relevant to the assessment, and whether the likely impacts of the proposed Project upon the qualifying features of the site, either alone or in-combination with other plans and projects, are likely to be significant (i.e. result in Likely Significant Effect (LSE)). Where LSE is not able to be excluded for designated sites, then an Appropriate Assessment (AA) must be undertaken (Stage 2 of the HRA process), to inform whether the proposed Project, alone or in-combination, could result in an adverse effect on the integrity of the site, in view of its conservation objectives.

The AA is undertaken by the relevant authority. Mitigation measures can be taken into consideration during the AA, but not during Stage 1. If an adverse effect on the integrity of a site is determined, then Stage 3 (Assessment of Alternatives) and Stage 4 (Assessment of Imperative Reasons of Overriding Public Interest (IROPI)) will be undertaken.

The aforementioned site-specific surveys, additional data requirements (listed below) and information presented in this EIA scoping document will be used to inform the HRA Stage 1. The survey records will be used to inform the species present in the Study Area. The connectivity of these species to potential protected sites can be determined through known mean max foraging ranges and migratory routes (as discussed briefly here, to be supplemented by additional literature reviews in the HRA), taking into account the seasonality of the species at the site. SNH (2018) guidance on how to apportion the origin of the seabirds to SPAs in the vicinity will be followed. The impacts to be assessed under the HRA will likely follow those identified in the EIA. Table 6-21 summarises the proposed additional data collection for ornithology.

Table 6-21: Proposed Additional Data Collection for Ornithology

Data requirement	Method	Purpose / Rationale
Desk-based study	Once all of the project description elements of the Project have been finalised (e.g. selection of offshore cable route, cable landfall site, onshore substation location, onshore cable route and onward grid connection) a desk-based study will be carried out to gather up-to-date data for these areas.	This will provide information on which species are present in these areas and the spatial and temporal distribution of species using the site. The findings of the desk-based study will inform the need for further surveys. These data will be used to inform the EIA.
Offshore bird surveys (Project area of interest and 4 km buffer)	A proposed Bird Survey Specification was submitted to NRW in August 2019 to seek agreement on the required works prior to surveys commencing. Following feedback from NRW, Digital Aerial Survey (DAS) will be the method of data collection to inform the EIA. It is proposed that the Project site, plus a surrounding 4 km buffer, will be surveyed monthly to gather seabird species abundance and distribution data over a 24-month period from October 2019 to September 2021. Survey data will include species, count, sex (where possible), age (where possible), flight height, flight direction, activity (in flight or on sea surface, rafting / loafing, etc.), position, and date and timestamp.	To provide project-specific baseline site characterisation data for the offshore Project area and surrounding area. This will provide information on which species are present in the area and the spatial and temporal distribution of species using the site. Flight height data will be used in collision risk Modelling. These data will be used to inform the EIA.
Onshore bird surveys	Once the onshore elements of the Project have been finalised (e.g. selection of cable landfall site, substation location, onshore cable route and onward grid connection), the need for further surveys of these areas will be informed by the findings of the desk-based study. Any survey area around the landfall / onshore areas will include a buffer of 100 m. Onshore surveys may also include crepuscular / nocturnal surveys to account for resting birds on passage (particularly in relation to waders), particularly around high tide.	To provide up-to-date project-specific data. These data will be used to inform the EIA.

Data requirement	Method	Purpose / Rationale
	Breeding bird surveys may be required for all of the locations of the onshore project infrastructure to provide up-to-date data. The need for winter bird surveys will be considered based on the locations of the project infrastructure and available data. If Angle Bay is selected as the cable landfall option, the Wetland Bird Survey counts (WeBS) will be utilised.	

6.6. Terrestrial Ecology

Table 6-22 sets out international and national habitat and species legislation that is used as a framework to identify terrestrial species and habitats of relevance to the proposed Project.

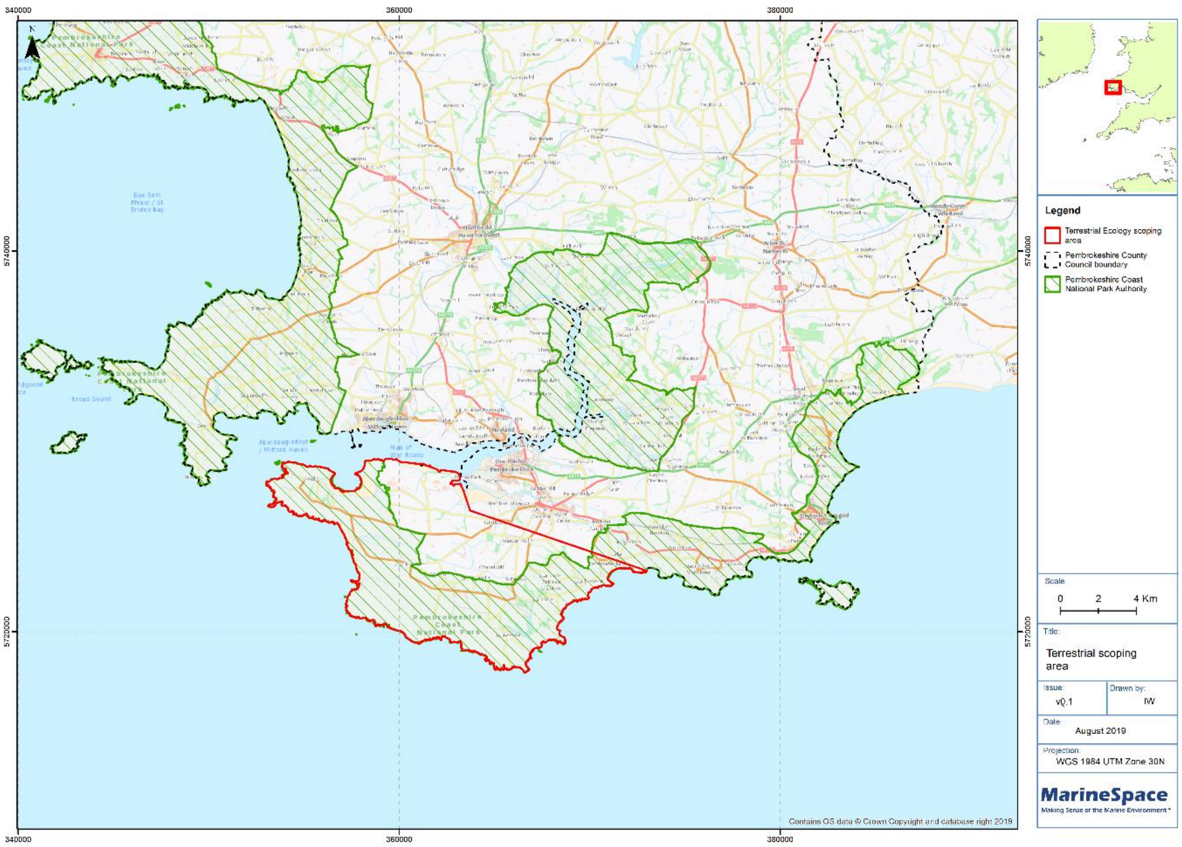
Table 6-22: Habitat and Species Legislation

Designation	Definition
International Legislation – EC Habitats Directive	
Annex I Habitat and Annex II Species	Habitats listed in Annex I and Annex II of the EC Habitats Directive are most in need of protection at a European level and for which Special Areas of Conservation (SAC) are designated. A sub-set identifies those which are considered to be 'priority' because they are particularly vulnerable.
Annex IV Species	Species listed in Annex IV of the EC Habitats Directive afforded strict protection independently of their designation under a SAC. These species are recognized as European Protected Species (EPS).
International Legislation – EC Birds Directive	
Annex I Species	Species listed in Annex I of the EC Birds Directive are most in need of protection at a European level and for which Special Protection Areas (SPA) are designated.
National Legislation – Wildlife and Countryside Act 1981 (as amended)	
Schedule 5 Species	Species listed in Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) are notified as receiving protection under Section 9 of the WCA.
Schedule 7 Habitats and Species	Habitat or species listed as being of principal importance in Wales, under Section 7 of the Environment (Wales) Act 2016.
Schedule 8 Species	Plant species listed in Schedule 8 are protected from picking, uprooting or destruction, and from sale.

6.6.1. Study Area

The terrestrial ecology study area is defined in Figure 6.10 and incorporates the majority of the Castlemartin Peninsula. It also extends east as far as Freshwater East and covers an area north of the Cleddau waterway. This area covers a number of potential landfall options for the export cable, potential onshore cable routes from landfall to the proposed substation and potential locations for the onshore substation.

Figure 6.10: Extent of the Terrestrial Ecology Study Area



6.6.2. Baseline Data

This assessment is based on a desktop study, with data sourced from publicly available information. The following sources have been reviewed in completing this assessment on terrestrial ecology:

- NRW Terrestrial Phase 1 Habitat Survey – habitat cover data derived from recording undertaken in 1979 and updated in 1991 (Lle, 2019);
- NRW Habitats Network – connectivity mapping available for broadleaved woodland, heathland, unimproved grassland, fens and bogs (NRW, 2019);
- Local Nature Reserves; Ancient Woodland Inventory; Designated Sites; Habitat inventory (data.gov.uk, 2019);
- NBN Atlas (NBN Atlas, 2019);
- Pembrokeshire Wave Demonstration Zone EIA Scoping Report (Wave Hub Ltd, 2018)
- Citations for SAC and SPA designated sites;
- Local Biodiversity Action Plan (Pembrokeshire Biodiversity Partnership, 2011); and

- Biodiversity Assessment Maps (Pembrokeshire Biodiversity Partnership, 2011).

6.6.3. Existing Environment

6.6.3.1. Habitats

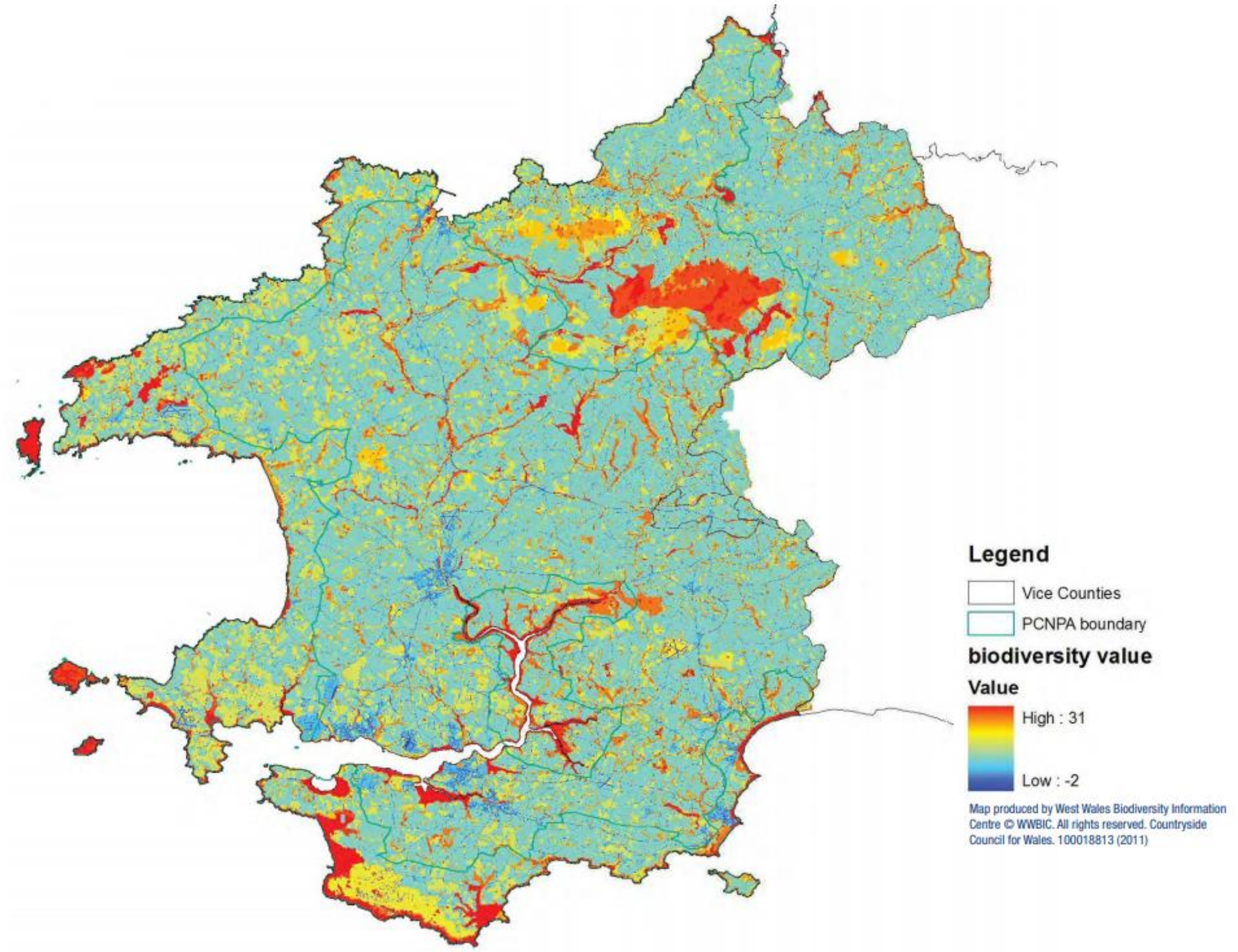
The Castlemartin peninsula is a rich and varied environment with a range of internationally, nationally and locally designated sites, considered further in Section 6.1 (Designated Sites). Of specific relevance to the proposed Project is the Pembrokeshire Bat Sites and Bosherston Lakes SAC, Limestone Coast of South West Wales SAC, Broomhill Burrows SSSI and Castlemartin Range SSSI as landfall and the onshore cable route may directly cross part of these sites or indirectly affect qualifying mobile features. The preferred onshore substation sites are within 2 km of the Pembrokeshire Marine SAC and Milford Haven Waterway SSSI and 2 km of Somerton Meadows SSSI. It is not anticipated that the site will encroach into these designated sites although indirect impacts, such as pollution or disturbance may affect the integrity of the sites. The potential impacts on designated sites will be considered further once the Project design is finalised however, in the absence of a detailed design, a precautionary approach has been applied.

The desktop review has identified the main habitats within the study area, see Table 6-23 below, however Extended Phase 1 surveys will be required once the preferred landfall, onshore cable route and onshore substation location have been confirmed to inform further protected species surveys, identify features of nature conservation interest, and inform the EIA. Figure 6.11 shows biodiversity values across Pembrokeshire and provides an overview of high value sites within the Castlemartin peninsula.

Table 6-23: Summary of Habitats within the Study Area

Habitat	Qualifying Feature	Protection Status	Importance
Sand dunes; **Vegetated sea cliffs and slopes (maritime and dry heath);** **Calcareous grassland;** **Ponds and lakes**	Yes	Annex I Habitat Section 7 Habitat	International
Neutral unimproved grassland; **Semi-natural broadleaved woodland;** **Wetlands;** **Improved grassland and cultivated land (field margins);** **Streams and rivers;** **Roadside verges**	Yes	Section 7 Habitat	National, regional
Industrial / built up	No	None	Negligible

Figure 6.11 Biodiversity Assessment Map (Pembrokeshire Biodiversity Partnership, 2011)



6.6.3.2. Species

The range of terrestrial habitats listed in Table 6-24 support a diverse and varied range of species, some of which are qualifying features of designated sites and are of international and national importance. Further surveys, informed by the final Project design and layout, and guided by the Extended Phase 1 survey results, will be targeted at protected species and important ecological features. These will inform the EIA and allow a thorough assessment of presence and potential impact to be undertaken. However, an overview of key species known to occur in the terrestrial study area is provided in Table 6-24 to represent likely constraints. This list is not exhaustive and is meant as a brief overview only.

Table 6-24: Summary of Species within the Terrestrial Study Area

Habitat	Protection Status	Qualifying Feature	Importance
Greater horseshoe bat *Rhinolophus ferrumequinum*; lesser horseshoe bat *Rhinolophus hipposideros*; **Otter *Lutra lutra***	Annex II and IV Species Schedule 5 Species	Yes	International
Myotis bat species *Myotis brandti, M. mystacinus, M. bechsteinii;* barbastelle bat *Barbastella barbastellus*	Annex IV Species Schedule 5 Species	No	International
Adder *Vipera berus*	Schedule 5 Species Section 7 Species	No	National
Marsh fritillary butterfly *Euphydryas aurinia*	Annex II Species	Yes	National
Shrill carder bee *Bombus sylvarum*	Section 7 Species	No	National
Petalwort *Petalophyllum ralfsii*	Annex II Species Schedule 8 Species	No	International

A notable omission from the above list is the hazel dormouse. There are no known records of dormouse on the Castlemartin peninsula and the closest record is at least 10 km beyond the study area's eastern boundary. Recent surveys, undertaken in support of large infrastructure projects in the vicinity of the terrestrial study area, have confirmed absence of dormice, following 1 years' worth of surveys in accordance with best practice. Suitable habitats for dormice are isolated across the peninsula and optimum areas lie outside the likely footprint of the proposed Project, with connectivity between these areas and likely landfall and cable routes being severed by competing land uses such as agriculture.

It should also be noted that great crested newts (GCN) are not present in Pembrokeshire and no records exist within the County. Pembrokeshire falls out with their optimum habitat range and there has been no requirement on larger infrastructure projects to complete GCN surveys.

6.6.4. Identification of Key Sensitives and Potential Impacts

Table 6-25 provides a summary of the potential effects arising from the Project on those habitat and species receptors identified above. This is to be further defined once landfall, cable route, and the substation location has been confirmed; however at this stage a precautionary approach has been applied and impacts scoped in or out on this basis. It has been assumed that the onshore cable route would be left *in situ* as and when the Project is decommissioned, to avoid any unnecessary disturbance or harm.

6.6.5. Potential Mitigation

The initial focus of mitigation on terrestrial ecological features for the proposed Project will be to design out any impact through careful siting to avoid vulnerable habitats and species. The use of construction techniques that result in the least disturbance and damage, and phasing development so as to avoid the most sensitive times of the year for species and habitats, will also be key measures. Where these initial mitigation measures are not possible, as part of the detailed design process, specific mitigation and, where necessary, enhancement will be developed and discussed with the relevant stakeholders, for example NRW or the LPA.

Notwithstanding the above, the following approach will be adopted to ensure decisions are based on the best available information, and the most appropriate mitigation is proposed:

- Detailed surveys will be programmed in, to be undertaken by qualified, experienced and, where necessary, licensed ecologists, and in accordance with published guidance where this exists, and best practice;
- The results of the survey work will inform the final design and siting, to design out adverse impacts, and consideration will be given to construction techniques and phasing. For example, if horizontal directional drilling (HDD) cannot be used under hedgebanks, methods such as the translocation of sections will be proposed to allow the retention of the seed base and a quicker regrowth; and
- Operational mitigation will also be considered, for example using intelligent technology for the lighting of the substation and potential access road; planting schemes; and monitoring.

Table 6-25: Potential Effects and Rationale for Scoping

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Habitats				
Sand dunes	Direct disturbance and loss of habitat within the dune system due to the installation / decommissioning of onshore cable route and associated working areas.	Construction	Yes	Both areas of dunes within the study area are designated features, part of the SAC and SSSI, and further information on landfall and construction method is required before understanding the significance of impact.
Vegetated sea cliffs and slopes (maritime and dry heath)	Damage, disturbance and loss of cliffs, grassland and associated species through the installation of onshore cable and disturbance from working areas.	Construction	Yes	The cliffs and maritime grassland are sensitive to disturbance, and slow to recover, so any level of disturbance may be considered significant. These habitats are features of the SAC and SSSI and further assessment is required.
Calcareous grassland	The overland installation of the onshore cable from landfall may disturb, damage or result in the loss of areas of grassland.	Construction	Yes	Large areas of grassland may be affected depending on the final route. Due to the sensitive nature of this habitat and protected status further assessment is required.
Neutral unimproved grassland	Installation of the onshore cable route may result in the direct disturbance, damage or loss of areas of grassland. Lay down areas of associated works may also cause harm.	Construction	Yes	The cable route from landfall may result in a significant effect on this SSSI feature. Due to the sensitivity of this habitat further information is required to assess impacts.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Semi-natural broadleaved woodland	Significant disturbance, damage and loss may occur as a result of the installation or decommission of the onshore cable route through an area of woodland. Damage from lay down areas or associated works may also occur.	Construction	Yes	If the route or areas disturbed by landfall coincide with areas of woodland it is likely to result in significant impacts which require further assessment once the scheme is finalised.
Ponds and lakes	No direct effect expected on ponds or lakes, although disturbance or damage to associated habitats may arise from excavations and installation of onshore cable route. Pollution incidences may also occur on connected watercourses.	Construction	Yes	Although no ponds or lakes have been identified at the potential landfall sites, onshore cable routes would seek to avoid lake or pond features. Further information is required prior to scoping out any significant impact.
Streams and rivers	Direct disturbance and damage to streams, rivers and associated habitats may arise during the installation of the onshore cable or, indirectly, from work on hydrologically connected habitats.	Construction	Yes	Watercourses and associated habitats and species are vulnerable to disturbance and damage, sometimes taking a long time to recover. Further detailed assessment is required to establish the significance of any impact.
Wetlands	No direct impacts are expected to areas of wetland, however indirect impacts such as pollution incidences may occur on connected watercourses.	Construction	Yes	No areas of wetland are expected to be directly affected, however a final assessment will be undertaken once the final route is confirmed.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Improved grassland (pasture)	Excavation of the onshore cable route is likely to directly disturb improved grassland and associated habitats such as field margins. Field margins may be severed or temporarily damaged depending on construction method.	Construction	Yes	Improved grassland is of negligible value, however associated habitats such as field margins are of intrinsic value at a local and regional level and further assessment is required.
Cultivated land	Excavation of the onshore cable route is likely to directly disturb cultivated land and associated habitats such as field margins. Field margins may be severed or temporarily damaged depending on construction method.	Construction	Yes	Cultivated land is of negligible value, however associated habitats such as field margins are of intrinsic value at a local and regional level and further assessment is required.
Roadside verges	Disturbance, severance, or temporary loss arising from the installation of the onshore cable route, will direct affect roadside verges. Damage may also be caused in accessing sites during construction.	Construction	Yes	Roadside verges are a valuable habitat and severance of the verge network may result in significant impacts if this feature is the only means of connectivity through the area. Further assessment is required once final route and construction methodology is known.
Species				
Greater and lesser horseshoe bats	It is not expected that roost sites will be directed impacted; however, should cable installation run close to bunkers or caves, indirect disturbance may occur. Direct and indirect impacts will affect foraging and commuting bats during all phases of the Project. These relate to severance of	Construction Operational Decommissioning	Yes	Both species are features of the SAC and exceptionally vulnerable to severance of connectivity and disturbance from noise and light. Detailed assessment will be required once the onshore cable route and onshore substation location have been finalised, to understand the significance of impact.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
	connectivity to habitat features such as hedgerows and woodland from the cable installation; temporary disturbance or loss of foraging habitat as a result of cable installation; and increased noise, light and vibration from construction, decommissioning and during the operation of the substation.			
Myotis bat species	As above	Construction Operational Decommissioning	Yes	Although not features of the SAC, these species are Annex IV species vulnerable to severance of connectivity and disturbance from noise and light. Detailed assessment will be required once the onshore cable route and onshore substation location have been finalised, to understand the significance of impact.
Barbastelle bat	As above	Construction Operational Decommissioning	Yes	As above
Otter	Disturbance or damage to habitats supporting resting or breeding otters may occur at landfall sites and along the cable route. There is a risk of pollution incidences on hydrologically connected features affecting foraging otters, and also an increase in noise, lighting, and vibration during construction, operation and decommission.	Construction Operational Decommissioning	Yes	Otters are an SAC feature and vulnerable to habitat fragmentation, loss of connectivity and pollution. Depending on the final landfall, onshore cable route, and onshore substation, the impacts of the Project may be significant. Further assessment will be required.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Dormouse	Disturbance to habitat, severance of connectivity and a loss of foraging habitat may occur as a result of cable route or the substation siting.	Construction Operational Decommissioning	No	There are no records of dormice in the study area and limited suitable habitats, therefore no impact is anticipated.
Adder	Adders are sensitive to habitat fragmentation and disturbance and the installation of the onshore cable route may disturb suitable habitats. Impacts may also arise at landfall sites and associated construction lay down areas.	Construction	Yes	Due to the potential cable route crossing valuable adder habitat, further assessment is required to understand the significance of the potential impact.
Great crested newt	Disturbance to habitat, severance of connectivity, and a loss of foraging habitat may occur as a result of cable route or the substation siting.	Construction Operational Decommissioning	No	There are no records of great crested newt in Pembrokeshire, and limited suitable habitats, therefore no impact is anticipated.
Marsh fritillary butterfly	Breeding habitat may be disturbed or lost during the installation of the cable route or from associated construction lay down areas.	Construction	Yes	Certain areas support marsh fritillary and until the final landfall and cable route are defined, it will not be possible to assess the significance of impact.
Shrill carder bee	Excavations and associated works from the onshore cable route may disturb and destroy habitat supporting the shrill carder bee resulting in mortality or loss of feeding areas.	Construction	Yes	Shrill carder bee are exceptionally vulnerable to habitat loss and any disturbance may be considered significant. Further assessment is required once the onshore cable route / location of the onshore substation is finalised.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Petalwort	Excavations and associated works from landfall and the onshore cable route may disturb and destroy the dune habitat resulting in a loss of plants or habitat quality.	Construction	Yes	Petalwort are vulnerable to habitat loss, and disturbance may be significant. Further assessment is required once landfall and the onshore cable route / location of the onshore substation is finalised.

6.6.6. Proposed Approach to Environmental Assessment

The formal Scoping Opinion issued by NRW will inform the approach to the environmental assessment and it is anticipated that further discussions will be held with the relevant stakeholders, NRW and the LPAs, to confirm the scope and schedule of any terrestrial ecology surveys. The continued development of the proposed Project design envelope will further inform the approach to EIA as impacts and receptors are confirmed when the precise nature and locations of the development are fixed. The approach will be iterative and NRW will be kept informed with progress via regular meetings throughout the EIA process.

The following surveys (Table 6-26) are proposed to inform the terrestrial ecology aspect of the EIA.

Table 6-26: Proposed Terrestrial Ecology Surveys to Inform the EIA

Survey Type	Proposed Spatial Extent	Proposed Timing	Objective
Extended Phase 1 survey	Survey to extend from landfall, along the preferred onshore cable route, at the proposed substation location (including areas for laydown), and for the route from the substation to Pembroke Power Station.	Spring / summer 2020	To provide a record of habitats and ecological features across the onshore Project area and determine the need for any protected species surveys or more detailed habitat surveys.
National Vegetation Classification (NVC) botanical survey	As above	Spring / summer 2020	To focus on types, location, and quality of plant species that may be affected by the proposed development.
Bat surveys	Further discussions will be held with NRW and the LPAs to agree the scope of the surveys.	It is anticipated these may commence spring 2020.	Surveys will be required to identify foraging areas, important connectivity, and potentially new roosts sites to enable the final design to avoid these areas or propose construction methods that will reduce harm e.g. HDD under hedgerows to avoid severance of connectivity.
Otter surveys	The surveys will focus on landfall, where the onshore cable route crosses watercourses or associated habitats, and where biological data (for example otter road causalities) record otter presence within the boundary of the proposed development.	It is anticipated these may commence spring 2020.	Surveys will be required to identify foraging areas, breeding and resting sites, to enable the final design to avoid these areas or propose construction methods that will reduce harm.

Survey Type	Proposed Spatial Extent	Proposed Timing	Objective
Badger surveys	The extended Phase 1 survey will identify areas of badger activity, and badger surveys will focus on these	Autumn/ winter 2020	To identify the location of active badger setts and areas of activity including foraging. This will inform site layout or establish the requirement for a licence.
Reptiles surveys	The extended Phase 1 survey will identify areas of suitable reptile habitat and presence. Discussions will be held with NRW and the LPA on implementing a Reptile Mitigation Strategy for medium and low risk areas.	Spring 2021	To identify areas of reptile suitability and inform the development of a Reptile Mitigation Strategy.
Amphibian and invertebrate surveys	Depending on findings of the extended Phase 1 survey, amphibian and invertebrates surveys may be required.	2020	To inform the Project design.
Dormouse surveys	Due to the evidence provided above, it is not the intention of SBE to undertake dormouse surveys, being unreasonable and disproportionate to the likely impact, unless evidence of presence has recently been established.	N/A	N/A
Great crested newt surveys	Due to the evidence provided above it is not the intention of SBE to undertake great crested newt surveys, being unreasonable and disproportionate to the likely impact, unless evidence of presence has recently been established.	N/A	N/A

The results of these surveys, along with additional desk-based data collation and feedback from consultation with key stakeholders, will be used to inform the detailed impact assessments for each species and habitat present in the Study Area. The impact assessments for terrestrial ecology will be conducted in accordance with the Guidelines for Ecological Impact Assessment in the UK and Ireland; Terrestrial, Freshwater and Coastal (CIEEM, 2018). Appropriate mitigation and conservation proposals (including any long-term management that may be required), as well as monitoring proposals, will be set out within the final ES.

Sufficient information will be presented to allow the Competent Authority to undertake an appropriate assessment under Regulation 61 of the Conservation of Habitats and Species Regulations 2017. Consideration will also be given on how the proposal will meet the three tests as set out in Regulation 57 of the Conservation of Habitats and Species Regulations 2017. The EIA will also identify where further licences may be required (e.g. European Protected Species Licences).

6.7. References

Baines ME, and Evans PGH, 2012. Atlas of the Marine Mammals of Wales. Countryside Council for Wales Monitoring Report No. 68. 2nd edition. 139pp.

Bladwell S, Noble SG, Taylor R, Cryer J, Galliford H, Hayhow DB, Kirby W, Smith D, Vanstone A, and Wotton SR, 2018. *The state of birds in Wales 2018.* The RSPB, BTO, NRW and WOS. RSPB Cymru, Cardiff.

BirdLife International, 2019. Seabird Tracking Database. Available online at http://seabirdtracking.org/ [Accessed August 2019].

Boelens RGV, Walsh AR, Parsons AP, and Maloney DM, 1999. *Ireland's marine and coastal areas and adjacent seas: an environmental review.* Quality Status Report on behalf of the Departments of Environment and Local Government and Marine & Natural Resources. Marine Institute. Dublin.

BTO (British Ornithological Trust), 2019. Bird Atlas 2007-2011 Mapstore. Available online at https://app.bto.org/mapstore/StoreServlet [Accessed August 2019].

Büche B, and Stubbings E, 2018. *Grey Seal Breeding Census, Skomer Island 2017*. NRW Evidence Report number 195. The Wildlife Trust of South and West Wales.

Cardigan Bay SAC, 2019. Cardigan Bay SAC. Available online at: http://www.cardiganbaysac.org.uk/ [Accessed August 2019].

Coull, K.A., Johnstone, R., and Rogers, S.I., 1998. Fisheries Sensitivity Maps in British Waters. Published and distributed by UKOOA Ltd.

CIEEM (Chartered Institute of Ecology and Environmental Management), 2018. Chartered Institute of Ecology and Environmental Management: Guidelines for ecological impact assessment in the UK and Ireland: Terrestrial, freshwater, coastal and marine.

Data.gov.uk, 2019. Available online at: https://data.gov.uk/data/map-preview?e=-2.60886500&n=53.51306700&s=51.24082900&url=http%3A%2F%2Flle.gov.wales%2Fservices%2Fwms%2Fnrw%3F&w=-5.77774100 [accessed August 2019]

Donavon J, and Rees G, 1994. Birds of Pembrokeshire: Status and Atlas of Pembrokeshire Birds. ISBN 9780902794023.

Eaton M, Aebischer N, Brown A, Hearn R, Lock L, Musgrove A, Noble DG, Stroud DA, and Gregory R, 2015. *Birds of Conservation Concern 4: the population status of birds in the UK, Channel Islands and Isle of Man*. British Birds, 108, 708-746. Available online at: https://www.rspb.org.uk/globalassets/downloads/documents/conservation-projects/bocc4-report.pdf [Accessed August 2019].

Ellis, J.R., Milligan, S.P., Readdy, L., Tayler, N., and Brown, M.J., 2012. Spawning and nursery grounds of selected fish species in UK waters. Science Series Technical Report no. 147. Published by the Centre for Environment, Fisheries and Aquaculture Science (CEFAS).

Furness RW, and Wade EA, 2012. *Vulnerability of Scottish seabirds to offsore wind turbines - Report to Marine Scotland*. Glasgow: MacArthur Green Ltd.

Furness RW, Wade HM, and Masden EA, 2013. Assessing vulnerability of seabird populations to offshore wind farms. *Journal of Environmental Management* 119C pp 56-66. DOI: 10.1016/j.jenvman.2013.01.025.

Fuzzi S, Baltensperger U, Carslaw K, Decesari S, Denier van der Gon H, Facchini MC, Fowler D, Koren I, Langford B, Lohmann U,Nemitz E, Pandis S, Riipinen I, Rudich Y, Schaap M, Slowik JG, Spracklen DV, Vignati E, Wild M, Williams M, and Gilardoni S, 2015. Particulate matter, air quality and climate: lessons learned and future needs.

Hammond PS, Lacey C, Gilles A, Viquerat S, Börjesson P, Herr H, Macleod K, Ridoux V, Santos MR, Scheidat M, Teilmann J, Vingada J, and Øien N, 2017. *Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys*. Wageningen Marine Research.

Intertek, 2016. Greenlink Interconnector: Environmental Scoping Report – UK Marine Route. Reference No. P1975_R3994_Rev1

Intertek, 2019. *Planning and Consultation Marine License Application Wales.* Available online at: https://www.greenlink.ie/marine-licence-application-wales [Accessed August 2019].

JNCC (Joint Nature Conservation Committee), 2001. *SPA Description: Castlemartin Coast.* Available online at: http://archive.jncc.gov.uk/default.aspx?page=2062 [Accessed August 2019].

JNCC, 2017. *Skomer, Skokholm and the Seas off Pembrokeshire / Sgoer, sgogwm a Moroedd Penfro SPA.* Available online at: http://archive.jncc.gov.uk/default.aspx?page=7497 [Accessed August 2017].

JNCC (Joint Nature Conservation Committee), 2019a. *West Wales Marine / Gorllewin Cymru Forol MPA.* Available online at: http://archive.jncc.gov.uk/default.aspx?page=7343 [Accessed August 2019].

JNCC (Joint Nature Conservation Committee), 2019b. Bristol Channel Approaches / Dynesfeydd Môr Hafren MPA. Available online at: http://archive.jncc.gov.uk/default.aspx?page=7241 [Accessed August 2019].

JNCC (Joint Nature Conservation Committee), 2019c. Cardigan Bay/ Bae Ceredigion. Available online at: https://sac.jncc.gov.uk/site/UK0012712 [Accessed August 2019].

JNCC (Joint Nature Conservation Committee), 2019d. Seabird Monitoring Programme. Available online at: http://archive.jncc.gov.uk/smp/ [Accessed August 2019].

JNCC (Joint Nature Conservation Committee), 2019e. *Natura 200 – Standard Data Form: Anglesey Terns / Morwenoliaid Ynys Mon.* Available online at: http://archive.jncc.gov.uk/pdf/SPA/UK9013061.pdf [Accessed August 2019].

Kober K, Webb A, Win I, Lewis M, O'Brien S, Wilson LJ, and Reid JB, 2010. *An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs.* JNCC report, 431.

MarLIN (The Marine Life Information Network), 2019. *Species list.* Available online at: https://www.marlin.ac.uk/species [Accessed August 2019].

MarineSpace, 2019. Outputs from GIS-based spawning potential tool, developed on behalf of the MMO.

National Biodiversity Network (NBN) Atlas, 2019. Data records. Available online at: https://records.nbnatlas.org/explore/your-area#51.648735084919466|-4.993335897460952|12|ALL_SPECIES [accessed August 2019]

NMFS (National Marine Fisheries Service), 2018. *2018 Revisions to: Technical guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts.* U.S. Dept. of Commerce, NOAA. NOAA Technical Memorandum, NMFS-OPR-59.

NPL (National Physics Laboratory), 2014. *Good Practice Guide No. 133: Underwater Noise Measurement.* Crown Copyright 2014, ISSN: 1368-6550.

NRW (Natural Resources Wales), 2002a. *Site of Special Scientific Interest Citation: Pembrokeshire, Dale and South Marloes Coast.* Available online at: https://naturalresources.wales/media/646793/SSSI_0585_Citation_EN00157af.pdf [Accessed August 2019].

NRW (Natural Resources Wales), 2002b. *Site of Special Scientific Interest Citation: Pembrokeshire, Milford Haven Waterway.* Available online at: https://naturalresources.wales/media/639589/SSSI_0282_Citation_EN0010ded.pdf [Accessed August 2019].

NRW (Natural Resources Wales), 2003. *Site of Special Scientific Interest Citation: Pembrokeshire, Arfordir Penrhyn Angle / Angle Peninsula Coast.* Available online at: https://naturalresources.wales/media/655205/SSSI_0923_Citation_EN0017f83.pdf [Accessed August 2019].

Paxton CGM, Scott-Hayward L, Mackenzie M, Rexstad E, and Thomas L, 2016. *Revised Phase II Data Analysis of Joint Cetacean Protocol Data Resources with Advisory Note.* JNCC Report 517, ISSN 0963-8091.

Pembrokeshire Avifauna, 2019. *Species List.* Available online at: http://pembsbirds.squarespace.com/avifauna/ [Accessed August 2019].

Pembrokeshire Biodiversity Partnership, 2011. State of Wildlife in Pembrokeshire. Available at: https://www.pembrokeshire.gov.uk/objview.asp?object_id=3595&language= [accessed September 2019]

Pembrokeshire Bird Group, 2019. *The Pembrokeshire Bird List.* Available online at: https://drive.google.com/file/d/15HtTQ9802iQRL469MhCiRalQbxIYniOm/view [Accessed August 2019].

Pembrokeshire Marine SAC, 2006. *Pembrokeshire Marine Special Area of Conservation Draft Management Scheme.* Produced by Sue Burton on behalf of the Relevant Authorities Group. 157 pp.

Pembrokeshire Marine SAC, 2019. *Pembrokeshire Marine Special Area of Conservation.* Available online at http://www.pembrokeshiremarinesac.org.uk/ [Accessed August 2019].

Piniak WED, Eckert SA, Harms CA, and Stringer EM, 2012. *Underwater hearing sensitivity of the leatherback sea turtle (Dermochelys coriacea): Assessing the potential effect of anthropogenic noise.* Report published by the U.S. Department of the Interior, Bureau of Ocean Energy Management. 35pp.

Reid JB, Evans PGH, and Northridge SP, 2003. Atlas of Cetacean distribution in north-west European waters. Joint Nature Conservation Committee.

Sparling C, and Smith K, 2019. Defining project envelopes for marine energy projects: Review and Tidal energy test facility and marine mammals case study. Available online at: https://cdn.naturalresources.wales/media/688271/eng-nrw-report-274-review-and-tidal-energy-test-facility-and-marine-mammals-case-study.pdf [Accessed August 2019]

Southall BL, Finneran JJ, Reichmuth C, Nachtigall PE, Ketten DR, Bowles AE, Ellison WT, Nowacek DP, and Tyack PL, 2019. Marine mammal noise exposure criteria: updated scientific recommendations for residual hearing effects. *Aquatic Mammals* 45(2): pp.125-232.

Thaxter CB, Ross-Smith VH, Clark NA, Barber L, Clewley G, Conway GL, Masden EA, Bouten W, and Burton NHK, 2015. *Measuring the interaction between lesser black-backed gulls and herring gulls from the Skokholm and Skomer SPA and Morecambe Bay SPA and Offshore Wind Farm Development Sites: First year report.* Report of work by the BTO in association with the University of Amsterdam and collaboration with the Environmental Research Institute on behalf of the Department of Energy and Climate Change.

Thaxter CB, Ross-Smith VH, and Cook ASCP, 2015. How high do birds fly? A review of current datasets and an appraisal of current methodologies for collecting flight height data: Literature review. BTO Research Report No. 666.

Thaxter CB, Lascelles B, Sugar K, Cook ASCP, Roos S, Bolton M, Langston RHW, and Burton NHK, 2012. *Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas*. Biological Conservation 156, pp 53-61. (DOI): 10.1016/j.biocon.2011.12.009.

Walmsley SA, and Pawson MG, 2007. *The coastal fisheries of England and Wales, Part V: a review of their status 2005-06*. Science Series Technical Report, Cefas Lowestoft, 140, 83pp

Wave Hub Limited, 2018. Pembrokeshire Demonstration Zone Feasibility Study Environmental Scoping Report. Project No. 122674. Prepared for Wave Hub limited.

WeBS (The Wetland Bird Survey), 2019. *Waterbirds in the UK 2017/18.* A report produced by the BTO, RSPB, JNCC, and WWT.

The Wildlife Trust South and West Wales, 2017. *Pembrokeshire Bird Report 2017.* 58pp. Available online at https://drive.google.com/file/d/1wf7Y5uMLElG1HM159KegMZtdS3Ot2HEA/view [Accessed August 2019].

Wilson MW, Balmer DE, Jones K, King VA, Raw D, Rollie CJ, Rooney E, Ruddock M, Smith GD, Stevenson A, Sirling-Aid PK, Wernham CV, Weston JM, and Noble DG, 2018. *The breeding population of peregrine falcon Falco peregrinus in the United Kingdom, Isle of Man and Channel Islands in 2014*. Bird Study 65(1), 1-19.

Wotton SR, Bladwell S, Mattingley W, Morris NG, Raw D, Ruddock M, Stevension A, and Eaton MA, 2018. *Status of the Hen Harrier* Circus cyaneus *in the UK and Isle of Man in 2016*. Bird Study 65(2), 145-160.

7. Human Environment

7.1. Commercial Fisheries

7.1.1. Study Area

The Study Area, including the proposed offshore array, export cable routes and landfall, lies within the International Council for the Exploration of the Sea (ICES) Statistical Rectangles 32E4 and 31E4. Whilst information presented in this section relates to the wider Irish Sea region, and official fisheries data from these ICES rectangles will be used to inform the environmental assessment on commercial fishing receptors, such data may under-represent the smaller, inshore fishing fleet (<10 m). Therefore, it is proposed that other available, smaller-scale studies will also be used, alongside consultation with local fishing organisations and fleets of south Wales, the Severn, north Devon and Cornwall, as well as non-UK fleets that fish this region.

7.1.2. Baseline Data

This desk-based summary has identified the following available datasets which are of relevance to the Study Area and will be analysed further as part of any environmental assessment:

- Marine Management Organisation (MMO) UK fleet landings by selected ICES Rectangle;
- MMO UK and foreign fleet landings into the UK by port;
- Welsh Government, Marine Planning Portal, Natural Resources Wales (NRW) – Sea Fish Atlas;
- European Commission, Scientific, Technical and Economic Committee for Fisheries (STECF) non-UK landings by ICES Rectangles;
- MMO Geographical Information System (GIS) dataset for UK and Non-UK >15 m vessel fishing activity;
- MMO Vessel Monitoring System (VMS) fishing activity data for UK vessels >15 m;
- MMO Marine Information System;
- Natural England's (NE) Finding Sanctuary Project;
- Activity surveys undertaken by Devon and Severn Inshore Fisheries and Conservation Authority (D&SIFCA); and
- Commercial fisheries activity report from the Greenlink Interconnector Environmental Report (Greenlink, 2019).

To support these existing datasets and ensure that the inshore (<10 m) fishing fleet is represented, the following regional fisheries organisations have also been identified and have been contacted to provide comment at this stage of the Project. Specifically, the organisations below have been issued a chart showing the broad Area of Search for the proposed offshore array (and export cable route) with a request to provide information on key areas of fishing interest. Outputs from this initial consultation have been used to inform final site selection, and also to develop further understanding of existing fishing activity in the Study Area.

- West Wales Shell Fisherman's Association (WWSFA);
- Welsh Fishermen's Association (WFA);

- South and West Wales Fishing Communities (SWWFC);
- Devon and Severn IFCA (D&SIFCA); and
- North Devon Fishermen's Association (NDFA).

7.1.3. Existing Baseline

Commercial fishing is widely distributed in the Irish and Celtic Sea, and from data and information detailed above it has been identified that the offshore part of the Study Area (array) is recognised by both UK and non-UK (Irish, French, Belgian) commercial fishing vessels. The inshore part of the Study Area (export cable and landfall), off the coast of Pembrokeshire, is known to be important for potting by the local, inshore fishing fleet.

The closest fishing port to the Study Area is the Port of Milford Haven. In 2017, the number of fishing vessels registered to the Port of Milford Haven was 450, 93% of which were <10 m. The number of fishermen based in the port was 321. In 2017, 500 tonnes of demersal fish and 1,000 tonnes of shellfish were landed into Milford Haven, representing values of £1.5 million and £2 million respectively.

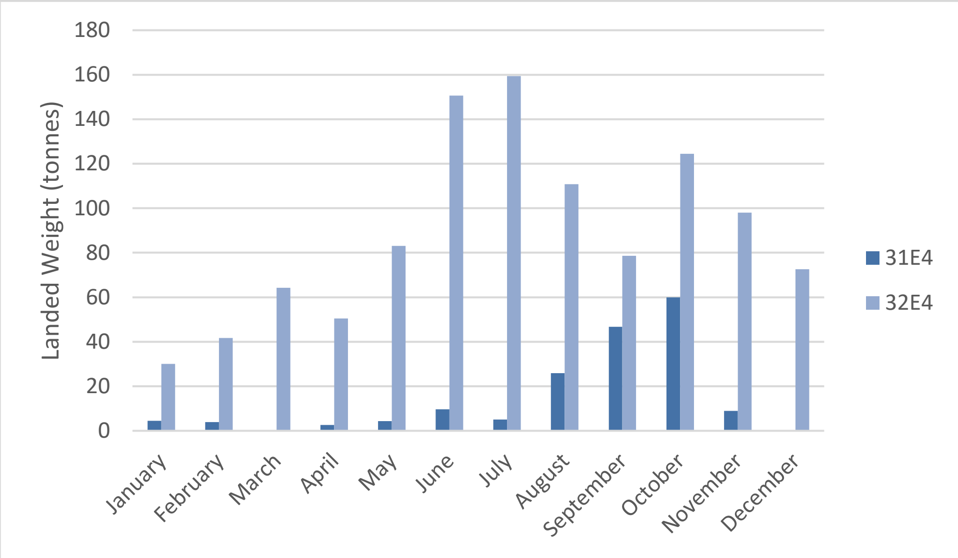
Fisheries within the Celtic Sea region are managed through the EU Common Fisheries Policy (CFP) with fisheries of some stocks managed by the North East Atlantic Fisheries Commission (NEAFC) and by coastal state agreements.

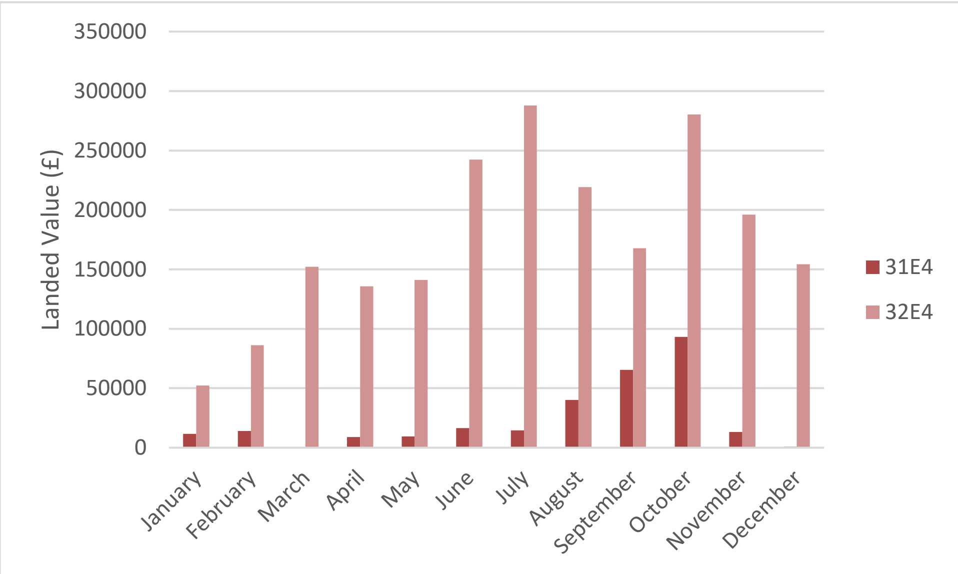
7.1.3.1. Value of Landings and Effort

In terms of landed weight and value, demersal and shellfish species are most prevalent within and around the Study Area. Based on MMO fisheries data for 2016, the weight and value of landings by all vessels from ICES rectangle 32E4 (export cables and landfall) was over 1,000 tonnes of fish (all species) with a value of over £2 million. Of this value, £1.3 million was landed by <10 m vessels. Over £1.9 million of the total value was made up by shellfish landings (Figure 7.1). These data highlight the importance of the Welsh inshore static gear (potting) fishery in the Study Area.

Landings from ICES rectangle 31E4 (offshore array area) were dominated by demersal species, caught using both mobile (beam trawls, demersal trawls / seine) and static methods (pots and traps and drift / fixed nets). All landings were from the >10 m fishing fleet. Based on MMO fisheries data for 2016, the weight and value of landings by all vessels from ICES rectangle 31E4 was just over 170 tonnes of fish (all species) with a value of over £280,000. Significantly higher landings were recorded for ICES rectangle 32E4, suggesting that the proposed array site lies in an area of relatively lower commercial fishing activity, compared with the inshore region.

Figure 7.1: Total Landed Weight (Tonnes) and Value (£) in 2016 from ICES Rectangles 31E4 and 32E4 by All Vessels (Source: MMO, 2017)



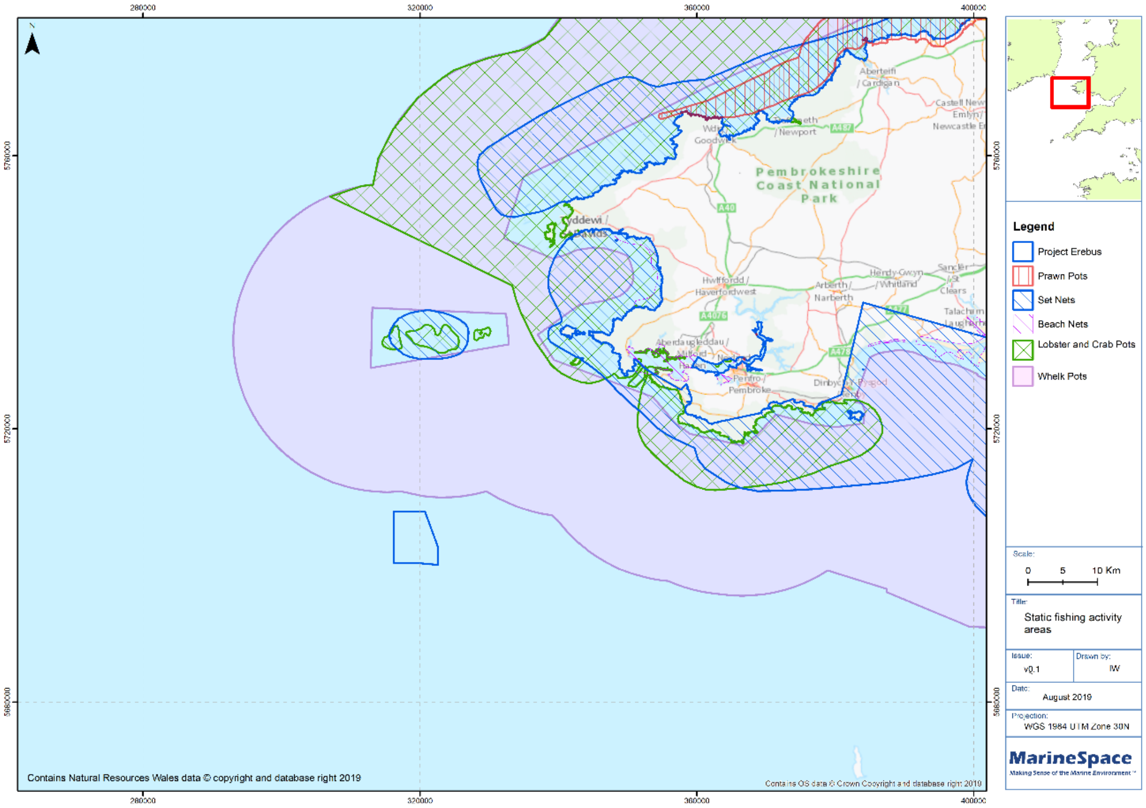


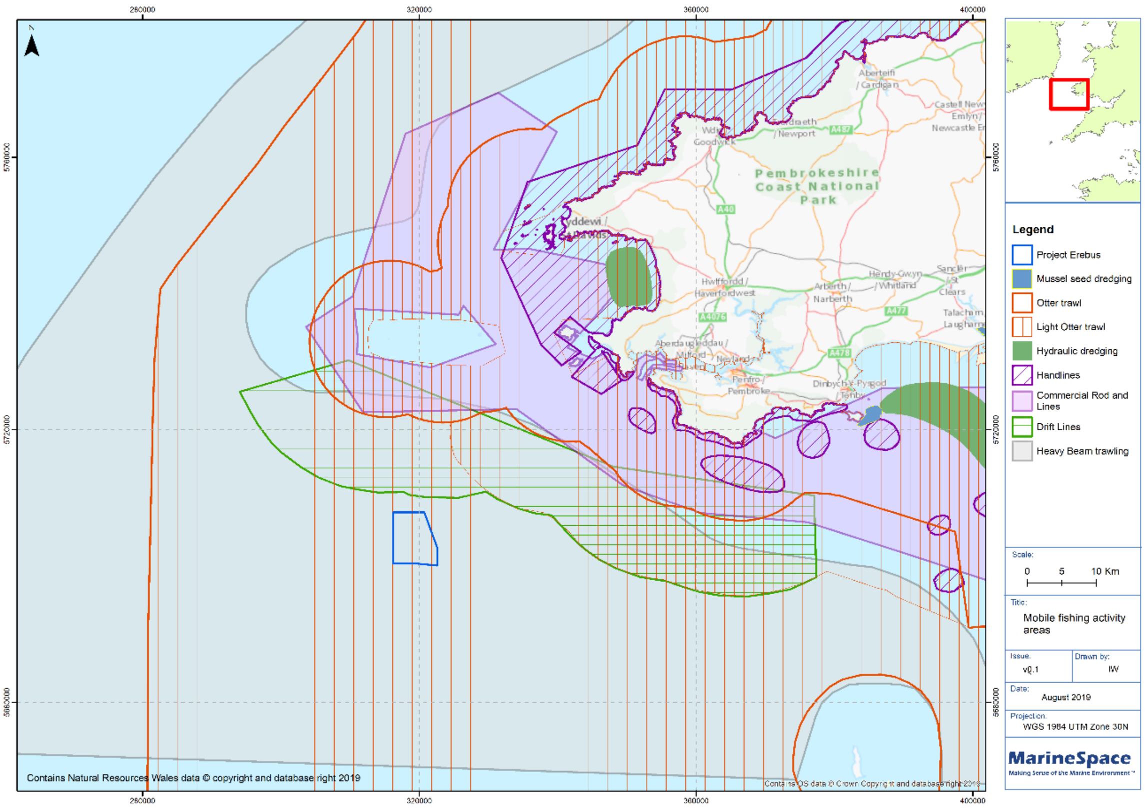
7.1.3.2. Fishing Vessels, Fishing Grounds and Target Species

Shellfish Species

The shellfish industry in south Wales is now considered to be of the greatest local economic importance in terms of commercial fishing activity. There are valuable potting grounds for crab, lobster and whelk around the Pembrokeshire coast (Figure 7.2). With the exception of larger vessels working out of Milford Haven, most fishing off the southwest coast of Wales occurs close inshore, with very few boats working outside 6 miles. Since 1995, a significant whelk fishery has developed in Carmarthen Bay and offshore of the Gower, Fishguard and Milford Haven.

Figure 7.2: Indicative Static (Top) and Mobile (Bottom) Fishing Regions around the Pembrokeshire Coast (Source: NRW, 2002a)





Warmer months see a peak in crab and lobster potting activities, while the whelk fishery is dominant through the winter with 1,000–2,000 pots being set per vessel. Pots are also set for prawns in parts of the north Pembrokeshire coast and there is some limited potting for green crab in Milford Haven. Several local and (mainly) Scottish visiting boats dredge for scallops in Cardigan Bay (further north than the Study Area), particularly in winter, landing into Fishguard and Milford Haven, and trawlers target native oysters in winter in Swansea Bay and Milford Haven.

Demersal Species

Key demersal target species landed from within the Study Area include cod, haddock, ling, monkfish, plaice, ray, skate and sole. Flatfish and rays (principally thornback) are taken in fixed nets and otter and beam trawls from spring through to the end of the year. Gill nets and otter trawls target cod and whiting during the colder months. Large-meshed tangle nets are used for rays and large flatfish such as turbot.

The trawler fleet concentrates its efforts in the Bristol Channel and Cardigan Bay and lands a mixed catch throughout the year. These trawlers (mostly <10 m) fish mainly inshore, and the sole fishery attracts visiting beam trawlers from the south coast of Devon, Cornwall and Belgium.

Pelagic Species

Pelagic fish landings from this area are mainly of herring and mackerel, and of relatively lower economic importance compared with demersal and shellfish species.

Non-UK Vessels

International vessels fish waters in and around the Study Area, most commonly from Ireland, France and Belgium. A summary of STECF data showed that the key species landed by the Irish, French and Belgian fleets in the vicinity of the Study Area were European sprat, great Atlantic scallop, edible crab, ray / skate, haddock, anglerfish, whiting, sole, megrim and thornback and blonde ray.

7.1.3.3. Intertidal Commercial Fishing Activity

The intertidal regions of the Pembrokeshire coast are recognised for harvesting cockles, mussels, Pacific and native oysters, clams and razor shell. There could, potentially, be a conflict with existing intertidal fishing activities and intertidal regions of the proposed export cable and landfall locations.

7.1.4. Identification of Key Sensitivities and Potential Impacts

Table 7-1: Key Sensitivities and Potential Impacts to the Commercial Fisheries Receptors in the Study Area.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Commercial Fisheries	Loss / damage to fishing grounds (long term) due to presence of floating turbine anchors / cable protection (and associated reduction in revenue).	Construction Operational Decommissioning	Yes	Data have shown the offshore (array) part of the Study Area to be of lower importance in terms of landed weight and value than inshore regions, however, this area still represents a commonly used fishing ground by both UK and non-UK vessels.
Commercial Fisheries	Loss / damage to fishing grounds (long term) due to presence of cable (export) protection.	Construction Operational Decommissioning	Yes	Data have shown the inshore part of the Study Area to be an important region for commercial fishing. The final offshore cable route selected may pass close to / through inshore reef features which are known to represent important habitat for bass – a key target species for commercial and recreational fishermen.
Commercial Fisheries	Restricted access to / displacement from fishing grounds (long term).	Construction Operational Decommissioning	Yes	Vessels may be restricted from accessing usual fishing grounds due to statutory exclusions, safety zones or avoidance of the area by fishing vessels due to safety reasons.
Commercial Fisheries	Reduction in water depth.	Construction Operational Decommissioning	Yes	Fishing activity may be displaced, or loss of grounds may occur in shallow waters due to safety, if a reduction in water depth results from installation of project infrastructure.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Commercial Fisheries	Contamination of fish stocks.	Construction Operational Decommissioning	Yes	Installation methods may result in sediment plumes and increased suspended sediment which may in turn impact upon fish stocks and water quality.
Commercial Fisheries	Snagging resulting from seabed obstruction.	Construction Operational Decommissioning	Yes	Fishing activity may be displaced, or loss of grounds may occur due to safety, if a seabed obstruction exists.
Intertidal Commercial Fisheries	Restricted access to / displacement from fishing grounds (temporary).	Construction Operational Decommissioning	Yes	Data has shown the inshore Study Area to be an important region for commercial fishing.

7.1.5. Potential Mitigation

Potential impacts, detailed in Table 7-1, that may arise from the development of the proposed Project could be mitigated via the following measures:

- Good communication and regular engagement with the commercial fishing community through a dedicated project Fisheries Liaison Officer (FLO);
- Use of Safety Zones around installation vessels during construction and major maintenance works;
- Ensuring all subsea cables are buried to suitable depths to avoid interaction with fishing gear. Where burial is not possible, due to ground conditions, ensuring appropriate cable protection is deployed and clearly marked on relevant charts;
- Development of agreed transit routes for construction vessels to avoid damage to static gear; and
- Clearly marking the development site and project infrastructure.

Any specific mitigation measures would be discussed and proposed during the EIA phase and would be agreed with the regulatory authority and relevant fishing representatives.

7.1.6. Proposed Approach to Environmental Assessment

The approach to assessing the impacts of the proposed Project on commercial fishing receptors will include further data collection and engagement as outlined below:

- Detailed desk-based fisheries assessment to identify key fishing grounds, seasons, and techniques – using ICES data supplemented with other studies, data, and reports from the region, as detailed in Section 7.1.2; and
- Consultation – meetings with fisheries organisations, representatives and stakeholders including;
    - WWSFA;
    - WFA;
    - SWWFC;
    - D&SIFCA;
    - NDFA;
    - National Federation of Fisherman's Organisations (NFFO);
    - Welsh Marine Fisheries Advisory Group (WMFAG);
    - Welsh Government Fisheries Officer, Milford Haven;
    - Cornish Fish Producers Association (CFPO); and
    - South West Fish Producers Organisation (SWFPO).

Both formal data and reports, as well as local knowledge, will be used to understand commercial fishing activity with the Study Area and to fully assess both direct and indirect impacts during the installation, operation and decommissioning phases. Due to differing characteristics, such as sensitivity to types of impacts, recoverability etc., specific receptor groups will be defined and potential impacts on these groups will be assessed. As way of example, one receptor group may be <10 m inshore potting vessels, whilst another may be >10 m non-UK vessels fishing outside 6 nm. This approach will ensure all key potential impacts are properly assessed.

Where appropriate, mitigation measures will be proposed and residual impacts then presented.

Other than the detailed consultation outlined above, no specific surveys of commercial fisheries activity are proposed during the EIA stage.

7.2. Shipping and Navigation

7.2.1. Study Area

The Study Area encompasses the marine and coastal activities within a search area of approximately 20 km radius around the proposed offshore array site and also within 5 km either side of the possible export cable routes and landfall locations.

7.2.2. Baseline Data

This chapter presents an overview of the baseline environment, based on a high-level review of available data sources. A detailed baseline assessment would be proposed as part of the Navigation Risk Assessment (NRA) and ES.

Navigational Features

The navigational features baseline has been established following a review of:

- Admiralty Charts of various dates;
- RYA UK Coastal Atlas of Recreational Boating 2016;
- MMO datasets on shipping routes and port locations (ABPmer UK 2015 National Dataset for Marine Vessel Traffic); and
- Marine Character Areas – MCA 23 – South Pembrokeshire Open Waters, NRW 2015.

Marine Traffic

Site-specific historic AIS data were accessed by MarineSpace for the period January 2015-December 2015. These data cover a full year of vessel movements through the proposed Study Area. However, it should be noted that there are limitations with AIS data as many small leisure and fishing vessels are not equipped with AIS transmitters or, if they are, the transmitters may not be switched on if power saving is a concern.

Furthermore, while AIS is mandatory on most larger vessels, it is possible to switch transmitters off and it is not unknown for certain marine traffic to do so (for example military vessels not wishing to reveal their locations).

There are also certain vessels which are categorised as ‘other’ on the AIS platform, these may include smaller vessels including pleasure craft, yachts and fishing vessels, but also include vessels of other categories also listed.

Detailed marine traffic baseline data will be established via marine traffic surveys undertaken as part of the NRA process – see Table 7-4.

Initial pre-application consultation has also been carried out with the Maritime Coastguard Agency (telecon; 24 July 2019) to introduce the project and to discuss potential impacts and the proposed approach to assessment.

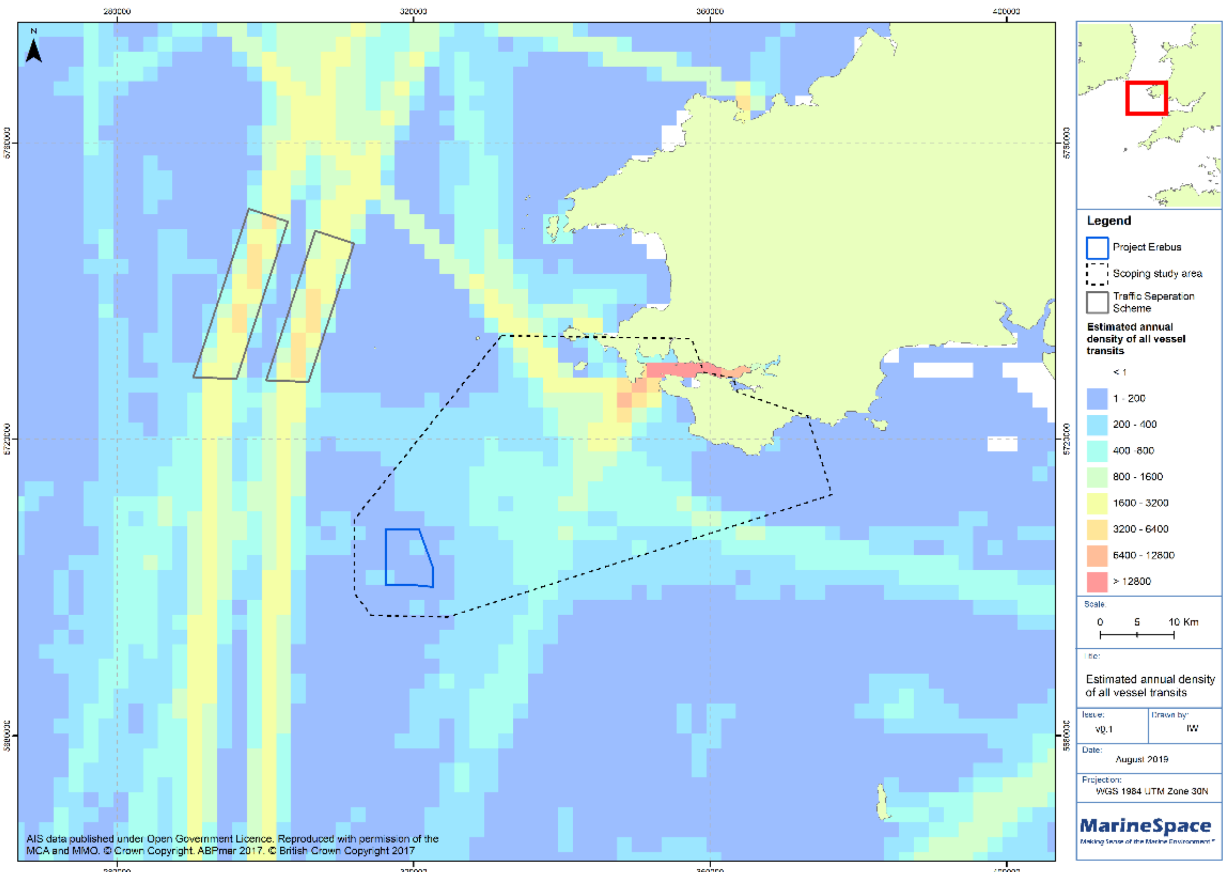
7.2.3. Baseline Environment

Navigational Features

The key navigational features in the vicinity of the proposed Study Area are established shipping channels as shown in Figure 7.3 but it should be noted that the proposed Project area has been selected to avoid major shipping lanes in the region. The principal navigation route for vessels transiting north to south in this region is located to the west of the proposed array site boundary, with the “Off Smalls” north south Traffic Separation System (TSS), located approximately 15 nm north northeast of the proposed Project area. For vessels transiting east to west, vessels pass predominantly to the north.

Closer inshore, the principal navigation route for vessels transiting east to west (located to the northeast of the proposed Project Area) contains the convergence of the shipping lanes heading for Milford Haven and also includes vessel transiting to and from the Celtic Sea and in and out of Milford Haven and the English Channel. All the aforementioned navigation routes are used by large cargo vessels, tankers, and ferries; but also smaller craft such as fishing vessels and recreational boats. The exact marine export cable corridor is not yet known, however, it will most likely pass across one or both of these navigation routes.

Figure 7.3: Estimated Annual Density of all Vessel Transits 2015



For some of the proposed landfall options (e.g. Freshwater West, West Angle Bay and Angle Bay), the marine export cable route will enter, or be in close vicinity of the vessel approach to Milford Haven. Milford Haven is the fifth largest port in the UK. The Milford Haven Port Authority (MHPA) provides port, harbour and associated services, as well as servicing the navigational needs of the three major oil refineries in the Haven. Milford Haven Waterway also contains a passenger ferry service. Annually, the Milford Haven ferry terminal handles 62,000 Ro-Ro units and 325,000 passengers for Irish Ferries (MHPA, 2017). A twice daily ferry service runs from Pembroke Dock ferry terminal to Rosslare, Southern Ireland. There are informal anchorages present in proximity to the possible export cable route, principally for vessels waiting to dock at Milford Haven.

A number of harbours, quays and marinas also exist in this region which are used by recreational vessel traffic in the vicinity of the proposed Project Area. These recreational vessels may also use the navigational channels to the northeast, along the proposed export cable route area, and a small number may be present within the wider proposed Project Area, although the number and frequency decreases towards the proposed Project Area. The harbours, quays and marinas in the vicinity of the proposed Project Area, cable routes and landfalls include: Milford Haven Marina, Neyland Yacht Haven, Stackpole Quay and Tenby.

Sailing and motor cruising are popular activities in this region with sailing clubs and facilities to launch motor vessels located along the coast. Due to Ministry of Defence (MoD) restrictions, there are no formal anchorages along this part of the south coast although Freshwater Bay and Barafundle Bay traditionally provide sheltered anchorages for vessels passing through these waters.

Using the historic AIS data collected between January 2015 to December 2015, approximately 1,500 vessels were recorded as transiting through the proposed Project Area. The numbers and categories of each vessel type are presented in Table 7-2.

Table 7-2: Counts of Vessels Transiting the Project Area 2015 (AIS, 2015)

Vessel Category	Vessel count
Unknown	4,087
Non-port service craft	599
Port service craft	7,084
Vessels engaged in dredging or underwater operations	233
High speed craft	796
Military or law enforcement	491
Passenger	3,963
Cargo	9,850
Tankers	6,074

Fishing vessels	7,196
Recreational vessels	799

7.2.4. Identification of Key Sensitivities and Potential Impacts

Table 7-3 below summarises the potential impacts of the proposed Project on navigational receptors identified as part of the baseline assessment (see Table 7-3). However, it should be noted that a full baseline assessment, as part of the NRA, may identify additional impacts on receptors that could not have been identified using the data considered within this Scoping Report.

7.2.5. Potential Mitigation

Potential mitigation measures that could be applied to reduce impacts on shipping and navigation receptors are outlined below. Development of these measures to make them specific to the proposed Project will occur via the formal NRA process and will be presented in the final ES. All construction, operational and maintenance operations are to be fully compliant with legislation, guidance and best practice as well as in accordance with up to date written procedures, e.g. MCA Guidance on Offshore Renewable Energy Installation: Requirements, Advice and Guidance for Search and Rescue and Emergency Response MGN 543.

- Promulgation of information to local stakeholders through local Notices to Mariners (NTM) and other appropriate Maritime Safety Information (MSI) dissemination methods. Rolling and regular updates during construction phases. Planning and coordination between developer and vessel operators. Selection of suitable installation and maintenance vessels and ensuring all personnel are trained and competent persons. Use of appropriate Personal Protective Equipment (PPE) by personnel;
- GPS off station alarm / SCADA (Supervisory Control and Data Acquisition) monitoring system;
- Mooring arrangements for the floating turbines will be carried out in accordance with the MCA and HSE Guidance '*Regulatory expectations on moorings for floating wind and marine devices*', which also include Third Party Verification;
- Incidents and near misses will be reported and investigated by developer and operators;
- Incidents to be reported to the MAIB in accordance with MGN 564: Marine Casualty and Marine Incident Reporting;
- All offshore infrastructure, and the site boundaries, to be marked in accordance with Trinity House requirements; Devices to be marked in accordance with MGN 543 and to comply with IALA standards;
- Once operational, the entire site and cable route should be surveyed and charted as required by UKHO. Changes to charted depth arising from wind turbines and associated moorings, and the burial depth of cabling, should be surveyed and marked on navigational charts;
- Formulation and implementation of an Emergency Response Co-operation Plan (ERCoP);
- Passage plans for construction and maintenance craft;

Table 7-3: Key Sensitivities and Potential Impacts for Navigation and Shipping

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Recreational and commercial vessels	Interaction of Project vessels with commercial, fishing and recreational vessels.	Construction Operational Decommissioning	Yes	During the construction/decommissioning phase, the presence of installation vessels undertaking construction activities within the offshore Project Area has the potential to interfere with other marine users. During the operational phase, work boats within the Project Area may impact on other marine users. The significance of impact will be dependent on the construction port and selected landfall / cable route.
Recreational and commercial vessels	Impacts on vessel routes.	Construction Decommissioning	Yes	There are no transit routes currently passing through the offshore site which are likely to be displaced. However, there are transit routes running across the proposed export cable area which are likely to be displaced during the construction and decommissioning phases of the project including displacement due to avoidance of the area by vessels for safety reasons. There is also potential for extending transiting time for fishing vessels and vessels leaving / approaching Milford Haven from the south. The significance of impact will be dependent on the construction port and selected landfall/cable route.
Recreational and commercial vessels	Displacement of anchorages.	Construction Operational Decommissioning	Yes	Displacement of informal anchorages could result in hindrances for the shipping industry. The significance of impact will be dependent on the construction port and selected landfall / cable route.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Recreational and commercial vessels	Impacts on navigational safety.	Construction Operational Decommissioning	Yes	The installation of any export cable protection in nearshore regions may potentially reduce the navigable water depth within the Project Area. If cable armouring is required, this would further reduce the navigable water depth within the cable corridor.
Recreational and commercial vessels	Increased collision risk with other marine users.	Construction Operational Decommissioning	Yes	The presence of additional vessels operating in the Project Area has the potential to increase vessel to vessel collision risk. The significance of impact will be dependent on the distance between construction port and location of selected landfall / cable route.
Recreational and commercial vessels	Increased collision risk with Project devices.	Construction Operational Decommissioning	Yes	The physical presence of structures within the Project Area has the potential to increase the vessel to structure collision risk for vessels, including those drifting or without power.
Recreational and commercial vessels	Potential collision between passing / work vessels and project infrastructure.	Construction Operational Decommissioning	Yes	Activities associated with the proposed Project may diminish emergency response capability (including Search and Rescue (SAR) and pollution response) within the proposed Project Area.
Recreational and commercial vessels	Interaction with subsea cables.	Construction Operational Decommissioning	Yes	The significance of impact will be dependent on the selected landfall / cable route. As part of embedded mitigation, planned cables will be either buried or protected by rock placement to ensure they do not pose a risk to anchoring or fishing gear within the area. The project will also include mitigation to ensure that they are maintained throughout the life of the project and do not become exposed.

(Mitigation cont'd)

- Safety zones (construction and O&M phases only) of appropriate configuration, extent and application to specified vessels;
- Marine Traffic Control for project vessels during construction;
- Co-ordination Centre from construction phase onwards;
- Appropriate cable burial depth will be determined and applied, as far as possible, via a Cable Burial Risk Assessment (CBRA) using the Carbon Trust methodology (Carbon Trust, 2015);
- Subject to marine traffic volumes, an anchor penetration study may also be necessary prior to construction commencing;
- Inter-array and export cable protection where burial to appropriate depth not possible (without leading to >5% reduction in navigable water depths);
- Minimum clearance of turbine rotor blade tip above Mean High Water Springs; and
- Vessel nomination as guard vessel during construction / decommissioning activities.

7.2.6. Proposed Approach to Environmental Assessment

To inform the baseline conditions for the EIA, an initial desktop study of existing AIS and vessel data collected previously for the Study Area will be undertaken, utilising existing data sets where available. Data gaps will be identified and addressed as appropriate.

Specific datasets that will be reviewed will include:

- Marine Accident Investigation Branch (MAIB) maritime incident data;
- Royal National Lifeboat Institute (RNLI) maritime incident data;
- Anchorage Areas Admiralty Charts To inform the baseline conditions for the EIA;
- International Maritime Organisation (IMO) routeing measures;
- Admiralty Charts;
- Admiralty Sailing Directions Admiralty Charts;
- Royal Yachting Association UK Coastal Atlas of Recreational Boating (2009) and GIS shapefiles; and
- Area-specific data held by MHPA.

An NRA will be undertaken and submitted in accordance with MGN 543 and the MCA Methodology for Assessing the Marine Navigational Safety and Emergency Response Risks of Offshore Renewable Energy Installations.

Marine traffic surveys will be undertaken to inform the NRA process – see Table 7-4 below. MGN 543 requires that traffic studies should be completed within 24 months prior to the ES submission or they would expect a new traffic study to be undertaken.

The NRA process will include a Preliminary Hazard Analysis (PHA) and detailed stakeholder risk workshops. Amongst a range of navigation and safety issue, the NRA will also assess Under Keel Clearance (UKC) issues.

Table 7-4: Proposed Shipping and Navigation Surveys to Inform the EIA

Survey Type	Proposed Spatial Extent	Proposed Timing	Objective
Marine traffic (AIS, radar, visual)	Offshore array and cable corridor with 10 km buffer	2 x 14 day surveys (Summer 2020) (Winter early 2021)	To gather site-specific data on shipping activity in and around the proposed project area. Data will be used to inform the NRA and the eventual EIA process.

7.3. Coastal and Marine Infrastructure and Other Users

7.3.1. Study Area

The Study Area for coastal and marine infrastructure and other users encompasses an area of an approximate 50 km radius from the proposed offshore array site (in all directions) and also a distance of 5 km either side of the possible export cable routes and landfall locations.

7.3.2. Existing Baseline Data

This section has been informed by a desk-based review of a series of established data sources. These include:

- MMO Interactive Map (MMO, 2019);
- Lle – Wales Marine Planning Portal;
- GIS data from The Crown Estate;
- Environmental Report for Greenlink Interconnector (Intertek, 2019);
- KIS-ORCA; and
- EMODnet.

7.3.3. Existing Baseline

Figure 7.4 identifies the range of coastal and marine infrastructure and other user activity in the vicinity of the project area. These are described further below.

7.3.3.1. Military Activity

The offshore array is located approximately 15 km outside the MoD Castlemartin Practice Areas – see Figure 7.4. Although the route is not yet finalised, the marine export cable may potentially pass through the MoD Castlemartin Danger Area, depending on the identified landfall location. Information from the MoD suggests that for most of the year, only the smaller (nearest to shore) firing templates are used. However, for around two weeks of the year the larger templates are used with the potential of debris up to the boundary of the Danger Area. This will not directly affect the offshore array area.

However, if the final export cable route does pass through this area it will be necessary to liaise with the MoD on the specific route and level of protection afforded to the cable to ensure no damage arises during firing exercises and other military activities.

In addition to routine firing operations at Castlemartin Range, radar, communication and surveillance operations also occur here, as well as occasional Royal Navy operations, including low-flying exercises at times.

Pre-application consultation between SBE and the MoD has already been undertaken and this will continue throughout the EIA process.

7.3.3.2. Unexploded Ordnance (UXO)

There are currently limited data available on the amount, type and distribution of UXO in the Study Area. However, due to the proximity of the inshore part of the Study Area to Castlemartin Range, the potential for UXO is judged to be high. As part of EIA characterisation surveys, magnetometer data will be collected that will be assessed for potential UXO issues.

7.3.3.3. Marine Disposal Sites

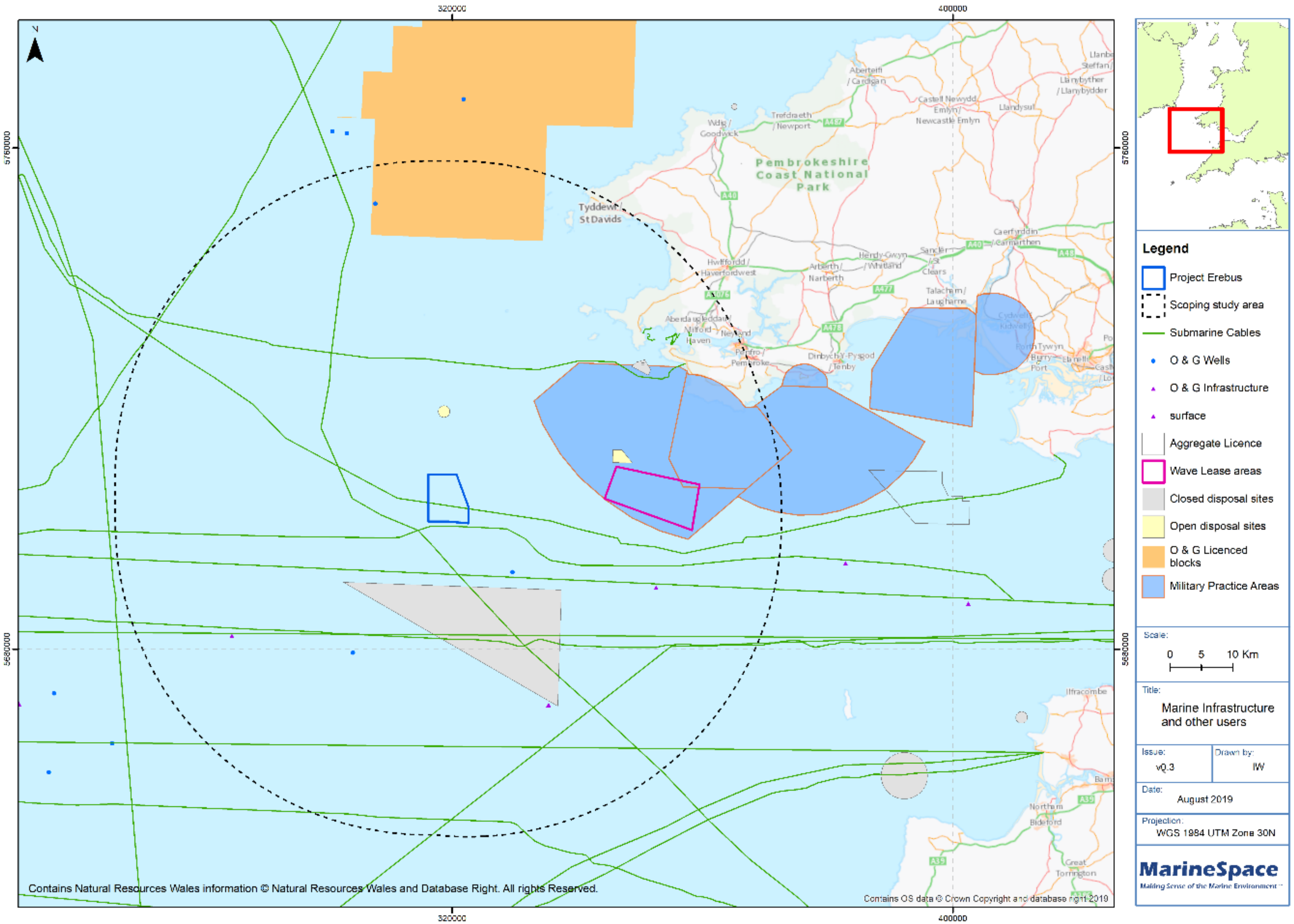
There are several marine disposal sites in this region. Details of these are provided below:

- Milford Haven Three (LU169): OPEN: located 9 km to the north of the offshore array;
- Milford Haven Industrial (LU040): CLOSED: located approximately 10 km to the south of the offshore array;
- Milford Haven Two (LU168): OPEN: located approximately 24 km to the east of the offshore array. Milford Haven Port Authority (MHPA) has predicted that, between 2018 and 2026, 480,000m^3 of material will be disposed at LU169, with 88,000 m^3 of coarse sand deposited at LU168;
- Milford Haven (LU170): CLOSED: located approximately 33 km to the northwest of the offshore array;
- St Anne’s Head (LU180): CLOSED: located approximately 34 km to the northwest of the offshore array; and
- Closed ammunitions disposal site (which may contain UXO) that stretches along the Pembrokeshire coast.

7.3.3.4. Ports and Harbours

A number of ports and harbours exist within the Study Area. Milford Haven is located 44 km from the offshore array and is the fifth largest port in the UK. The Milford Haven Port Authority (MHPA) provides port and associated services, as well as the navigational needs of the three major oil refineries in the Haven. Milford Haven Waterway also contains a passenger ferry service. Annually, the Milford Haven ferry terminal handles 62,000 Ro-Ro units and 325,000 passengers for Irish Ferries (MHPA, 2017). A twice daily ferry service runs from Pembroke Dock Ferry Terminal to Rosslare, Southern Ireland.

Figure 7.4: Coastal and Marine Infrastructure and Other Users Study Area and Activities



7.3.3.5. Subsea Cables

There are several submarine cables (all telecommunication) of relevance to the proposed Project (Table 7-5).

Table 7-5: Subsea Cables in Study Area

Cable Name (Asset Owner)	Status	Distance from offshore array	Distance from export cable corridor
Solas (Vodafone)	Active	Within	0.5 km
Tata Atlantic (Tata Telecoms)	Active	0.5 km	3 km
UK-Ireland Crossing 2 (Level 3 Ltd)	Active	2 km	10 km
TGN Atlantic (Tata Telecoms)	Active	8 km	10 km
PTAT (Vodafone)	Unknown	18 km	20 km
Tata Western Europe UK-Portugal (Tata Telecoms)	Active	19 km	21 km
Greenlink Interconnector (GIL)	In Planning	17 km	Potential interaction dependent on landfall location of export cable

7.3.3.6. Oil and Gas Extraction

There is no existing or proposed oil and gas extraction infrastructure in proximity to the proposed Project, including the potential cable export route. There is also no gas storage or carbon capture storage infrastructure located in the vicinity of the proposed Project. There is one current licence block in the scoping area. Licence P2287 is operated by ENI UK limited and is located approximately 38 km north of the Project. The licence started in September 2015 and its current status is extant. No oil and gas blocks in recent licensing rounds have been offered or awarded in proximity to the proposed Project and potential cable export routes. There is one historic exploratory wellhead located approximately 10 km southeast of the Project.

7.3.3.7. Aggregate Extraction

There are no existing licensed, application or aggregate option areas in proximity to the proposed Project. The closest aggregate area is located approximately 64 km east of the site, in the Bristol Channel. Within the region of the proposed Project there are areas of potential future aggregate resource previous identified by the Crown Estate (The Crown Estate, 2019).

7.3.3.8. Other Renewable Energy

The Pembrokeshire Demonstration Zone (PDZ) is located approximately 22 km east of the proposed Project area. This site is not consented or operational at the time of writing. The site is eventually intended to provide a site for testing multiple offshore renewable energy devices (wave and FLOW), with a total maximum deployed capacity of 100 MW. Within the scoping report for the PDZ project, Freshwater West has been identified as a possible export cable landing location.

The Marine Energy Test Area (META) is located to the north of the offshore array. The META project consists of eight test sites where marine energy testing activities will be permitted. Five of the sites are defined as Phase 1 sites and are located within the Milford Haven waterway. Of the three remaining Phase 2 sites, one (East Pickard Bay) is located close to one of the potential landfall options for the proposed Project, off Freshwater West. This is the location where the proposed mWave device is being developed by Bombora Wave Power Ltd.

7.3.4. Identification of Key Sensitivities and Potential Impacts

Table 7-6 below summarises the potential impacts of the proposed Project on the coastal and marine infrastructure and other users identified as part of the preceding baseline assessment. Where no impacts are predicted on certain receptors these are identified and proposed to be scoped out of any future EIA.

7.3.5. Potential Mitigation

Relevant stakeholders, owners and operators with existing or proposed infrastructure that may interact with the project will be consulted, at an appropriate stage, in order to identify appropriate mitigation measures and legal agreements for consideration.

7.3.6. Proposed Approach to Environmental Assessment

Potential impacts on coastal and marine infrastructure and other users will be assessed using the standard EIA Methodology set out in Section 3. The impact assessment will consider the potential for impacts during the construction, operation and maintenance, and decommissioning phases of the Project. Impacts will be defined as:

- Direct impacts: these may arise from impacts associated with the construction, operation and maintenance, or decommissioning of the Project;
- Indirect impacts: these may be experienced by a receptor that is removed (e.g. in space or time) from the direct impact; and
- Cumulative impacts: these may occur as a result of the project in conjunction with other existing or planned projects within the study area for each receptor.

The impact assessment process will also rely heavily on targeted consultation with key stakeholders, such as the asset owners of existing subsea cables, MHPA and local port operators and the MoD.

Table 7-6: Key Sensitivities and Potential impacts for Marine Infrastructure and Other Users

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Military Activity	Disruption to existing MoD and Royal Navy activity in and around the Castlemartin range and surrounding sea area	Construction Operational Decommissioning	Yes	The exact scope for construction activity and, subsequently, fully operational WTGs to interfere with MoD operations (including radars, communications and surveillance systems) is currently unknown and will require further assessment within the EIA.
Unexploded Ordnance (UXO)	Interaction with UXO has the potential to cause risk to life and damage to ecological receptors	Construction Decommissioning	Yes	Due to the proximity of military activity there is potential for encountering UXO and as such, assessment will be required within the EIA.
Disposal Sites	Risk of construction works / vessels creating direct impacts (disturbance of spoil material) on known marine disposal sites.	Construction Operational Decommissioning	No	The nearest open disposal site is located 9 km to the north of the offshore array area. As no project infrastructure will be located in this disposal site, no direct impacts (disturbance of spoil material) are predicted.
Ports and Harbours	Disruption to routine port operations via project-related activities.	Construction Operational Decommissioning	Yes	The exact scope of interference on existing port operations (including vessel movements; maintenance dredging) is not clear and will require further assessment within the EIA.
Cables	Damage to existing cables	Construction Operational Decommissioning	Yes	The 'Solas' telecommunication cable crosses the offshore array area. Construction activities for the proposed Project may interact with this existing cable and cause damage. Depending on export cable routing, there is also potential for interaction with the Greenlink interconnector cable, potentially resulting in interference to the cable.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Aggregate Extraction	Potential impact on licensed marine aggregate activities	Construction Operational Decommissioning	No	No licensed marine aggregate activities occur within the study area so there is no scope for impacts.
Oil and Gas Operations	Potential impact on licensed oil and gas exploration activities	Construction Operational Decommissioning	No	No licensed oil and gas exploration activities occur within the study area so there is no scope for impacts.
Other Renewable Energy Projects	Potential adverse impacts on planned marine renewable energy projects in the Study Area	Construction Operational Decommissioning	Yes	The exact scope of interference on other planned marine renewables energy projects (PDZ; META; Bombora) is not clear and will require further assessment within the EIA.

7.4. Aviation and Radar

7.4.1. Study Area

The extent of the Study Area for the assessment of impacts on aviation and radar is set out in Figure 7.5 and has been informed using the National Air Traffic Services (NATS) 'self-assessment maps' (NATS, 2017a). The available spatial data layers illustrate any potential interactions with 54 air-ground-air (AGA) communication stations, 55 navigation aids and 20 secondary surveillance radar operated by NATS En Route plc (NERL) in the UK.

7.4.2. Baseline Data

Information on the location and type of aviation and radar receptors that may be impacted by the proposed Project have been collated from the NATS sources. Information presented in the Pembrokeshire Demonstration Zone EIA Scoping Report (Wave Hub, 2018) has also been reviewed and presented, where appropriate.

7.4.3. Existing Baseline

7.4.3.1. Airports

The closest commercial airport to the Project Area is Cardiff, approximately 150 km from the offshore array. Other commercial airports are located at Bristol (200 km from offshore array), Exeter (170 km from offshore array) and Newquay (120 km from offshore array). Aerodromes that support light aircraft traffic also exist at Haverfordwest (56 km from offshore array) and Swansea (104 km from offshore array).

7.4.3.2. Military Airfields

The closest operational RAF base to the offshore array area is MoD St Athan in the Vale of Glamorgan (approximately 140 km from the offshore array). MoD St Athan is home to No. 4 School of Technical Training which provides continued training to personnel from all three Services and MoD civilian staff. MoD St Athan is also home to the University of Wales Air Squadron.

RAF Valley, on Anglesey, is located approximately 200 km to the north of the offshore array area. RAF Valley is home to No. 4 Flying Training School and the Mountain Rescue Service, the military's only high readiness, all weather search and rescue, aircraft post-crash management asset. Whilst these RAF stations are >100 km away from the offshore array, aircraft operating from these bases may transit through the airspace above the offshore array, where the WTGs will be located.

7.4.3.3. International Air Traffic Services

International commercial flights are controlled by national air traffic control centres who control their respective Flight Information Ranges (FIR). The London FIR covers England and Wales, including the proposed Project area (offshore array). The London FIR is split into UK Airspace Sectors and the boundary of two sectors (Brecon and Berryhead) crosses the Study Area.

The UK Civil Aviation Authority (UKCAA) is the regulatory authority for the London FIR and air traffic services are provided by NERL (NATS, 2017b). NERL has extensive infrastructure in place across the UK, to ensure that aircraft flies safely and efficiently; comprising of radars, communication systems and navigational aids.

7.4.3.4. Primary Surveillance Radars

There are three primary surveillance radars in the wider region, all located in North Devon. There is also an important aviation navigation beacon located at Strumble Head, north Pembrokeshire. Figure 7.5 (based on NATS' self-assessment maps of November 2017), indicates that WTGs with a height range of 200 m (this proposal assumes a maximum tip height of <200m) are likely to be outside the line of sight of the primary surveillance radars operated or used by NERL which provides *en-route* services to civil and military aircraft. The location of secondary surveillance radars (SSRs) with a 10 km buffer, (e.g. Strumble Head), are also shown in Figure 7.5. NATS advises that effects on SSRs are only relevant to consider when WTGs are located less than 10 km from the SSR. As Figure 7.5 shows, the offshore array lies outside the area of interaction with any SSR.

7.4.3.5. Aeronautical Navigational Aids and Communication Systems

Installation and operation of the proposed WTGs has the potential to impact a wide range of aviation navigation aids and communication systems, including air-ground communications facilities. The effects of potential interactions between Air Traffic Controls (ATCs) and aircraft are currently being investigated further, with reports to be published in due course. In the meantime, the UKCAA's guidance (Section GEN-01 of CAP 670) should be adhered to.

7.4.3.6. Offshore Helicopter Operations

Unlike locations in other parts of the UK, where there are oil and gas facilities that require regular crew transfers, commercial offshore helicopter operations in this region are limited to Search and Rescue (SAR) operations. In 2013, Bristow Helicopters Ltd won the UK Government national contract to deliver SAR operations on behalf of the Maritime and Coastguard Agency (MCA).

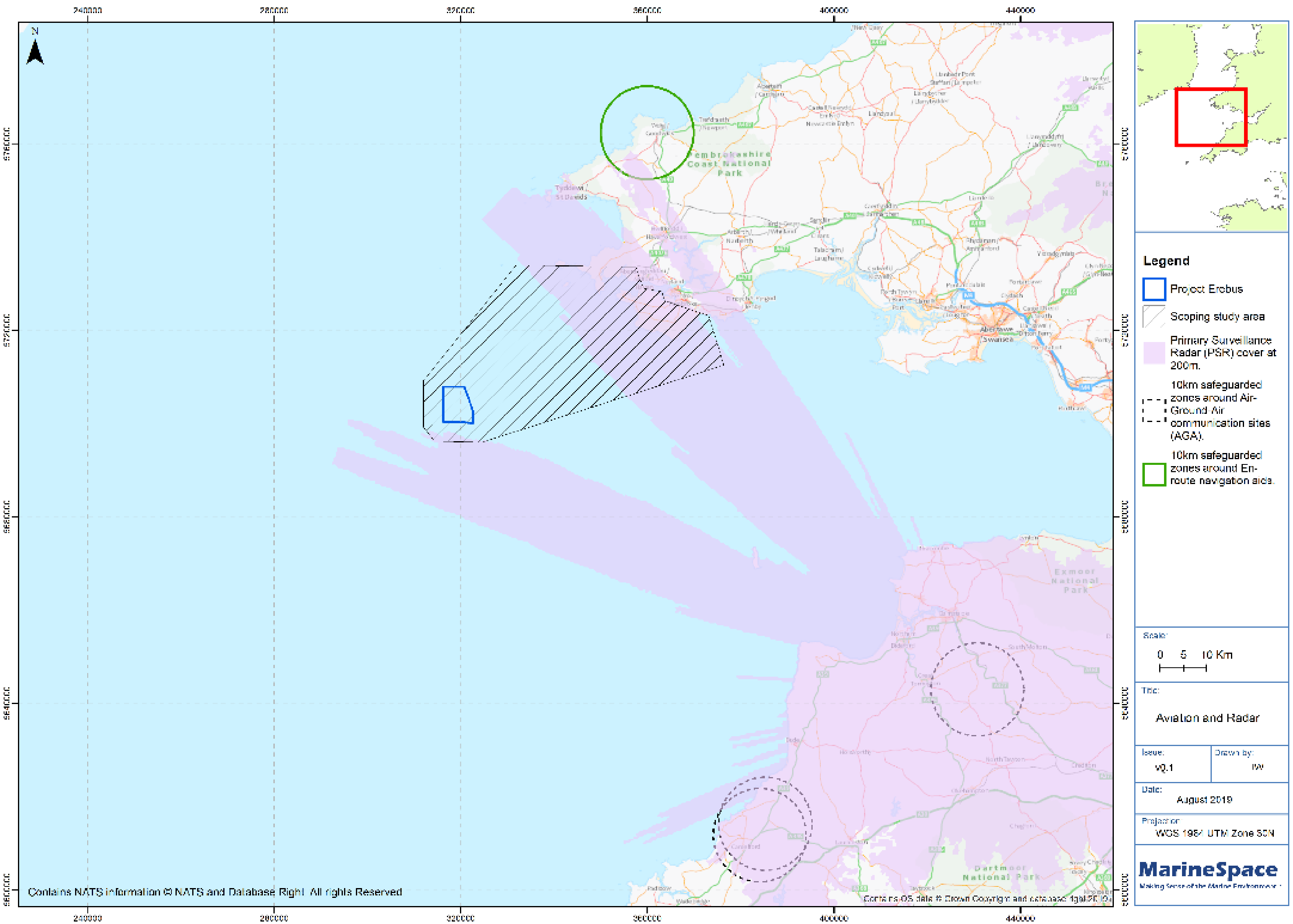
Bristow now operates on behalf of Her Majesty's Coastguard from 10 coastguard helicopter bases around the UK, responding to all SAR incidents for the whole of the UK. The closest SAR helicopter bases to the proposed Project area are St Athan (Vale of Glamorgan) and Newquay (Cornwall). SAR operations often involve flying at less than 1,500 ft (457 m). Assessment of potential impacts on SAR operations will be assessed within the project-specific NRA and will adhere to guidance set out in MGN543.

Potential impacts are outlined below in Table 7-7.

7.4.4. Potential Mitigation

Mitigation measures are to be explored at the earliest opportunity with relevant authorities. This will include adherence to the guidance documents specified above. Mitigation measures may include the use of aviation warning lighting fitted to WTG masts, and the marking of WTGs on aeronautical and nautical charts. Other offshore windfarms in the UK have mitigated impacts using technologies that remove clutter (the Non-Auto Initiation Zone) from radar signal.

Figure 7.5: Aviation and Radar Receptors in Study Area



7.4.5. Identification of Key Sensitivities and Potential Impacts

Table 7-7: Identification of Key Sensitivities and Potential Impacts

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
All aircraft	Increased collision risk due to offshore WTG infrastructure.	Construction Operational Decommissioning	Yes	Risk of collision due to interference with radar and communications systems.
Primary Surveillance Radar	Physical obstruction of WTGs and the generation of unwanted returns (returns that are not aircraft) to radar. Interference.	Construction Operational Decommissioning	Yes	Risk of collision due to interference with radar.
Aeronautical navigation aids and communication systems	Possibility of WTGs interfering with radio communication between Air Traffic Controllers and aircraft under their control.	Construction Operational Decommissioning	Yes	Risk of aircraft collision due to interference with communications systems.
Offshore helicopter operations (SAR)	Risk of interaction between SAR helicopter service and offshore infrastructure.	Construction Operational Decommissioning	Yes	Offshore search and rescue helicopter operations could be affected adversely by WTGs.

7.4.6. Proposed Approach to Environmental Assessment

A pre-planning assessment will be undertaken in conjunction with NATS as soon as possible in the EIA process. This assessment will determine the scope for the proposed project to raise concerns from the two main aviation stakeholders: (1) NATS; and (2) airport authorities.

At many UK airports, NATS provides ATC services and also some safeguarding services. It is often the ATC provider who delivers technical and operational advice on OWF applications, in which case they advise the airport authority on whether to object or not. However, the airport authority will make the ultimate decision.

The following assessments will be required:

1. Airport Technical: This will look at radar line of sight to determine whether or not the proposed development is likely to produce returns on any radars. It will also assess the potential impact on communications and navigation equipment;
2. Operational: This will take the results of the technical assessment and pass them to the operational units that use the assets. The unit assessors will then decide if the proposal might have an impact on the specific operational criteria in place at that unit;
3. Obstacle Limitation Surface (OLS) assessment: This examines the physical safeguarding of any local airport and the protection of various surfaces. In general, the OLS assesses surfaces up to 15 km from a runway. It is designed to ensure that obstacles do not prevent normal airport operations; and
4. Instrument Flight Procedures and ATC Surveillance Minimum Altitude Chart (IFP / ATCSMAC): This assessment will check the effect that obstacles might have on the Instrument Flight Procedures and the minimum levels that can be allocated under radar control at the airport.

Following consultation with NATS, it is proposed that one of the following assessments will be requested to be provided by NATS:

1. Airport Technical and Operational Assessment (TOPA). This includes technical and operational assessments in relation to airport assets. The report details the likely impact and the operational response of the relevant ATC unit;
2. *En-route* Technical and Operational Assessment (TOPA). This includes technical and operational assessments in relation to *en-route* assets. The report details the likely impact and the operational response of the relevant ATC centre; and
3. Combined Airport and *En-route* Technical and Operational Assessment (TOPA). This includes both an airport and *En-route* TOPA.

Once key potential impacts are identified, they will be assessed using the standard EIA matrix set out in Section 3.

No project-specific surveys are proposed with respect to aviation and radar.

7.5. Archaeology and Cultural Heritage

7.5.1. Study Area

The Study Area for the scoping assessment can be seen in Figure 7.6 and comprises: the offshore array area, potential offshore cable routes, landfall, onshore cable routes and associated onshore substation, adjacent to Pembroke Power Station.

7.5.2. Existing Baseline Data

The baseline data reviewed to inform this high-level desk based assessment includes:

- Milford Haven Area Historic Landscape Characterisation (Cadw, 2001);
- West Coast Palaeolandscapes Study (Fitch and Gaffney, 2011);
- A Research Framework for the Archaeology of Wales (IFA Wales, 2016);
- Lle, Geo-Portal for Wales (Lle, 2019); and
- Wales Marine Planning Portal (Welsh Government, 2019).

No Project-specific surveys have been undertaken to inform this report. As noted above further detailed searches and reviews will be required for the full EIA. Details of the data searches are provided in Section 7.5.7.

7.5.3. Baseline Environment

7.5.3.1. Offshore Archaeology and Cultural Heritage

Within the offshore region of the proposed Project, the Quaternary geology of the marine environment is identified as till with thin layers of recent marine sediments (Holocene sands and gravelly sands) overlaying the bedrock (BGS, 2019; Intertek, 2019), thickening offshore in the west. There is a high tidal range in the area, described in further detail in Section 5, indicating potential for the movement of sediment through the region. The presence of exposed bedrock suggests that there is potential for burial and exposure in localised areas.

The West Coast Palaeolandscapes Survey (WCPS) is a large regional assessment undertaken by the University of Birmingham (Fitch and Gaffney, 2011). Focusing on Late Quaternary and Holocene landscapes, the Study Area is located east of the proposed Project (Figure 7.6), however, its findings indicate that palaeochannels and flood plain deposits (peat and organic material) may be present to the southwest of the Project. Peat beds were identified at Frainslake Sands, near Freshwater West (Site No. 8.43.1; OSPAR) between 1995-2005 (Lle, 2019; Welsh Government, 2019), indicating potential for palaeolanscapes to be identified in the region. The WCPS indicates that there is a high potential for surviving deposits, however with no offshore ground truthing, this potential is unverified.

The geology and dynamics of the Study Area indicates a low to medium potential for palaeolandscapes or *in-situ* palaeoarchaeology, that increases closer to shore and at potential landfall locations, where sites have previously been identified; for example, flint artefacts in the vicinity of Freshwater West, and Palaeolithic burials in caves similar to those located near Bullslaughter Bay.

Known sites of archaeology and cultural heritage, specifically maritime or aviation sites were reviewed via the Wales marine planning portal (Welsh Government, 2019). Currently, the nearest protected site is located to the northwest of the scoping Study Area, on The Smalls reef (Figure 7.6), where an 11th Century Viking sword hilt was located amongst the rocks (Reference No. DW4; Welsh Government, 2019). A large number of sites present in the National Monuments Record of Wales (identified from documented losses, non-designated known and unknown wrecks), are present off the Pembrokeshire coast (Welsh Government, 2019) (Figure 7.6).

With the close proximity of the historic port of Milford Haven, and the local conditions of submerged rocks and reef, the distribution of wrecks is to be expected, with a greater cluster around the mouth of the estuary. Further data relating to a full list of records will be reviewed for the EIA, see Section 7.5.6. It is noted that some non-designated wrecks and their locations have been identified from historic surveys; however, some wreck locations are identified only by the snagging of fishing gear, and as such the positioning is less accurate. It is understood that although these records are of great importance in identifying potential, confirming presence or absence using geophysical methods is highly recommended.

There is potential for previously undiscovered wrecks and aircraft to be present within the region however, the preservation potential of the marine environment in this region is limited by shallow sand coverage, meaning a limited burial potential, and by the likely erosion of exposed surfaces in such a high energy environment, as noted above.

This suggests that potential for the discovery of previously undiscovered wrecks is low within the offshore scoping Study Area in comparison, for example, to marine areas where there is substantial sand coverage and correspondingly higher potential for burial. The potential increases further inshore, within areas of mobile sediment coverage, see Section 5.1.

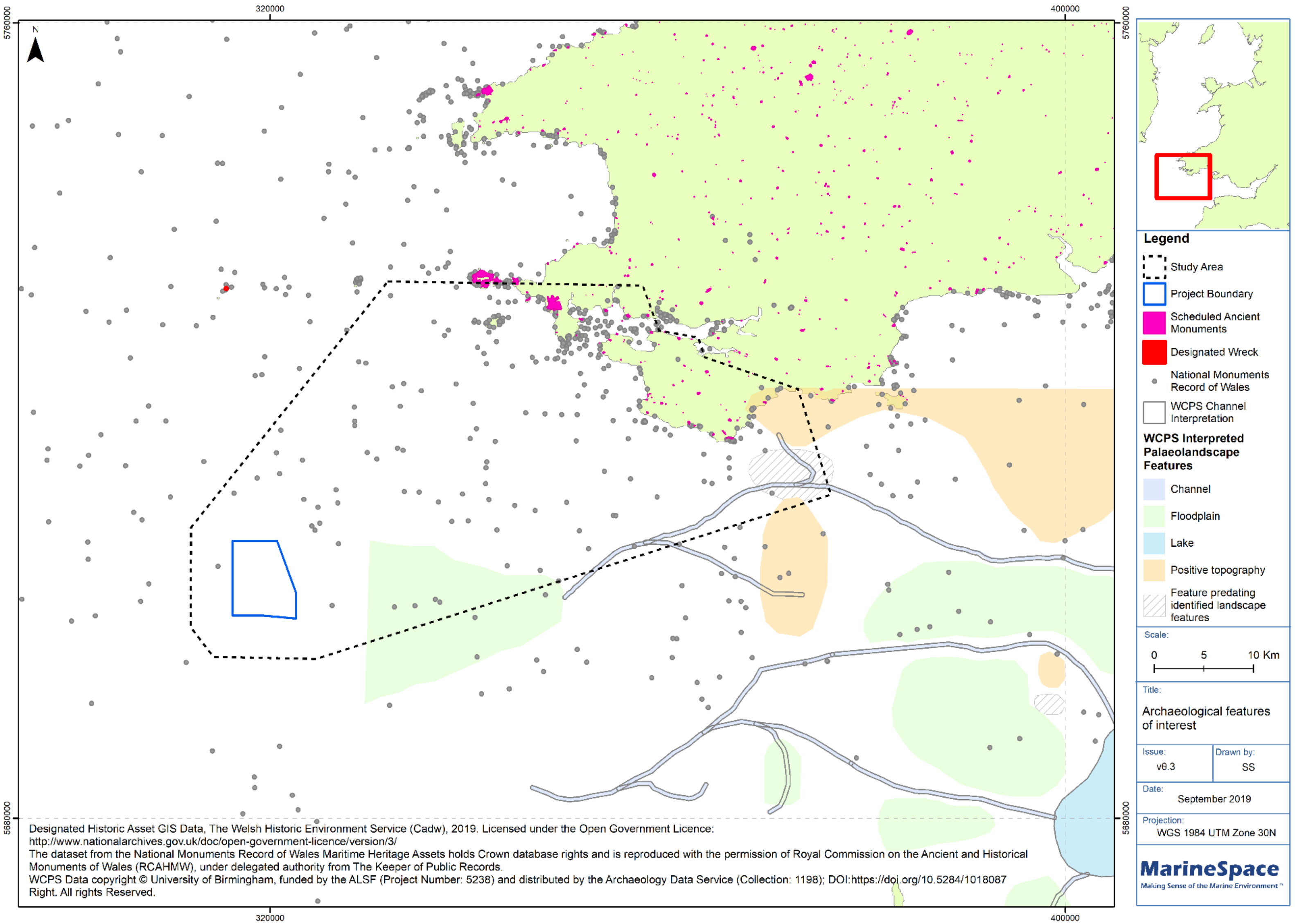
7.5.3.2. Onshore Archaeology and Cultural Heritage

This section considers onshore archaeology and cultural heritage, and the overlap between onshore and offshore at potential landfall locations.

As discussed in Section 7.5.3.1, exposed peat beds have been recorded to the south of Freshwater West, with tree stumps, fallen trees, roots and branches, dated to 5250-4550 BC (Intertek, 2016). Storms in 2013-2014 also exposed wrecks on Freshwater West beach, including the ‘Upside down wreck’, identified as *Willemoes of Thuro*, a wooden schooner built in 1911 (Welsh Government, 2019). The recent discovery of recorded wrecks 7-29ecognizin the potential for additional sites to be identified. There are recorded losses also present on and around Bullslaughter Bay (Welsh Government, 2019).

In the vicinity of potential landfall sites are a number of designated sites, including Scheduled Ancient Monuments (SAMs; Lle, 2019) (Figure 7.6). A selected number of these have been listed here, further detailed assessment will be undertaken once landfall and onshore cable routes have been confirmed:

Figure 7.6: Archaeological Features of Interest (Sources: Lle, 2019; Fitch and Gaffney, 2011)



- West Angle Bay Early Medieval Settlement – Medieval Cemetery (sixth to tenth centuries AD) on the cliff top overlooking West Angle Bay;
- Crocksydam Camp – Prehistoric Promontory Fort (c. 800 BC – AD 43) on the headland by Bullslaughter Bay;
- Linney Tobruk Shelters – coastal battery built 1943 south of Freshwater West;
- Gravel Bay – anti-aircraft battery from WWII, located north of Freshwater West;
- Crow Back Tumulus – round barrow of Bronze Age (c. 2300 – 800 BC), located south of Freshwater West; and
- Devil's Quoit Burial Chamber – a Chambered tomb of Neolithic period (c. 4,400 BC – 2,900 BC), located northeast of Freshwater West.

Pembrokeshire County Council and Pembrokeshire Coast National Park have designated Conservation Areas in this region. These will be reviewed once the scheme details and location are finalised.

In addition to these designated sites, there are a large number of non-designated heritage assets. These assets provide evidence of human activity from early Prehistoric through to MoDern times and a full assessment of these will be required as part of the EIA.

7.5.4. Identification of Key Sensitivities and Potential Impacts

The key sensitivities for archaeology and cultural heritage include:

- Palaeolandscape features, including submerged peat and organic deposits;
- Maritime wrecks and debris;
- Aviation wrecks and debris; and
- Designated sites and listed buildings.

These sensitivities can be impacted directly or indirectly from the proposed Project. Direct impacts on heritage assets involve permanent damage or destruction of archaeological material or its physical setting (context), with no ability to replace what has been lost. This would include impacts from the footprint of construction, operation, maintenance and decommissioning of the proposed Project, as well as its associated activities. This type of impact would be considered of major significance.

Indirect impacts occur when direct impacts have effects beyond their primary footprint, which can affect archaeological sites or materials some distance away by a change in the hydrodynamic or sedimentary process caused by installation of infrastructure or associated activities. These processes can trigger either a negative effect by degradation of the heritage asset or context, by physical, biological or chemical processes; or a positive effect by preservation of the heritage asset via burial.

Key sensitivities and potential impacts associated with the proposed Project to be considered as part of the full EIA are listed in Table 7-8.

Table 7-8: Key Sensitivities and Potential Impacts for Archaeology and Cultural Heritage

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Buried Archaeological / (Palaeo) Environmental Remains	Direct impacts on sites within the footprint of the proposed Project causing destruction or damage of the assets. Indirect impact associated with changes to marine and coastal processes	Construction Operational Decommissioning	Yes	High potential for an impact to be of permanent negative effect, and without mitigation would be of major significance. Exposure of buried remains following changes to marine or coastal processes could result in increased degradation. Conversely, burial of remains caused by changes to marine or coastal processes could be considered positive.
Maritime and Aviation Sites	Direct impacts on sites within the footprint of the proposed Project causing destruction or damage of the assets. Indirect impact associated with changes to marine and coastal processes.	Construction Operational Decommissioning	Yes	High potential for an impact to be of permanent negative effect, and without mitigation would be of major significance. Exposure of buried remains following changes to marine or coastal processes could result in increased degradation. Conversely, burial of remains caused by changes to marine or coastal processes could be considered positive.
Marine and Intertidal Heritage Assets	Direct impacts of sites within the footprint of the proposed Project. Indirect impacts associated with changes to marine and coastal processes.	Construction Operational Decommissioning	Yes	High potential for an impact to be of permanent negative effect, and without mitigation would be of major significance. Exposure of buried archaeological remains following changes to marine or costal processes could result in increased degradation of those remains. Conversely, increased burial of remains previously exposed to marine processes could be considered a positive impact.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Onshore Heritage Assets	Impacts to the setting of heritage assets.	Construction Operational Decommissioning	Yes	High potential that the introduction of a new development, with associated activities, could negatively affect the setting of the heritage asset without mitigation.
Historic Landscape and Seascape	Changes to the historic character of the area.	Construction Operational	Yes	High potential that the introduction of a new development, with associated activities, could negatively affect the setting of the heritage asset without mitigation.
Current Archaeological Research in Wales	Potential positive impact of publishing fieldwork results and archaeologically assessed geophysical and geotechnical data, as well as any finds identified.	Construction	Yes	The acquisition of new information on shore and offshore through geophysical, geotechnical and fieldwork surveys could significantly contribute to the understanding of archaeology in the region.

7.5.5. Potential Mitigation

A full assessment of the significance of these impacts and potential mitigation would be considered during the EIA and would be based on the key Project parameters defined at this stage. The following standard mitigation practices, will be applied where necessary:

- Avoidance of known heritage assets (preservation *in situ*):
    - Implementation of Archaeological Exclusion Zones (AEZ) around identified marine and terrestrial heritage assets;
    - Micro-siting of design to avoid marine geophysical anomalies of possible archaeological interest; and
    - Micro-siting of design to avoid known, onshore heritage assets.
- Further investigation and excavation of heritage assets which cannot be avoided (preservation by record):
    - Geoarchaeological assessment and the production of a Quaternary sedimentary deposit MoDel;
    - Further investigation of marine heritage assets through the acquisition of high-resolution geophysical data, and where necessary Remote Operated Vehicle (ROV) or diver survey (in unavoidable route areas);
    - Onshore fieldwork / excavation including set-piece (open-area) excavation, strip, map and record (or sample) excavation and watching briefs (targeted and general); and
- Adherence to the Offshore Renewables Protocol for Archaeological Discoveries (ORPAD) (The Crown Estate, 2010) to address unexpected discoveries of archaeological material during construction offshore.

All mitigation measures would be set out in a draft Written Scheme of Investigations (WSI) to reflect the proposed approach to archaeological mitigation for onshore, intertidal and offshore works associated with the proposed Project. Fieldwork would include subsequent post excavation assessment, and analysis, publication and archiving (where appropriate).

7.5.6. Proposed Approach to Environmental Assessment

A final Study Area, comprising the proposed works (onshore, intertidal and offshore) plus an appropriate buffer (e.g. 1 km) will be established, and form the basis for data acquisition. The buffer will ensure that all heritage assets adjacent to, or in proximity of, the footprint of the proposed works are incorporated in the assessment. A larger Study Area to assess settings impacts may be relevant, in accordance with the landscape, seascape and visual impact assessment undertaken for the Project.

In line with requirements specified in Planning Policy Wales, Note 24 (Cadw, Welsh Government, 2017a), Table 7-9 summarises the data collection that will be undertaken to achieve a proportionate assessment for archaeology and cultural heritage.

Table 7-9: Proposed Additional Data Collection for Archaeology and Cultural Heritage

Data Requirement	Method	Purpose / Rationale
Records held by Cadw on designated sites	Request record search from the defined Study Area directly from Cadw.	To identify the nature and extent of designated heritage assets which could be impacted by the Project.
Information held by Pembrokeshire County Council and Pembrokeshire Coast National Park on conservation area and assets of local interest	Information available online or from Dyfed Archaeological Trust as archaeological advisors to PCC and PCNPA.	To identify the nature and extent of historic areas and locally designated assets which could be impacted by the Project.
Records from the HER maintained by Dyfed Archaeological Trust	Request record search from the defined Study Area directly from Dyfed Archaeological Trust.	To identify the nature and extent of non-designated heritage assets which could be impacted by the Project.
Records from the National Monuments Record of Wales, held by RCAHMW	Request record search from the defined Study Area directly from RCAHMW.	To identify the nature and extent of non-designated heritage assets which could be impacted by the scheme and to use records of maritime and aviation losses to assess the potential for previously undiscovered wrecks and aircraft offshore.
Records of wrecks and obstructions held by the UKHO	Request record search from the defined Study Area via either UKHO or a third-party provider.	To identify the locations of wrecks and obstructions previously recorded within the Study Area and to evaluate their archaeological potential.
Records of finds from the Receiver of Wreck	Request record search from the defined Study Area directly from the Receiver of Wreck.	To identify the locations of finds indicating wrecks or other potential heritage asset which could be impacted by the scheme.
Geoarchaeological assessment of geotechnical data	Specialist geoarchaeological contractor required to undertake assessment of current available geotechnical survey data. Further Project-specific surveys will take full account of relevant guidance to ensure that data collected are suitable for archaeological analysis.	To investigate the presence of sub-surface archaeological deposits and palaeoenvironmental data for geoarchaeological assessment and analysis and the production of a Quaternary sedimentary deposit MoDel (this is in part a mitigation measure as well as a data requirement).

Data Requirement	Method	Purpose / Rationale
Archaeological assessment of marine geophysical data	Specialist archaeological contractor required to undertake assessment of current available geophysical survey data. Further Project-specific geophysical survey will take full account of relevant guidance to ensure that data collected are suitable for archaeological analysis.	To identify the locations of wrecks, aircraft crash sites and geophysical anomalies of possible archaeological interest.
Targeted investigation and survey of areas of archaeological potential onshore	Where identified as required by the DBA, walkover surveys or site visits to ground truth the results and undertake settings assessments. Recommendation for geophysical survey, metal detecting, fieldwalking, earthworks surveys and trial trenching to be identified and undertaken by a specialist archaeological contractor, where required.	To provide further information on the presence of buried archaeological remains within the onshore cable corridors and substation sites.
Results of specialist assessments undertaken for the Project.	Modelling associated with marine geology, geomorphology and sedimentary processes and marine coastal processes and with landscape, seascape and visual impacts.	To provide detailed assessment of changes to hydrodynamic and sedimentary process that may indirectly impact heritage assets and to understand the interaction of elements of the Project with the setting of heritage assets.
Historic maps and charts, aerial photography and LiDAR data	Data from third party providers and online resources, as applicable.	To provide further information, where possible, on the historic landscape / seascape and on the potential for heritage assets to be present within the Study Area.
Secondary sources and archaeological research	Search of online and published sources.	To provide contextual information relating to the archaeology and character of the Study Area.

As noted in Table 7-9, a summary of the surveys that may arise from the DBA are provided in Table 7-10. The assessed onshore and marine data will, in conjunction with existing records of, for example, scheduled monuments, wrecks, obstructions and documented losses, help to establish the full nature and extent of heritage assets both onshore and offshore.

Table 7-10: Proposed Archaeological Surveys to Inform the EIA

Survey Type	Proposed Spatial Extent	Proposed Timing	Objective
Marine geophysical survey	Minimum 1 km buffer around Project footprint	Summer 2020	To undertake the acquisition of geophysical data (including, multibeam bathymetry, multibeam backscatter, sidescan sonar, sub-bottom profiler and magnetometer data) to identify sites of potential archaeological interest
Walk over survey	Selected sites onshore, at landfall and along cable route	Summer 2020	To identify sites of archaeological potential, if the significance of archaeological remains cannot be adequately defined by the DBA
Onshore geophysical survey	At sites identified by the DBA and / or walk over	Post DBA	To identify sites of archaeological potential if the significance of archaeological remains cannot be adequately defined by the DBA
Visual inspection	Selected locations with viewpoints	Summer 2020	To assess the cultural heritage landscape

The assessment will be carried out in accordance with the Welsh Government (Cadw) guidance, plus further relevant industry guidance and best practice advice notes including, but not limited to:

- Historic Environment Guidance for the Offshore Renewable Energy Sector (Wessex Archaeology, 2007);
- Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (Oxford Archaeology, 2008);
- Code of Practice for Seabed Development (Joint Nautical Archaeology Policy Committee, 2008);
- MoDel Clauses for Archaeological Written Schemes of Investigating: Offshore Renewables Projects (The Crown Estate 2010);
- Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector (Gribble and Leather, 2011);
- Marine Geophysics Data Acquisition, Processing and Interpretation: Guidance Note (EH, 2013);
- Standard and Guidance for Historic Environment Desktop Based Assessments (CifA2014) and Code of Conduct (CifA, 2017);
- Standard Guidance for Archaeological Geophysical Survey (CifA, 2016); and

- Protocol for Archaeological Discoveries (PAD), (The Crown Estate 2014).

Any relevant information obtained from the DBA and evaluation stages on mitigation will inform the EIA and be embedded in the Project’s design in order to avoid impacts to known heritage assets.

Consultation will be undertaken at key stages throughout the assessment process with key stakeholders, such as Cadw, PCC, PCNPA and Dyfed Archaeological Trust, including discussions to confirm the scope of archaeological assessment and surveys.

7.6. Land Use

7.6.1. Study Area

The study area, see Figure 7.7 incorporates the landward aspects of the proposed Project, coinciding with the area assessed in Section 6.5 (Terrestrial Ecology). The area extends from the Mean Low Water Mark (MLWM) and includes the preferred landfall sites, onshore cable route options and proposed onshore substation locations.

7.6.2. Baseline Data

The assessment is based on a desk top study utilising publicly available information and documents from the following sources:

- Pembrokeshire Coast National Park Local Development Plan, September 2010 (PCNP, 2010);
- Pembrokeshire Coast National Park Local Development Plan – Deposit Plan, March 2018 (PCNP, 2018);
- Pembrokeshire County Council Local Development Plan, February 2013 (PCC, 2013);
- NRW Terrestrial Phase 1 Habitat Survey – habitat cover data derived from recording undertaken in 1979 and updated in 1991 (Lle, 2019);
- NBN Atlas (NBN Atlas, 2019); and
- Magic (Defra, 2019).

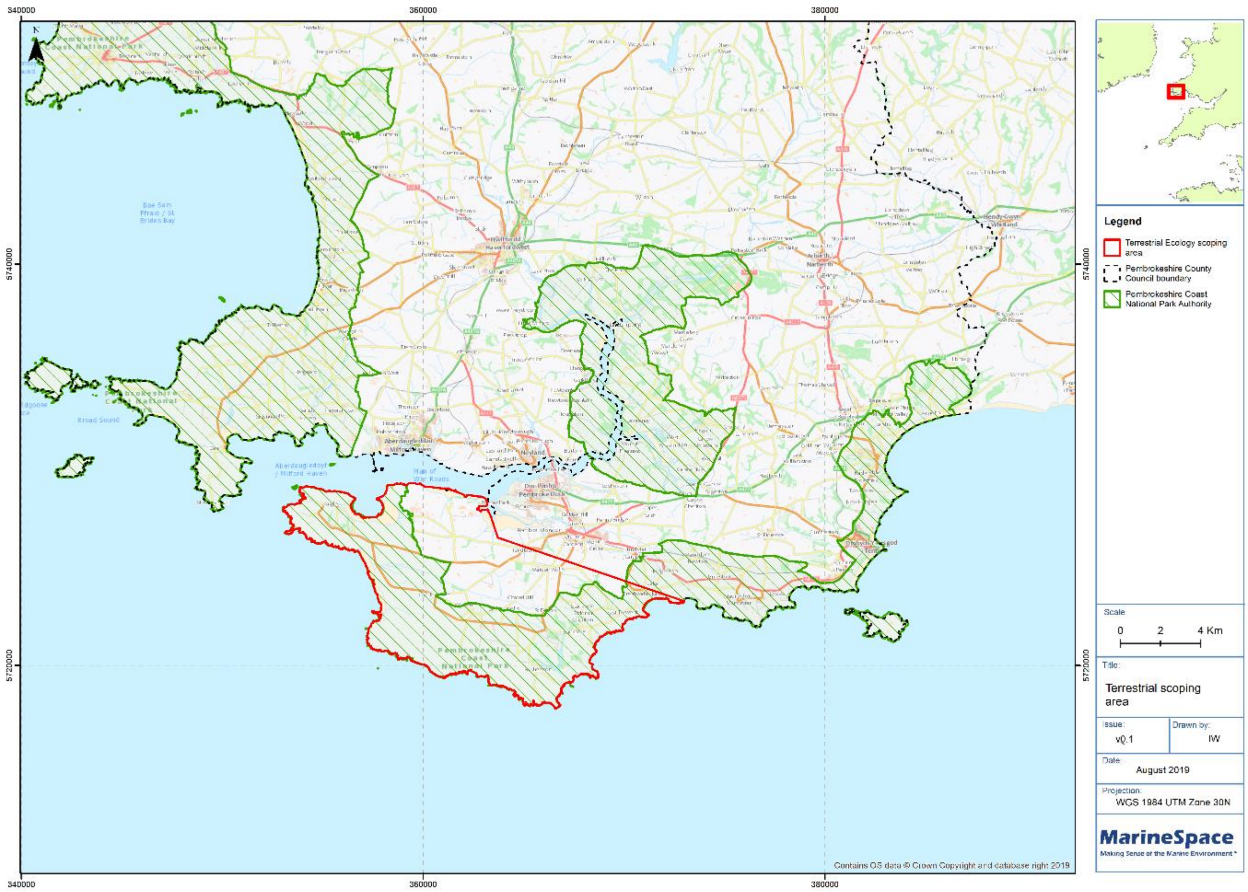
7.6.3. Existing Environment

Land use in the terrestrial parts of the Study Area can be broadly defined into the following categories, for which further details are provided below:

- Settlements;
- Industrial;
- Military;
- Pembrokeshire Coast National Park (including the coastal strip); and
- Agriculture

The primary urban and suburban centres within or close to the Study Area are Pembroke and Pembroke Dock, located to the northeast of the peninsula. The peninsula is primarily rural in nature, and is characterised by small villages scattered across the Study Area including Stackpole, Bosherston, Maiden Wells, Angle and Hundleton.

Figure 7.7: Scoping Study Area for Land Use



The peninsula is bordered to the north by the Milford Haven Waterway, (which itself lies within the boundaries of the Pembrokeshire Marine Special Area of Conservation (SAC). Milford Haven is a critically important port for the energy industry as well as supporting a Wales-Ireland passenger and vehicle ferry and numerous other commercial and recreational activities.

To the north of the study area and serviced by Milford Haven Port Authority (MHPA) is the Valero Oil and Gas Refinery, a strategic energy site, critical for the energy security of the UK. To the east of the Valero refinery is the 2,000 MW combined-cycle gas turbine (CCGT) Pembroke Power Station; owned and operated by RWE Innogy. The anticipated grid connection point for this proposed Project will be close to this existing power station. Both sites fall within the Haven Waterway Enterprise Zone, which stretches to the north across the Waterway to incorporate other key energy facilities, including South Hook Liquefied Natural Gas (LNG) regasification plant (the largest LNG terminal in Europe), the smaller Dragon LNG terminal, and the Valero Gas Terminal (Business Wales, 2018).

Several solar farms are located across the peninsula, those relevant to the proposed Project include Hoplass and Wogaston Farm, Rhoscrowther; and Chapel Farm, St Twynnetts.

Although not yet consented, the Greenlink project, a 500 MW subsea cable electricity interconnector linking existing grids in Ireland and Wales, is proposed to make landfall at Freshwater West, with an onshore cable route to a substation located to the southeast of Pembroke Power Station (Greenlink, 2018). It is also worth recognizing the ongoing High Court appeal process for the 12.5 MW Rhoscrowther wind farm, south of Valero Oil Refinery (Rhoscrowther Wind Farm, 2017).

Pembrokeshire Coast National Park (PCNP) is the UK's only coastal national park and is one of only three in Wales. PCNP was designated in 1952 and Pembrokeshire Coast National Park Authority (PCNPA) was established in 1996 to manage the Park and implement the following two statutory duties:

- To conserve and enhance the natural beauty, wildlife and cultural heritage of the National Park; and
- To promote opportunities for public enjoyment and understanding of its special qualities.

Approximately 50% of the Study Area falls within the PCNP, the rest is within Pembrokeshire County Council (PCC) jurisdiction. The National Park is primarily private land, and across the Study Area ownership is spread between residential and farm ownership and several large landowners including the MoD, National Trust, Valero and RWE Innogy.

The coastal strip falls within the PCNP boundary and, within the Study Area, includes a number of beaches (e.g. Freshwater West; West Angle Bay), more secluded coves and bays (e.g. Bullslaughter Bay) and other coastal habitats (e.g. sea cliffs, sand dunes). More details on key coastal and terrestrial ecological habitats are provided in other relevant sections of this report.

One of the most important aspects of land-use in the southern and western part of the peninsula is the Castlemartin firing range which, covers approximately 5,900 hectares. The range is the only UK range available for direct-fire live gunnery exercises with both on-land impact areas and a large offshore safety area (Defence Estates, 2018). Merrion Camp is part of the Castlemartin training area and located to the north of the firing range.

Another key land-use in the Study Area is agriculture, with these areas primarily comprising grassland, pastoral land for sheep, beef and dairy along with small areas of arable, farmed by a mix of small farming communities and those farmers operating large scale farms.

Much of the coastal strip is made up of rough grazing, reflecting the designated sites and use of grazing for management purposes (Magic, 2018). Areas of woodland are found at Orielton and Stackpole, both part of the Pembrokeshire Bat Sites and Bosherston Lakes SAC.

7.6.4. Identification of Key Sensitivities and Potential Impacts

Table 7-12 (below) provides a summary of the potential effects arising from the proposed Project on those land use receptors identified above. The potential impacts will be defined further once final landfall, onshore cable route and onshore substation location has been confirmed. However, potential impacts have been scoped in or out on the information currently available. It has been assumed that the onshore cable route would be left in situ as and when the proposed Project is decommissioned to avoid any unnecessary disturbance or harm however this will be reviewed upon further decommissioning planning.

7.6.5. Potential Mitigation

Further investigation is required to establish the level of impact arising from the proposed Project on land use, excluding settlements, which have been scoped out. This will identify appropriate mitigation however the following will be implemented in the next phase of project development:

- Liaison with a Land Agent to engage local landowners and identify the most appropriate route or location that will result in least disturbance or damage;
- The proposed Project will be designed, and techniques chosen to avoid permeant impacts arising during construction, operation, and decommissioning;
- Where possible a road route will be considered for the onshore cable route to reduce impacts on private landowners; and
- Consultation will be undertaken with local landowners and communities to understand any future uses for land and ensure the Project limits potential adverse impacts on the land use in the study area.

7.6.6. Proposed Approach to Environmental Assessment

The potential impacts on land use in and around the proposed onshore infrastructure identified above will be further defined as the project design develops. Engagement with key onshore stakeholders (landowners, PCNPA, PCC, MoD) will also be undertaken, as defined in the Project Stakeholder Management Plan, to ensure that all local issues are discussed and, where appropriate, assessed fully via the EIA process.

The Scoping Opinion will also inform the approach to the EIA. The approach will be iterative the level of impact assessed through each stage.

Table 7-11: Additional Data Required for Land Use

Data Requirement and Purpose	Data Collection Method
Confirmation of land use along the onshore cable route and at the onshore substation location to assess the significance of impact arising from the proposed Project.	Liaison with Land Agents, local land owners (including MoD and NT), PCC and PCNPA.
Review of the PCNPA Local Development Plan 2 (upon adoption) and engagement with development teams at PCC and PCNPA to understand future aspirations for land use across the peninsula.	Review of published plans and engagement with the LPAs.

Table 7-12: Key Sensitivities and Potential Impacts for Land Use

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Settlements	Disturbance or limiting development through the installation of onshore cable or siting of the substation.	Construction	No	It is not anticipated that landfall will affect any settlements. The onshore route will not pass through any settlements. The substation may be visible from parts of Pembroke Dock, this is considered further under Section 6.8.
Industrial	Disturbance or limiting development through the installation of onshore cable or siting of the substation.	Construction Operational	Yes	None of the preferred landfall sites are within the vicinity of known business, industry or energy sites. The onshore cable route and substation location have yet to be finalised and although it is not anticipated they would interfere with the operation of any identified sites a further assessment will be undertaken once the preferred route is confirmed.
National Park	Disturbance and damage to the special qualities of the Park affecting management, natural beauty, wildlife and cultural heritage.	Construction Operational Decommissioning	Yes	Until landfall, onshore cable route and location of the substation have been confirmed there is potential for impact on land use within the National Park boundary and further assessment is required to establish the significance of the impact.
Military	Potential disruption and restriction of terrestrial military operations arising from the installation of the onshore cable route.	Construction Decommissioning	Yes	Until landfall and the onshore cable route have been confirmed there is potential for an impact on military operations and further assessment is required to establish the significance of the impact.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Agriculture	The preferred sites for landfall would not affect agricultural land however disruption and disturbance may arise from the installation of the onshore cable route and siting of the substation.	Construction Decommissioning	Yes	Until the onshore cable route and location of the substation have been confirmed there is potential for an impact agriculture and further assessment is required to establish the significance of the impact.

7.7. Traffic and Transport

7.7.1. Study Area

The Study Area for this section focuses on the onshore part of the Project Study Area, see Figure 7.8 The Study Area includes the proposed landfall options, recognising the requirement for access during construction and potentially for maintenance works. The onshore cable route has not yet been finalised, however, it is anticipated that one option will be to follow the road network from the proposed landfall to the substation location.

In the absence of a final agreed onshore cable route, a strategic assessment of the road network has been undertaken for this Scoping Report and it is acknowledged that further assessments will be required once the onshore cable route is confirmed. The Study Area also includes the areas around the proposed onshore substation locations and the onward connection from the proposed substation to the grid connection at Pembroke Power Station.

It is the intention of the developer, SBE, to support the local supply chain so it is anticipated that much of the project infrastructure will be shipped into Pembroke Port, with some assembly undertaken within the Port area before being shipped offshore. Port feasibility studies are being undertaken but will not be ready to inform this Scoping Report, although it is proposed that all primary components of the Project infrastructure, for example the blades, towers and windfloat, will arrive by boat.

There may be elements of infrastructure delivered to Pembroke Port by road, however it is not expected that these would require specialist transportation, instead utilising standard HGV. Due to the uncertainty in respect of delivery to Pembroke Port more detailed planning will be required as the specifics of the proposed Project are finalised.

7.7.2. Baseline Data

This section has been informed by a desktop study utilising publicly available information, mapping and data. It has also been informed via initial pre-application consultation with key local stakeholders including MHPA, PCNPA and PCC.

7.7.3. Baseline Environment

The primary access route to the Study Area is via the A477, the main road from St Clears to Pembroke Dock. This route would service transportation to Pembroke Port, the proposed landfall and substation locations, and the proposed onshore cable routes.

Figure 7.8: The Scoping Study Area for Traffic and Transport

Access to the proposed onshore substation locations benefits from recent MoDifications made to the road network to provide a direct route for traffic to Pembroke Power Station. This route is from the A477, via the A4075, A4139 around Pembroke, turning onto the B4319 (utilising the new Maidenwell bypass), before joining the B4320, to the turn off at Wallaston Green. Continuing along the B4320 would provide access to Freshwater West, West Angle Bay and Angle. Access to Bullslaughter Bay (potential landfall location) would follow the above route to Maidenwell before turning off on the B4319 to Merrion. From Merrion to the proposed landfall site, access would be agreed with the MoD to cross Castlemartin Range.

The onshore cable route from Freshwater West, West Angle Bay and Angle Bay (potential landfall locations) will either be cross country or follow the road network. The options will affect the B4319 and B4320 and smaller access roads to Rhoscrowther and at Wallaston Green.

An onshore cable route from Bullslaughter Bay may also follow a cross country route or follow parts of, or all of, the road network. Without knowing the specific route it is not possible to identify all roads affected, however it is likely that the B4319, Windmill Lane, Axton Hill, the B4320 and the smaller access roads to Rhoscrowther and Wallaston Green may be affected.

7.7.4. Identification of Key Sensitivities and Potential Impacts

The Institute of Environmental Assessment published the ‘Guidelines for the Environmental Assessment of Road Traffic’ (GEART) (1993), as guidance for the assessment of impacts of transport and traffic from new developments.

Further assessment under GEART will be required, however the guidelines provide a framework for assessment, which is considered in the following table, Table 7-13. The framework includes accidents and safety; noise and vibration; air quality; driver delay and pedestrian severance.

7.7.5. Potential Mitigation

The development of potential mitigation options will be an iterative process, developed as the proposed Project's final design is confirmed and as further assessments are undertaken to understand the significance of impact on local communities, pedestrians and other road users. Options such as scheduling work around busy times of year, to avoid coinciding with visitor traffic, and busy times of the day to avoid school times; utilising construction techniques to reduce the need for road closures; and the development of Construction Traffic Management Plan, are likely to be adopted.

7.7.6. Proposed Approach to Environmental Assessment

As discussed above further assessment is required once the final Project designs are confirmed. Throughout the EIA process key stakeholders such as the Highways Authority (PPC) and local communities will be consulted with to inform the development of Transport Plans and mitigation options.

Table 7-13: Key Sensitivities and Potential Impacts for Traffic and Transport

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Pedestrians, other road users and local communities	As a result of increased traffic there is potential for an associated increase in accidents and a reduced level safety for road users and pedestrians.	Construction Operational Decommissioning	Yes	The potential for highway safety to be impacted may be significant and further assessment is required to understand the potential levels of traffic, duration of presence and the associated impact.
Pedestrians, other road users and local communities	An increased level of noise and vibration would be expected if traffic levels were to increase significantly.	Construction Operational Decommissioning	Yes	Noise and vibration are likely to be worse in built up areas, although the levels of traffic are unknown. Due to the potential routes through Pembroke and Pembroke Dock further assessment is required to understand the level of impact.
Pedestrians, other road users and local communities	Air quality may be impacted if traffic levels were to increase significantly.	Construction Operational Decommissioning	Yes	Although the levels of traffic are unknown, due to the potential impact on air quality further assessment is required to understand the significance of the impact.
Pedestrians, other road users and local communities	Delays are likely to arise due to the installation of the onshore cable route and if landfall is at Freshwater West.	Construction Operational Decommissioning	Yes	The installation of the onshore cable route in the existing road network would cause significant delays and disruption. The road network from landfall to substation is predominantly narrow, in some places single carriageway, and although the area is not heavily populated it is a busy tourist destination. Further assessment is required once the final onshore cable route is confirmed.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Pedestrians, other road users and local communities	Severance, of local communities to services and facilities may arise.	Construction Operational Decommissioning	Yes	The impact the Project would have will depend on the final onshore cable route and proposed landfall and substation locations. Further assessment is required once finalised to assess the level of impact.

Table 7-14 sets out proposed surveys to inform the EIA process.

Table 7-14: Proposed Surveys to Inform the Traffic and Transport Assessment

Survey Type	Proposed Spatial Extent	Proposed Timing	Objective
Desktop transport assessment to review existing condition	Within the onshore terrestrial Study Area	Summer 2020	The review would collect data on road status, main routes to be impacted, traffic movement and volumes to understand the level of impact on transport and traffic and develop mitigation.

7.8. Seascape, Landscape and Visual Impacts

7.8.1. Study Area

The Study Area for assessing potential effects on landscape, seascape and visual amenity from the offshore elements of the proposed Project (the WTGs), has been defined as a 45 km offset from the currently defined boundary.

This 45 km buffer is based on available literature - '*Visual Representation of Windfarms: Good Practice*' (SNH, 2017) recommends that for wind farms where turbines have a rotor tip of 150 m+ (as will be the case for this proposed Project), the initial Zone of Theoretical Visibility (ZTV) distance from the outer edge of the wind farm is 45 km. This is the distance at which WTGs could theoretically be visible, rather than the distance at which significant effects are expected.

There is also potential for visual impacts from the onshore substation. The maximum height of this element of the project will be approximately 11 m and the proposed footprint is currently estimated to be 77 x 63 m. The study area for the onshore visual impact assessment is as shown in **Figure 6.10**.

7.8.2. Baseline Data

The assessment is based on a desk top study utilising publicly available information and documents from the following sources:

- Pembrokeshire Coast National Park Local Development Plan (PCNPA, 2010);
- Seascape Character Assessment (PCNPA, 2013a);
- Landscape Character Assessment (PCNPA, 2011b);
- Interactive Map (MAGIC, 2018);
- Registered Landscapes of Outstanding or Special Interest (Dyfed Archaeological Trust, 2018b);
- National Seascape Assessment for Wales (NRW, 2015b);
- Renewable Energy (PCNPA, 2011c);

- National Character Area Profile 159: Lundy (Natural England, 2013);
- Lundy, Strategic Planning and Policy (Devon County Council, 2018);
- The Pembrokeshire Coast Path (Visit Pembrokeshire, 2018);
- Gower Landscape Character Assessment (Gower Landscape Partnership, 2013);
- Cumulative Impact of Wind Turbines on Landscape and Visual Amenity (PCNPA, 2013b); and
- Initial appraisal of Project Erebus visual impact and photomontages (prepared for SBE by Macroworks Ltd, 2019).

7.8.3. Existing Environment

A key aspect of the existing environment in the context of Seascape, Landscape and Visual Impact Assessment (SLVIA) is the proximity of the Pembrokeshire Coast National Park to the offshore components of the proposed Project; and the fact that onshore components will likely lie within the PCNP boundary. Of the many features that make the PCNP such an important area for natural heritage, landscape and seascape are particularly significant. Further details on relevant Landscape Character Areas (LCAs) and Seascape Character Areas (SCAs) are provided below.

The Gower Area of Outstanding Natural Beauty (AONB) is approximately 88 km east of the proposed offshore array area. AONBs are designated under the Countryside and Rights of Way (CROW) Act 2000 for the purpose of conserving and enhancing the natural beauty of the area.

There are a number of designated heritage assets throughout the Study Area including scheduled monuments, listed buildings and conservation areas. While Section 7.5 deals with impacts on cultural heritage in its own right, this section considers the effects of development on landscape character, and the role that cultural heritage has in defining that character.

Much of the Pembrokeshire coast within the Study Area is defined as Heritage Coast and therefore protected through local planning policy. This is a non-statutory designation but highlights the value of the coast for its exceptional scenic quality, largely undeveloped land and features of interest.

South Pembrokeshire Heritage Coast, from Giltar Point to Angle Bay, is the closest to the offshore array site (38 km) and potential landfall options Freshwater West and Bullslaughter Bay fall within this Heritage Coast. Lundy Island is also designated as Heritage Coast, as is the Gower Peninsula.

Table 7-15 (below) and Figure 7.9 provides a summary of SCAs in and around the proposed Study Area. These SCAs were defined in Pembrokeshire Coast National Park Seascape Character Assessment, adopted 2013, as Supplementary Planning Guidance (PCNPA, 2013a).

Table 7-15: Summary of relevant Seascape Character Areas in Study Area

SCA	Factors contributing to sensitivity
SCA26: Skokholm and Grassholm coast waters	• Remote, unspoilt rural coastline and island of importance for marine and island nature conservation and geological interest; • Historic character of the area and openness of the terrestrial landscape; • Focal points of headlands and islands; and • Pembrokeshire Coast Path as a sensitive receptor.

SCA	Factors contributing to sensitivity
SCA27: Grassholm and The Smalls	• Simple, open, wild and remote character with views of the western coast and islands; • Forms part of the open setting for of the western coast and islands overlooked by the Pembrokeshire Coast National Park contributing to the sense of remoteness and wildness in these areas; • Marine and Grassholm nature conservation value; and • Pembrokeshire and Wales Coast Path as a sensitive receptor overlooking the area at a distance.
SCA29: Southern Inshore Waters	• The majority of the area is within the Pembrokeshire Marine SAC; • The area wraps around Skomer and Skokholm to the west forming an important part of their setting; • The area forms part of the unspoilt view from the western and southern coast, including from the Pembrokeshire Coast Path; and • Open sea area with unspoilt, simple, consistent and unified marine character at a vast scale and a significant sense of openness and remoteness.
SCA30: Southern Offshore Waters	• Small part in the Pembrokeshire Marine SAC; • Land would be apparent to the east and forms part of the unspoilt view from the southern coast, including from the Pembrokeshire Coast Path; and • Open sea area with unspoilt, simple, consistent and unified marine character at a vast scale and a significant sense of openness, tranquility and remoteness.
SCA31: Outer Milford Haven	• Remote, unspoilt cliffs and sheltered bays and estuaries; • Popular recreational destinations such as Dale; • Nature conservation interest especially around Dale; • Richness of military and nautical history; and • Pembrokeshire Coast Path as a sensitive receptor.
SCA34: Freshwater West	• Remote, unspoilt sweep of beaches and dune system with craggy cliffs; • Wide views across bay and to focal points such as St Ann's Head; • Tranquility when no firing on ranges; • Important recreational destination; and • Pembrokeshire Coast Path as a sensitive receptor.
SCA35: Castlemartin Coastal Waters	• Remote, wild, exposed coastline; • Spectacular indented cliffs with numerous features such as arches, stacks and caves; • Significant nature conservation and archaeological interest; • Military range; • Commercial shipping and ferries on route to Milford Haven to the west; • Openness and sustained sea views, including views on clear day to Lundy Island; and • Pembrokeshire Coast Path is a sensitive receptor.
SCA36: Stackpole Coastal Waters	• Steep indented coastline with cliffs and coves forming a natural coastal edge; • Rural pastoral character of the hinterland and dunes, with very limited built form;

SCA	Factors contributing to sensitivity
	• Pembrokeshire Coast Path as a sensitive receptor; • Nature conservation interest of coast, grassland and dunes; • Special relationship between Bosherston Lakes inland with Broad Haven beach; • Distinctive, historically important Stackpole Warren dune system; • Wide, unspoilt views from the headlands to open sea and along the coast and channeled views such as from Broad Haven beach to Church Rock; and • Feeling of tranquility in places especially out of season, away from the Castlemartin range.

NRW has also produced an assessment of Marine Character Areas (MCAs) in their publication National Seascape Assessment for Wales (NRW, 2015b).

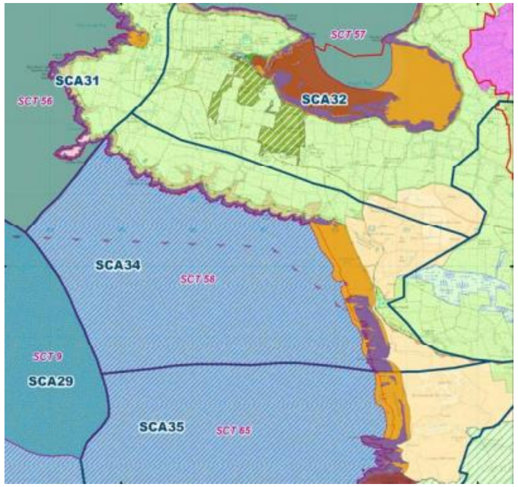
Table 7-16: Summary of relevant Marine Character Areas in Study Area

MCA	Aesthetic Qualities
MCA21: Milford Haven	The ria forms a unifying theme between the two distinctly contrasting characters of the enclosed upper stretches in the east and the open body of water in the west. Inland, the intricate river systems of the upper ria are highly regarded for their scenic rural beauty – the sinuous waterways, inlets, bays and side creeks are a haven of tranquility. As the ria widens, the levels of tranquility reduce and human activities increase. The majority of vessel movements are around Pembroke Dock, Milford Port, and the marinas at Neyland and Milford – here the waterway becomes very busy as large oil tankers, jetties and dock apparatus, and industrial buildings hum with activity (and associated night-time lighting). Exposure is greatest at the mouth of the estuary and on the elevated headlands. Here the full force of the prevailing southwesterlies blowing in off the Atlantic can be felt, battering the coastline on a stormy day. The doglegged feeder channels provide shelter and a contrasting feeling of calm, which increase as one travels further through their inland courses. There is a prevailing sense of shelter within the rural upper reaches of the ria with a strong sense of naturalness and tranquility.
MCA22: South Pembrokeshire Coastal & Inshore Waters	Views from the sea and from headlands along this predominately unsettled coastline are key to how this area is experienced, with red sandstone cliffs and white limestone cliffs creating areas of distinct character and a dramatic backdrop. The prominent local landmarks of Manorbier Castle and Well Chapel are located on these low cliffs, forming historical features when viewed from the sea. The headlands of St Govan’s Head, Stackpole Head and Old Castle Head act as visual markers for sea users, usually as places to be avoided due to the difficult sea conditions they create. Wide uninterrupted views can be gained out to sea and along the coast with important views to and from Caldey Island (MCA 24), including views to Lundy Island and the north Devon coast via the Bristol Channel (MCA 28). These include distant glimpses of the hills of Exmoor National Park and the cliffs of the North Devon AONB. Feelings of tranquility and remoteness are strong away from the coastal car parks and beaches and when the firing ranges are not in use. The MCA can become very exposed on headlands, including at Castle Head where the full force of westerlies

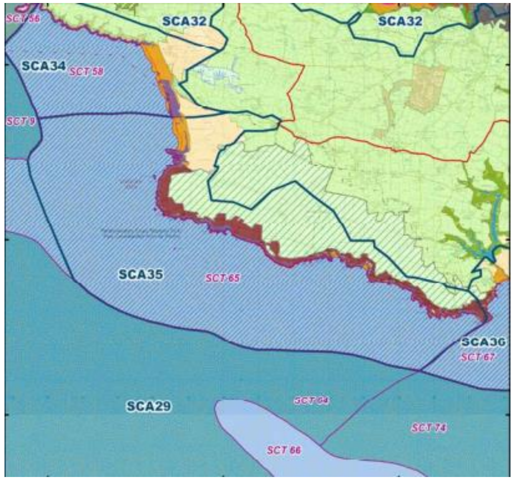
MCA	Aesthetic Qualities
	are felt. Rough seas are also experienced offshore at Turbot Bank and over St Gowan Shoals, creating a sense of danger, foreboding and being at the hands of nature. The open sea forming the transitional border with MCA 23 creates a simple, consistent and unified marine character at a vast scale, evoking a significant sense of openness, remoteness and exposure.
MCA23: South Pembrokeshire Open Waters	The rugged coastline of Pembrokeshire Coast National Park (backing MCA 22) forms a dramatic backdrop to the eastern half of the MCA – including the outlines of prominent limestone headlands such as St Govan's Head and Stackpole Head. The structures and associated lights from coastal development, including the tall refinery chimneys and flares at Milford Haven (MCA 21), can diminish an overriding sense of remoteness. These qualities can also be diminished during live firing from the MoD bases at Castlemartin and Manorbier, whilst the sounds and movements of the sea form dominating naturalistic factors for the majority of the time. The southern and western extents of the MCA have limited visibility with the adjacent coastlines; mainly influenced by the movement of large vessels approaching Milford Haven and travelling along the Bristol Channel (MCA 28). When marine transport is absent a pervading sense of isolation, exposure and wildness takes over. The MCA forms a strong maritime setting to the Pembrokeshire Coast National Park to the north, as well as acting as a distant backdrop to views from Lundy Island and the North Devon coast (including North Devon AONB and Exmoor National Park). Caldey Island creates a characterful seascape feature in the east, marking the entry into Carmarthen Bay (MCA 24). Views to Gower AONB, including the distinctive form of Worm's Head (MCA 25), also feature in eastward vistas to frame this open marine area.

Figure 7.9: Seascape Characteristic Areas (PCNPA, 2013)

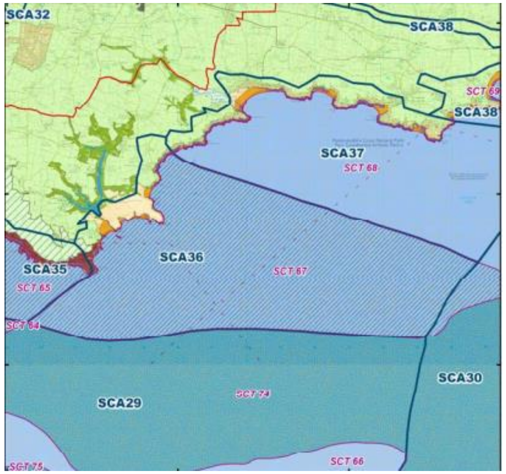
No.34 Freshwater West



No.35 Castlemartin Coastal Waters



No.36 Stackpole Coastal Waters



No.37 Freshwater East and Manorbier

There are six Registered Landscapes of Outstanding or Special Interest in the Study Area: Stackpole Warren (46 km from the offshore array); Milford Haven Waterway (44 km from the offshore array); Manorbier (56 km from the offshore array); Skomer Island (33 km from the offshore array); Taf and Towy Estuary (85 km from the offshore array); and St David's Peninsula and Ramsey Head (44 km from the offshore array). These are localised character areas, defined by the Welsh Archaeological Trusts, and concerned with how historic land management has led to landscape character.

Lundy Island is 66 km to the southeast of the offshore array area and is described by Devon County Council in their local character assessment and in Natural England's National Character Area profile 159 Lundy (2013): "*Rugged cliffs… heathland / grassland mosaic with an open, windswept feel and views across the sea… sense of isolation… Lundy has one village.*"

With respect to LCAs, details are provided below.

Table 7-17: Summary of relevant Landscape Character Areas in Study Area

LCA	Characteristics
LCA6: Castlemartin/Merrion Ranges	• A very exposed broad expanse of rolling lowland with associated coastal cliffs. The area is largely occupied by the MoD for national defence purposes for both live fire and dry military training; • This area is gently undulating grassland on an exposed coastal plateau on the southern tip of Pembrokeshire. The area has a low level of built development yet is characterised by evidence of former quarries and scattered villages and a strong military influence on range areas to the north and west of the Aspect Area; and • There is a series of rocky cliffs and steep slopes with some small sheltered coves on the south coast. The cliffs contain fewer sharp indentations than cliffs elsewhere in the National Park and feature high levels of cliff-top coastal grassland.
LCA7: Angle Peninsula	• A peninsula of rolling lowland and associated coastal land with low cliffs and a stretch of low estuarine frontage on the south side of the outer part of Milford Haven, at Angle Bay; • The area contains some exposed hill tops with scattered farmsteads in an agricultural landscape. The open landform and borrowed coastal views of indented cliffs and slopes give the area a strong coastal feel, especially to the west; and • There is a high incidence of traditional cottage buildings in Angle village and a distinctive local linear field pattern. Views over Milford Haven Waterway to the oil refineries and installations creates a visual detractor but views to West Angle Bay and over to St Ann's Head are attractive.
LCA8: Freshwater West / Brownslade Burrows	• An area of rolling lowland, almost devoid of settlement, with associated coastal areas of fixed sand dunes, low sea cliffs and bays; and • The landscape is characterised by a distinctive gently undulating open area dominated by sand dunes backed by marshy fields at the western end of Castlemartin Corse. The close visual and sensory association with the coast adds to the sense of place, especially when strong southwesterly winds blow and raise a high surf along the broad sweep of exposed beach and rocky foreshore.

There are a number of National Nature Reserves (NNRs) within the Study Area; although these are not designated specifically to protect the landscape, they are likely to attract visitors whose views could be affected by the proposals. Stackpole NNR is the closest to the offshore array at approximately 47 km.

7.8.4. Potential Mitigation

Potential mitigation that may be appropriate to implement to reduce significance of any SLVIA impacts include:

- As far as possible, when also considering engineering and wind resource issues, seek to position the WTGs within the offshore array in a way that minimizes any visual impact issues from land;
- Use appropriate, industry-standard paint colours for WTGs;
- Ensuring potential visual impacts are considered in the final site selection process for the onshore substation; and
- Sensitive design / screening of the final onshore substation.

7.8.5. Environmental Appraisal Approach

In preparing this section, reference has been made to key guidance documents, including:

- Guidelines for Landscape and Visual Impact Assessment 3rd Edition (GLVIA) (Landscape Institute / IEMA, 2013);
- Visual Representation of Windfarms: Good Practice (SNH, 2017); and
- Offshore Wind Turbine Visibility and Visual Impact Threshold Distances (Sullivan *et al.*, 2013).

LANDMAP is the formally adopted methodology for landscape assessment in Wales, and NRW expects all landscape impact assessments in Wales to apply the use of LANDMAP. PCNPA has produced the Pembrokeshire Coast National Park Landscape Character Assessment, which analyses LANDMAP within the National Park, and was adopted in 2011 as Supplementary Planning Guidance (SPG) (PCNPA, 2011b). This character assessment has therefore been used to inform the landscape baseline within the National Park area.

A full SLVIA will be undertaken in line with GLVIA. Effects on landscape / seascape character and on visual amenity will be assessed and presented separately in the final SLVIA. The assessment of effects on landscape / seascape character will involve an analysis of existing character assessments as well as a site visit by a landscape architect to confirm the validity of these assessments and identify the character areas which may be affected.

The assessment of effects on visual amenity will involve the production of a Zone of Theoretical Visibility (ZTV) to accurately define the SLVIA study area, by indicating the areas from which the proposed development could theoretically be visible. Landscape architects will also visit the site to assess key viewpoints from within the ZTV. These viewpoints will be agreed in in advance with PCNPA / PCC at the start of the SLVIA process. Consultation will also be held with Local Planning Authorities that cover the Gower and Lundy areas to determine if viewpoints are required in these areas, subject to the outputs of the ZTV process.

For selected key views, verified photomontages will be produced so that representative visual representation of the proposed WTGs can be provided. A worst-case scenario in terms of maximum WTG blade tip height will be used as the basis of the assessment. To inform the EIA Scoping report an indicative photomontage has been produced, showing the turbines at 45km, see Figure 7.10 and Appendix C.

The assessment will also take into account any cumulative impacts of the WTGs in conjunction with any other OWF (PDZ), or other structures with high vertical elevation, in line with the guidance document '*Cumulative Impact of Wind Turbines on Landscape and Visual Amenity*' (PCNPA, 2013b).

As for the WTGs and offshore project components, for the onshore substation, a worst-case scenario will be assessed in term of dimensions, including height. Viewpoints and photomontages may also be required to assess this project element, subject to feedback in the formal Scoping Opinion and via consultation with PCNPA / PCC at early stages of the SLVIA process.

7.8.6. Identification of Key Sensitivities and Potential Impacts

Table 7-18 provides a summary of the potential effects arising from the proposed Project (offshore, landfall and onshore components) on seascape, landscape and visual receptors.

Table 7-18: Key Sensitivities and Potential Impacts for Seascape, Landscape and Visual Impacts

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Landscape Character of the PCNP	Adverse impact on landscape character of the PCNP from offshore WTGs and onshore substation.	Construction Operational Decommissioning	Yes	The study area has a high number of sensitive visual receptors. The EIA will need to carefully assess potential impacts.
Character of Registered Landscapes of Outstanding or Special Interest	Registered Landscapes of Outstanding or Special Interest lie in close proximity to proposed works.	Construction Operational Decommissioning	Yes	The EIA will need to carefully assess potential impacts on Registered Landscapes of Outstanding or Special Interest.
Regional Seascape Character	WTGs and associated offshore infrastructure would be new features in the seascape.	Construction Operational Decommissioning	Yes	The EIA will need to carefully assess potential impacts on SCAs due to sensitivity of these and the relatively unspoilt nature of the seascape off Pembrokeshire.
Users of the Pembrokeshire Coast Path and other PRoWs.	Adverse impact on visual amenity via all project phases.	Construction Operational Decommissioning	Yes	Users of the coast path and other PRoWs in the study area will be highly sensitive to visual impact as the existing, mainly undeveloped nature of this coastal area is one of the main reasons that users visit this area.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Other coastal users, including beach / recreational users	Adverse impact on visual amenity via all project phases.	Construction Operational Decommissioning	Yes	Local beach users / recreational users may be sensitive to visual impacts and as such, detailed assessment will be required in the EIA.
Local residents	Adverse visual impact via construction works and final project infrastructure (WTGs offshore; onshore substation).	Construction Operational Decommissioning	Yes	Even though the study area has relatively small settlements and a small population level, when compared to other parts of Pembrokeshire, an assessment of potential visual impacts will still be required in the EIA.
Visitors to Lundy Island	Visual impact on seascape for visitors to Lundy Island.	Operational	Yes	Visitors to Lundy Island may visit to experience the clear seascape that exists around the Island. Scope for this to be affected by the WTGs will need to be assessed within the EIA.
Landscape Character of Gower AONB	NA	Operational	No	The Gower AONB is a highly sensitive receptor due to being designated for landscape. However, it is 87 km from the offshore array so significant effects on this AONB are not expected.

Figure 7.10 shows a sample photomontage of a PPI platform with GE12MW Halidade turbine at a distance of 45km, as viewed from MHWS (see Appendix C for PDF). The image is a generic coastal shot captured by Macro Works, used to demonstrate the potential visibility of this specific turbine and platform combination from 45km from shore. Studies suggest that turbines will be difficult to discern at this distance and may only be visible in exceptionally clear weather and with concentrated viewing.

Figure 7.10 Sample Photomontage for the Proposed Floating Offshore Wind Farm at 45km (MHWS)

Table 7-19: Additional Data Required for Seascape and Landscape Visual Impact Assessment

Data Requirement and Purpose	Data Collection Method
ZTV (to refine the SLVIA study area)	Digital ZTV produced using GIS.
Photographs from key viewpoints (to be agreed with PCNPA / PCC) in order to assess views of key receptor groups.	Site visit by landscape architect / SLVIA consultant.
Photomontage of WTGs (to assess what WTGs and onshore substation may look like from representative view points).	Photos from site visit and WTG parameter values provided by SBE.
Cumulative WTG ZTV (to assess cumulative effects).	Obtain location and heights of other existing or proposed WTGs from PCNPA / PCC. Produce digital ZTV to show where cumulative effects could occur.

7.9. Underwater Noise and Vibration

7.9.1. Study Area

The Study Area for the subsea noise assessment will cover the offshore Project Area, as presented in Figure 2.1. The final route for the export cable has not yet been selected, therefore, for the purposes of this report, the area encompassing all possible cable route options and the offshore array area have been considered.

7.9.2. Baseline Environment

There is a variety of noise sources which occur within UK territorial waters, both natural and anthropogenic. Natural noise sources include wind and wave action, fish and marine mammal species vocalisations, and geological events such as earthquakes. Anthropogenic sources include land-based construction noise transmitted through the seabed, vessel noise, at sea seismic surveys, and the use of fishing and navy sonar. The nature of the seabed topography and sediment will affect how quickly and easily any noise generated in the area will travel.

To identify noise sensitive receptors and noise sources present within the Study Area, this section has utilised information from:

- Chapter 4 (Project Description); and
- Chapter 6 (Biological Environment and Nature Conservation).

A detailed description of baseline subsea noise would be provided fully during the EIA.

7.9.3. Identification of Key Sensitivities and Potential Impacts

The main source of underwater noise and vibration during construction works is created from percussive piling or drilling. However, for this proposed Project, it is not anticipated that piling or drilling will be necessary (see Section 4 (Project Description)) therefore, potential subsea noise emissions are expected to be very low.

Other noise sources arising from construction activities include vessel movements, installation of anchors, seabed preparation, cable installation and preparation. Furthermore, noise and vibration may depend on the preferred method for cable installation at the final landfall site, e.g. if HDD is required. There is also the possibility that UXO detonation may be required.

During the operational phases of the Project, noise sources will be largely restricted to noise generated from operational WTGs and limited vessel movements.

Table 7-20: Key Sensitivities and Potential impacts for Subsea Noise

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In/Out
Ecological Receptors, marine mammals and fish.	Disturbance to behaviour patterns, changes in ability to communicate, hearing damage, physical trauma	Construction Operation Decommissioning	Yes	Although noise and vibration levels are not expected to be significant, impacts on ecological receptors can be adverse and further assessment is required to understand the significance of potential sources.

7.9.4. Potential Mitigation

Offshore construction would follow best practice measures to limit the impacts of noise on sensitive receptors and adhere to the latest guidance to apply relevant thresholds / criteria (Popper *et al.*, Hawkins *et al.*, 2014; NOAA, 2016).

7.9.5. Proposed Approach to Environmental Assessment

As subsea noise is readily transmitted underwater, and there is potential for sound emissions to adversely affect marine mammals and fish, a precautionary approach has been applied. Although the impacts arising from noise and vibration are expected to be low, further desk-based assessment of potential impact will be undertaken during the EIA process. The approach to the EIA and data gathering will be informed by a desk-based assessment and discussions with the regulators and key stakeholders.

The EIA, where appropriate, will be supported by, and include:

- A review and assessment of the potential noise and vibration effects of FLOW renewable energy devices on marine fauna (with specific reference to FLOW projects such as HyWind and Kincardine which have undertaken EIA studies), including assessment of subsea noise effects of similar technology to that planned to be deployed on this proposed Project;

- A desk-based review of the latest available evidence on the hearing sensitivities and potential effects on benthic invertebrates, marine reptiles, seabirds and diving bird species; and

Due to the limited scope for subsea noise impacts (due to no percussive piling works), no project-specific subsea noise surveys are proposed to characterise the site for EIA purposes.

7.10. Airborne Noise and Vibration

7.10.1. Study Area

The Study Area for this assessment is shown in Figure 2.1 and covers offshore and onshore project areas, including the preferred options for landfall, onshore cable routes and onshore substation locations.

The offshore array is located approximately 44 km southwest from the coast of Pembrokeshire. Onshore, the proposed Project design is not yet finalised but potential landfall options include Angle Bay, West Angle Bay or Freshwater West, with the onshore route from landfall to the onshore substation. The onshore substation is anticipated to be located in close proximity (within 2 km) to the existing Pembroke Power Station.

Although very rural in nature, the onshore Study Area is bordered by the MoD Castlemartin firing range to the east, Valero oil and gas refinery to the west and Pembroke Power Station to the east.

7.10.2. Baseline Data

This assessment is informed by a desktop study, utilising Google aerial maps and Local Development Plan maps to identify existing noise sources and potential receptors sensitive to increased levels of noise or vibration.

7.10.3. Baseline Environment

Across most of the Castlemartin peninsula, where onshore works will likely be located, ambient noise level is limited to local road noise and birdsong, except when firing at the nearby Castlemartin MoD range is underway. There is also significant background industrial noise in the vicinity of the Valero refinery and Pembroke Power Station.

The largest urban areas close to the proposed onshore works are Pembroke Dock, and Pembroke to the east of the study area. Residential properties are otherwise focused in small villages, such as Angle, or hamlets, such as Rhoscrowther. Out with these residential areas, small farms and pockets of houses are located sporadically across the peninsula.

The peninsula also falls within Pembrokeshire Coast National Park, with much of the coast designated as SSSI or SACs and bordered by the Wales Coast Path. The area is popular with tourists and is an important destination for visitors.

Offshore, airborne noise is limited to that generated by commercial shipping that transits through this region, to and from Milford Haven and also ambient noise generated by metocean conditions.

7.10.4. Identification of Key Sensitivities and Potential Impacts

Given the distance of the proposed WTGs from shore it is considered that there would be no impact on any onshore receptors via airborne noise generated by these Project components. There are also very limited offshore receptors sensitive to airborne noise which, when coupled with the low airborne noise emissions predicted (no piling is proposed during the construction phase), results in a prediction of no impact.

Therefore, it is proposed to scope out the impact of airborne noise from any aspect of the offshore works.

The potential remains for both landfall and onshore works to generate airborne noise and impact on sensitive receptors. Therefore, it is proposed that airborne noise from onshore (and landfall) works be assessed fully in the EIA.

7.10.5. Potential Mitigation

Onshore construction and decommissioning works will adhere to best practice and industry guidance to reduce airborne noise and vibration. Other measures such as timing of works will be considered and applied where possible.

Airborne noise and vibration arising from onshore operation, primarily of the substation will be reduced through careful design, siting, use of technology and the installation and operation of acoustic barriers. This strategy will be developed following further assessment for the EIA.

7.10.6. Proposed Approach to Environmental Assessment

Further work is required to identify and assess impacts from airborne noise and vibration arising from any onshore (and landfall) works.

A detailed desktop study will be undertaken, supported if necessary, by a baseline noise survey in the area of proposed works. This study will list and define all key receptors. Any further assessment will be informed by the Scoping Opinion and further discussions with relevant stakeholders, including NRW and the LPA. The exact scope of this more detailed assessment will also be developed further once the preferred location of all the onshore works is known as the final preferred location(s) may have more / less scope for airborne noise impacts than other locations.

Table 7-21: Key Sensitivities and Potential impacts for Airborne Noise

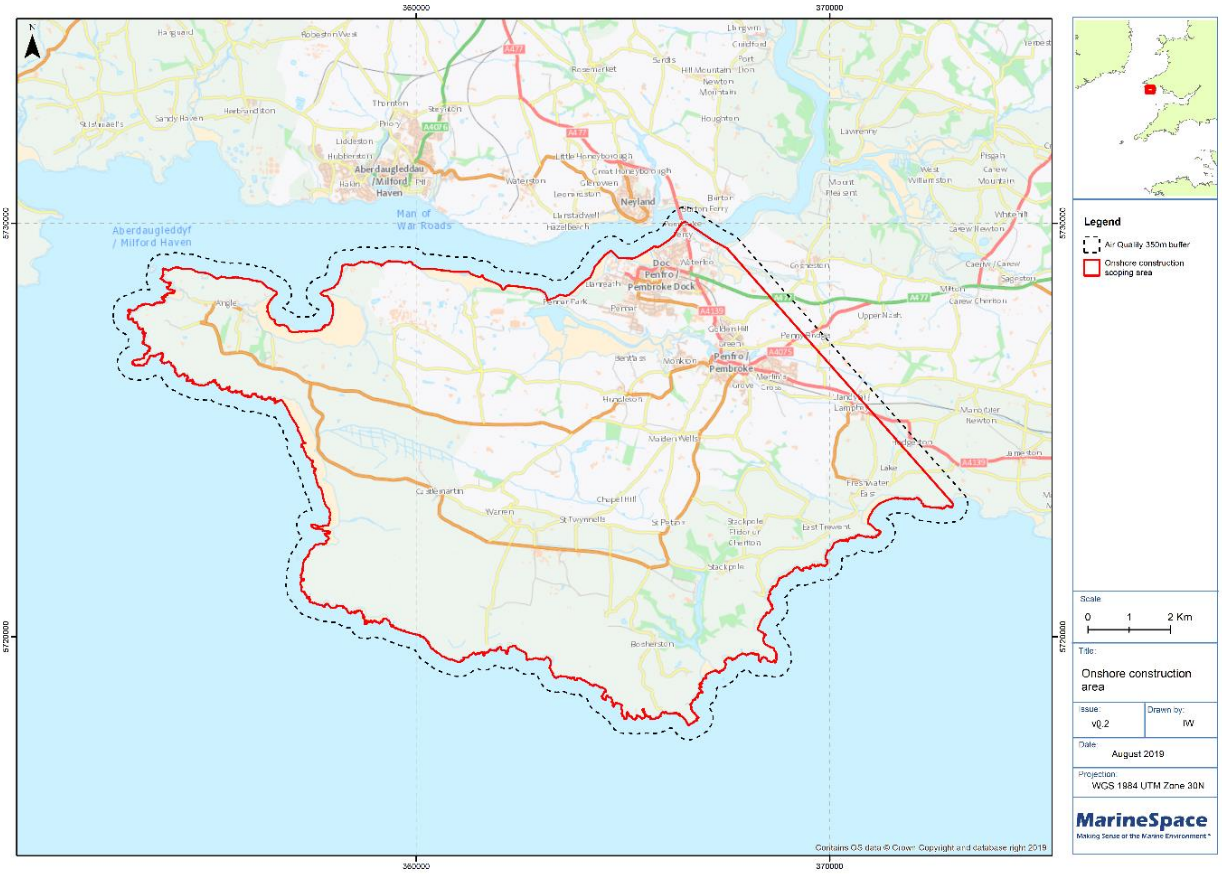
Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Onshore Ecological Receptors	Disturbance to behaviour patterns including nesting, roosting foraging and breeding arising from the installation of the onshore cable (including landfall) and onshore substation.	Construction Operational Decommissioning	Yes	Onshore construction, operational and decommissioning phases have the potential to create noise and disturb ecological receptors including birds, bats and otters. As the onshore elements have yet to be finalised further assessment will be required to establish the significance of the impact.
Onshore Human Receptors	Noise disturbance arising during all phases of the project to onshore receptors such as residential areas and sensitive sites in the National Park.	Construction Operational Decommissioning.	Yes	Onshore construction, operational and decommissioning phases have the potential to create noise and disturb human receptors such as residential areas, tourist destination and the Wales Coast Path. As the onshore elements have yet to be finalised further assessment will be required to establish the significance of the impact.
Offshore Ecological and Human Receptors	Noise disturbance arising during all phases of the project to offshore receptors.	Construction Operational Decommissioning.	No	Limited airborne noise is predicted to be generated at any stage of the proposed project; and there are also limited sensitive receptors to airborne noise in the offshore environment.

7.11. Air Quality

7.11.1. Study Area

The extent of the air quality Study Area is shown below. Exact locations of cable landfall, onshore cable route and onshore substation are not yet finalised but all these project elements will be sited within the Study Area shown below. Definition of the air quality Study Area has followed the Institute of Air Quality Management (IAQM) guidance (IAQM and EPUK, 2017) and includes the area within 350 m of any onshore construction works, within which construction phase air quality (dust) impacts may be experienced.

Figure 7.11: Extent of Air Quality Study Area, including the 350 m Buffer Area from Potential Onshore Construction Works



The air quality Study Area has also followed Highways Agency guidance (Highways Agency, 2007), and will also include areas within 200 m of roads predicted to experience an increase in traffic flows.

7.11.2. Baseline Data

The study is desktop based and uses publicly available monitored pollution data collected by Pembrokeshire County Council (PCC) (Pembrokeshire County Council, 2017).

7.11.3. Baseline Environment

Air Quality Management

In the commercial main street areas of Haverfordwest and Pembroke, PCC has declared statutory Air Quality Management Areas (AQMAs) for exceedances of the annual mean nitrogen dioxide (NO_2) objective. Road traffic is the principal contributor of emissions, as both the locations are subject to the "*canyon effect*", where are high sided buildings on either side of a narrow road results in a low available dispersion of the local air. The Haverfordwest AQMA is located over 8 km northeast of the air quality Study Area and is not anticipated to be affected by the development. The Pembroke AQMA is within the air quality Study Area.

Air Quality Monitoring

Under the Local Air Quality Management (LAQM) regime, PCC carries out automatic and passive air quality monitoring. The methods employed for monitoring include passive diffusion tubes, active samplers and real-time automatic analysers. The nearest automatic air quality monitor is located at Narberth and is operated by Defra as part of the Automatic Urban and Rural Network (AURN). It is located approximately 17 km northeast of the air quality Study Area.

The 2017 Progress Report (PCC, 2017), which is the latest publicly available Local Air Quality Management report for PCC, states that diffusion tube monitoring is undertaken where there are concerns over public exposure to pollutants from road vehicles. The monitoring is mainly focused around Haverfordwest and Pembroke. As Pembroke is potentially located within the Project Area, the monitoring data from this area were evaluated to provide an overview of air quality. Monitoring data for 2014 – 2016 are detailed in Table 7-22.

Table 7-22: Pembroke Air Quality Monitoring Data 2014-2016

Tube Location ID	AQMA	Annual Mean NO_2 level ($\mu g/m^3$)		
		2014	2015	2016
PCC40 (Main St Pembroke)	No	28.3	22.2	21.9
PCC41 (Main St Pembroke)	Yes	37.9	25	25.4
PCC42 (Main St Pembroke)	Yes	41	25.3	22.4
PCC43 (Main St Pembroke)	Yes	47.8	32.2	34.2
PCC44 (Main St Pembroke)	Yes	33.7	37	36.6

PCC45 (Main St Pembroke)	Yes	29	41	44
PCC47 (Main St Pembroke)	No	26.8	24.6	26.4
PCC48 (Main St Pembroke)	No	16.2	14.3	14.2

As detailed in Table 7-22, NO_2 concentrations between 2014 and 2016 were above the annual mean objective (40 µg/m^3) at several locations.

Automated analysers were introduced in 2010 at Pennar Cants to monitor air quality at Pembroke Power Station. However, in 2016 Pembroke Council stopped the monitoring of the area due to consistently low results.

7.11.4. Identification of Key Sensitivities and Potential Impacts

7.11.4.1. Offshore

Air quality and particulate matter (as indicated by concentrations of gases which are potentially harmful to human health) is not generally considered to be an issue for offshore developments (Fuzzi *et al.*, 2015). The main concerns over air quality come from sources of combustion products onshore and are related to emissions from road transport and land-based industry (Defra, 2011). Potential air quality pressures from the offshore elements of the proposed Project will primarily occur from engine exhaust emissions from marine vessels used during installation and maintenance. It is proposed that given these emissions will be emitted in the coastal or offshore environment, away from any major terrestrial emission sources, the emissions from the proposed Project are not expected to cause a deterioration in the local air quality. It is also concluded that offshore emissions from the Project will not be a significant contributor to global emissions and, as discussed in Section 1.4 (Project Need), the project will help to reduce CO_2 emissions and meet climate policy targets in the long-term.

7.11.4.2. Onshore

Table 7-23 sets out the key sensitivities and potential impacts for onshore air quality arising from the Project.

7.11.5. Potential Mitigation

Options for mitigation will be informed by further assessments, discussed below; and as the proposed Project design is finalised. However, all onshore construction and decommissioning works will adhere to best practice and industry guidance to reduce the potential impacts to air quality. Furthermore, where possible, the proposed Project will minimise vehicle movement during the construction and decommissioning phases and avoid sensitive ecological receptors.

Table 7-23: Key Sensitivities and Potential Impacts for Onshore Air Quality

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Human Health	Impacts from dust and fine particulate matter may affect human health during the Project phases.	Construction Decommissioning	Yes	Potential increased dust particles created during construction may lead to impacts on human health.
	Human health impacts arising from vehicle emissions.	Construction Operational Decommissioning	Yes	An increase in vehicle movements caused, primarily, during construction, may increase pollutant concentrations. However, until the location of landfall, onshore cable route, and proposed site of the substation, are confirmed it is not possible to assess the significance of the impact.
Ecological Receptors	Impacts from dust and fine particulate matter; and vehicle emissions may impact ecological receptors during the Project phases.	Construction Operational Decommissioning	Yes	Ecological receptors, including features of designated sites that are sensitive to nitrogen or acid deposition, may be impacted by significant increases in dust or emissions. Further assessment will be required once the full extent of the Project is confirmed to understand the level of impact.

7.11.6. Proposed Approach to Environmental Assessment

Further work is required to identify and assess impacts to air quality arising from any onshore works. Subsequent assessments will be informed by the formal Scoping Opinion and discussions with relevant stakeholders, including NRW and PCC. The exact scope of these assessments will be developed further once the preferred location of all onshore works is known, as the impacts arising from the proposed location(s) may vary depending on siting.

Air quality assessments will be undertaken in accordance with guidance provided by the IAQM in the document '*Guidance on the Assessment of Dusts from Demolition and Construction 2014*' (IAQM, 2014).

7.12. Tourism and Recreation

7.12.1. Study Area

The Study Area relevant to this EIA topic is the main EIA Scoping Area shown in Figure 2.1. This area encompasses the main array site plus a 4 km buffer, a broad potential export cable corridor, and series of potential landfall locations, and also a large onshore area within which onshore infrastructure will be located.

7.12.2. Baseline Data

Key sources of data used to inform this section include:

- MMO Interactive Map (MMO, 2017);
- Wales Marine Planning Portal (Welsh Government, 2017c);
- Information presented in EIA Scoping Reports / ESs for other infrastructure projects in this region (PDZ, META, Greenlink); and
- Various recreation and tourism websites.

7.12.3. Baseline Environment

7.12.3.1. Marine Recreational Users (Offshore and Coastal)

Marine recreational use in and around the main array site is limited due to its distance offshore, with a low level of recreational sailing activity recorded in this area. Recreational use increases closer to shore, with a higher density of sailing vessels and other users, including, but not limited to, jet-skis, recreational (hobby) angling vessels, diving, surfing, kayaking and wind-surfing.

Recreational vessels that use this area are likely to be predominantly local vessels, operating out of the large number of local ports and harbours that exist in the south Pembrokeshire region. These include Neyland Marina, Milford Marina, Tenby, Saundersfoot, Fishguard and Stackpole Quay. Some recreational vessel activity will also be via visiting vessels from home ports further afield, including north Wales, north Devon, Cornwall, and the Republic of Ireland. There are nine Royal Yachting Association (RYA) clubs, nine RYA training centres, and also a number of marinas and slipways across the south Pembrokeshire region.

Closer inshore, near potential landfall locations such as Freshwater West, surfing is a particular high-intensity recreational activity, with both local and visiting surfers taking advantage of well-renowned surf breaks and associated onshore facilities.

Diving is a popular activity in the offshore Study Area with regular trips to well-known wreck and reef sites leaving from ports including Milford Haven, Dale, Little Haven and Martin’s Haven.

There are a number of charter angling vessels that operate off the south Pembrokeshire coast, with five vessels listed[13] as operating out of Milford Haven, and others operating out of a variety of other ports including Saundersfoot and, further afield, Swansea and Penarth.

Freshwater West (potential landfall location) is a large sandy beach that, in addition to surfing (see above), also offers recreational opportunities for swimmers, runners, walkers, horse-riders and, occasionally, kite-surfing. Rock-climbing is also a popular activity in the south Pembrokeshire region, with world-renowned locations close to proposed landfall locations.

7.12.3.2. Tourism and Terrestrial Recreation

Pembrokeshire is an extremely popular tourist destination that attracts visitors from all of the UK and overseas. The Pembrokeshire Coast National Park is the only fully coastal National Park in the UK and the Pembrokeshire Coastal Path is a world renowned 186 mile path that starts in St Dogmaels in north Pembrokeshire and ends in Amroth, south Pembrokeshire. The Coast Path attracts around 1 million user days annually and represents one of the county’s most important economic assets.

Pembrokeshire also contains a large number of beaches and small towns and villages that are key to the local tourist industry. All the proposed landfall locations occur within the National Park Boundary and the Coastal Path also runs through these areas. Across Pembrokeshire, 12 beaches had Blue Flag Award status in 2017, the highest number of any county in the country. 14 beaches were also awarded the prestigious Green Coast Award in 2017.

Cycling is also a popular tourist activity across Pembrokeshire and, in recent years, Ironman Wales has been held at Tenby, attracting over 2,000 competitors and tens of thousands of spectators. The bike course element of this popular triathlon event includes roads on the Angle peninsula, including some around Freshwater West.

[13] https://www.charterboats-uk.co.uk/port

7.12.4. Identification of Key Sensitivities and Potential Impacts

Table 7-24 provides a summary of the potential effects arising from the proposed Project on those tourism and recreation receptors identified above. These potential impacts will be defined further once landfall, cable route and the substation location has been confirmed.

Table 7-24: Key Sensitivities and Potential Impacts for Tourism

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Recreational vessel activity (sailing, angling, diving, wildlife trips)	Obstruction / alteration to regular recreational routes via construction activity (including export cable installation). Obstruction to anchorages, marinas, slipways etc. during construction activity (including export cable installation). Displacement of vessels (long term) or temporary) due to Safety Zones during construction phase. Reduced access to preferred angling marks / impacts on target species.	Construction Operational Decommissioning	Yes	The offshore nature of the proposed Project means that scope for impacts on marine vessel users exists and will require assessment within the EIA.
Coastal recreational users	Disruption / reduced access to preferred areas for nearshore recreational users, including surfers, divers, swimmers.	Construction Decommissioning	Yes	Proposed landfall and nearshore cable installation works will create disruption during construction and decommissioning phases. The exact scale and significance will need to be assessed by the EIA.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Coastal tourism	Disruption / reduced access to beaches at proposed landfall locations.	Construction Decommissioning	Yes	Proposed landfall works will create temporary disruption on beach users and will require assessment within the EIA.
	Disruption / reduced access to Pembrokeshire Coast Path.	Construction Decommissioning	Yes	Proposed landfall works may require temporary disruption / diversion of the Pembrokeshire Coast Path. The exact scale and significance of this will need to be assessed within the EIA.
	Visual impact on tourists of construction works and operational scheme.	Construction Operational Decommissioning	Yes	Temporary visual impacts are expected during construction and decommissioning. During the operational phase, the distance offshore of the planned WTGs (>40 km), means that visual impacts on tourism are not expected. However, in the absence of visualisation data at this stage of the project, this potential impact is scoped in for assessment.
Terrestrial recreational users	Disruption to cyclists, walkers.	Construction Decommissioning	Yes	Construction of the onshore infrastructure (onshore cable, onshore substation) will potentially create impacts on cyclists, walkers in the study area. The exact scale and significance of these impacts will be assessed within the EIA.

7.12.5. Potential Mitigation

Potential mitigation measures that could reduce the significance of impacts on recreation and tourism receptors include, but are not limited to, the following:

- Ensuring that key tourism and recreational organisations (marine and terrestrial) are included in the Project Stakeholder Management Plan and that a series of meetings is scheduled throughout the EIA process to provide updates and to gather further information on potential impacts;
- To ensure as much advance warning as possible is provided, with respect to any construction works that have the potential to create impacts on tourism and recreational receptors;
- To ensure adequate signage and information boards are used to notify locals and tourists of planned works;
- To monitor the suitability of mitigation measures implemented on other projects in this area (potential Greenlink interconnector; META; Bombora wave energy project etc.) with respect to reducing impacts on tourism and recreational receptors. Where appropriate, adopt and Modify these for use on this proposed Project; and
- As far as possible, seek to schedule works at landfall away from peak tourism periods (summer months).

7.12.6. Proposed Approach to Environmental Assessment

As part of the main Project Stakeholder Management Strategy, all local and regional tourism and recreational organisations will be consulted at an early stage of the EIA process in order to:

- Gather information on existing activities in the proposed study area;
- Identify potential impacts via the proposed Project; and
- Identify appropriate mitigation measures.

Based on feedback from the formal Scoping Opinion and these targeted meetings, a full list of potential impacts will be identified and used as the basis of the assessment. Potential impacts during all project phases will be assessed using a standard EIA methodology, with sensitivity of receptor and magnitude of effect combined to predict impact significance.

7.13. Socioeconomics

7.13.1. Study Area

The proposed study area for assessing potential socio-economic impacts will cover several differing geographic scales:

- Local (Pembrokeshire);
- Regional (South Wales); and
- National (Wales).

7.13.2. Baseline Data

This socio-economic section is based on a desktop study of publicly available data from the Office for National Statistics, Nomis, and from StatsWales. Reference is also made, where appropriate, to content within the Pembrokeshire Demonstration Zone EIA scoping Report (Wave Hub Ltd, 2018). The similar Project details and location of this planned proposed Project and the Pembrokeshire Demonstration Zone mean that many of the socio-economic figures presented in the PDZ EIA Scoping Report are relevant for this proposed Project.

7.13.3. Population

The most recent mid-year report distributed by Office for National Statistics (ONS), June 2019, identified the population of Pembrokeshire as 125,055 people - a 3% increase on the previous 10 years. This is similar to the Welsh population (4% increase), and slightly lower than the UK's population (7% increase). In terms of age, individuals between the ages of 0-15 years and 16-64 years had declined slightly over the same time period (4% and 3% respectively). However, residents over the age of 65 years had shown a significant increase of 29% since 2008, which highlights that Pembrokeshire as a county has an ageing population and a decrease in those who are of economically active age (16-64 years). In Wales, and the UK as a whole, there has been an increase in population across all the age ranges.

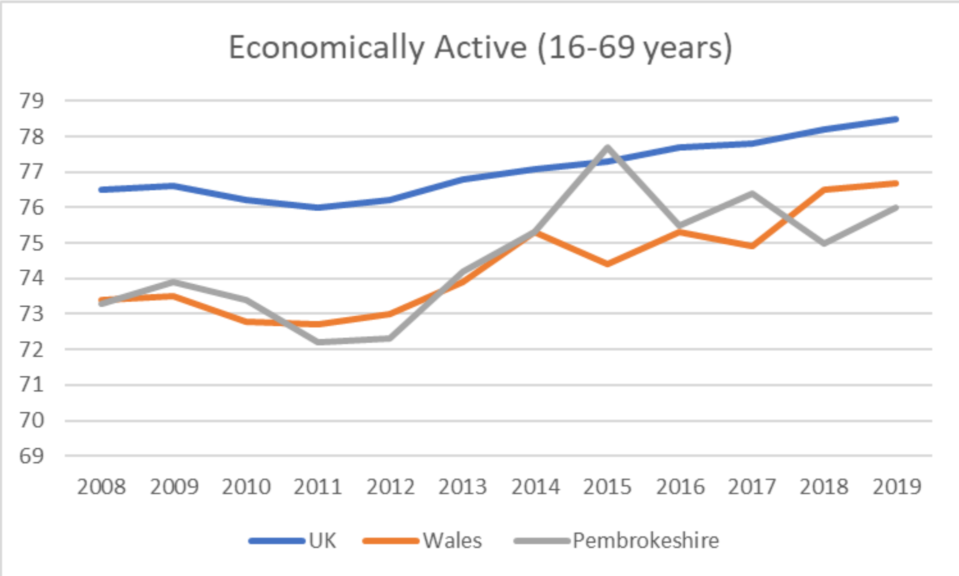
Table 7-25: Mid-Year (2018) Population Estimates by Age (Source: Office of National Statistics, 2019)

Area	Population 2008	Population 2018	% change
Pembrokeshire	121,134	125,055	3%
Age 0-15	22,414	21,423	-4%
Age 16-64	73,790	71,502	-3%
Age 65+	24,930	32,130	29%
Wales	3,025,867	3,138,631	4%
Age 0-15	558,911	562,709	1%
Age 16-64	1,928,555	1,923,929	-0.25%
Age 65+	538,401	651,993	21%
UK	61,823,772	66,435,550	7%
Age 0-15	11,701,906	12,624,179	8%
Age 16-64	40,218,238	41,615,814	3%
Age 65+	9,893,628	12,165,557	23%

7.13.4. Economically Active

Latest statistics (mid-2019; ONS, 2019) show that 76% of people aged 16-69 in Pembrokeshire are economically active.

Figure 7.12: Percentage of Economically Active People by Area (Source: Annual Population Survey (published June 2019), Office for National Statistics via StatsWales)

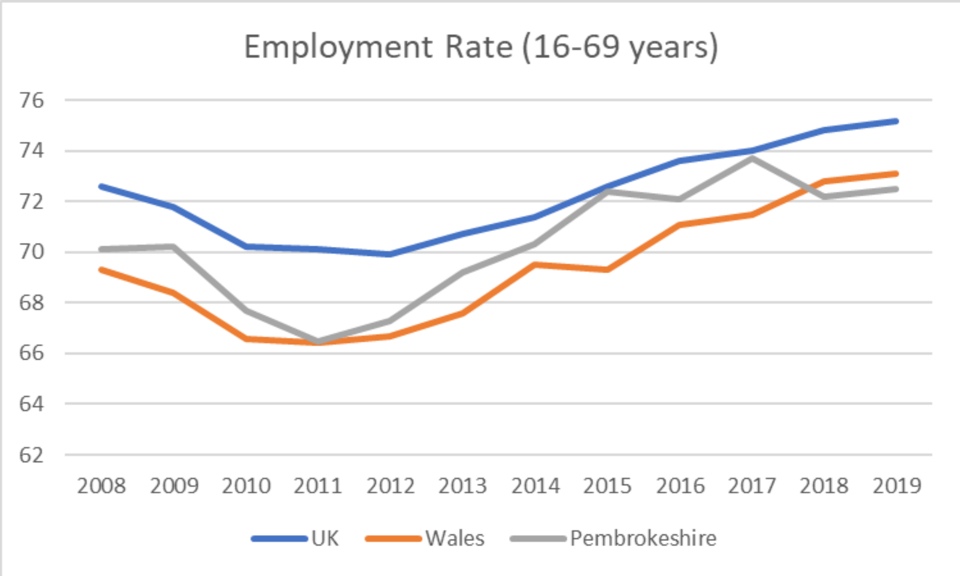


This is similar to the Welsh figure of 76.7% and only slightly lower than the UK average of 78.5%. There has been a 2.7% increase in Pembrokeshire's economic activity since 2008, compared to 3.3% increase in Wales and 2% in the UK as whole.

7.13.5. Employment Rate

Mid-year reporting in 2019 (ONS, 2019), shows the overall employment rate within Pembrokeshire is 72.5%, compared with a figure of 73.1% for Wales, and 75.2% for the wider UK (Figure 7.13). The employment rate within Pembrokeshire has risen by 2.4% since 2008, compared with 3.8% across Wales, and 0.45% across the entire UK.

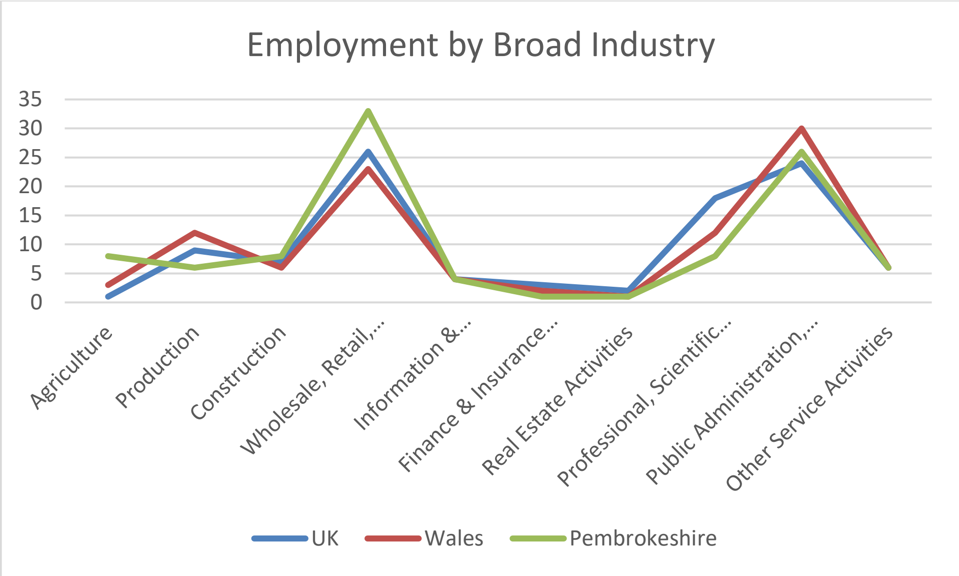
Figure 7.13: Employment Rate by Area (Source: Annual Population Survey (published June 2019), Office for National Statistics via StatsWales)



7.13.6. Workplace Employment by Broad Industry

The largest broad industry sector of Pembrokeshire's employment is 'wholesale, retail, transport, hotels and food' employing 33% of the working population between 16 to 69 (Figure 7.14). This is linked to the county's seasonal tourist trade. This is not dissimilar, albeit slightly higher, than the rest of Wales (26%) and the UK (23%). The second largest industry area is 'public administration, defence, education and health' at 26% of the working population between 16 to 69, slightly lower than wider Wales (30%) and similar to the UK (24%). 'Agriculture', 'construction' and 'professional, scientific and technical activities; administration and support service activities' all represent 8% of employment within the county. Agriculture within Pembrokeshire at 8%, is higher than Wales and the UK (3% and 1% respectively). Construction at 8% is similar (6% and 7%), and 'professional, scientific and technical activities (8%) is lower in Pembrokeshire than in Wales (12%) and the UK as whole (18%). 'Administration and support service activities' is reported at 26% in Pembrokeshire, compared to 30% in Wales and 24% in the wider UK. Production sits at 6%, slightly behind both Wales (12%) and the UK (9%). The remaining industries of 'information and communication' (4%), 'finance and insurance activities' (1%) and 'real estate activities' (1%), are all similar to the Wales and UK figures.

Figure 7.14: Employment by Broad Industry (Source: StatsWales, 2019)



7.13.7. People in Employment by Occupation

Mid-year 2019 statistics show that Pembrokeshire has a higher proportion of managers, directors and senior officials than both Wales and Great Britain (11.1%, compared to 9.7% and 10.9%, respectively) (Table 7-26). However, there is a lower figure of people in professional occupations (15.2%, compared with 18.7% and 20.9% respectively). Pembrokeshire has a higher rate of skilled trade, caring, leisure and other services, and elementary occupations, than Wales and the UK as a whole. Administrative and secretarial, sales and customer service roles are at a similar level to Wales and the UK. Within Pembrokeshire there are variations of a few percent lower than Wales and UK for process, plant and machinery operatives.

Table 7-26: Employment by Occupation (April-March 2018) (Source: ONS, 2019, via Nomis)

	Pembrokeshire (numbers)	Pembrokeshire (%)	Wales (%)	United Kingdom (%)
Managers, directors and senior officials	6,100	11.1	9.7	10.9
Professional occupations	8,400	15.2	18.7	20.9
Associate professional and technical	6,000	10.9	13.8	14.8
Administrative and secretarial	4,600	8.4	9.5	9.9
Skilled trades occupations	9,200	16.7	11.6	10.1

Caring, leisure and other service occupations	6,700	12.1	10	9
Sales and customer service occupations	3,700	6.7	7.9	7.4
Process plant and machine operatives	3,000	5.4	7.3	6.3
Elementary occupations	7,300	13.3	10.9	10.3

A different statistical data set (ONS via Nomis) (Table 7-27) identifies social care and trade peaks (both 17.5%), as the highest job types in Pembrokeshire.

Table 7-27: Employment Jobs by Sector (Source: ONS Business and Employment Survey, via Nomis)

	Pembrokeshire (employee jobs)	Pembrokeshire (%)	Wales (%)	United Kingdom (%)
Total Employee Jobs	40,000			
Full-time	23,000	57.5	65.3	67.5
Part-time	17,000	42.5	34.7	32.5
Employee jobs by industry				
Mining and quarrying	125	0.3	0.1	0.2
Manufacturing	2,000	5	11.2	8.2
Electricity, gas, steam and air conditioning supply	225	0.6	0.6	0.5
Water supply; sewerage, waste management and remediation activities	350	0.9	1	0.7
Construction	2,250	5.6	4.2	4.8
Wholesale and retail trade; repair of motor vehicles and motorcycles	7,000	17.5	14	15.2
Transportation and storage	1,750	4.4	3.3	4.7
Accommodation and food service activities	6,000	15	7.7	7.5
Information and	1,250	3.1	4.2	4.4

	Pembrokeshire (employee jobs)	Pembrokeshire (%)	Wales (%)	United Kingdom (%)
communication				
Financial and insurance activities	300	0.8	2.4	3.5
Real estate activities	400	1	1.2	1.7
Professional, scientific and technical activities	1,750	4.4	5.3	8.4
Administrative and support service activities	1,250	3.1	6.8	9.1
Public administration and defence; compulsory social security	2,000	5	7.1	4.3
Education	4,000	10	9.9	8.9
Human health and social work activities	7,000	17.5	16.1	13.3
Arts, entertainment and recreation	1,750	4.4	2.7	2.6
Other service activities	800	2	2	

7.13.8. Business and Enterprise

Pembrokeshire has a higher business survival rate than both Wales and the UK, reported in 2018 as 94% survival, as opposed to 91% in Wales and 90% in the UK as a whole (Office for National Statistics, 2018**)**.

7.13.9. Gross Value Added (GVA)

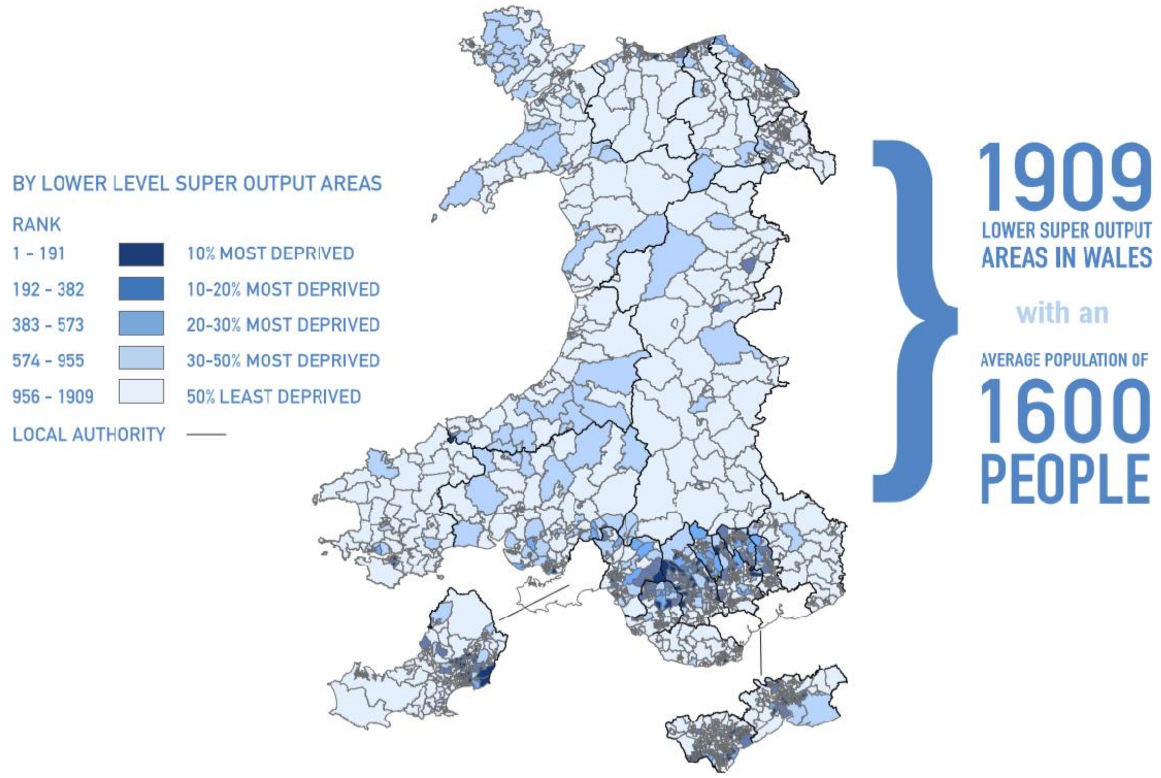
Gross value-added (GVA) is one of the most widely used measures of economic impact. It is defined as the contribution to the economy (value of goods or services) of each individual producer, industry or sector. In 2017 (latest available data), Pembrokeshire GVA was £2,298m, corresponding to £18,427 per head. This was within the context of southwest Wales at £2,305m (£17,610 per head), and the whole of Wales at £62,188m (£19,899 per head).

7.13.10. Welsh Index of Multiple Deprivation (WIMD)

The Welsh Index of Multiple Deprivation assesses deprivation within small areas of Wales, against the following criteria: income, employment, health education, access to community services, safety, physical environment and housing.

The most recent WIMD was published in 2014, with the next WIMD to be published in Autumn 2019. There was a small update in 2015, although none of the updated information featured Pembrokeshire.

Figure 7.15: Infographic Showing the Welsh Index of Multiple Deprivation (From: WIMD, 2014)



The infographic shows that the majority of Pembrokeshire falls within the 50% least deprived category, with some pockets of the county falling within 30-50% most deprived, a small area within the 20-30% most deprived category, and some areas around the towns of Pembroke Dock and Pembroke within the 10% most deprived category. The areas scored lowest in relation to access to services, education, health and income.

7.13.11. Identification of Key Sensitivities and Potential Impacts

The proposed Project has the potential to create a wide range of socio-economic impacts to Pembrokeshire and the wider southwest Wales region. An Offshore Renewable Energy Catapult (ORE Catapult) Modelling report, produced in September 2018, identifies the FLOW industry could be worth a net economic benefit of £2bn per year by 2050. The return for this investment is anticipated to be 9,300 direct and 7,700 indirect jobs and £33.6bn of GVA supported by 2050, representing £15 of GVA for each £1 invested in early stage support. It states that economic benefits will accrue from the supply chain winning a large share of the domestic and export market, and from allowing a smooth transition for personnel and organisations from a retreating oil and gas sector.

In addition to the economic benefits stated above, the proposed Project could also contribute to enhancing the following for the region:

- Reduced carbon emissions from electricity production;
- Improvements to existing infrastructure (through leases at ports and contracts with local supply chain);
- Increased knowledge as a result of research and development in floating wind technologies;
- Supply chain development/clustering increasing Wales' ability to service future domestic and international demand;
- Improvements to energy security (depending on the mix of electricity generation displaced);
- Positive social impacts, such as impacts on employment, inequality and earnings.

7.13.12. Potential Mitigation

Mitigation and monitoring measures will be identified early in the proposed Project's lifetime, via engagement with relevant local agencies (e.g. Pembrokeshire County Council, Marine Energy Wales, Marine Energy Engineering Centre of Excellence, ORE Catapult), Pembrokeshire Coast National Park Authority, Port of Milford Haven, Welsh Government) for consideration during on-going environmental assessments and Project development activities. These may entail investigation of measures to maximise supply chain and training opportunities within Pembrokeshire and Wales; and monitoring of Project expenditure, particularly in terms of local employment and business opportunities (e.g. via contracts).

7.13.13. Proposed Approach to Environmental Assessment

A common approach will be used for the assessment of socio-economics; namely:

- Establishing the baseline conditions through a combination of desk review (using existing information as far as possible), and consultations; and will take into account any committed development projects which could change the baseline in the future;
- Identifying potential environmental impacts which could result from development of the proposed Project. These will include potential adverse impacts and potential beneficial impacts;
- Identification of mitigation measures to prevent, reduce and, where possible offset any potential negative impacts which could either by themselves, or in combination with other impacts have a significant adverse effect and agreement of these measures with the Project team; and
- Assessment of the level of significance of all residual effects (direct and indirect, adverse and beneficial, short-term and long-term, permanent and temporary) taking account of committed mitigation measures.

As part of the impact assessment process, an initial impact screening assessment will be undertaken that will assess all potential impacts. Standard EIA methodology (receptor sensitivity X effect magnitude) will be used to determine significance of impacts. Only impacts identified as potentially significant will then be subject to more detailed impact assessment within the main Chapter. This approach was recently used within the EIA for the Morlais tidal energy project. Table 7.13.5 summarises the proposed additional data collection to inform the socio-economic assessment.

It is important to note that this chapter of the eventual ES will ensure socio-economic impacts are assessed within the context of EIA Regulations. The chapter will not represent a full report into the potential socio-economic implications of the proposed Project.

Table 7-28: Key Sensitivities and Potential Impacts for Socio-Economic

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Aging population	The proposed Project could offer attractive options for employment; for those of economically active age to move to the area.	Construction Operational Decommissioning	Yes	The in-migration of economically active population into Pembrokeshire would be considered a positive impact.
Economically active and employment	The proposed Project could create direct and indirect jobs via the Project, in terms of employment and supply chain opportunities, as well as safeguarding jobs in of existing areas of supply chain, ports and marine services.	Construction Operational Decommissioning	Yes	Job security and the creation of new jobs would be considered a positive socio-economic contribution.
Redress industry sectors	Create an increase in Professional roles and reduce the reliance on seasonal roles.	Construction Operational Decommissioning	Yes	Creating more diverse employment opportunities across the county would be considered a positive socio-economic contribution and result in an impact on local business and employment opportunities.
GVA and productivity	Increase productivity for the region, as long as supply chain benefits remain in the local economy.	Construction Operational Decommissioning	Yes	An objective of the Project, and aim for the developer, is to develop the local supply chain to support employment in the county; and although some elements of manufacture may have to be outsourced, where possible all resources will be sourced locally.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Welsh Index of Multiple Deprivation	Increase revenue opportunities within the region, bringing in more cashflow and contributing to more economic benefit. Over time, this may improve opportunities to address health and income aspects around the Pembroke Dock area (where infrastructure and current supply chain employment is based / could increase).	Construction Operational Decommissioning	Yes	As above, it is the intention for the Project to directly contribute to local employment and the local supply chain thus indirectly improving health and income.
Wellbeing of future generations - green branding for locality	Implementation of mitigation measures that strengthen the 'green' credentials of the Project / locality will potentially lead to beneficial effects on the wellbeing of future generations for all phases.	Construction Operational Decommissioning	Yes	This is a tangible potential beneficial impact that links to Welsh legislation and should be assessed in detail within the EIA.
Level of commerce activity - green cluster creation	Implementation of measures that increase the understanding of the Project and establish a strong green cluster locally, will potentially lead to beneficial effects.	Construction Operational Decommissioning	Yes	This is a tangible potential beneficial impact that has been noted in other areas (e.g. Orkney) so should be assessed in detail within the EIA.

Topic / Receptor	Potential Impacts	Project Phase	Further Assessment at EIA Stage (scoped in)	Rationale for Impact Scoped In / Out
Training impacts - new skills and competence needs	The proposed Project will offer temporary employment opportunities both in terms of direct construction jobs and opportunities in the supply chain.	Construction Operational Decommissioning	Yes	This is a tangible potential beneficial impact and is very relevant to marine energy aspirations and strategy in Pembrokeshire. Therefore, it should be assessed in detail within the EIA.
Increased supply chain experience and case studies in relation to better marine renewables knowledge	Development of local supply chain will continue to progress and gain for their service portfolio from experience within the Project.	Construction Operational Decommissioning	Yes	As above.
Energy security - more green electricity, local supply, diversity of supply	The Project will help to beneficially support a transition to a more decentralised and decarbonised energy Model by showing how other types of renewable energy may be able to contribute effectively to local, regional and UK energy supply.	Operational	Yes	This is a tangible potential beneficial impact and is very relevant to marine energy aspirations and strategy in Pembrokeshire, Wales and the wider UK. Therefore, it should be assessed in detail within the EIA.

Table 7-29: Proposed Additional Data Collection to Inform Socio-Economic Assessment

Data Type Required	Capture Method	Analysis Method	Onward Usage
Supply chain capability within Wales and appetite to service the Project.	ORE Catapult, working in partnership with Wales and South West regions (funded by Isles of Scilly LEP and WG) commenced work on a Supply Chain Study in August 2019. The work entitled '*Benefits of Floating Offshore Wind to Wales and the South West*' is due for finalisation October / November.	1. Initial desk review of report. 2. Liaise with delivery agents, inputting stakeholders and supply chain, to ascertain relevant suppliers to Project.	Utilise the report to develop good engagement with local suppliers and appropriate tenders (and subsequent contracts), in alignment with Project procurement guidelines. Working with the local supply chain as much as possible will help to maximise such benefits to local enterprises and the local population.
Area economic status	WIMD report Autumn 2019	Download from portal	Ensure maximum opportunities for the region and monitor employment, supply chain etc. engagement benefits, to assess Project impact.

7.14. Human Health

7.14.1. Study Area

The Study Area for this assessment is shown in Figure 2.1 and covers offshore and onshore project areas, including the preferred options for landfall, onshore cable routes and onshore substation locations.

7.14.2. Baseline Data

Baseline data from other sections, including Airborne Noise, Air Quality and Population has been used to inform this section of the scoping report. No specific baseline data has been collected at this stage however feedback from scoping will inform the requirement for further assessments and desk-based reviews. Electromagnetic radiation (EMF) during operation (via power cables) is not covered within other chapter but is considered further in this section.

7.14.3. Baseline Environment

There is currently limited information on the human health baseline environment within the proposed study area. A summary of health provision and health issues is provided below.

Within the proposed study area health provisions include 15 GP practices and 29 pharmacies. The County's only general hospital is Withybush Hospital in Haverfordwest; there are two community hospitals in Pembroke Dock and Tenby.

Data from the 2011 census shows 22.3% of the population of the County have a long-term illness, which equates to 25,477 people and covers any long-term illness, health problem or disability that limits daily activities or work (ONS, 2001; Welsh Health Survey, 2015).

The primary health issues in the County are considered to be obesity, 63% of the adult population in the County are considered to be obese; and an aging population, Pembrokeshire has a higher % of 65+ year old residents than the rest of the UK (WAG, 2016).

7.14.4. Identification of Key Sensitivities and Potential Impacts

As outlined above, the majority of potential impacts on human health will be addressed via other parts of the EIA process, with the exception being EMF, this is discussed further below.

Impacts arising from traffic and transport are considered in 7.7; airborne noise and vibration in Section 7.10; and air quality in 7.11. Potential impacts include accidents and safety; noise and vibration; impacts from dust and fine particulate matter and vehicle emissions.

EMFs are both naturally produced and a result of human activities, through the natural magnetic field of the Earth and through voltage. The Earth's magnetic field is produced by currents deep inside the core of the planet; the Earth is also subject to electric fields produced by electrical activity in the atmosphere such as thunderstorms. This magnetic field is referred to as a static or "DC" field as it is usually constant and varies in size only slowly over time. Other fields that alternate in their intensity more frequently over time are referred to as alternating or "AC" fields. In the UK, the Earth's magnetic field is approximately 50 µT.

EMFs are also produced via electricity production, distribution and use, including substations, power line and household equipment. Electric fields are produced by a voltage, which is recorded at 230 volts (V) inside UK homes whereas electrical distribution systems in the UK utilise much higher voltages generally from 11,000 to 400,000 volts (11kV to 400kV). Higher voltages relate to a greater electric field, measured in volts per metre (V/m). However, electric fields are eliminated through burying of cables due to the ground and protective sheaths around cables.

The proposed Project will involve maximum voltages of up to 66,000 (66kV). Magnetic fields are measured in microteslas (µT) and are produced by current, which is a measure of the flow of electricity. Generally, the higher the current (measured in amperes or amps) the greater the magnetic field.

No other elements of the proposed Project are anticipated to cause an impact on the human health.

7.14.5. Potential Mitigation

Mitigation relevant to impacts arising from traffic and transport; airborne noise and vibration; and air quality are considered further in the relevant sections, set out above.

The electrical infrastructure will be designed to comply with current guidelines on levels of public exposure and design of electrical infrastructure.

7.14.6. Proposed Approach to Environmental Assessment

Assessment of potential impacts on human health via traffic and transport; airborne noise and vibration; and air quality will be assessed via methodologies set out in other sections of this report.

With respect to potential EMF impacts, details of the maximum voltages that will apply to this project will be considered in the context of local populations and relevant industry guidance and standards. Potential impacts will be addressed via the standard EIA matrix set out in Section 3. The definition of key receptors will be defined and agreed with key stakeholders prior to the assessment commencing.

7.15. References

ABPmer, 2015. *National AIS Data Set for 2015.* Available online at https://abpmer.maps.arcgis.com/apps/webappviewer/index.html?id=9a09c04c390a4faa8918095b08201be3 [accessed September 2019].

BGS (British Geological Survey), 2019. GeoIndex Offshore. Available online at: http://mapapps2.bgs.ac.uk/geoindex_offshore/home.html# [Accessed August 2019]

Business Wales, 2018. Milford Haven Enterprise Zone. Available online at: https://businesswales.gov.wales/enterprisezones/sites/enterprisezones/files/haven_waterway_-_boundary_map_0%5B1%5D.pdf [accessed August 2019]

Cadw (Cadw: Welsh Historic Monuments), 1999. Caring for Coastal Heritage. ISBN 1 85760 1769. Available online at: https://cadw.gov.wales/sites/default/files/2019-05/Caring_for_Coastal_Heritage_EN_CY.pdf [Accessed August 2019]

Carbon Trust, 2015. *Cable Burial Risk Assessment Methodology; Guidance for the Preparation of Cable Burial Depth of Lowering Specification. Report No. CTC835.* A report produced for the Carbon Trust. 62 pp. Available online at https://www.carbontrust.com/media/622265/cable-burial-risk-assessment-guidance.pdf [accessed September 2019].

CIfA (Chartered Institute for Archaeologists), 2014. Standard and Guidance for Historic Environment Desk-Based Assessments. Chartered Institute for Archaeologists. Available online at: http://www.archaeologists.net/sites/default/files/CIfAS&GDBA_2.pdf [Accessed August 2019]

CIfA (Charted Institute for Archaeologists), 2016. Standard and guidance for archaeological geophysical survey. Published 2014, Updated Jun 2016. Available online at: https://www.archaeologists.net/sites/default/files/CIfAS%26GGeophysics_2.pdf [Accessed August 2019]

CIfA (Chartered Institute for Archaeologists), 2017. Code of Conduct. Chartered Institute for Archaeologists. Available online at: https://www.archaeologists.net/sites/default/files/CIfAS%26GDBA_3.pdf [Accessed August 2019]

Defence Estates, 2018. Public Information Leaflet. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/43344/dte_info_leaflet_pembroke.pdf [Accessed August 2019]

Defra (Department for Environment, Food and Rural Affairs), 2011. Causes of Air Pollution. Available online at: https://uk-air.defra.gov.uk/air-pollution/causes [Accessed August 2019].

Defra (Department for Environment, Food and Rural Affairs), 2019. Magic. Available: https://magic.defra.gov.uk/MagicMap.aspx [Accessed August 2019]

EH (English Heritage), 2013. Marine Geophysics Data Acquisition, Processing and Interpretation: Guidance Notes.

Fitch S, and Gaffney V, 2011. West Coast Palaolandscapes Survey. Available online at: http://archaeologydataservice.ac.uk/archiveDS/archiveDownload?t=arch-1198-1/dissemination/pdf/Report/WCPS_V15_0606.pdf [Accessed August 2019]

Greenlink, 2018. Greenlink Interconnector. Available online at: https://www.greenlink.ie/ [Accessed August 2019]

Gribble J, and Leather S, 2011.Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector. Commissioned by COWRIE Ltd for EMU Ltd. Project reference: GEOARCH-09.

Highways Agency, 2007. Design Manual for Roads and Bridges HA07/07, Air Quality. Environmental Assessment, Vol 11, Section 3.

IAQM (Institute of Air Quality Management and Environmental Protection UK) and EPUK (Environmental Protection UK), 2017. Land Use Planning and Development Control: Planning for Air Quality, January 2017.

IAQM (Institute of Air Quality Management and Environmental Protection UK), 2014. Guidance on the Assessment of Dust from Demolition and ConstructionIEMA (2016). Delivering proportionate EIA: A collaborative strategy for enhancing UK Environmental Impact Assessment practice.

IEMA (Institute of Environmental Management and Assessment), 2018. Perspectives upon proportionate EIA: Thoughts pieces from UK practice. Impact Assessment Outlook Journal. Volume 1, December 2018.

IFA Wales (Institute for Archaeologists Wales / Cymru), 2016. A Research Framework for the Archaeology of Wales. DRAFT Refresh Review Documents 2016. Available online at: https://www.archaeoleg.org.uk/documents2016.html [Accessed August 2019]

JNAPC (Joint Nautical Archaeology Policy Committee) and The Crown Estate, 2006. JNAPC Code of Practice for Seabed Development. 2006. Available online at: http://www.jnapc.org.uk/jnapc_brochure_may_2006.pdf [Accessed August 2019]

Intertek, 2016. Greenlink Interconnector: Environmental Scoping Report – UK Marine Route. Reference No. P1975_R3994_Rev1

Intertek, 2019. *Planning and Consultation Marine License Application Wales.* Available online at: https://www.greenlink.ie/marine-licence-application-wales [Accessed August 2019].

Lle, 2019. Available online at: http://lle.gov.wales/home [Accessed August 2019]

MMO (Marine Management Organisation), 2017. UK fleet landings by ICES Rectangle (2012-2016). Available online at: https://www.gov.uk/government/statistical-data-sets/uk-fleet-landings-by-ices-rectangle [Accessed August 2019].

MMO (Marine Management Organisation), 2019. *Marine Planning Evidence.* Available online at: http://defra.maps.arcgis.com/apps/webappviewer/index.html?id=2c2f6e66c0464fa99d99fd6d8822ddef [Accessed August 2019].

NATS (National Air Traffic Services), 2017a. Self-Assessment Maps, Wind Farms. National Air Traffic Services. Available online at: https://www.nats.aero/services/information/wind-farms/self-assessment-maps/ [Accessed August 2019]

NATS (National Air Traffic Services), 2017b. Introduction to Airspace. National Air Traffic Services. Available online at: https://www.nats.aero/ae-home/introduction-to-airspace/ [Accessed August 2019]

National Trust, 2019. *Wildlife watching at Freshwater West.* Available online at: https://www.nationaltrust.org.uk/features/wildlife-watching-at-freshwater-west [Accessed August 2019]

Nedwell JR, Parvin SJ, Edwards B, Workman R, Brooker AG, and Kynoch JE, 2007. *Measurement and interpretation of underwater noise during construction and operation of offshore windfarms in UK waters*. Report commissioned and published by COWRIE Ltd. ISBN: 978-0-9554279-5-4.

Nomis, 2018. Nomis Reports by Region. Available online at: https://www.nomisweb.co.uk/reports/lmp/la/1946157391/report.aspx [accessed August 2019]

NRW (Natural Resources Wales), 2010. Sea Fish Atlas. Available online at: http://lle.gov.wales/apps/marineportal/ [Accessed August 2019]

NRW (Natural Resources Wales), 2014. *National Landscape Character NLCA48 Milford Haven.* 8pp.

NRW (Natural Resources Wales), 2015. *Marine Character Areas MCA 23 South Pembrokeshire Open Waters.* 7pp. Available online at: https://naturalresources.wales/media/674501/mca-23-south-pembrokeshire-open-waters-final.pdf [Accessed August 2019].

NRW (Natural Resources Wales), 2019. Habitat Networks. Available online at: https://naturalresourceswales.sharefile.eu/share/view/sbf07ff88e0a48839/fo0c8913-09c9-4adb-8f8a-385f4e267d57 [Accessed August 2019]

Office for National Statistics, 2011. 1991, 2001 and 2011 Census data. Available from: www.statswales.gov.wales/Catalogue/Census/2011/LimitingLongTermIllnessDisability-by-LocalAuthority [accessed October 2019).

ONS (Office for National Statistics), 2018a. Regional Accounts. Available online at: https://www.ons.gov.uk/economy/regionalaccounts [Accessed August 2019]

ONS (Office for National Statistics), 2018b. ONS Business Surveys. Available online at: https://www.ons.gov.uk/surveys/informationforbusinesses/businesssurveys/businessregisterandemploymentsurvey [Accessed August 2019]

ONS (Office for National Statistics), 2019. ONS Annual Population Survey. Available online at: https://www.ons.gov.uk/surveys/informationforbusinesses/businesssurveys/businessregisterandemploymentsurvey [Accessed August 2019]

ORE Catapult (Offshore Renewable Energy Catapult), 2018. Macroeconomic Benefits of Floating Offshore Wind in the UK. Available online at: https://s3-eu-west-

1.amazonaws.com/media.newore.catapult/app/uploads/2018/10/29105933/PN000244-FWMS-Report_FINAL.pdf [Accessed August 2019]

Oxford Archaeology, 2008. Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy. 2008. Guidance prepared by Oxford Archaeology and issued by COWRIE.

PCC (Pembrokeshire County Council), 2013. Local Development Plan. Available online at: https://www.pembrokeshire.gov.uk/adopted-local-development-plan [accessed August 2019]

PCC (Pembrokeshire County Council), 2017. Air Quality Progress Report.

PCC (Pembrokeshire County Council), 2018. Listed Building and Conservation Areas. Available online at: https://www.pembrokeshire.gov.uk/listed-buildings-and-conservation-area/conservation-areas [Accessed August 2019]

PCC (Pembrokeshire County Council), 2019. Draft Landscape Character Assessment. Available at: https://www.pembrokeshire.gov.uk/adopted-local-development-plan/ldp-supplementary-planning-guidance [accessed September 2019]

PCNP (Pembrokeshire Coast National Park), 2010. Pembrokeshire Coast National Park Local Development Plan. Available online at: https://www.pembrokeshirecoast.wales/Files/files/Dev%20Plans/LDP2/Deposit/Deposit%20Local%20Development%20Plan%20POST%20NPA%2028th%20of%20March.pdf [accessed August 2019]

PCNP (Pembrokeshire Coast National Park), 2013a. *Pembrokeshire Coast National Park Seascape Character Assessment: No. 35, Castlemartin coastal waters.* Available online at: https://www.pembrokeshirecoast.wales/files/files/Dev%20Plans/AdoptedSPG/SCA35%20Castlemartin%20coastal%20waters.pdf [Accessed August 2019].

PCNP (Pembrokeshire Coast National Park), 2013b. *Pembrokeshire Coast National Park Seascape Character Assessment: No. 32, Inner Milford Haven.* Available online at: https://www.pembrokeshirecoast.wales/files/files/Dev%20Plans/AdoptedSPG/SCA32%20Inner%20Milford%20Haven.pdf [Accessed August 2019].

PCNP (Pembrokeshire Coast National Park), 2013c. Landscape Character Areas Supplementary Planning Guidance. Available at: https://www.pembrokeshirecoast.wales/default.asp?PID=249 [accessed September 2019]

PCNP (Pembrokeshire Coast National Park), 2018. Pembrokeshire Coast National Park Local Development Plan, Deposit Plan. Available online at: https://www.pembrokeshirecoast.wales/Files/files/Dev%20Plans/LDP2/Deposit/Deposit%20Local%20Development%20Plan%20POST%20NPA%2028th%20of%20March.pdf [accessed August 2019]

Royal Haskoning DHV, 2017. Norfolk Vanguard Offshore Wind Farm. Appendix 5.1 Underwater Noise Assessment, Preliminary Environmental Information Report. Vol 3.

Rhoscrowther Wind Farm, 2017. About Rhoscrowther Wind Farm. Available online at: http://rhoscrowtherwindfarm.co.uk/ [Accessed August 2019]

SNH (Scottish Natural Heritage), 2001. *Natura Casework Guidance: Consideration of Proposals Affecting SPAs and SACs*. SNH Guidance Note Series.

StatsWales, 2019. Business, Economy and Labour. Available online at: https://statswales.gov.wales/Catalogue/Business-Economy-andLabour-Market/Businesses/Business-Demography [Accessed August 2019]

Scientific, Technical and Economic Committee for Fisheries, 2018. Fisheries Dependent Information: Data by quarter-rectangle. Available online at: https://stecf.jrc.ec.europa.eu/dd/effort/graphs-quarter [Accessed September 2019].

The Crown Estate, 2010. *Model Clauses for Archaeological Written Schemes of Investigation: Offshore Renewables Projects*

The Crown Estate, 2014. *Protocol for Archaeological Discoveries (PAD): Offshore Renewables Projects*

The Crown Estate, 2019. *Maps and GIS data.* Available at: https://www.thecrownestate.co.uk/en-gb/resources/maps-and-gis-data/ [Accessed August 2019]

UK Government, 2016. MGN 543 Offshore Renewable Energy Installations Safety Response, Guidance. August 2016.

WAG, 2016. Obesity Levels. Available from: www.gov.wales/docs/statistics/2016/160622-welsh-health-survey-trends-2003-04-04-2015-en.xlsx [accessed October 2019]

Wave Hub Limited, 2018. Pembrokeshire Demonstration Zone Feasibility Study Environmental Scoping Report. Project No. 122674. Prepared for Wave Hub limited.

Welsh Assembly Government, 2011. Conservation Principles for the Sustainable Management of the Historic Environment in Wales. Available online at: https://cadw.gov.wales/sites/default/files/2019-05/Conservation_Principles%20for%20the%20sustainable%20managment%20fo%20the%20historic%20environment%20of%20Wales.pdf [Accessed August 2019]

Welsh Government, 2017a. Planning Policy Wales. Technical Advice Note 24: The Historic Environment. May 2017. Digital ISBN 978-1-4734-9461-9. Available online at: https://gweddill.gov.wales/docs/desh/policy/180223tan-24-the-historic-environment-en.pdf [Accessed August 2019]

Welsh Government, 2017b. Managing Historic Character in Wales. May 2017. Available online at: https://cadw.gov.wales/sites/default/files/2019-05/Managing%20Historic%20Character%20in%20Wales%20%20EN.pdf [Accessed August 2019]

Welsh Government, 2017c. Setting of Historic Assets in Wales. May 2017. Available online at: https://cadw.gov.wales/sites/default/files/2019-05/20170531Setting%20of%20Historic%20Assets%20in%20Wales%2026918%20EN.pdf [Accessed August 2019]

Welsh Government, 2019b. Wales Marine Planning Portal. Available online at: http://lle.gov.wales/apps/marineportal/#lat=52.5129&lon=-3.9111&z=8 [Accessed August 2019]

Welsh Health Survey, 2005. 2003/05 Local Authority Report, National Assembly for Wales.

Wessex Archaeology Ltd, 2007. Historical Guidance for the Offshore Renewables Energy Sector. Commissioned by COWRIE Ltd. Reference: ARCH-11-05. ISBN-13-978-0-9554279-1-6.

8. Cumulative Effects Assessment

8.1. Overview

This section of the scoping report presents the proposed approach to Cumulative Effects Assessment (CEA) for the proposed Project. CEA is a requirement under the EIA Regulations 2017 (Schedule 4, Paragraph 5(e)). For the purpose of this report and the future EIA, cumulative effects are defined as those effects on a receptor that may arise when the development is considered together with other existing and / or approved projects.

Even though the proposed Project does not quality as a Nationally Significant Infrastructure Project (NSIP), details set out within PINS Advice Note 17 (PINS, 2015) have been used as the basis of this assessment.

8.2. Approach

8.2.1. Guidance

The proposed approach to CEA takes account of the following documents:

- PINS guidance (Advice Note 17, Cumulative Effect Assessment, PINS 2015); and
- Cumulative Impact Assessment Guidelines: Guiding Principles for Cumulative Impacts Assessment in Offshore Wind Farms (Renewable UK, 2013).

PINS guidance (Advice Note 17, PINS 2015b) identifies that the following types of major developments in the wider study area should be taken into consideration in any CEA:

- Projects under construction;
- Consented / permitted application(s) - but not yet implemented;
- Submitted application(s) - but not yet determined;
- Projects on the National Infrastructure Planning Portal's Programme of Projects;
- Projects identified in the relevant development plan (and emerging development plans – with appropriate weight given as they move closer to adoption) recognising that much information on any relevant proposals will be limited; and
- Projects identified in other plans and programmes (as appropriate) which set the framework for future development consents / approvals, where such development is reasonably likely to come forward.

Projects that were built and operational at the time that survey data were collected have been classified as part of the baseline conditions. For those projects that were only partially constructed, or have only recently been completed, the full extent of the impacts arising from the development(s) may not be known and have therefore been included within the CEA.

8.2.2. Staged Approach

It is proposed that the 4-stage approach outlined in PINS Advice Note 17 is followed for the CEA of the proposed Project, outlined in Table 8-1.

Table 8-1: Staged Approach to Cumulative Effects Assessment

CEA Stage	Description
Stage 1 - Establish the project's Zone of Influence (ZOI) and identify a long list of '*other development*'	The Project undertakes a desk study to identify the zone of influence (ZOI) for the development, for the topics that are proposed to be scoped into the EIA. The ZOI analysis must be documented (i.e. table of topics and ZOI), with supporting GIS. The long list 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 (county, development type, when occurring, etc.) is documented in a matrix (Matrix 1), 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). The project then consults with the relevant planning authority(ies) and statutory consultees regarding the long list.
Stage 2 – Identify shortlist of '*other development*' for the CEA	PINS have provided inclusion / 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 (Matrix 2). Documented information on each '*other development*' is likely to be high level at this stage, outlining the key issues to take forward.
Stage 3 – Information Gathering	All available information on the '*other developments*' within the shortlist generated at Stage 2 is collated to inform the CEA. This information is ideally included within Matrix 2.
Stage 4 - Assessment	The project reviews each of the '*other development*' in turn to assess whether cumulative effects may arise (documented in Matrix 2). Matrix 2 should also include any mitigation measures where adverse cumulative effects are identified and should clearly signpost to the relevant means of securing mitigation (e.g. DCO requirements and associated mitigation plans). While not to be used as a means to shift the burden of mitigation, it may be appropriate to ascertain the contribution of each development to the effect (done via professional judgement). This may be useful during the consultation with other developers to identify means to jointly address mitigation of significance adverse cumulative effects and means to ensure delivery.

Table 8-2 summarises the offshore search extents for the CEA.

Table 8-2: Cumulative Effects Assessment Offshore Search Area Extents

Project or Plan	Extent of Search Area
Marine aggregate and disposal	Up to 50 km from the offshore array area and offshore export cable corridor
Offshore energy	Up to 200 km from the offshore array area and offshore export cable corridor
Commercial fisheries	Up to 200 km from the offshore array area and offshore export cable corridor
Oil and gas	Up to 200 km from the offshore array area and offshore export cable corridor
Cables and pipelines	Up to 50 km from the offshore array area and offshore
Shipping	Up to 200 km from the offshore array area and offshore export cable corridor
Military, aviation and Radar	Up to 200 km from the offshore array area and offshore export cable corridor
Coastal	Up to 200 km from the offshore array area and offshore export cable corridor

With respect to onshore works, the following extents of search area will be used within the CEA:

- Landfall: Up to 5 km from the landfall areas;
- Onshore export cable corridor: Up to 5 km from the cable corridor (including within);
- Onshore Substation: Up to 5 km from the substation location.

Once the CEA long list is created (Stage 1 above), all projects and plans will be screened, based on the potential for interaction with the proposed Project. Interaction may be either temporal, spatial or conceptual. The screening of plans or projects will be based upon the potential impacts of each in combination with the proposed Project, therefore, the plan or project may be screened out for one receptor / topic of the ES but screened in for another.

Those plans or projects that are screened in will be carried forward into the CEA.

The screening process will follow the criteria in Table 8-3 below:

Table 8-3: Cumulative Effects Assessment Screening Criteria

Screened Out	Screened In
Project or plan included as part of the baseline (therefore not considered in CEA); Low data confidence;	Project, plan or activity considered as part of the baseline but has ongoing effects. There is a potential for a cumulative impact to occur.

No conceptual effect-receptor pathway exists; No physical effect-receptor overlap; or No temporal overlap.	

During the screening process it is important to follow the steps above in the defined order as this will allow a clear justification for screening projects in or out. Additionally, this will then allow, for projects with low data availability, the screening out of effects that cannot be included due to lack of data, while screening in those that can be considered with the available data.

8.3. Potential Cumulative Impacts

Based on current understanding of the type of effects that may be created by the proposed Project and also the location a sample of the status of other projects and plans in the wider study area, the following potential cumulative effects have been identified and will require assessment (Table 8-4 and Table Table 8-5). This will be confirmed by following the CEA process detailed in preceding sections.

Table 8-4: Cumulative Effects Assessment Offshore Search Area Extents

Project or Plan	Potential Cumulative Impacts
Greenlink Interconnector	Underwater noise and vibration Impacts on marine mammals, fish and shellfish, designated sites Marine seabed and water quality Commercial fisheries and shipping and navigation
Bombora Wave Energy Project	Underwater noise and vibration Impacts on ornithology and marine mammals, fish and shellfish, designated sites Seascape, landscape and visual impacts Marine seabed and water quality Commercial fisheries and shipping and navigation
META	Underwater noise and vibration Impacts on ornithology and marine mammals, fish and shellfish, designated sites Seascape, landscape and visual impacts Marine seabed and water quality Commercial fisheries and shipping and navigation
MHPA Maintenance Dredging	Underwater noise and vibration Impacts on marine mammals, fish and shellfish, designated sites Marine seabed and water quality Commercial fisheries and shipping and navigation

Table 8-5: Cumulative Effects Assessment Onshore Search Area Extents

Project or Plan	Potential Cumulative Impacts
Greenlink Interconnector	Terrestrial ecology, ornithology and designated sites Traffic and Transport
Bombora Wave Energy Project	Terrestrial ecology, ornithology and designated sites Traffic and Transport
META	Terrestrial ecology, ornithology and designated sites Traffic and Transport
Pembroke Power Station Emergency Backup Generator	Landscape and visual impacts Designated sites and terrestrial ecology Traffic and transport
Valero CHP Cogeneration Unit	Landscape and visual impacts Designated sites and terrestrial ecology Traffic and transport
Rhoscrowther Wind Farm	Landscape and visual impacts Designated sites and terrestrial ecology Traffic and transport
Blackbridge Energy from Waste Facility	Designated sites and terrestrial ecology
Milford Haven Waterfront Masterplan	Designated sites and terrestrial ecology
Solar Farms at Hoplass and Wogaston Farm, Rhoscrowther and Chapel Farm	Land use

8.4. References

PINS (2015). Advice Note 17: Cumulative Effects Assessment. Available at:https://infrastructure.planninginspectorate.gov.uk/legislation-and-advice/advicenotes. Accessed 15/09/19.

RenewableUK (2013). Cumulative Impact Assessment Guidelines: Guiding Principles for Cumulative Impacts Assessment in Offshore Wind Farms. Available at: http://www.nerc.ac.uk/innovation/activities/infrastructure/offshore/cumulativeimpact-assessment-guidelines/ Accessed 15/08/19.

9. Summary of Impacts

9.1. Potential Impacts and Scope of EIA

Table 9-1 provides a summary of the potential impacts identified within the Scoping Report and the proposed scope of the EIA and subsequent ES.

Table 9-1: Summary of Potential Impacts and Scope of EIA

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Physical environment – physical processes			
Sediment transport	Changes to sediment transport system through changes in wave and current climate.	Construction Operational Decommissioning	Changes in metocean conditions are possible as a result of construction and / or presence of structures within the proposed Project site. However, it is not expected that there would be a significant change from baseline hydrodynamic conditions and, thus, little effect on baseline sediment transport. This will be confirmed through the EIA.
Coastal erosion	Changes in sediment transport at the coast.	Construction Operational Decommissioning	Changes to local hydrodynamic regime, for example, changes to tidal energy and wave directions may result in changes to the coastal erosive regime. While this is unlikely, due to the importance of the receptor this will be scoped into EIA.
Seabed morphology	Modification of seabed morphology as a result of anchoring structure.	Construction Operational	Placement of anchoring on the seabed may have the potentially to locally alter hydrodynamics, potentially causing scour and associated alterations to seabed morphology. It is not expected that there will be a significant change to baseline conditions, however this will be confirmed during EIA.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Sediment transport	Increases in suspended particles which may become part of the local sediment transport regime through drilling of anchors into hard rock seabed, or their removal during decommissioning.	Construction Decommissioning	Levels of additional sediment generated as part of the construction or decommissioning are expected to be negligible when compared with the baseline local and regional sediment transport, and of a temporary duration.
Physical environment – marine sediment and water quality			
Water quality (suspended sediment)	Increases in suspended particles which may become part of the local sediment transport regime through drilling of anchors into hard rock seabed, or their removal during decommissioning.	Construction Decommissioning	Increased suspended sediments leading to smothering of surrounding habitats or a release of contaminated sediments is very unlikely in a strongly tidal area. If an increase in suspended sediments does occur, this will be rapidly dispersed due to tidal flows. The tidal flows will also reduce any smothering potential due to increased dilution and dispersion rates.
Water quality (suspended sediment)	Changes to sediment transport system through changes in wave and current climate.	Construction Operational Decommissioning	Increased suspended sediments leading to smothering of surrounding habitats or a release of contaminated sediments as a result of changes in hydrodynamics is very unlikely in a strongly tidal area. If an increase in suspended sediments does occur, this will be rapidly dispersed due to tidal flows. The tidal flows will also reduce any smothering potential due to increased dilution and dispersion rates.
Water quality (chemical contamination)	Pollution through unplanned leaks and spills.	**Scoped out**	The risk of accidental and unplanned release of chemicals and pollutants is considered extremely low. An Environmental Management Plan (EMP) will be produced, with procedures that will minimise the risk of such events and contain measures to minimise the impacts should they occur. These effects will therefore not be considered further in the EIA.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Sediment quality (contamination of marine sediments)	Pollution through unplanned leaks and spills.	**Scoped out**	The risk of accidental and unplanned release of chemicals and pollutants is considered extremely low. An Environmental Management Plan (EMP) will be produced, with procedures that will minimise the risk of such events and contain measures to minimise the impacts should they occur. These effects will therefore not be considered further in the EIA.
Physical environment – onshore geology, geomorphology and soils			
Geological features	Damage or disturbance of geological features of interest (including national and regional designated sites).	Construction Decommissioning	As the exact cable route is currently unknown, there is potential for disturbance of geological features of interest and is therefore scoped in for assessment. It is not anticipatedthat there will be an impact on geological features from the onshore works. With the exception of the landfall, no significant excavation into the underlying geology would be expected, with any excavations being within surface soils. Landfall installation would either require open trenching or HDD drilling through rock.
Geomorphology / Soils	Damage or removal of geomorphological (topographical) and / or soil features.	Construction Decommissioning	Excavation of the onshore cable route and groundworks for the substation are expected to be predominantly within areas that are already Modified. As cable will be buried, it is not anticipated that there would be permanent changes to geomorphology or topography, although there may be temporary disturbance during construction and possibly decommissioning phases. Once buried, the ground level of the cable route would be returned to near baseline conditions. Therefore, it is not anticipated that there would be an impact on geomorphology or topography.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Soil	Compaction and degradation of soils.	Construction Decommissioning	Excavation works during installation of the onshore cable route is likely to disturb surface soils. This can result in compaction and degradation of excavated soils, particularly topsoil. The extent of significance would be influenced by the final locations and construction methodology used. In addition, construction plant activities may also cause compaction of soils in the surrounding working area. Installation in areas of made ground are less likely to result in impacts to surface soils.
Physical environment – onshore groundwater and hydrology			
Hydrology	Changes to hydrology (including private water supplies).	Construction Operational Decommissioning	The cable route may need to cross hydrological features such as streams or drainage channels. The impacts of this will be dependent on construction methodology, location and nature of hydrological features in the development area.
Surface Water Bodies	Sediment suspended as a result of construction or decommissioning activities may enter surface water bodies.	Construction Decommissioning	Increased sediment supply could result in localised increases in turbidity and alter sediment deposition patterns and locations downstream of the source point.
Surface Water Bodies and Groundwater	Release of contaminants to surface waters and groundwater.	Construction Decommissioning	Onshore activities associated with construction and decommissioning works have the potential for accidental release of contaminants which could directly enter surface water bodies or enter the groundwater.
Flood Risk	Alteration to flood risk as a result of onshore works.	Construction Operational Decommissioning	The onshore works may be located within areas at risk from river, tidal or coastal flooding. The impacts of this will be dependent on construction methodology, location and nature of hydrological features and flood risk zones in the area of works, which is currently unknown. Flood risk (including sea level rise associated with climate change) should therefore be considered further as part of the EIA.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Water Framework Directive			
WFD Designated Water Bodies	Increase in suspended sediments during construction and decommissioning (installation of cables and during landfall activities).	Construction Decommissioning	Increased suspended sediments, sufficient to lead to deterioration in status, is very unlikely in the tidal coastal area. If an increase in suspended sediments does occur, this will be rapidly dispersed due to tidal flows. Increased sediment supply as a result of onshore activities could potentially result in localised increases in turbidity in river, lake, and groundwater water bodies
WFD Designated Water Bodies	Suspension of contaminated sediments into the water column during construction and decommissioning. Contaminants adsorbed onto particles could be released to designated water bodies.	Construction Decommissioning	Onshore activities associated with construction and decommissioning works have the potential for accidental release of contaminants which could directly enter surface water bodies or enter the groundwater.
WFD Designated Water Bodies	Accidental release of contaminants from onshore vessels and plant.	Construction Decommissioning	Onshore activities associated with construction and decommissioning works have the potential for accidental release of contaminants which could directly enter surface water bodies or enter the groundwater.
Terrestrial ecology - habitats			
Sand dune habitat	Direct disturbance and loss of habitat within the dune system along onshore cable route.	Construction Decommissioning	Two areas of dunes within the study area are designated features, part of SAC and SSSI. Further information on landfall and construction method is required before understanding the significance of impact.
Vegetated sea cliffs and slopes (maritime and dry heath)	Damage, disturbance and loss of cliffs, grassland and associated species along onshore cable route.	Construction	Cliffs and maritime grassland are sensitive to disturbance and slow to recover, so any level of disturbance may be considered significant. These habitats within the study area are features of SAC and SSSI.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Calcareous grassland	Damage, disturbance and loss of areas of grassland and associated species along onshore cable route.	Construction	Large areas of grassland may be affected depending on the final route. Due to the sensitive nature of this habitat and protected status further assessment is required.
Neutral unimproved grassland	Damage, disturbance and loss of areas of grassland and associated species along onshore cable route and lay down areas of associated works.	Construction	Areas of neutral unimproved grassland are sensitive to disturbance and these habitats within the study area are features of SSSI. Further information is required to assess impacts.
Semi-natural broadleaved woodland	Damage, disturbance and loss of areas of woodland and associated species along onshore cable route and lay down areas of associated works.	Construction Decommissioning	If the route or areas disturbed by landfall coincide with areas of woodland it is likely to result in significant impacts which require further assessment once the scheme is finalised.
Ponds and Lakes	No direct effect expected but possible damage, disturbance to ponds or lakes along onshore cable route. Pollution incidences may also occur on connected watercourses.	Construction	Although no ponds or lakes have been identified at the potential landfall sites and onshore cable routes would seek to avoid lake or pond features, further information is required prior to scoping out any significant impact.
Streams and Rivers	Direct damage and disturbance to streams, rivers and associated habitats along onshore cable route or indirectly from work on hydrologically connected habitats.	Construction	Watercourses and associated habitats and species are vulnerable to disturbance and damage, sometimes taking a long time to recover. Further detailed assessment is required to establish the significance of the impact.
Wetlands	Direct damage and disturbance to wetlands and associated habitats along onshore cable route.	**Scoped out**	No areas of wetland are expected to be directly affected by the onshore cable route.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Wetlands	Indirect impacts such as pollution incidences may occur on connected watercourses.	Construction	Possible indirect effects pending confirmation of final cable route. A final assessment will be undertaken once the route is confirmed.
Improved Grassland (pasture)	Direct damage and disturbance to improved grassland and associated habitats such as field margins along onshore cable route.	Construction	Improved grassland is of negligible value however associated habitats such as field margins are of intrinsic value at a local and regional level. Field margins may be severed or temporarily damaged depending on construction method.
Cultivated land	Direct damage and disturbance to cultivated land and associated habitats such as field margins along onshore cable route.	Construction	Cultivated land is of negligible value however associated habitats such as field margins are of intrinsic value at a local and regional level. Field margins may be severed or temporarily damaged depending on construction method.
Roadside verges	Disturbance, severance or temporary loss along onshore cable route. Damage may also be caused in accessing sites during construction.	Construction	Roadside verges are a valuable habitat and severance of the verge network may result in significant impacts if this feature is the only means of connectivity through the area. Further assessment is required once final route and construction methodology is known.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Terrestrial ecology - species			
Bats (Greater and lesser horseshoe bats, Myotis bat species, barbastelle bat)	Direct or indirect disturbance along onshore cable route.	Construction Operational Decommissioning	Roost site not likely to be directly impacted but if cable installation runs close to bunkers or caves disturbance may occur. Direct and indirect impacts may affect foraging and commuting bats during all phases of the Project. These relate to severance of connectivity to habitat features such as hedgerows and woodland from the cable installation; temporary disturbance or loss of foraging habitat as a result of cable installation; and increased noise, light and vibration from construction, decommissioning and during the operation of the substation. All bat species are exceptionally vulnerable to severance of connectivity and disturbance from noise and light. Detailed assessment will be required once the onshore cable route and onshore substation location have been finalized. All species are either SAC feature or Annex IV species.
Otter	Direct or indirect disturbance at landfall, along onshore cable route and onshore works to species and supporting habitat.	Construction Decommissioning	Possible disturbance to habitats supporting resting or breeding otters may occur at landfall sites and along the onshore cable route. There is a risk of pollution incidences on hydrologically connected features affecting foraging otters and also an increase in noise, lighting and vibration during construction, operation and decommission. Otters are a SAC feature and vulnerable to habitat fragmentation, loss of connectivity and pollution. Depending on the final landfall, onshore cable route and onshore substation the impacts of the Project may be significant. Further assessment will be required.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Dormouse	Disturbance to habitat, severance of connectivity and loss of foraging habitat along cable route or substation siting.	**Scoped out**	There are no records of dormice in the study area and limited suitable habitats therefore no impact is anticipated
Adder	Direct or indirect disturbance at landfall, along onshore cable route and onshore works to species and supporting habitat.	Construction	Adders are sensitive to habitat fragmentation and disturbance and the installation of the onshore cable route may disturb suitable habitats. Impacts may also arise at landfall sites and associated construction lay down areas.
Great crested newt	Disturbance to habitat, severance of connectivity and a loss of foraging habitat may occur as a result of cable route or the substation siting.	**Scoped out**	There are no records of great crested newt in Pembrokeshire and limited suitable habitats therefore no impact is anticipated.
Marsh fritillary butterfly	Disturbance or loss of breeding habitat along cable route or from associated construction lay down areas.	Construction	Certain areas within the study area support marsh fritillary and until the final landfall and cable route are defined it will not be possible to assess the significance of impact.
Shrill carder bee	Loss or disturbance of supporting habitat along onshore cable route.	Construction	Excavations and associated works from the onshore cable route may disturb and destroy habitat supporting the shrill carder bee resulting in mortality or loss of feeding areas. Shrill carder bee are exceptionally vulnerable to habitat loss and any disturbance may be considered significant. Further assessment is required once the onshore cable route / location of the onshore substation is finalised.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Petalwort	Loss or disturbance of supporting dune habitat at landfall and along onshore cable route.	Construction	Excavations and associated works from landfall and the onshore cable route may disturb and destroy the dune habitat resulting in a loss of plants or habitat quality. Petalwort are vulnerable to habitat loss and disturbance may be significant. Further assessment is required once landfall and the onshore cable route/location of the onshore substation is finalised.
Benthic and intertidal ecology			
Benthic habitats and species (offshore)	Direct loss of and disturbance to seabed and habitats and species during installation, maintenance, and removal of offshore Project infrastructure specifically anchor mooring and cable laying (including laying of cable protection).	Construction Operational Decommissioning	Activities could cause physical disturbance to habitats and species and habitat loss /displacement. The sensitivity of the habitats will depend on the species present, which will be determined during baseline surveys. The extent of this effect will be limited to the project infrastructure footprint. Habitat loss may be temporary, such as through vessel anchoring, or permanent (i.e. for the duration of the Project) if it is due to footprint of infrastructure installation. No piling or drilling to install infrastructure within the Project site is anticipated at this stage. The offshore site is not known to contain any *Modiolus Modiolus* beds as can be associated with the A5.27 EUNIS habitat type. It is likely to contain mostly robust fauna that has limited sensitivity and a wide area of A5.27 available. There are no known Annex I habitats in the project site. However, as the species present are not known this impact will be taken forward to the EIA.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Benthic habitats and species (offshore and intertidal)	Direct loss of and disturbance to seabed and habitats and species Installation, maintenance, and removal of cable route and landfall (including laying of cable protection) can affect benthic habitats through smothering or decreases in water quality.	Construction Operational Decommissioning	Activities could cause physical disturbance to habitats and species and habitat loss /displacement. The sensitivity of the habitats will depend on the species present, which will be determined during baseline surveys. The extent of this effect will be limited to the Project infrastructure footprint. Habitat loss may be temporary, such as through vessel anchoring, or permanent (i.e. for the duration of the Project) if it is due to footprint of infrastructure installation. No piling or drilling is anticipated at this stage for cable installation, though it may be that horizontal directional drilling (HDD) is required. The inshore area has known Annex I habitats and features that are designated as part of the Pembrokeshire Marine SAC, such as sea caves, subtidal sandbanks, intertidal mud and sand flats, and reefs. These may be highly localised and support significant biodiversity. This impact will be assessed under the EIA. Mitigation measures can be undertaken to reduce these impacts.
Habitats and associated species along the cable route	Effects on seabed habitats and species due to increased suspended sediment concentration and sediment deposition during cable laying and protection	Construction Decommissioning	Activities could lead to smothering or decreases in water quality. The amount of resuspended sediment is expected to be minimal, as is the footprint of any such sediment plume that will be detectable above background conditions (though this will depend on hydrodynamic conditions at the time). Most of the Project footprint is in an area of coarse sediment (i.e. sand) or rock, further reducing the likelihood for notable sediment resuspension, though there are areas of fine / muddy sand. The species present (aside from Annex I habitats) are not well known, therefore it is not possible to determine their sensitivity to this effect, and as such it is scoped into the EIA.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
All benthic habitats and species	Introduction of new habitat through Project infrastructure, in particular through cable protection.	Operational	Potential to affect the established environment by providing new habitat / ecosystem function. This could be a potential benefit to the environment as it may increase presence of species that are known to use hard structures for protection or species that attach to similar hard substructures
All benthic habitats and species	Introduction of marine invasive non-native species (INNS) from other regions via vessel hull or ballast water, which could displace local fauna	Construction Operational Decommissioning	Vessels used during the project may inadvertently transport INNS. This can have significant impacts on local fauna through displacement, and the effects may not be restricted to the immediate area as any INNS could spread rapidly. It is expected that infrastructure will be brought into and out of the nearby Pembroke Dock, which may reduce the likelihood for INNS to be introduced. Nevertheless, this impact will be assessed in the EIA.
Offshore benthic habitats and species	Effects on seabed habitats and species due to changes in hydrodynamic regime resulting from subsea infrastructure	**Scoped out**	There is expected to be minimal subsea infrastructure due to the semisubmersible nature of the project. The changes to hydrodynamics are anticipated to be negligible, therefore it has been scoped out of the EIA. These effects will therefore not be considered further in the EIA.
All benthic habitats and species	Pollution due to unplanned leaks and spills	**Scoped out**	The risk of accidental and unplanned release of chemicals and pollutants is considered extremely low. An Environmental Management Plan (EMP) will be produced, with procedures that will minimise the risk of such events and contain measures to minimise the impacts should they occur. These effects will therefore not be considered further in the EIA.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Fish and shellfish			
Demersal fish (spawning and nursery areas)	Habitat loss and / or disturbance to spawning and nursery areas, including placement of scour protection / cable armour	Construction Operational Decommissioning	Species that lay their eggs on specific seabed types, such as herring, or species that live in specific sediments, such as sand eel, may be affected by activities that have the potential to disturb, alter or remove seabed sediments e.g. cable trenching. The significance of the impact would be dependent on methods, Project design and location.
Demersal fish and shellfish	Increases in sediment or water temperature as a result of cable operation	**Scoped out**	The exact amount of heating depends on cable specification and surrounding sediment characteristics; however, heat will dissipate quickly, and any heating will only be marginally above baseline conditions. No impacts are expected to demersal fish species and shellfish in close contact with the seabed. This effect will not be considered further in the EIA.
Demersal fish and shellfish	Disturbance as a result of vessel activity	Construction Operational Decommissioning	Disturbance from vessel operations will be short-term and localised, however the significance of the impact will be considered further in the EIA.
All fish and shellfish species	Impacts from underwater noise and vibration	Construction Operational Decommissioning	Underwater noise and vibration from operations has the potential to displace migratory fish from their migration routes if this passes through the offshore scoping area during construction. During the operational period, noise levels are expected to be significantly lower than those during construction or decommissioning. The sensitivity of species to underwater noise is not well documented and pathways of migratory fish are not well understood once individuals leave rivers.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Shellfish	Loss of shellfish habitat	Construction Operational	Loss of habitat through placement of devices and swept area of mooring cables has the potential to remove habitat for shellfish. The significance of this would be dependent on the final Project design and the importance of the area for shellfish.
Fish and shellfish	Impacts on fish and shellfish through a decrease in water quality	Construction Decommissioning	Construction methods that create sediment plumes also have the potential to release contaminants (if present) into the water column. This could result in decreased water quality that could impact on the health of fish and shellfish populations and potentially impact on the quality of commercial species. The significance of the impact will depend on the construction methodology, the presence of contaminants and the abundance of species in the offshore scoping area.
Fish and shellfish	Resource availability through loss of habitat	Construction Operational Decommissioning	The loss or alteration of habitats within the development have the potential to impact on resource availability and prey distribution within the offshore scoping area. The significance of the impact will be influenced by the extent of any change to benthic habitats and the importance of those areas as a resource.
Migratory fish	EMF as a barrier to migratory fish	**Scoped out**	Potential EMF effects on fish species has been investigated and there is no clear evidence of any adverse impacts as demonstrated in previously assessed and consented Offshore Wind Farms (OWF). Post-construction monitoring of fish in operational OWF projects around the UK has shown no absence of electro-sensitive species (rays; dogfish) in these areas, indicating that installed subsea cables have no impact on these species.
Fish and shellfish	Effects of fishing restrictions	NA	See commercial fisheries below

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Fish and shellfish	Pollution due to unplanned leaks and spills	**Scoped out**	The risk of accidental and unplanned release of chemicals and pollutants is considered extremely low. An Environmental Management Plan (EMP) will be produced, with procedures that will minimise the risk of such events and contain measures to minimise the impacts should they occur. These effects will therefore not be considered further in the EIA.
All fish species (including migratory species)	Ghost fishing from lost fishing gear caught around mooring lines and cables could pose an entanglement risk to fish.	Operation	There is a risk that fish using the area may become entangled with derelict fishing gear, though the likelihood of this is poorly understood. For previous FLOW projects in Scottish waters, Marine Science Scotland stated that they consider that the effects of "*ghost fishing*", whereby derelict fishing gear becomes entangled on the mooring lines and has the potential to then entangle fish, as very difficult to quantify at this stage.
Marine mammals and reptiles (turtles)			
Pinnipeds	Disturbance through vessel presence	Construction Operational Decommissioning	The presence of vessels close to the coast could lead to the disturbance of coastal and onshore habitats used by seals e.g. haul-out sites, breeding and foraging areas. The level of disturbance is correlated with the distance from the vessel; at <900 m seals can exhibit a fleeing response, at 900-1,500 m the vessels is detectable, and at 1,500 m the vessel is not detectable.
Cetaceans and reptiles	Disturbance through vessel presence	Construction Operational Decommissioning	The presence of vessels during construction and cable laying activity could lead to the disturbance of marine mammals and turtles. Effects are likely to be minor and very temporary in nature but will be considered in the EIA.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
All marine mammals	Disturbance due to underwater noise	Construction Operational Decommissioning	All marine mammals are sensitive to underwater noise, using it for prey detection, predator avoidance, communication, navigation etc. Anthropogenic sources of underwater noise can result in disturbance due to behavioural changes or masking of other sounds. The sound levels generated by the Project are expected to be limited with no piling or drilling predicted, reducing the likelihood of significant effects. However, disturbance by vessel noise, trenching, or cable and cable protection laying cannot be discounted at this stage.
Marine reptiles (turtles)	Disturbance due to underwater noise	Construction Decommissioning	Little is known about the sensitivity of marine turtles to underwater noise. However recent research indicates that they are sensitive to low frequencies (peak hearing for leatherback turtles is 100-400 kHz) such as those produced during project operations (Piniak *et al.,* 2012).
All marine mammals and reptiles	Physical or auditory injury due to underwater noise from routine Project activity	**Scoped out**	No piling, drilling or other activities likely to produce sounds levels likely to cause physical or auditory injury are predicted. These effects will therefore not be considered further in the EIA. Note that physical or auditory injury due to UXOs is scoped into the EIA (see below).
All marine mammals and reptiles	Physical or auditory injury due to controlled detonation of UXOs	Construction	The area is close to a firing range so UXOs may be present. Controlled UXO detonation, if required, can cause lethal and sub-lethal injuries to marine mammals and reptiles, with the severity of injury decreasing with distance from the explosion. Though it is not certain that UXOs will be discovered, the impact has been scoped into the EIA due to its potential severity.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
All marine mammals and reptiles	Collision risk from vessels	Construction Operational Decommissioning	Marine mammals and turtles can be impacted by ship strikes. Large, slow moving cetaceans are particularly vulnerable.
All marine mammals and reptiles	Indirect effects due to changes in turbidity and water clarity	**Scoped out**	The marine mammal species likely to occur within the Project site inhabit coastal waters that are often turbid, and so they will have a natural level of adaptation to increased sediment suspension. In addition, there is minimal suspended sediment expected to be generated due to the semi-submersible nature of the Project, and the great water depth will restrict the effects to a small fraction of the water column near the seabed. These effects will therefore not be considered further in the EIA.
All marine mammals and reptiles	Physical barrier effects of subsea infrastructure to regular movements of marine mammals and reptiles	Operational	The configuration of the turbines and moorings is currently unknown. This interaction has been scoped in as a precautionary measure.
All marine mammals and reptiles	Entanglement with subsea infrastructure including mooring lines and cabling and ghost fishing from for lost fishing gear.	Operational	Large cetaceans (such as minke whales) are considered at greatest risk to this impact. Subsea infrastructure may also become entangled with derelict fishing gear, which may further increase the chance of entanglement, though the likelihood of this is poorly understood.
All marine mammals and reptiles	Indirect effects due to changes in prey species	Construction Operational Decommissioning	All marine mammal and turtle species could be impacted by changes affecting their prey resulting from the Project. The assessment of this in the EIA will consider the assessment of impacts to key prey species in the benthic ecology and fish and shellfish ecology chapters. This may include impacts that have been scoped out as a direct risk to marine mammals and reptiles, such as sedimentation.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
All marine mammals and reptiles	Effects of electro-magnetic fields (EMF)	**Scoped out**	A growing evidence base on the effects of EMF indicates that their effects dissipate quickly in the marine environment. Subsea cables for the Project are unlikely to emit electromagnetic frequency (EMF), which could impact the navigation of marine mammal and turtle species. These effects will therefore not be considered further in the EIA
All marine mammals and reptiles	Pollution due to unplanned leaks and spills	**Scoped out**	The risk of accidental and unplanned release of chemicals and pollutants is considered extremely low. An Environmental Management Plan (EMP) will be produced, with procedures that will minimise the risk of such events and contain measures to minimise the impacts should they occur. These effects will therefore not be considered further in the EIA.
Offshore ornithology			
Diving birds (divers, grebes, cormorant / shag, seaducks, gannet, terns and auks)	Disturbance (displacement) to birds due to noise from construction and decommissioning activities, including general vessel movements.	Construction Decommissioning	Data from construction and operational phases of OWF projects around the UK coast indicate that displacement of certain bird species can occur due to vessel movements during construction and operational works.
Diving birds (divers, grebes, cormorant / shag, seaducks, gannet, terns, and auks)	Ghost fishing from lost fishing gear caught around mooring lines and cables could pose an entanglement risk to diving seabirds.	Operational	There is a risk that diving seabirds may become entangled with derelict fishing gear, though the likelihood of this is poorly understood. For previous FLOW projects in Scottish waters, Marine Science Scotland stated that they consider that the effects of "*ghost fishing*", whereby derelict fishing gear becomes entangled on the mooring lines and has the potential to then entangle diving seabirds, as very difficult to quantify at this stage.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Diving birds (divers, grebes, cormorant / shag, seaducks, gannet, terns, and auks)	Disturbance to foraging diving birds from underwater noise and vibration from operational floating WTGs.	Operational	Underwater noise and vibration from the operating WTGs may disrupt or interfere with the ability of diving birds to forage successfully. The offshore bird surveys will provide information to inform which diving species are present in the area.
All seabirds (divers, grebes, cormorant / shag, seaducks, tubenoses, gannet, gulls, terns, and auks) and migratory birds (incl. waders and wildfowl)	Collision risk with WTGs	Operational	Birds in flight are at risk of collision from WTGs. Key sensitivities include migrating birds and birds in transit between breeding sites and foraging areas. The offshore bird surveys will determine which species are present and the spatial and temporal distribution of flight activity through the wind farm area.
All seabirds (divers, grebes, cormorant / shag, seaducks, tubenoses, gannet, gulls, terns, and auks)	Displacement (avoidance) effects of birds from foraging or loafing areas due to effective loss of habitat if birds avoid the wind farm and its surrounds due to the physical presence of project infrastructure and maintenance activities.	Operational	The presence of offshore WTGs and associated project infrastructure and maintenance activities has the potential to result in displacement of birds from the wind farm and surrounding area. The offshore bird surveys will provide information to inform which species are present in the area and the spatial and temporal distribution of species using the site.
All seabirds (divers, grebes, cormorant / shag, seaducks, tubenoses, gannet, gulls, terns, and auks) and migratory birds (incl. waders and wildfowl)	Physical barrier effects of WTGs to regular movements of birds to and from breeding colonies or on migration	Operational	The introduction of WTGs may result in a barrier effect to birds. Those species that make regular movements through the wind farm area between breeding sites and foraging sites or birds on migration are most sensitive. The offshore bird surveys will determine which species are present and the spatial and temporal distribution of flight activity through the wind farm area.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
All seabirds (divers, grebes, cormorant / shag, seaducks, tubenoses, gannet, gulls, terns, and auks)	Direct loss of seabed habitat used by foraging birds due to placement of project infrastructure	Construction Operational Decommissioning	Placement of offshore project infrastructure may result in the loss of benthic habitat within the project footprint. This is likely to be limited to the locations of the electrical infrastructure and drag embedment anchor locations. The area of habitat disturbed by the anchors is likely to be very small and the resulting loss of prey resource is likely to be negligible. The offshore bird surveys will provide data on the importance of these areas to foraging birds.
Seabirds (cormorant / shag, gulls and terns)	Creation of roosting habitat for birds due to presence of floating platforms and associated infrastructure	Operational	The introduction of floating platforms and associated infrastructure presents the opportunity for new roosting habitat which may be utilised by foraging birds. The offshore bird surveys will provide information to inform which species are present in the area.
Seabirds (tubenoses)	Attraction of nocturnal seabirds (shearwaters and petrels) to lighting on project infrastructure	Operational	The potential for nocturnal species such as petrels and shearwaters to be negatively affected (attraction or disorientation) by lighting associated with project infrastructure is unknown and should be considered as part of the EIA process.
All marine birds (seabirds, auks, divers, grebes, terns, wildfowl and gulls)	Pollution due to unplanned leaks and spills	Construction Operational Decommissioning	The risk of accidental and unplanned release of chemicals and pollutants is considered extremely low. An Environmental Management Plan (EMP) will be produced, with procedures that will minimise the risk of such events and contain measures to minimise the impacts should they occur. These effects will also be considered via the assessment of Major Accidents and Disasters.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Onshore ornithology			
All coastal and terrestrial birds	Direct loss of breeding, roosting and foraging habitat due to the placement of project infrastructure	Construction Operational Decommissioning	The footprint of the onshore works may result in loss of breeding, foraging or roosting habitat. Onshore surveys will be required to determine which species and habitats are present and to inform placement and routing of infrastructure to minimise effects.
All coastal and terrestrial birds	Disturbance (noise and visual) to birds from installation and decommissioning activities	Construction Decommissioning	Construction activities for the onshore works may result in potential disturbance to breeding, foraging or roosting birds. Construction and decommissioning activities will be of limited duration and any disturbance effects will be temporary. Onshore surveys will be required to determine which species are present and to inform placement and routing of infrastructure to minimise effects.
All coastal and terrestrial birds	Displacement of birds from breeding, foraging or roosting areas due to effective loss of habitat if birds avoid the area due to the physical presence of project infrastructure and maintenance activities	Operational	The presence of the onshore substation and associated maintenance activities may result in the displacement of breeding, foraging or roosting birds within the surrounding area. Onshore surveys will be required to determine which species are present and to inform placement and routing of infrastructure to minimise effects.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Commercial fisheries			
All relevant offshore commercial fisheries	Permanent changes of access or loss / damage to fishing grounds due to presence of floating turbine anchors/cable protection	Construction Operational Decommissioning	Data have shown the offshore (array) part of the Study Area to be of lower importance in terms of landed weight and value than inshore regions, however, this area still represents a commonly used fishing ground by both UK and non-UK vessels. Fishing activity may be displaced, or loss of grounds may occur due to safety if a reduction in water depth results from installation of Project infrastructure.
All relevant offshore commercial fisheries	Temporary restrictions of access to fishing grounds	Construction Operational Decommissioning	Vessels may be restricted from accessing usual fishing grounds due to statutory exclusions, safety zones or avoidance of the area by fishing vessels due to safety reasons.
All relevant offshore commercial fisheries	Permanent changes of access or loss / damage to fishing grounds due to presence of export cable and cable protection	Construction Operational Decommissioning	Data have shown the inshore part of the Study Area to be an important region for commercial fishing. The final offshore cable route selected may pass close to / through inshore reef features which are known to represent important habitat for bass – a key commercial and recreational target species.
All relevant offshore commercial fisheries	Changes in abundance of targeted species	Construction	Construction activity may cause temporary effects on water quality and suspended sediment which may in turn impact upon target species stocks.
All relevant offshore commercial fisheries	Snagging and loss of mobile gear	Construction Operational Decommissioning	Fishing activity may be restricted, or loss of grounds may occur due to safety if a seabed obstruction exists.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
All relevant intertidal commercial fisheries	Temporary restrictions of access to intertidal areas	Construction Operational Decommissioning	Data have shown the inshore Study Area to be an important region for commercial fishing.
Shipping and navigation			
Recreational and commercial vessels	Interaction of Project vessels with commercial, fishing and recreational vessels	Construction Operational Decommissioning	During the construction phase the presence of installation vessels undertaking construction activities within the offshore Project Area have the potential to interfere with other marine users. During the operational phase, work boats within the Project Area may impact on other marine users. The significance of impact will be dependent on the construction port and selected landfall / cable route.
Recreational and commercial vessels	Impacts on vessel routes	Construction Decommissioning	There are no transit routes currently passing through the offshore site which are likely to be displaced. However, there are transit routes running across the proposed export cable which are likely to be displaced during the construction and decommissioning phases of the Project including displacement due to presence of statutory exclusion, establishment of safety zones around the export cable route or avoidance of the area by vessels for safety reasons. There is also potential for extending transiting time for fishing vessels and vessels leaving / approaching Milford Haven from the south. The significance of impact will be dependent on the construction port and selected landfall / cable route.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Recreational and commercial vessels	Displacement of anchorages	Construction Operational Decommissioning	Displacement of informal anchorages could result in hindrances for the shipping industry. The significance of impact will be dependent on the construction port and selected landfall / cable route.
Recreational and commercial vessels	Impacts on navigational safety	Construction Operational Decommissioning	The installation and operation of export cable structures may potentially reduce the navigable water depth within the Project Area. If cable armouring is required, this would further reduce the navigable water depth within the cable corridor.
Recreational and commercial vessels	Increased collision risk with other marine users	Construction Operational Decommissioning	The presence of additional vessels operating in the Project Area has the potential to increase vessel to vessel collision risk. The significance of impact will be dependent on the distance between construction port and location of selected landfall/offshore cable route.
Recreational and commercial vessels	Increased collision risk with Project devices	Construction Operational Decommissioning	The physical presence of structures within the Project Area has the potential to increase the vessel to structure collision risk for vessels.
Recreational and commercial vessels	Potential collision between passing / work vessels and Project infrastructure	Construction Operational Decommissioning	Activities associated with the proposed Project may diminish emergency response capability (including Search and Rescue (SAR) and pollution response) within the proposed Project Area.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Recreational and commercial vessels	Interaction with subsea cables	Construction Operational Decommissioning	The significance of impact will be dependent on the selected landfall / cable route. As part of embedded mitigation planned cables will be either buried or protected by rock placement to ensure they do not pose a risk to anchoring or fishing gear within the area. The project will also include mitigation to ensure that they are maintained throughout the life of the project and do not become exposed.
Ports and harbours	Interference with maintenance of channels and access	Construction Operational Decommissioning	Depending upon location of preferred export cable route there is potential for interference with maintenance of navigational channels and access.
Other sea users			
Existing cables and pipelines	Impact on existing / planned cables and pipelines	Construction Operational Decommissioning	'Solas' cable crosses Project area. Activities associated with development of the Project may interact with existing infrastructure and cause damage. Depending on export cable routing, there is potential for interaction with Greenlink interconnector cable, potentially resulting in damage to cable.
At sea disposal sites	Risk of sedimentation plumes settling on potential cable routes.	**Scoped out**	The nearest open disposal site is located 9km to the north of the Project area, which is likely outside the envelope of suspended plume. Should export cables be sited in closer proximity to the open disposal sites, any additional sediment settling on the export cable may have a positive impact in increasing / maintaining burial depth. This effect will therefore not be considered further in the EIA.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Ports and harbours	Impacts on ports and harbours	Construction Operational Decommissioning	Depending upon location of preferred export cable route there is potential for interference with maintenance of navigational channels and access.
Military, UXO, aviation and radar			
Aviation	Interference with aviation (e.g. helicopter routes)	Construction Operational Decommissioning	Risk of collision due to interference with radar and communications systems
Radar and aviation	Interference with radar	Construction Operational Decommissioning	Risk of collision due to interference with radar
UXO	Inadvertent detonation of marine UXO	Construction	The area is close to a firing range so UXOs may be present. Controlled UXO detonation will be used if UXO detected, but potential for inadvertent detonation exists. Though it is not certain that UXOs will be discovered, the impact has been scoped into the EIA due to its potential severity.
Military activities	Interference with military activities	Construction Operational Decommissioning	Risk of potential interactions with military activity is currently unknown and further engagement with MoD will be sought.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Archaeology and cultural heritage			
Buried Archaeological/ (Paleo) Environmental remains (marine and terrestrial)	Direct disturbance or loss of known and unknown marine and terrestrial archaeological/paleo-environmental assets of importance within the footprint of the proposed Project.	Construction Decommissioning	High potential for an impact to be of permanent negative effect, and without mitigation would be of major significance.
Buried Archaeological/ (Paleo) Environmental remains (marine)	Indirect disturbance or loss of known and unknown marine archaeological / paleo-environmental assets of importance associated with changes to marine and coastal processes.	Construction Operational Decommissioning	Exposure of buried remains following changes to marine or coastal processes could result in increased degradation. Conversely, burial of remains caused by changes to marine or coastal processes could be considered positive.
Maritime and aviation assets (ship and aircraft wrecks)	Direct disturbance or loss of known and unknown assets of cultural and historical importance within the footprint of the proposed Project.	Construction Decommissioning	High potential for an impact to be of permanent negative effect, and without mitigation would be of major significance.
Maritime and aviation assets (ship and aircraft wrecks)	Indirect disturbance or loss of known and unknown maritime and aviation assets of cultural and historical importance associated with changes to marine and coastal processes.	Construction Operational Decommissioning	Exposure of buried assets following changes to marine or coastal processes could result in increased degradation. Conversely, burial of assets caused by changes to marine or coastal processes could be considered positive.
Marine, intertidal and onshore heritage assets	Direct disturbance or loss of known and unknown assets of heritage importance within the offshore and onshore footprint of the proposed Project.	Construction Operational Decommissioning	High potential for an impact to be of permanent negative effect, and without mitigation would be of major significance. The introduction of a new development, with activities associated, could negatively affect the setting of the heritage assets.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Marine and intertidal heritage assets	Indirect disturbance or loss of known and unknown assets of heritage importance associated with changes to marine and coastal processes.	Construction Operational Decommissioning	Exposure of buried assets following changes to marine or coastal processes could result in increased degradation. Conversely, burial of assets caused by changes to marine or coastal processes could be considered positive.
Historic Landscape and Seascape	Changes to the historic character of the area.	Construction Operational	The introduction of a new development, with activities associated, could negatively affect the setting of the heritage assets
Current Archaeological Research in Wales	Potential positive impact of publishing fieldwork results and archaeologically assessed geophysical and geotechnical data, as well as any finds identified	Construction	The acquisition of new information on shore and offshore through geophysical, geotechnical and fieldwork surveys could significantly contribute to the understanding of archaeology in the region
Land use			
Settlements	Disturbance or limiting development through the installation of onshore cable or siting of the substation.	Construction	It is not anticipated that landfall will affect any settlements. The onshore route will not pass through any settlements. The substation may be visible from parts of Pembroke Dock.
Business, Industry and Energy Generation	Disturbance or limiting development through the installation of onshore cable or siting of the substation.	Construction Operational	None of the preferred landfall sites are within the vicinity of known business, industry or energy sites. The onshore cable route and substation location have yet to be finalised and although it is not anticipated they would interfere with the operation of any identified sites a further assessment will be undertaken once the preferred route is confirmed.
National Park	Disturbance and damage to the special qualities of the Park affecting management, natural beauty, wildlife and cultural heritage.	Construction Operational Decommissioning	Until landfall, onshore cable route and location of the substation have been confirmed there is potential for impact on the National Park and further assessment is required to establish the significance of the impact.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Military	Potential disruption and restriction of military operations arising from the installation of the onshore cable route.	Construction Decommissioning	Until landfall and the onshore cable route have been confirmed there is potential for an impact on military operations and further assessment is required to establish the significance of the impact.
Agriculture	The preferred sites for landfall would not affect agricultural land however disruption and disturbance may arise from the installation of the onshore cable route and siting of the substation.	Construction Decommissioning	Until the onshore cable route and location of the substation have been confirmed there is potential for an impact agriculture and further assessment is required to establish the significance of the impact.
Traffic and transport			
Pedestrians, other road users and local communities	Increased risk of accidents and reduced level safety for road users and pedestrians through increased traffic.	Construction Operational Decommissioning	The potential for highway safety to be impacted may be significant and further assessment is required to understand the potential levels of traffic, duration of presence and the associated impact.
Pedestrians, other road users and local communities	Increased noise and vibration through increased traffic.	Construction Operational Decommissioning	Noise and vibration are likely to be worse in built up areas so although the levels of traffic are unknown, due to the potential routes through Pembroke and Pembroke Dock further assessment is required to understand the level of impact.
Pedestrians, other road users and local communities	Deterioration in air quality through increased traffic.	Construction Operational Decommissioning	Although the levels of traffic are unknown due to the potential impact on air quality further assessment is required to understand the significance of the impact.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Pedestrians, other road users and local communities	Traffic and transport delays during the installation of the onshore cable route and landfall.	Construction Operational Decommissioning	The installation of the onshore cable route in the existing road network would cause significant delays and disruption. If landfall is at Freshwater West, the road network from landfall to substation is predominantly narrow, in some place's single carriageway and although the area is not heavily populated it is a busy tourist destination. Further assessment is required once the final onshore cable route is confirmed.
Pedestrians, other road users and local communities	Severance, of local communities to services and facilities during the installation of the onshore cable route and landfall.	Construction Operational Decommissioning	The impact the Project would have will depend on the final onshore cable route and proposed landfall and substation locations. Further assessment is required once finalised to assess the level of impact.
Landscape, seascape and visual impacts			
Landscape character of the Pembrokeshire Coast National Park	Impact on landscape character of the Pembrokeshire Coast National Park.	Construction Operational Decommissioning	Possible adverse impact on landscape character of the PCNP from offshore WTGs and onshore substation. The Project area has a high number of sensitive visual receptors. The EIA will need to carefully assess potential impacts.
Character of Registered Landscapes of Outstanding or Special Interest	Impact on Registered Landscapes of Outstanding or Special Interest.	Construction Operational Decommissioning	Registered Landscapes of Outstanding or Special Interest are in proximity to the proposed works. The EIA will need to carefully assess potential impacts on Registered Landscapes of Outstanding or Special Interest.
Regional Seascape Character	Change to the Regional Seascape Character through introduction of new features to the seascape.	Construction Operational Decommissioning	WTGs and associated offshore infrastructure would be new features in the seascape. The EIA will need to carefully assess potential impacts on SCA's due to sensitivity of these and the relatively unspoilt nature of the seascape off Pembrokeshire.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Users of the Pembrokeshire Coast Path and other Public Rights of Way	Adverse impact on visual amenity.	Construction Operational Decommissioning	Users of the Coast path and other PRoWs in the study area will be highly sensitive to visual impact as the existing, mainly undeveloped nature of this coastal area is one of the main reasons that users visit this area.
Other coastal users, including beach / recreational users	Adverse impact on visual amenity.	Construction Operational Decommissioning	Local beach users / recreational users may be sensitive to visual impacts and as such, detailed assessment will be required in the EIA.
Local residents	Adverse visual impact via construction works and final project infrastructure (WTGs offshore; onshore substation).	Construction Operational Decommissioning	Adverse visual impact via construction works and onshore Project infrastructure (WTGs offshore; onshore substation). Even though the study area has relatively small settlements and a small population level, when compared to other parts of Pembrokeshire, an assessment of potential visual impacts will still be required in the EIA.
Visitors to Lundy Island	Visual impact on seascape for visitors to Lundy Island.	Operational	Visitors to Lundy Island may visit to experience the clear seascape that exists around the Island. Scope for this to be affected by the WTGs will need to be assessed within the EIA.
Landscape Character of Gower AONB	Impact on landscape character of the Gower AONB.	**Scoped out**	The Gower AONB is a highly sensitive receptor due to being designated for landscape. However it is 87 km from the offshore array so significant effects on this AONB are not expected.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Underwater noise and vibration			
Diving birds (seabirds, auks, divers, grebes, wildfowl)	Disturbance to foraging diving birds from underwater noise and vibration from operational floating wind turbines	Operational	Underwater noise and vibration from the operating wind turbines may disrupt or interfere with the ability of diving birds to forage successfully. The offshore bird surveys will provide information to inform which diving species are present in the area.
Fish and shellfish species	Impacts from underwater noise and vibration	Construction Operational Decommissioning	Underwater noise and vibration from operations has the potential to displace migratory fish from their migration routes if this passes through the offshore scoping area during construction. During the operational period, noise levels are expected to be significantly lower than those during construction or decommissioning. The sensitivity of species to underwater noise is not well documented and pathways of migratory fish are not well understood once individuals leave rivers.
All marine mammals	Disturbance due to underwater noise	Construction Operational Decommissioning	All marine mammals are sensitive to underwater noise, using it for prey detection, predator avoidance, communication, navigation etc. Anthropogenic sources of underwater noise can result in disturbance due to behavioural changes or masking of other sounds. The sound levels generated by the Project are expected to be limited with no piling or drilling predicted, reducing the likelihood of significant effects. However, disturbance by vessel noise, trenching, or cable and cable protection laying cannot be discounted at this stage.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Marine reptiles (turtles)	Disturbance due to underwater noise	Construction Decommissioning	Little is known about the sensitivity of marine turtles to underwater noise. However recent research indicates that they are sensitive to low frequencies (peak hearing for leatherback turtles is 100-400 kHz) such as those produced during project operations (Piniak *et al.,* 2012).
All marine mammals and reptiles	Physical or auditory injury due to underwater noise from routine Project activity	Scoped out	No piling, drilling or other activities likely to produce sounds levels likely to cause physical or auditory injury are predicted. These effects will therefore not be considered further in the EIA. Note that physical or auditory injury due to UXOs is scoped into the EIA (see below).
Airborne noise and vibration			
Ecological Receptors (species)	Disturbance to key behaviour including nesting, roosting foraging and breeding arising from airborne noise created by Project.	Construction Operational Decommissioning	Onshore construction, operational and decommissioning phases have the potential to create noise and disturb ecological receptors including birds, bats and otters. As the onshore elements have yet to be finalised further assessment will be required to establish the significance of the impact.
Human Receptors	Noise disturbance arising to onshore receptors such as residential areas and sensitive sites in the National Park.	Construction Operational Decommissioning	Onshore construction, operational and decommissioning phases have the potential to create noise and disturb human receptors such as residential areas, tourist destination and the Wales Coast path. As the onshore elements have yet to be finalised further assessment will be required to establish the significance of the impact.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Air quality			
Pedestrians, other road users and local communities	Deterioration in air quality through increased traffic.	Construction Operational Decommissioning	Although the levels of traffic are unknown due to the potential impact on air quality further assessment is required to understand the significance of the impact.
Pedestrians, other road users and local communities	Deterioration in air quality through increased traffic.	Construction Operational Decommissioning	Although the levels of traffic are unknown due to the potential impact on air quality further assessment is required to understand the significance of the impact.
Human health	Generation of dust during onshore construction and decommissioning.	Construction Decommissioning	Potential increased dust and fine particulate matter during Project phases may lead to impacts on human health. Until the location of landfall, onshore cable route and proposed site of the substation are confirmed it is not possible to assess the significance of the impact.
Human health	Generation of vehicle emissions.	Construction Operational Decommissioning	An increase in vehicle movements caused primarily during construction, but potentially during other project phases may increase pollutant concentrations. Until the location of landfall, onshore cable route and proposed site of the substation are confirmed it is not possible to assess the significance of the impact.
Ecological receptors	Generation of dust during onshore construction and decommissioning.	Construction Decommissioning	Potential increased dust and fine particulate matter during Project phases may lead to impacts on ecological receptors, including features of designated sites. Until the location of landfall, onshore cable route and proposed site of the substation are confirmed it is not possible to assess the significance of the impact.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Ecological receptors	Generation of vehicle emissions.	Construction Operational Decommissioning	An increase in vehicle movements caused primarily during construction, but potentially during other project phases may increase pollutant concentrations. Ecological receptors, including features of designated sites that are sensitive to nitrogen or acid deposition may be impacted. Until the location of landfall, onshore cable route and proposed site of the substation are confirmed it is not possible to assess the significance of the impact.
Tourism and recreation			
Recreational vessel activity (sailing, angling, diving, wildlife trips)	Obstruction/alteration to regular recreational routes.	Construction Operational Decommissioning	Obstruction / alteration is possible during construction, maintenance and decommissioning activity (including export cable installation). The offshore nature of the proposed Project means that scope for impacts on marine vessel users exists and will require assessment within the EIA.
Recreational vessel activity (sailing, angling, diving, wildlife trips)	Obstruction to anchorages, marinas, slipways etc.	Construction Operational Decommissioning	Obstruction is possible during construction, maintenance and decommissioning activity (including export cable installation). The offshore nature of the proposed Project means that scope for impacts on marine vessel users exists and will require assessment within the EIA.
Recreational vessel activity (sailing, angling, diving, wildlife trips)	Displacement of vessels (permanent or temporary) due to Safety Zones.	Construction Operational Decommissioning	Obstruction is possible during construction, maintenance and decommissioning activity (including export cable installation). The offshore nature of the proposed Project means that scope for impacts on marine vessel users exists and will require assessment within the EIA.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Recreational angling	Reduced access to preferred angling marks / impacts on target species.	Construction Operational Decommissioning	Reduced access is possible during construction, maintenance and decommissioning activity.
Coastal recreational users	Disruption / reduced access to preferred areas for nearshore recreational users, including surfers, divers, swimmers.	Construction Decommissioning	Reduced access is possible during construction and decommissioning activity. Proposed landfall and nearshore cable installation works will create disruption during construction and decommissioning phases. The exact scale and significance will need to be assessed by the EIA.
Coastal tourism	Disruption / reduced access to beaches at proposed landfall locations.	Construction Decommissioning	Proposed landfall works will create temporary disruption on beach users and will require assessment within the EIA.
Coastal tourism	Disruption / reduced access to Pembrokeshire Coast Path.	Construction Decommissioning	Proposed landfall works may require temporary disruption/diversion of the Pembrokeshire Coast Path. The exact scale and significance of this will need to be assessed within the EIA.
Coastal tourism	Visual impact on tourists.	Construction Operational Decommissioning	Temporary visual impacts are expected during construction and decommissioning. In the operational phase, the distance offshore of the planned WTGs (>40 km) means that visual impacts on tourism are not expected. However, this potential impact is scoped in in the absence of visualisation data at this stage of the project.
Terrestrial recreational users	Disruption to cyclists, walkers.	Construction Decommissioning	Construction of the onshore infrastructure (onshore cable, onshore substation) will potentially create impacts on cyclists, walkers in the study area. The exact scale and significance of these impacts will be assessed within the EIA.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Socioeconomics			
Direct jobs and employment	Direct employment opportunities (local, regional and national)	Construction Operational Decommissioning	The Project is expected to create a range of direct and indirect jobs including professional roles helping reduce reliance in the area on seasonal roles. It is also expected to safeguard jobs in existing areas of supply chain, ports and marine services. Job security and the creation of new jobs and diverse employment opportunities would be considered a positive socio-economic contribution.
GVA	Direct Gross Value Added (GVA)	Construction Operational Decommissioning	The Project is expected to increase productivity for the region and local economy.
Supply chain	Direct and indirect supply chain opportunities	Construction Operational Decommissioning	An objective of the Project and aim for the developer is to develop the local supply chain to support local and regional employment. Where possible all resources will be sourced locally. Supply chain opportunities will include new technical skills, workboats, cranes, better marine knowledge etc.
Local tourism and business	Green cluster effects	Construction Operational Decommissioning	Implementation of measures that increase understanding of the Project and establish a strong green cluster locally could lead to multiple benefits.
Welsh Index of Multiple Deprivation	Inward investment	Construction Operational Decommissioning	Increase revenue opportunities within the region, bringing in more cashflow and contributing to more economic benefit. Over time, this may improve opportunities to address Health and Income aspects around the Pembroke Dock area (where infrastructure and supply chain employment is/could increase).

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Wellbeing of Future Generations wellbeing goals	Beneficial effects on the Wellbeing of Future Generations wellbeing goals	Construction Operational Decommissioning	Implementation of measures to strengthen the 'green' credentials of the Project will lead to beneficial effects on the Wellbeing of Future Generations wellbeing goals and green branding for the locality.
Skills and competence needs	Upskilling local, regional and national workforce	Construction Operational Decommissioning	Opportunities and requirements around upskilling the workforce to take advantage of opportunities presented by the Project.
Economically active population	Changes to population demographics	Construction Operational Decommissioning	The Project could offer attractive options for employment; those of economically active age to move to the area. The in migration of economically active population into the area would be considered a positive impact.
Energy security	Local green energy supply	Operational	The Project will support transition to a decentralised and decarbonised energy economy.
Human Health			
Pedestrians and local communities	Increased risk of accidents and reduced level safety through increased traffic.	Construction Operational Decommissioning	The potential for human health to be impacted via collisions or accidents may be affected and further assessment is required to understand the potential levels of traffic, duration of presence and the associated impact.
Pedestrians and local communities	Increased noise and vibration through increased traffic.	Construction Operational Decommissioning	Noise and vibration are likely to be worse in built up areas so although the levels of traffic are unknown, due to the potential routes through Pembroke and Pembroke Dock further assessment is required to understand the level of impact on human health.

Topic / Receptor	Potential Impact	Scoped into EIA Project phase(s)	Commentary (Including Justification for Potential Impact Being Scoped In / Out of EIA)
Pedestrians, other road users and local communities	Deterioration in air quality through increased traffic.	Construction Operational Decommissioning	Although the levels of traffic are unknown due to the potential impact on air quality further assessment is required to understand the significance of the impact human health.
Human Receptors	Noise disturbance arising to onshore receptors such as residential areas and sensitive sites in the National Park.	Construction Operational Decommissioning	Onshore construction, operational and decommissioning phases have the potential to create noise and impact human health. As the onshore elements have yet to be finalised further assessment will be required to establish the significance of the impact.
Human health	Generation of dust during onshore construction and decommissioning.	Construction Decommissioning	Potential increased dust and fine particulate matter during Project phases may lead to impacts on human health. Until the location of landfall, onshore cable route and proposed site of the substation are confirmed it is not possible to assess the significance of the impact.
Human health	Generation of vehicle emissions.	Construction Operational Decommissioning	An increase in vehicle movements caused primarily during construction, but potentially during other project phases may increase pollutant concentrations. Until the location of landfall, onshore cable route and proposed site of the substation are confirmed it is not possible to assess the significance of the impact.
Human health	EMFs produced via electricity production, distribution and use, including substations.	Operational	The proposed Project will involve maximum voltages of up to 66,000 (66kV) and further assessment is required to understand the level of impact on human health.

10. Appendices

Appendix A: **Approach to Habitats Regulation Assessment and Marine Conservation Zone Risk Assessment Process**

Appendix B: **Ornithology - Protected Species and Species of Conservation Importance Scoped within Offshore and Onshore Ornithological Study Area**

Appendix C: **Photomontage Floating Offshore Wind Farm at 45km**

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