Orbital Projects 5 Limited

Westray Tidal Array Environmental Impact Assessment: Scoping

Scoping Report

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XODUS

ORBITAL MARINE POWER

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ACRONYMS

ACRONYM	DEFINITION
AEZs	Archaeological Exclusion Zones
AfL	Agreement for Lease
AIS	Automatic Identification System
BDMPS	Biologically Defined Minimum Population Scales
BEIS	Department for Business, Energy and Industrial Strategy
BGS	British Geological Survey
BODC	British Oceanographic Data Centre
BTO	British Trust for Ornithology
CA	Conservation Area
CCC	Climate Change Committee
CEA	Cumulative Effects Assessment
CEFAS	Centre for Environment, Fisheries, and Aquaculture Science
CEMP	Construction Environment Management Plan
CHA	Competent Harbour Authority
COMAH	Control of Major Accident Hazards
COP	Conference of Parties
CRM	Collision Risk Modelling
CSEMP	Clean Seas Environment Monitoring Programme
DECC	Department of the Environment and Climate Change
EEA	European Economic Area
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMEC	European Marine Energy Centre
EMF	Effects of Electromagnetic fields
EPS	European Protected Species
ERM	Encounter Risk Modelling
ESAS	European Seabirds At Sea
EU	European Union
FAME	Future of the Atlantic Marine Environment

ACRONYM	DEFINITION
FSA	Formal Safety Assessment
HER	Historic Environment Record
HGDL	Historic Gardens and Designed Landscapes
HIE	Highlands and Islands Enterprise
HMS	Her Majesty's Ship
HRA	Habitats Regulations Assessment
IEMA	Institute of Environmental Management and Assessment
IMO	International Maritime Organisation
iPCoD	Interim Population Consequences of Disturbance
JCDP	Joint Cetacean Data Programme
JNAPC	Joint Nautical Archaeology Policy Committee
JNCC	Joint Nature Conservation Committee
LB	Listed buildings
LCCA	Local Coastal Character Areas
LCTs	landscape character types
LLAs	Local Landscape Areas
LOA	Length Overall
MAIB	Maritime Accident Investigation Branch
MarESA	Marine Evidence-based Sensitivity Assessment
MBES	Multi Beam Echo Sounder
MCA	Maritime and Coastguard Agency
MLWS	Mean Low Water Spring
MMO	Marine Mammal Observer
MoD	Ministry of Defence
MPA	Marine Protected Areas
MPPs	Marine Planning Partnerships
MD-LOT	Marine Directorate - Licensing Operations Team
MS-LOT	Marine Scotland - Licensing Operations Team
MW	Megawatt
NAMMCO	North Atlantic Marine Mammal Commission
NCMPA	Nature Conservation Marine Protected Area
NMPi	National Marine Plan interactive

ACRONYM	DEFINITION
NLB	Northern Lighthouse Board
NM	Nautical Miles
NPF3	The National Planning Framework 3
NRA	Navigational Risk Assessment
NRP	National Research Project Limited
OFA	Orkney Fisheries Association
OIC	Orkney Islands Council
OMPAG	Orkney Marine Planning Advisory Group
OREI	Offshore Renewable Energy Installations
PAC	Pre-application consultation
PAD	Protocol for Archaeological Discoveries
PBR	Potential Biological Removal
PCoD	Population Consequences of Disturbance
PEXA	Practice and Exercise Area
PMF	Priority Marine Features
pSPA	Proposed Special Protection Area
PVA	Population Viability Analysis
RCCA	Regional coastal character areas
REZ	Renewable energy zone
RNLI	Royal National Lifeboat Institution
ROV	Remote Operated Vehicle
RYA	Royal Yachting Association
SACs	Special areas of Conservation
SAR	Search and Rescue
SBP	Sub Bottom Profiler
SCADA	Supervisory Control and Data Acquisition
SCANS-III	Small Cetaceans in the European Atlantic and North Sea
ScARF	Scottish Archaeological Research Framework
SEA	Strategic Environmental Assessment
SEPA	Scottish Environment Protection Agency
SM	Scheduled Monuments
SPAs	Special Protection Areas

ACRONYM	DEFINITION
SPP	Scottish Planning Policy
SSC	Suspended Sediment Concentration
SPM	Suspended Particulate Matter
SSEN	Scottish and Southern Electricity Networks
SSS	Side Scan Sonar
SSSI	Sites of Special Scientific Interest
UK	United Kingdom
UKHO	United Kingdom Hydrographic Office
UXO	Unexploded Ordnance
VMS	Vessel Monitoring Services
WFD	Water Framework Directive
WHS	World Heritage Sites
WSI	Written Scheme of Investigation
WW1	World War 1
WW2	World War 2
ZTV	Zone of Theoretical Visibility

1 INTRODUCTION

1.1 Document Purpose

This Environmental Impact Assessment (EIA) Scoping Report has been prepared to support a request for a Scoping Opinion from Scottish Ministers in relation to the Westray Tidal Array, located in the Westray Firth, Orkney (hereafter 'Westray' or 'the Project'). This Scoping Report represents the first key stage of the EIA.

As the Project will be a generating station of greater than 1 MW, it requires the following consent and licences for the offshore infrastructure:

- A Section 36 (S36) consent under the Electricity Act (1989, as amended); and
- A marine licence under the Marine (Scotland) Act 2010.

The overall objectives of the EIA for the Project are to avoid or minimise potential adverse effects, and to meet the requirements of the following EIA Regulations:

- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 as amended by The Environmental Impact Assessment (Miscellaneous Amendments) (Scotland); and
- The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended) (Scotland).

The Scoping Report provides information on the sources of data that have been or will be used for characterisation of the baseline environment (for this Scoping Assessment and subsequent EIA), potential impacts that will be considered as part of the EIA process, and the impact assessment methodology. Where additional information is required, a proposed strategy for obtaining that information has also been provided. Receptors and impacts have been scoped in or out on the basis of lessons learned from the EIAs of other offshore renewable energy projects, including tidal stream energy developments. This Scoping Report has been developed on behalf of Orbital Marine Power by Xodus, with contribution from Royal HaskoningDHV.

1.2 The Developer

Orbital Marine Power (hereafter referred to as 'Orbital') is a Scottish company, based in Orkney and Edinburgh. Formerly Scotrenewables Tidal Power Ltd, Orbital has been developing and testing its tidal stream technology for 20 years, with a key objective to tackle climate change, delivering sustainable development and supporting the global transition away from fossil fuels.

The Orbital O2 device is the most powerful and technologically advanced tidal turbine in the world and has been deployed successfully in Orkney at the European Marine Energy Centre (EMEC). The floating O2 technology eases installation and access for maintenance, representing a breakthrough in technology cost and risk compared to alternative marine renewable devices. It also captures the strongest tidal currents, providing higher yield, as these exist close to the surface, rather than at the seabed. Further information on the O2 device is provided in Section 4.2.2.

1.3 Project Overview

An Agreement for Lease (AfL) in the Westray Firth was previously granted to Scottish and Southern Energy Renewables (SSER) (and subsequently transferred to DP Energy) for a project as part of The Crown Estate's Pentland Firth and Orkney Waters leasing round in 2010. SSER and DP Energy progressed the project through Scoping and undertook a suite of surveys during 2012 to 2014. That project (hereafter the 'former Westray AfL') was then put on hold and the former AfL has now expired.

Orbital secured an AfL from Crown Estate Scotland for a smaller region within the Westray Firth as the Westray South AfL, providing Orbital with rights to develop a tidal array within the AfL boundary. Since award of the AfL, Orbital are in discussions with Crown Estate Scotland for the expansion of the AfL to a larger region, which mostly encompasses the previous SSER former Westray AfL, in order to meet capacity generation. The proposed (and larger) Westray lease area (hereafter the 'Westray Tidal Array area') would support Orbital's tidal stream energy development, subject to receiving the necessary consents and licences outlined in Section 1.1. The existing Westray South AfL in addition to the larger Westray Tidal Array area are shown in Figure 1-1.

The Westray Project is adjacent to the EMEC Fall of Warness tidal demonstration site, which is also illustrated in Figure 1-1. It is intended that energy generated at Westray will be connected to the National Grid at the EMEC facility, EMEC is currently seeking the necessary consents to extend their site. As a result the Westray Project includes the Project tidal array area, with an interconnector cable, which will connect Westray to EMEC Fall of Warness in the marine environment.

In line with the ongoing consent application associated with the EMEC Fall of Warness tidal demonstration site, there is a region in the south of the Westray Tidal Array area, which overlaps with development ambitions for the EMEC Fall of Warness site. The region is also indicated in Figure 1-1, and relates to seabed within the Westray Tidal Array area that may be surrendered by Orbital in favour of EMEC's development. This region is termed the "Westray Potential Overlap Area" in the remainder of this Scoping Report. An assessment is completed on the basis of the Westray Tidal Array area as a whole, inclusive of this potential overlap area.

As the Westray Project will connect to the National Grid at the EMEC facility and will make cable landfall at the EMEC facility, the Westray Section 36 application will only comprise the offshore infrastructure within the Westray Tidal Array area, comprising the tidal array development and the subtidal interconnector cable(s) between the Westray development and the EMEC Fall of Warness tidal demonstration site.

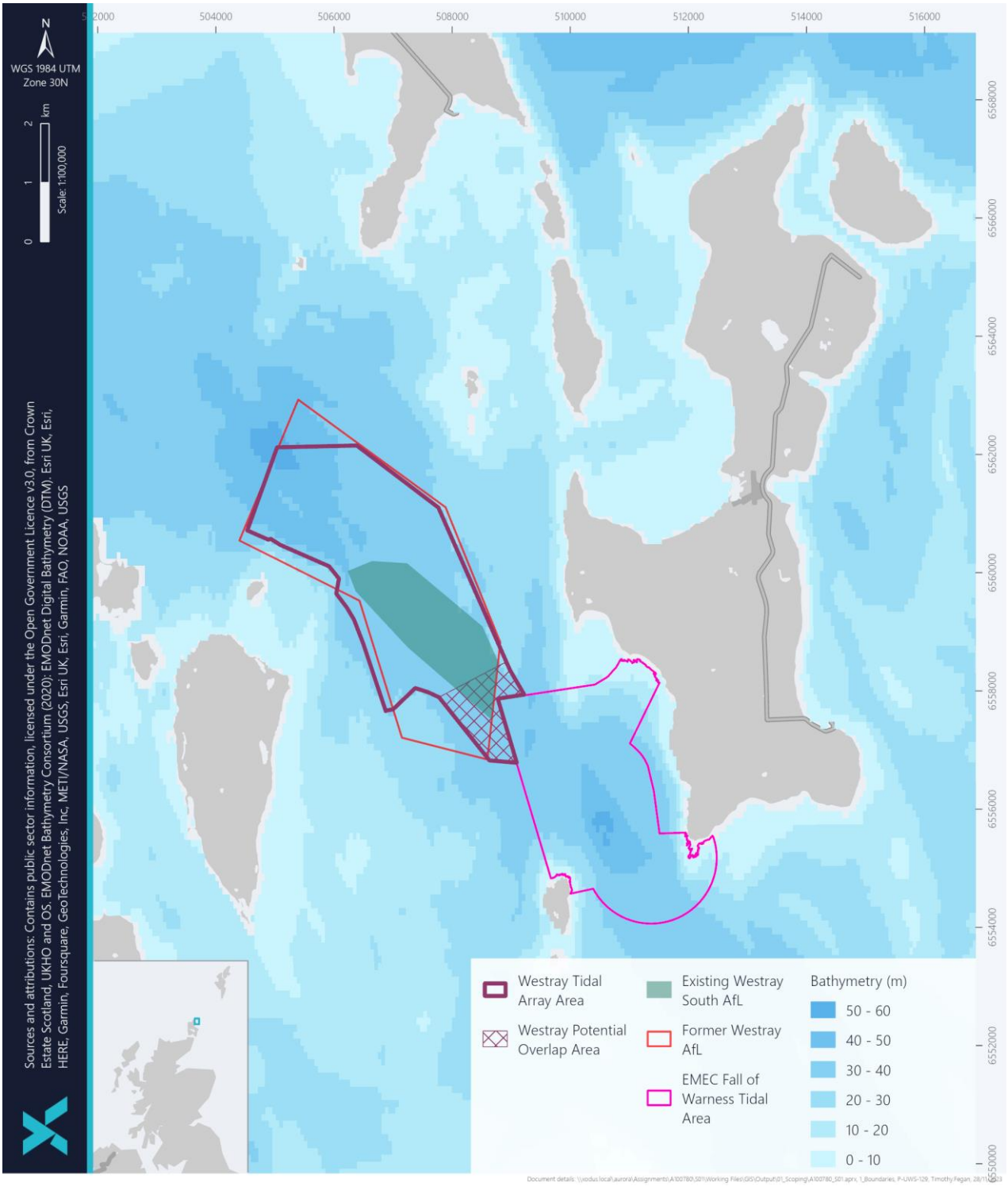

Figure 1-1 Westray Tidal Array Project Area

1.4 EIA and Consenting Process

The EIA process can be broadly summarised as having the following steps:

- Scoping: the applicant requests a Scoping Opinion form the Scottish Ministers through the production of a Scoping Report (i.e., this report);
- Pre-application consultation (PAC): the applicant is required to conduct PAC as required under the PAC regulations (Section 1.5);
- EIA Report preparation: this constitutes the bulk of the EIA process and pulls together the outcomes of the assessment of potential, or likely significant effects of the Project on the environment during the construction, operation & maintenance, and decommissioning stages of the Project lifecycle;
- Determination: the competent authority will examine all the documentation provided during the application process and reach a reasoned conclusion on the significant effects of the Project on the environment. The environmental information, and the conclusions reached, must be taken into account by the competent authority in deciding whether or not to give consent for the development. The competent authority must also consider whether any monitoring measures are appropriate; and
- Decision notice: the decision reached by the competent authority during the determination process must be published, through the form of a 'decision notice' that is made available to the public and consultation bodies. The decision notice incorporates the competent authority's reasoned conclusions on the significance of effects of the development on the environment.

1.5 Pre-Application Consultation

1.5.1 Pre-scoping

Orbital has engaged in early discussions with the statutory Regulator, consultees and stakeholders appropriate to the Westray Project, which include Marine Directorate Licence Operations Team (MD-LOT[1]), NatureScot, Orkney Islands Council and maritime stakeholders. The purpose of the early consultation is to discuss the Project and to support the development of this Scoping Report. Consultation completed to date is summarised in Table 1-1.

Table 1-1 Completed consultation to date

CONSULTEE	DESCRIPTION	CONSULTATION DATE
MD-LOT	Email correspondence with MD-LOT team clarifying the process for scoping and duration that feedback is valid for. Teams meeting with MD-LOT to outline Orbital development plans in Orkney, including the Westray Tidal Array, along with associated proposed timeframes. Teams meeting with MD-LOT team to update on progress the Westray Tidal Array and other Orkney	18th April 2023 22nd June 2023, 16th November 2022

[1] *MD-LOT were previously Marine Scotland – Licensing Operations Team (MS-LOT)*

CONSULTEE	DESCRIPTION	CONSULTATION DATE
	based projects. Reference was made to surveys being conducted to date.	
Orkney Islands Council	In person meeting with Orkney Islands Council (OIC) members at OIC offices. Attended by 20+ members. Orbital presented the project, approach to data collection and development, inclusive of positive local socio economic impacts of the project. Discussion from OIC members focused on OIC encouraging the project to progress.	7th November 2022
NatureScot	16th February 2023: Submission of the marine wildlife survey strategy for a collaborative survey approach between Orbital and EMEC, covering the Westray and Fall of Warness projects respectively. Survey strategy was submitted to NatureScot and MD-LOT. A response was received from NatureScot on 13th April 2023, providing some comments and further questions relating to the submitted survey strategy. 13th June 2023: Consultation meeting held to discuss the submitted strategy and attain feedback from NatureScot. 5th October 2023: Submission of the breeding season interim report, summarising results of the bird survey outputs achieved over the preceding five-months. 17th October 2023: Consultation meeting in relation to the breeding season interim report, with associated meeting minutes provided on 1st November 2023.	16th February 2023; 13th June 2023; 5th October 2023 and 17th October 2023
Orkney Ferries, Maritime Coastguard Agency (MCA), Northern Lighthouse Board (NLB), Royal Yachting Association (RYA) Scotland, Orkney Ferries, RNLI, Orkney Marinas, Orkney Fisheries and, Orkney Harbours	Microsoft Teams stakeholder workshop with key shipping and navigation stakeholders to introduce the proposed Project.	27th March 2023
Orkney Ferries	Face-to-face consultation meeting in Orkney to discuss the potential impacts on ferry routes. This discussion was supported by NASH Maritime and the proposed project boundary was altered to account for ferry routes to and from Westray.	25th April 2023
MCA, NLB and Chamber of Shipping	Stakeholder update meeting with shipping and navigation stakeholders.	20th October 2023

1.5.2 Scoping Consultation

Orbital will consult with the Regulator and appropriate consultees with respect to the information and approaches as presented within the submitted Scoping Report. Where there are key environmental sensitivities, workshops with key stakeholders will be completed to understand the potential for impacts and approaches being implemented to minimise such impacts.

1.5.3 Approach to Post-scoping Consultation

Where activity is planned within the Scottish Territorial Waters (i.e., from 0-12 NM), the Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013 (hereafter referred to as the PAC Regulations) apply. There are no statutory requirements for consultation during the pre-application stage for Section 36 consent applications; however, the principles of the PAC Regulations will be followed for all components of Westray.

The PAC Regulations require Orbital to notify the Maritime and Coastguard Agency (MCA), Northern Lighthouse Board (NLB), NatureScot, Scottish Environment Protection Agency (SEPA), and any other stakeholder as requested by MD-LOT.

Orbital, as the applicant, must hold at least one pre-application event at which these bodies are notified, and members of the public may provide comments to the applicant. Applicants must publish in a local newspaper a notice containing a description of the activity, detail where further information may be obtained, the date and place of the event, how and when comments should be submitted to the applicant. A PAC report must be submitted alongside the marine licence application.

2 NEED FOR THE PROJECT

The key drivers underpinning the need for the Project are:

- The need to reduce greenhouse gas emissions;
- The need for energy security; and
- The need to invest in innovative technologies.

2.1 The Need to Reduce Greenhouse Gas Emissions

The commitments made by the Paris Agreement to limit global temperature increase to below 2°C (preferably 1.5°C) were ratified by the UK foreign secretary in November 2016 and implemented through the fifth UK Carbon Budget. This commits the UK to a 57% reduction in carbon emissions by 2032, compared to emission levels in 1990 (BEIS, 2017). Most recently, in line with the recommendation of the Climate Change Committee (CCC) and the sixth Carbon Budget, the UK government has announced that it will set the world's most ambitious climate change target into law to reduce emissions by 78% by 2035 compared to 1990 levels (BEIS, 2021a).

The 2021 Progress in adapting to climate change report (CCC, 2021a) predicts that by 2050, summer temperatures in the UK are expected to increase by around 1.5°C above the 1981 - 2000 baseline (with a 0^0C – 3^0C uncertainty range). However, based on policies as of the end of the Conference of Parties (COP) 26, the CCC (2021b) states a global temperature increase of around 2.7°C by 2050 was expected.

Scotland's Energy Strategy: The Future of Energy in Scotland sets out a vision for the energy system in Scotland until 2050. The strategy sets a 2030 target for the equivalent of 50% of the energy for Scotland's heat, transport and electricity consumption to be supplied by renewable sources.

2.2 The Need for Energy Security

Energy security is about ensuring secure, reliable, uninterrupted supplies to consumers, and having a system that can effectively and efficiently respond and adapt to changes and shocks. It is made up of three characteristics: flexibility, adequacy and resilience (BEIS, 2017).

BEIS (2022a) provides the UK Energy Statistics for 2021. Energy consumption in 2021 remained low, however was up from 2020, but down by about 9% from levels in 2019. In 2020, energy demand was at levels last seen in the 1950s due to Covid-19 restrictions affecting industrial output, work, leisure, and travel, net energy import was 27.8% of the total energy used in the UK (BEIS, 2021b). In 2021, energy consumption was low, but increased from April as restrictions eased and energy requirements increased for industrial use and services. Russia launched a military invasion on Ukraine in February 2022, which affected the reliability of oil and gas supplies transiting through Ukraine to the rest of Europe and the UK. The geopolitical conflicts resulted in concerns of the security of energy supply chain in Europe, which ultimately influenced the global energy markets, leading to high fluctuation in the price of oil and gas. Since then, the average wholesale of gas and electricity prices have been more than three times higher than their average over the last four years (UK Government, 2023). The invasion on Ukraine has put pressure on the UK government as secure energy is necessary for economic growth as all businesses depend on energy. After being heavily reliant on fossil fuels for decades, the UK government's Department for Energy Security and Net Zero aim to replace the use of fossils fuels with renewable energy from UK based projects to protect the country from international energy markets (UK Government, 2023).

Tidal stream energy is a clean, renewable and highly predictable source of energy as it is powered by tides, which is highly predictable. Tides are influenced by gravitational forces exerted by the rotation of the moon, the sun, and the Earth. Therefore, making the generation of tidal stream energy completely predictable. Tides are also not affected by variable weather conditions like other forms of renewable energy production, e.g., solar and wind. As discussed in Section 1.2, Orbital's O2 device is the most powerful tidal stream device in the world. Westray therefore would represent an important step in the deployment of a commercial scale array of tidal stream energy.

2.3 The Need to Invest in Innovative Technologies

Tidal stream energy is a relatively new sector that uses the regular flow of tides to produce a non-intermittent power supply. Due to the close proximity to coastlines and the high energy density of water, tidal stream energy has a low carbon footprint. The EU has identified tidal stream energy, and more widely ocean energy (tidal and wave combined), as having the potential to contribute significantly to climate change reduction, socio-economic and energy security objectives. In 2014, the European Commission presented its action plan for achieving the potential for 'blue energy' by 2020 and beyond, aimed at facilitating the further development of the renewable ocean energy sector in Europe.

It is estimated that the UK has approximately 50% of Europe's tidal stream energy resource (BEIS, 2013). However, more recent studies indicate the UK is leading the world in tidal stream energy with an installed capacity of 10.1 MW and a further capacity under development of 40.8 MW as of 2023, followed by China, with an active installed capacity of 1.7 MW (LSE, 2023). The study completed by a consortium led by the London School of Economics and Political Science, the Grantham Research Institute of Climate Change and the Environment and Centre for Economic Performance reviewed whether tidal stream energy constitutes a strategic priority for sustainable growth in the UK, and if so, what immediate steps would be required to maximise potential growth opportunities. Conclusions determined that as a sizeable domestic renewable resource with high predictability, tidal stream energy has the potential to contribute to sustainable economic growth in the UK, enhancing net zero efforts, improving energy security and generating jobs across the country (LSE, 2023). Scotland was identified as well-placed to lead the development of the tidal stream energy sector within the UK.

As part of Contract for Difference (CfD) auction round 4 (AR4), the UK Government will invest £20 million into the tidal stream sector. Orbital secured 7.2 MW in AR4 for ongoing deployments within the EMEC Fall of Warness tidal demonstration site. After the success of AR4, expectations for tidal stream were high in AR5. Despite the ringfence minima halving from £20 million to £10 million, 53 MW of tidal stream projects across Wales and Scotland secured contracts at close to the maximum ASP, Orbital secure a further 7.2MW to expand deployment at the Fall of Warness. UK Government's successive support for tidal stream energy is a result of recognising the importance of developing the industry to contribute to an energy mix to deliver the UK's decarbonisation commitments and to support employment in green jobs (BEIS, 2021c). The ongoing contribution from the UK government towards the tidal stream energy sector through ringfencing the sector within the CfD scheme, provides the avenue for continued growth and development of the sector. This has been further supported by the introduction of a higher administrative strike price in AR2, raising from £202/MWh in AR5, to £261/MWh in AR6. With further clarity over budgeting allocated to the sector in advance of successive allocation rounds could encourage growth by accelerating deployment and catalyse drivers of cost reduction for the technology, as previously seen in other renewable sectors, particularly offshore wind.

3 SITE SELECTION

The 2010 Pentland Firth and Orkney Waters leasing round was informed by a Scottish Marine Renewable Strategic Environmental Appraisal (Faber Maunsell and METOC, 2007), which included an energy resource assessment and review of environmental, human and physical constraints. Lease areas including the former Westray AfL were then identified and subject to a plan-level Habitats Regulations Assessment (HRA) (Marine Scotland, 2016).

In 2021, Orbital carried out a review of potential sites across the UK for deployment of its technology. The main considerations for selection of preferred sites were environmental, engineering and economic factors, i.e. areas of strong tidal current speeds, sufficient water depths for the O2 technology, available grid capacity with least potential for significant environmental effects. The Westray Project site was selected for the following reasons:

- High tidal stream energy (c. 7 – 11 kW/m^2) and generally suitability water depths for Orbital tidal technology;
- Seabed gradient within acceptable limits for the technology;
- Potential for a suitable cable landfall site (at EMEC Tidal Test site) and a reasonably non-complex seabed terrain for the cable corridor;
- Outwith any sites designated for ornithological or ecological interests at European, national or local levels;
- No nearby nationally designated areas for landscape value;
- No Historic Marine Protected Areas of Protected Military Remains within the proposed site;
- Situated away from any river estuaries or narrow channels where salmonids may be funnelled or congregate;
- Situated within the Tidal Options identified within Scottish Sector Marine Power for Wind, Wave and Tidal (2013);
- Situated outwith Statutory Harbour areas;
- Not situated in a narrow channel where shipping and other sea-users would be impeded;
- No known power cables, telecoms cables, hydrocarbon pipelines or inshore telecoms cables within the site; and
- No known marine aggregations or dredging sites in proximity to the site.

The Westray Project has now been refined by Orbital, broadly within the former Westray AfL, to take account of the depth and tidal range most suitable to the O2 device, with the Project area illustrated in Figure 1-1.

4 PROJECT DESCRIPTION

4.1 Overview

The Westray Project would involve the installation, operation and decommissioning of around 70 Orbital O2 style tidal turbine devices at the Westray Firth, Orkney, with a total generating capacity of 170 MW. Station-keeping for each device would be via four mooring lines connected to either rock drilled or gravity anchors. There would be four anchors per device, or anchor sharing if deemed technically achievable following detailed design.

There would be up to five 33 kV electrical export cables. These would pass through EMEC Fall of Warness tidal demonstration site and make cable landfall and grid connection at onshore connection point within the confines of the EMEC facility.

As such, this scoping opinion request and subsequent Section 36 consent application solely pertains to the offshore elements of the Project within Westray Tidal Array area and export cable between the Project array and EMEC Fall of Warness tidal demonstration site. The export cable route through the EMEC Fall of Warness tidal demonstration site will be consented as part of EMEC's planned consent application to expand the capacity of the site to 50 MW. Any new onshore infrastructure (at the EMEC site) will be applied for as a separate planning application under the Town and Country Planning (Scotland) Act 1997.

The Project is targeting a CfD application in Quarter 1 (Q1) 2026 in AR 8. To achieve this, the Project will need all required onshore and offshore consents, as well as a grid connection. Pending successful CfD award, a final investment decision is to be completed by Q1 2028, with installation to take place around 2030. The project would operate for 25 years with decommissioning around 2055.

4.2 Design Envelope Approach

The Project Design Envelope approach (also known as the Rochdale Envelope approach) will be adopted for the Westray Project. This approach is used routinely in offshore wind consenting in accordance with the National Policy Statement (NPS EN-3 (paragraph 2.6.42)) which recognises that: *"Owing to the complex nature of offshore wind farm development, many of the details of a proposed scheme may be unknown to the applicant at the time of the application, possibly including:*

- *Precise location and configuration of turbines and associated development;*
- *Foundation type;*
- *Exact turbine tip height;*
- *Cable type and cable route; and*
- *Exact locations of offshore and/or onshore substations."*

This approach has also been successfully adopted in tidal stream energy consenting to date, notably at the MeyGen project and EMEC Fall of Warness tidal demonstration site.

The Westray Project Design Envelope will provide maximum and minimum parameters where appropriate to ensure the worst-case scenario can be quantified and assessed in the EIA. The project description, including the design envelope, has been outlined in the following sections in order to provide an overview of the proposed infrastructure of the Westray Project to inform this Scoping Assessment. Further detail on the Project Design

Envelope will be provided in the EIA Report as relevant, noting that Project parameters would be within the envelope presented here.

4.2.1 Infrastructure overview

It is anticipated that the Project will include the following:

- Up to 70 O2 devices, which are floating at the sea surface;
- Inter-array / umbilical cables between devices;
- Up to five export cables from the O2 devices at Westray to the EMEC transmission infrastructure; and
- Navigation markers as required, subject to the conclusions of a Navigational Risk Assessment (NRA) and consultation with the MCA and Northern Lighthouse Board (NLB).

The layout of O2 devices and associated cabling and navigation markers will be determined post-consent. However, a minimum separation of 130 m is to be applied between devices at the surface (i.e. between rotor tips and superstructure extents) during operation, while anchors may be shared between devices, with no separation at the seabed. Potential layout options will be considered within the stated minimum separation in order to inform the impact assessment.

4.2.2 O2 device

As introduced in Section 1.3, the floating O2 device will be deployed at Westray. The O2 is a floating tidal stream energy generator with a cylindrical floating steel superstructure, which houses power conversion and auxiliary systems.

Station keeping is provided to the superstructure via a multi-anchor catenary mooring system consisting of rope tethers, mooring chain and anchors.

Power is exported from the turbine via a dynamic cable from the superstructure to the seabed where it connects to seabed static cabling infrastructure that exports power ashore to the EMEC substation.

Table 4-1, Plate 4-1 and Plate 4-2 outline the indicative device parameters. Plate 4-3 and Plate 4-4 respectively show the O2 device in operation and maintenance mode with the rotors raised. The O2 device is rated to operate between flow speeds of 1 m/s and 5 m/s, which covers the range in flow speeds through this region of the Westray Firth for a large proportion of the tidal cycle. The O2 device, will therefore be operational for up to 75% of the flood-ebb tidal cycle. Further properties related to the O2 device that have been used to inform this Scoping Assessment are presented in Table 4-1.

Table 4-1 Indicative device parameters

PARAMETER	INDICATIVE VALUE
Maximum number of tidal turbine devices	70
Number of rotors per device	2
Maximum rotor diameter	26 m
Maximum number of rotor blades per device	4 (2 blades per rotor)
Maximum rotation speed	12 rpm
Maximum rotor swept area	534 m^2 per rotor (1068 m^2 per device)
Rated power per device	c. 2.4 MW
Rated current speed	2.5 m/s
Cut-in current speed	1 m/s
Shut down current speed	5 m/s
Maximum hull length	88 m
Maximum height above water	1.6 m
Depth to uppermost rotor tip during operation (rotors extended)	3.2 m
Maximum depth to bottom rotor tip (deepest point) during operation (rotors extended)	26 m
Floating structure diameters	4 m
Design life	25 years
Maximum number of mooring lines per device	4
Maximum mooring line length (each)	225 m
Maximum mooring spread	420 m x 220 m
Maximum number of anchors per device	4 (one per mooring line)
Minimum spacing between devices at the sea surface	130 m
Minimum separation distance between device anchors and mooring at the seabed	0 m (devices could share anchors)

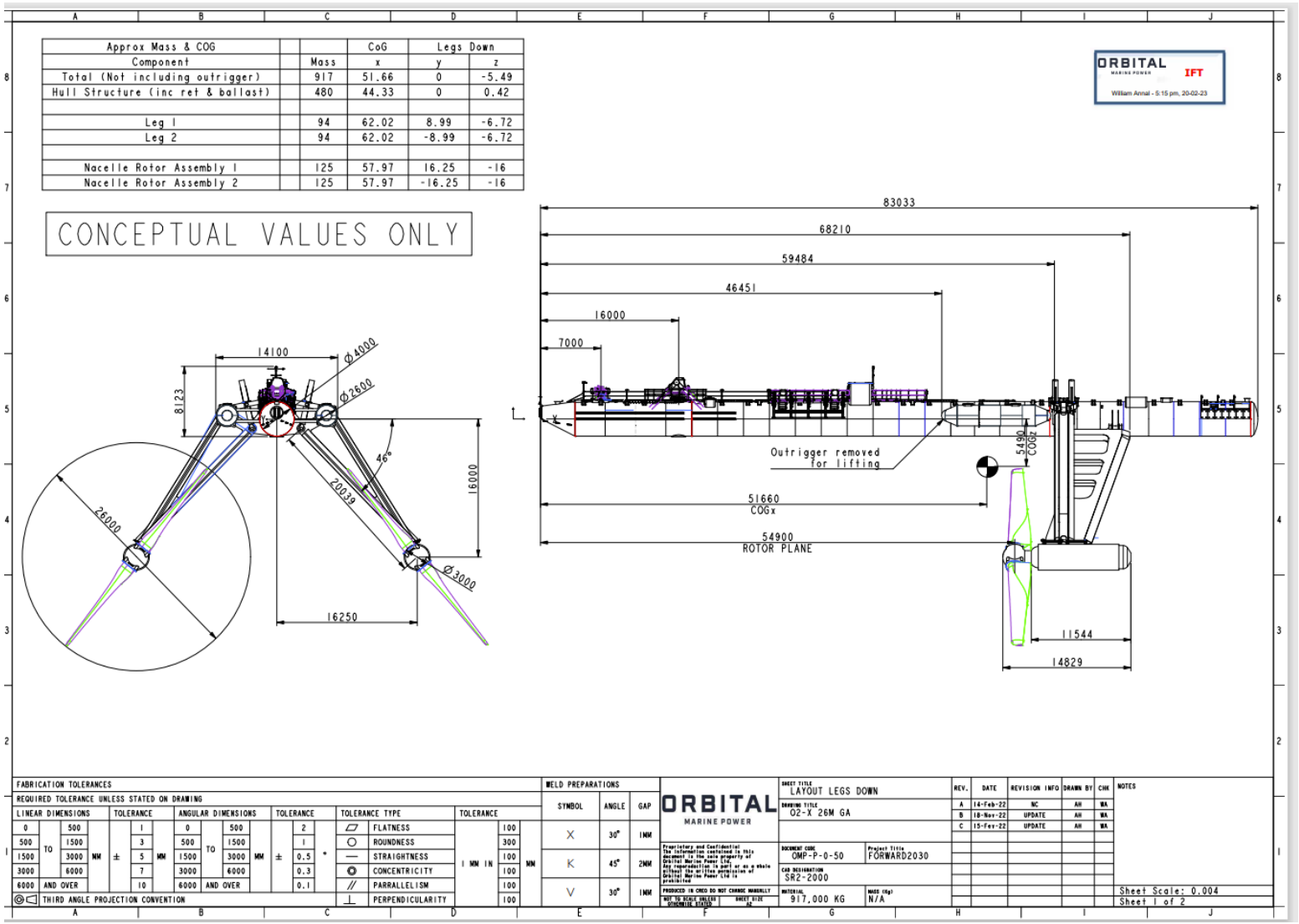

Plate 4-1 Indicative device parameters (front and lateral views)

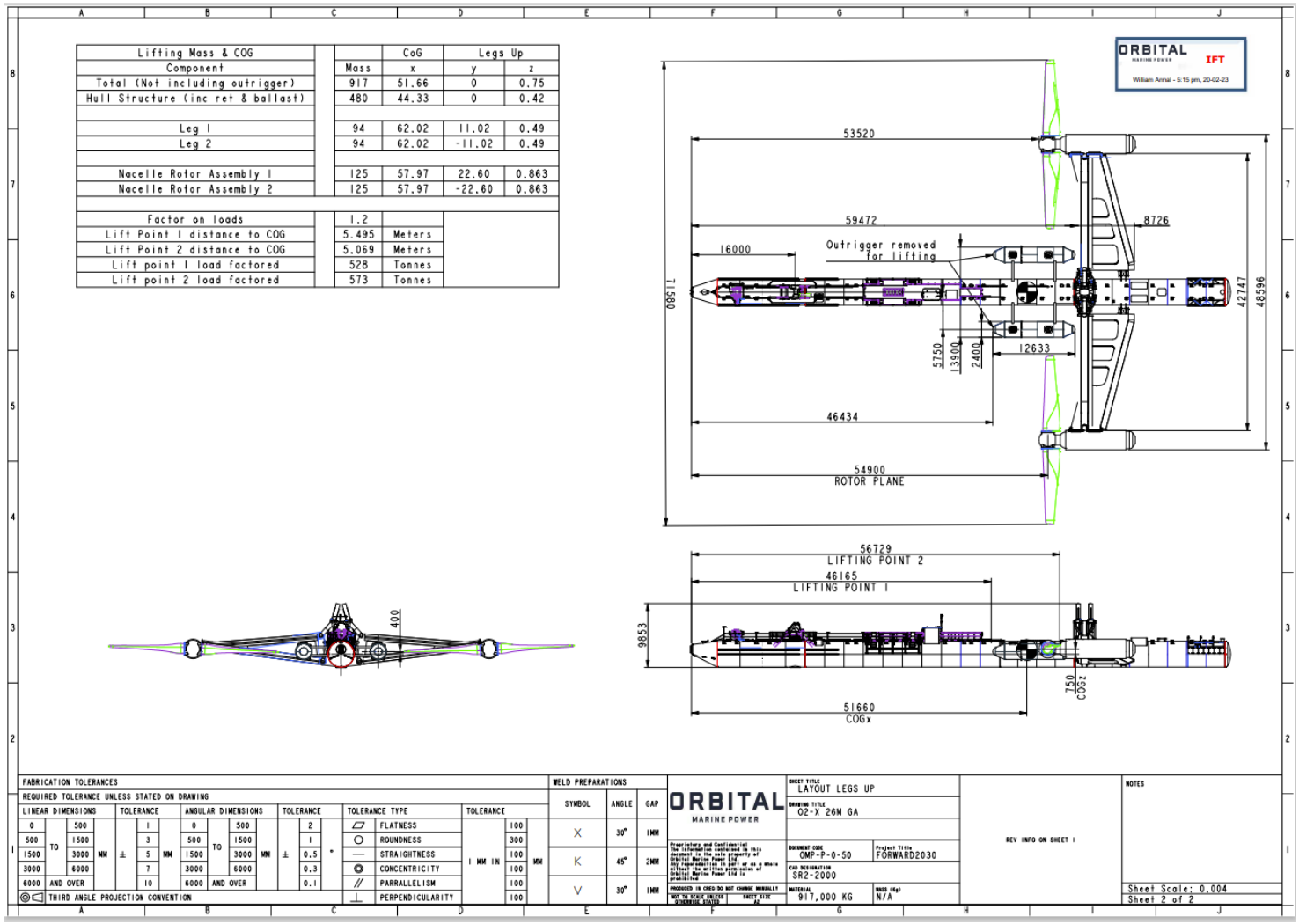

Plate 4-2 Indicative device parameters (top and lateral view without turbines)

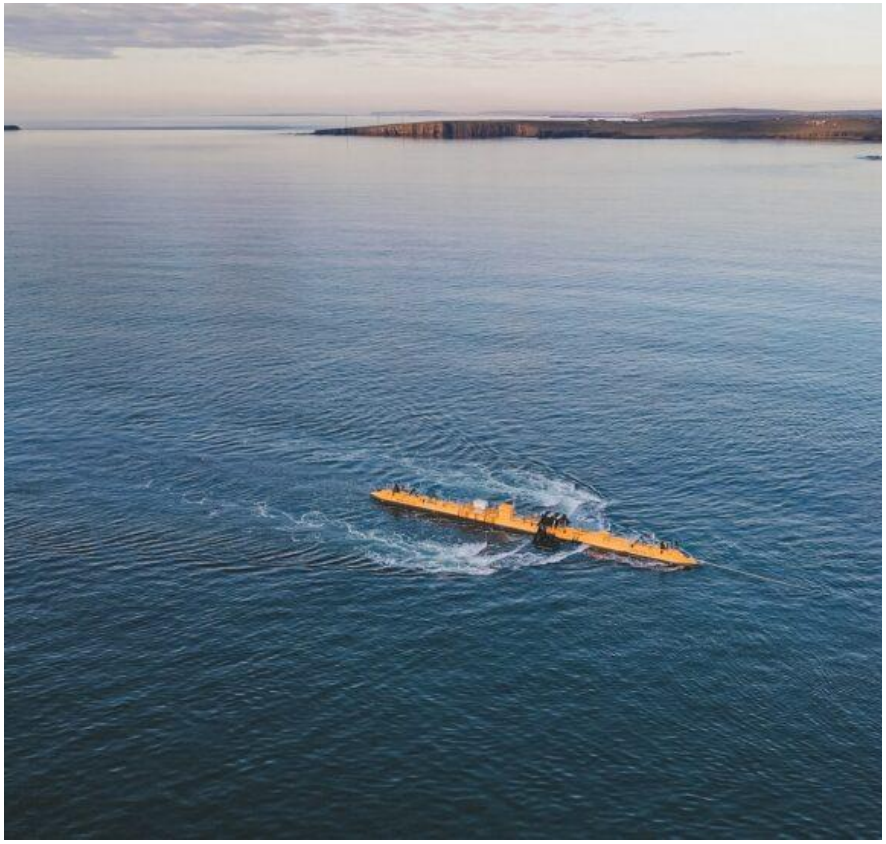

Plate 4-3 O2 in operation

Plate 4-4 O2 in maintenance mode with rotors raised

4.2.2.1 Mooring and anchoring system

The O2 devices will be secured to the seabed with four catenary mooring lines and anchors. Mooring lines may be studlink chain (c. 100 mm diameter) with synthetic rope in the upper sections (c. 170 mm diameter). An image of the indicative anchor spread is shown in Plate 4-5.

The device will be secured to the seabed using gravity and/or rockbolt anchors, subject to the ground conditions. It is possible that both options could be used across the array area. Up to four anchors will be used per device, with a total of up to 280 anchors for the Project. Estimates of properties for each anchor type are as follows, although this is still subject to refinement during detailed design:

- Gravity anchors comprise ballast of c. 11 m x 11 m x 2.5 m each. Equating to an estimated footprint of 121 m^2 per anchor and 484 m^2 per device; and
- Rockbolt anchors use steel vertical bolts drilled into the seabed. The rockbolt anchors would be up to c. 10 m in length, with c 1 m protruding the seabed, and c. 0.6 m in diameter each. Equating to an estimated footprint of 0.28 m^2 per anchor and 1.1 m^2 per device.

There is the potential for O2 devices to share anchors to minimise cost and seabed footprint.

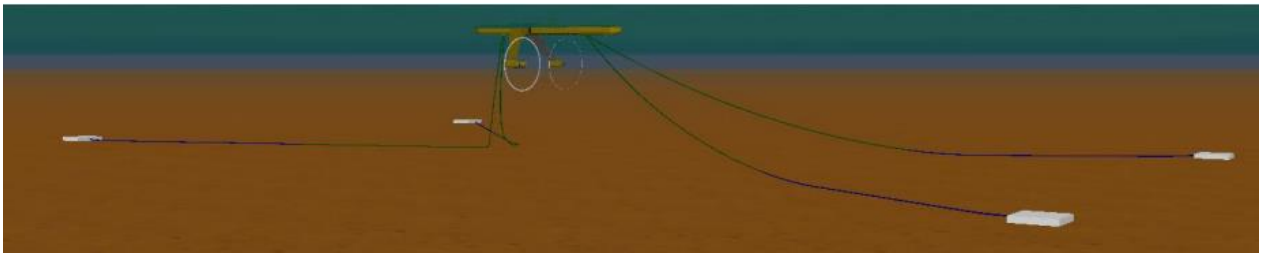

Plate 4-5 Indicative anchoring diagram

4.2.2.2 Scour protection

Concrete mattresses or rock aggregate bags will be placed around each anchor to prevent scour, where required. The seabed footprint of scour protection would be c. 145 m2 per anchor and 580 m2 per device. The height of scour protection above the seabed would be c. 0.3 m.

4.2.3 Installation of tidal devices

The O2 devices will be constructed onshore and towed to the Project array area for installation.

4.2.3.1 Anchor installation

Prior to the installation of the devices, the site will be surveyed using an ROV to support micro-siting, where previous geophysical survey has been completed across part of the former Westray AfL in 2014. In addition, sonar and ADCP measurements of the tidal currents at the site will also be collected to inform installation. Grab sampling of the seabed and core sampling will be undertaken to assess the suitability of the seabed for the anchoring technology. However, it is envisaged this would be completed post-consent of the Project.

Installation will depend on the type of anchors used, gravity anchors or rockbolts.

If gravity anchors are utilised, they will comprise gravity anchors comprised of modular heavy ballast sections installed into single holding structures located on the seabed. Each seabed structure or 'basket' would have the required volume to accept the total mass of ballast material in modular format.

The anchor basket will be pre-installed and made ready to accept ballast. A length of chain pre-connected will be deployed along with the anchor basket so that it is recoverable to the surface, this chain will form the first section of the chain based catenary mooring system.

The second section of mooring chain forming the main catenary will connect into the pre-installed first section on the deck of a work vessel on site. The completed mooring line will then be terminated with a mooring connector system which interfaces with the floating turbine.

If rock bolts are installed, a submersible and remotely operated drill rig will be deployed from a multi-cat vessel or similar inshore construction vessel. It will be operated by a hydraulic power unit (HPU) which will remain on the deck of the vessel during the operation. The drill rig will embed the rock anchor in the seabed; drilling time per anchor will be approximately 6-hours.

The anchors will be positioned using a Global Navigation Satellite System (GNSS) system, a heading sensor and cameras installed on the drilling rig. After installation of each anchor, the drill rig will be recovered before the support vessel's position is changed, using a pre-laid arrangement of moorings.

4.2.3.2 Cable installation

The cable installation process for the subsea array of floating orbital tidal turbines will involve the following steps:

- Cable Route Survey: Prior to installation, a thorough survey will be conducted using ROV, sonar, and ADCP measurements to assess the cable route. This survey will help identify potential obstacles, seafloor conditions, and any sensitive habitats or protected areas along the route;
- Cable Preparations: The subsea power cables will be prepared onshore, including the termination of connectors and the installation of necessary protection measures such as armour or insulation, depending on the cable specifications and environmental requirements;
- Cable Lay Vessel: A specialized cable lay vessel will be employed for the installation process. This vessel will have the capacity to transport and deploy the cables while maintaining control and stability in tidal streams;
- Cable Installation: The cable lay vessel will deploy the subsea power cables along the predetermined route using suitable cable laying techniques. These techniques may include ploughing, jetting, rock-cutting or other methods that minimize seafloor disturbance and protect the cable during installation;
- Cable Connection: At the turbine location, the cable end will be lifted, and any temporary keep weights will be removed. The cable end will then be passed over to the turbine structure for connection. The turbine will be equipped with appropriate equipment and mechanisms to secure and connect the cable, ensuring a reliable and efficient electrical connection;

- Cable Testing and Protection: After the cable is connected, testing procedures will be conducted to verify the integrity and functionality of the installed cable. Any necessary repairs or adjustments will be made to ensure optimal performance. Additionally, appropriate protection measures, such as burial or covering, will be implemented to safeguard the cable against external factors and potential damage; and
- Post-Installation Monitoring: Following the cable installation, post-installation monitoring will be carried out to assess the effectiveness of the installation process and identify any potential long-term impacts on the marine environment. This monitoring will help inform future maintenance and mitigation efforts.

4.2.3.3 Device installation

The installation of the O2 device will first involve towage of device and connection to moorings. These works require a vessel that has capacity to carefully move the turbine from the holding location, tow the turbine to the installation site and maintain control of the turbine in tidal stream during connection. This vessel will have the same specification as that required for towing the turbine.

The connection operation will take place over a neap tidal cycle (two slack periods) using the winching systems installed on the turbine to recover the catenary based mooring system and latch into the connection points installed on the terminal end of the synthetic risers. Once latched and locked into position the turbine will recover the dynamic riser section of cable for installation using the same winching process.

The cable end will be lifted and any temporary keep weights must be removed before passing over cable end to the turbine structure. Following connection of the turbine mechanically, the towing vessel will remove towing equipment and prepare the cable for installation. The turbine will then recover the cable into the turbine and connect to the electrical grid.

During all the installation activities an additional vessel for safety as well as line running and connecting mooring lines is required. This is expected to be a RHIB vessel selected with due consideration of the task required and area of operation.

Methods for anchoring the devices are discussed in Section 4.2.2.1.

4.2.4 Cables and cable protection

The inter-array and export (to the EMEC tidal demonstration site) cables will employ subsea power cables, which are equipped with armour and protective layers, typically made of steel or other robust materials. These layers enhance the cables' resistance to abrasion, impact, and external pressures, providing an additional level of protection.

The Project cables may be buried using methods as introduced in section 4.2.3.2, or may be surface laid with rock pins used to keep the cable pinned to the seabed. Approximate lengths of cables are as follows:

Up to 33 kV “daisy chains”, with a maximum of 15 dynamic inter-array cables connecting each O2 device to the main 33 kV export cable. Each cable could have a maximum length of 500 m; and

Up to five export cables comprising 33 kV, cables with a maximum length of 5 km each within the Westray Project. An additional 5 km length may extend between the Westray Project and the EMEC transmission infrastructure, however this is not part of the Westray Project envelope and is to be consented in relation to the ongoing EMEC Fall of Warness Section 36 application.

4.2.5 Installation programme

The full installation is expected to take 60-months and commence in the late 2020s. The total installation programme will be dependent upon how the project secures CfD or alternative revenue stream arrangements.

4.3 Operation and Maintenance

The operation of the devices will be monitored and controlled remotely via a Supervisory Control and Data Acquisition (SCADA) system which will run permanently on a dedicated computer located at an onshore location.

The O2 device is fundamentally designed for ease of access and maintenance. As a floating device, scheduled and unscheduled maintenance operations on electrical, control and hydraulic systems can be carried out onboard the device simply by transferring personnel from a small vessel such as a RIB onto the hull of the devices. From here personnel can enter the hull and access the majority of equipment. This is anticipated to be conducted several times a year.

For more significant maintenance operations or where weather conditions preclude a personnel transfer a device can be disconnected from its mooring and towed to a maintenance location. Once disconnected from its moorings, the rotor legs are retracted, and the low transport draught of the turbine allows the use of local shallow bays / pontoon facilities for maintenance. This is anticipated to be conducted once, maximum twice, per project lifetime.

The project will be operational for up to 25 years.

4.4 Decommissioning

The Offshore Renewable energy decommissioning guidance states that "an indication of the decommissioning proposals should be included as part of the statutory consenting or licensing process so that the feasibility of removing the infrastructure can be assessed as part of the application process" (Scottish Government, 2022).

The EIA will therefore include an assessment of the expected decommissioning works at the end of the project life (expected to be 25 years). It is likely that these will be largely a reverse of the construction processes, with potential for cable protection and scour protection to be left in situ where they have become colonised, subject to navigational safety. The decommissioning works will be subject to further environmental assessment prior to the time of decommissioning.

Decommissioning methods may change by the time the project is decommissioning, but it is envisaged that it would comprise the following activities:

- The electrical connections for the devices will be unlocked and capped, weighted and returned to the seabed;
- The mooring connections fore and aft of the floating platforms will be un-locked from the devices and returned to the neutral buoyancy position marked with the approved pick-up buoy;
- The devices will be towed off-site using a multicat vessel and taken to an appropriate harbour or sheltered bay location for temporary mooring;
- Each of the mooring shackles connecting the mooring lines to the mooring connectors will then be released and returned to the seabed with navigation/pick-up buoys attached to enable recovery;
- If gravity anchors are utilised, each of the anchor cages and ballasts will then be recovered including the mooring lines;
- If rockbolt anchors are utilised, the mooring lines will be recovered and the anchors themselves will be left in situ in the seabed to minimise the environmental impact associated with the decommissioning phase, with the exception of the extent of rockbolt element protruding from the seabed, which will be cut-off at the seabed. If rockbolt anchors that are fully removable become available, they will be considered for use and the decommissioning methodology updated accordingly;
- Rock bags will be recovered with a multi-cat style work vessel using a hydraulic actuated grab and subsea mounted 360 degree camera; and
- Cabling and any other remaining seabed infrastructure such as cable junction boxes would be removed, unless there were overriding reasons why it would be preferred for environmental impact reasons to leave some sections in situ.

4.5 Embedded Mitigation

This section outlines mitigation that Orbital commits to providing as part of the project design and delivery methods. It should be noted that Orbital has been deploying grid connected O2 tidal device within the EMEC Fall of Warnes tidal demonstration sites over the past 10 years, with a number of these mitigation and monitoring measures already being implemented, in line with environmental regulations and best practice. No negative environmental impacts have been seen to date over these periods of operation. The approach to identifying additional mitigation requirements through the EIA process is described in section 6.3.2.

4.5.1 Shipping and navigation mitigation

The following embedded measures will be provided to mitigate effects on shipping and navigation:

- Compliance with MGN 654 (MCA, 2021) and its annexes where applicable;
- Appropriate marking on Admiralty charts;
- Promulgation of information as required (e.g. Notice to Mariners, Kingfisher Bulletin);
- Buoyed construction area in agreement with Northern Lighthouse Board (NLB);
- Application for safety zones during construction and periods of major maintenance as appropriate;
- Marine coordination and communication to manage project vessel movements;
- Marking and lighting of the site in agreement with NLB and in line with IALA Recommendation O-139 (IALA, 2013); and
- Compliance with regulatory expectations on moorings for floating wind and marine devices (HSE/MCA 2017).

Many of the above measures have been agreed with various navigational stakeholders and are as a result of consented Marine Licences for the operation of the Orbital O2 tidal device within the EMEC Fall of Warness tidal demonstration site.

4.5.2 Archaeology and cultural heritage mitigation

In order to prevent significant impacts, it is recommended the following mitigation is embedded in the project design:

- The implementation of Archaeological Exclusion Zones (AEZs) where appropriate within which no development related activities will take place;
- Avoidance anomalies of possible archaeological interest by micro-siting of design where possible;
- Further investigation of any anomalies that cannot be avoided by micro-siting of design (i.e. using a diver or Remote Operated Vehicle (ROV));
- Assessment of potential prehistoric deposits including geoarchaeological recording of core samples, deposit modelling and archaeological input into any future sampling programme/s; and
- The archaeological assessment of any further geophysical data.

Additionally, a Written Scheme of Investigation (WSI) (of which an outline will be submitted with the application) and Protocol for Archaeological Discoveries (PAD) will be prepared to inform consultation. This will set out processes and procedures to be put in place on discovery of any marine archaeological features during construction, operation and maintenance or decommissioning. Where more detailed surveys of potential anomalies are required post-consent but pre-construction, these would need to be carried out in accordance with the WSI and PAD.

Reporting protocols are to form part of the construction environmental management plan. Should any archaeology or cultural heritage features be discovered during marine works, installation activities would avoid these sites and the County Archaeologist will be contacted and The Crown Estate (2014) reporting protocol for the discovery of previously unknown marine cultural material would be followed (https://www.wessexarch.co.uk/our-work/offshore-renewables-protocol-archaeological-discoveries).

4.5.3 Pollution mitigation

The UK is also a signatory to the International Convention for the Prevention of Pollution from Ships (the MARPOL Convention 73/78) and all ships flagged under signatory countries are subject to its requirements, regardless of where they sail. The convention includes regulations aimed at preventing and minimising pollution from ships, both accidental and that arising from routine operations. All work practices and vessels associated with the Project will adhere to the requirements of the MARPOL convention; specifically Annex 1 Regulations for the prevention of pollution by oil concerning machine waters, bilge waters and deck drainage and Annex IV Regulations for the prevention of pollution by sewage from ships concerning black and grey waters.

Oils and lubricants used in the O2 device will be biodegradable where possible and all chemicals would be certified to the relevant standard.

4.5.4 Co-operation with EMEC

Westray is adjacent to the EMEC Fall of Warness tidal demonstration site and the two projects have entered into a co-operation agreement to share information and transmission infrastructure in order to minimise impacts on the physical, biological and human environment. This is further evidenced through the joint marine wildlife survey for ornithology and marine mammals, which has been consulted on with NatureScot as introduced in Table 1-1.

5 POLICY AND LEGISLATIVE CONTEXT

Further to the Marine (Scotland) Act 2010 and Electricity Act 1989 underpinning the consents and licences required for Westray, and the EIA Regulations described in Section 1, the following sections set out the key policy and legislation of relevance to the Project.

5.1 Energy and Climate Change

5.1.1 Kyoto Protocol to the United Nations Framework Convention on Climate Change

The UK is a signatory to the Kyoto Protocol which commits state parties to reduce greenhouse gas emissions, which came into effect in 2005. Its commitments were transposed into UK law by the Climate Change Act 2008, which requires the net UK carbon account for the year 2050 to be 80% lower than the 1990 baseline.

5.1.2 European Union Renewable Energy Directive

To keep the European Union (EU) a global leader in renewables and as part of the Clean energy for all Europeans package, the Revised Renewable Energy Directive (2018/2001/EU) entered into force in 2018. This, in turn, helps the EU to meet its emissions reduction commitments under the Paris Agreement. The revised Renewable Energy Directive set the following targets:

- A minimum of 32% share of renewable energy consumption within the EU; and
- Member States to commit to the renewable energy consumption target as part of integrated national energy and climate plans, pursuant to Regulation (EU) 2018/1999 of the European Parliament and of the Council.

Since formally leaving the EU, the UK Government has committed to implement international environmental obligations in accordance with the EU (Withdrawal) Act 2018 and to maintain environmental commitments and legislation already made. On this basis, the existing EU renewable energy targets for the UK, including the EU Renewable Energy Directive 2009/28/EC will remain applicable.

5.1.3 Climate Change Act

The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 sets commitments for Scotland to reach Net Zero by 2045.

5.1.4 The Scottish Energy Strategy: The Future of Energy in Scotland

This Strategy sets out the Scottish Government 2050 vision for energy in Scotland. There are six visions for 2050, one of which includes renewable and low carbon solutions, specifically championing and exploring Scotland's huge renewable energy resources and ability to support energy targets.

5.1.5 Scotland's Emission Reduction Targets

Scotland has its own targets to reduce greenhouse gas emissions, which are set out in the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019. This Act aims to ensure Scotland contributes appropriately to the world's efforts to deliver on the Paris Agreement, reached at the 21st Conference of the Parties of the United Nations Framework Convention on Climate Change. The Emissions Reduction Targets includes a reduction of all greenhouse gases to net-zero by 2045 at the latest, with interim targets for reductions of at least 56% by 2020, 75% by 2030 and 90% by 2040.

5.2 Scottish Marine Policy and Legislation

5.2.1 National Planning Framework 4

The National Planning Framework (NPF) is a long-term plan for Scotland that identifies development and infrastructure needs. The fourth iteration (NPF4), guides spatial development until 2045, outlining national planning policies, designating national developments, and emphasising regional spatial priorities. NPF4 was adopted by the Scottish Ministers in February 2023, which subsequently replaces the previous framework, NPF3, and incorporates updated Scottish Planning Policy, consolidating spatial and thematic planning policies.

NPF4 does not cover marine areas, however, it recognises the role of onshore development in facilitating offshore renewable energy projects. Part 2 of NPF4 focuses on National Planning Policy, with several policies relevant to onshore elements of a project. However, as noted in section 1.3, the Westray Project is entirely offshore, with no onshore components. Policy 1 highlights the urgency of addressing the global climate crisis, ensuring it remains a priority in all plans and decisions. Policy 11 specifically aims to "encourage, promote and facilitate all forms of renewable energy development onshore and offshore". The policy supports opportunities for renewable energy development, encompassing onshore generation, storage, transmission, and distribution infrastructure.

Renewable energy is also a main theme within Annex B – National Developments Statements of Need, which describes the developments to be considered as national developments for consent handling purposes. Key national developments include:

1. Energy Innovation Development on the Islands which supports proposed developments in the Outer Hebrides, Shetland and Orkney Island groups, for renewable energy generation, renewable hydrogen production, infrastructure and shipping, and associated opportunities in the supply chain for fabrication, research and development; and
2. Strategic Renewable Electricity Generation and Transmission Infrastructure which supports renewable electricity generation, repowering, and expansion of the electricity grid.

5.2.2 Scottish Planning Policy

The NPF3 is supported by the Scottish Planning Policy (SPP) (Scottish Government, 2014b). This includes a series of topics, including renewable energy policies, and acknowledges Scotland's offshore renewable energy resources. With regard to the renewable energy sector, NPF3 presents a key vision in Scotland for the enhancement of the low carbon economy and to be a world leader in low carbon energy generation, both onshore and offshore.

The Plan has been developed in accordance with the strategic aims of the National Marine Plan (Marine Scotland, 2015a).

5.2.3 Scotland's National Marine Plan

The Scottish Government published the Marine Plan in 2014 which reflects the importance of marine renewables, including tidal stream energy and the Pentland Firth and Orkney Waters. The Plan states "*Scotland is a world-leading location in the development of marine renewable energy and has very significant wave and tidal stream energy resources. The UK Wave and Tidal Key Resource Areas Project found that Scottish waters offer the majority of the UK's wave resources (46 TWh/year) and significant tidal stream resources (32 TWh/year).*"

5.2.4 Regional Marine Plan

Regional marine plans are prepared by Marine Planning Partnerships (MPPs) representing the economic, community, environmental and recreational interests within a local marine region. MPPs are established to enable local ownership of policy development and decision making taking account of local circumstances[2].

The Orkney Islands Council (OIC) received the delegate functions from Scottish Ministers to develop a regional marine plan for Orkney in 2020 and subsequently set up the Orkney Marine Planning Advisory Group (OMPAG) to provide expert advice and guidance during the plan-making process. The OIC is currently developing the regional marine plan, with input from the OMPAG.

5.3 The Habitats and Birds Directive and Associated Regulations

The Council Directive 92/43/EEC (the Habitats Directive) was adopted in 1992, providing a means for the EU to meet its obligations under the Bern Convention. The aim of the Directive is to maintain or restore natural habitats and wild species listed on the Annexes at a favourable conservation status. This protection is granted through the designation of Special areas of Conservation (SACs) and European Protected Species (EPS).

The European Directive (2009/147/EC) on the conservation of wild birds (The Birds Directive) provides a framework for the conservation and management of wild birds within Europe. The Directive affords rare and vulnerable species listed under Annex I of the Directive, and regularly occurring migratory species, protection through the identification and designation of Special Protection Areas (SPAs).

Together SACs and SPAs (known as European Sites) formed part of the Natura 200 network but now these sites in the UK are known as the 'National site network[3]')

The Directives have been transposed into Scottish Law by various regulations, those of relevance to the Project include:

[2] *https://www.orkney.gov.uk/Service-Directory/D/orkney-marine-planning-partnership.htm#:~:text=Regional%20marine%20plans%20are%20prepared,taking%20account%20of%20local%20circumstances.*
[3] *The UK National site network is made up of SACs and SPAs designated at various points in time before exit day (i.e., UK sites that formed part of the EU's Natura 2000 network prior to exit day), and any sites designated under the Habitats Regulations after exit day.*

- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended); and
- The Conservation of Habitats and Species Regulations 2017.

These are hereafter referred to as the 'Habitats Regulations'.

The Habitats Regulations require that where a plan or project that is not directly connected with, or necessary to the management of a European site, but likely to have a significant effect, 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. A separate HRA Screening report has been prepared alongside this Scoping report.

5.4 European Protected Species (EPS) Licensing

EPS are animals and plants (species listed in Annex IV of the Habitats Directive) that are afforded protection under the Habitats Regulations. If any activity is likely to cause disturbance or injury to an EPS a licence is required to undertake the activity legally. In the case of Westray any requirement for an EPS Licence would be on advice from NatureScot or the Scottish Ministers, depending on the reason for the licence application. Although the grant of EPS licences is separate to the Section 36 and marine licence application process, it can be considered in parallel by Marine Scotland in order to constrict timelines.

Should additional pre-construction licences be required, these will be discussed and agreed with the relevant consenting authority during the pre-construction phase of the Project.

5.5 Nature Conservation Marine Protected Area (NCMPA)

Under section 82 of the Marine (Scotland) Act 2010, Marine Scotland is required to consider whether a licensable activity is capable of affecting (other than insignificantly) a protected feature in a Nature Conservation Marine Protected Area (NCMPA), or any ecological or geomorphological process on which the conservation of any protected feature in an NCMPA is dependent. There are currently no proposed NCMPAs in Orkney.

5.6 Decommissioning

Sections 105 to 114 of the Energy Act 2004 (as amended by the Energy Act 2008 and the Scotland Act 2016) (hereafter referred to as the Energy Act) contain statutory requirements in relation to the decommissioning of offshore renewable energy installations (OREI) and their related electricity lines. Under the terms of the Energy Act, Scottish Ministers may require a person who is responsible for these installations or lines in Scottish Waters or in a Scottish part of a renewable energy zone (REZ) to prepare (and carry out) a costed decommissioning programme for submission to and approval by Scottish Ministers (Scottish Government, 2022).

Scottish Ministers have the power to determine specific approaches to decommissioning, including stipulating what form, timing and size of financial securities are required. The expected content of a decommissioning programme includes decommissioning standards, financial security, residual liability, and industry cooperation and collaboration.

The scope of decommissioning requirements in Scotland is between the Mean Low Water Spring (MLWS) mark and the seaward limits of the territorial waters, including coastal water and the Scottish part of the REZ. The Energy

Act does not cover the intertidal zone; however, decommissioning of infrastructure within the intertidal zone should be carried out under any conditions attached to a Marine Licence (under the Marine Scotland Act 2010).

6 APPROACH TO EIA

This section describes the methodology that will be applied to the Westray EIA. It outlines the methodology for the identification and evaluation of potential likely significant environmental effects (as defined in the EIA Regulations) and presents the proposed methodology for the identification and evaluation of potential cumulative effects. A systematic and auditable evidence-based approach will be followed to evaluate and interpret the potential effects on physical, biological and human receptors. In accordance with the EIA Regulations the potential for significant risks to the receiving communities and environment through major accidents or disasters are also considered.

This scoping report identifies the receptors and likely significant effects to be considered further in the EIA report. Within the EIA Report, the assessment of each topic will be included in a separate chapter. Within each of the topic chapters, the following matters will be considered:

- Identification of the study area for the topic-specific assessments;
- Description of the planning policy and guidance context;
- Summary of consultation activity, including comments received in the scoping opinion and PAC;
- Description of the environmental baseline conditions;
- Assessment of natural trends on the baseline conditions, including due to climate change, should the Project not be progressed;
- Presentation of impact assessment, which includes:
    - Identification of the maximum design scenario for each impact;
    - A description of the mitigation measures adopted by orbital which seek to prevent, reduce or offset environmental effects of the Project; and
    - The assessment of the significance of identified effects.
- Identification of any future monitoring required;
- Assessment of any cumulative effects with other plans and project projects; and
- Inter-related effects, considering (for example) whether multiple construction impacts affecting the same receptor could increase the significance of effect upon that receptor.

6.1 Guidance

The following guidance and best practice documents have been developed to assist the EIA process:

- Scottish Government (2018) Marine Scotland Consenting and Licensing Guidance For Offshore Wind, Wave and Tidal stream energy Applications;
- Guidelines for Ecological Impact Assessment (EcIA) in the UK and Ireland – Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018);
- Environmental impact assessment for offshore renewable energy projects (British Standards Institute (BSI), 2015); and
- IEMA Environmental Impact Assessment Guide to Shaping Quality Development (IEMA, 2015).

Each technical chapter of the EIA Report will document relevant specialist guidance which has been considered in undertaking the baseline characterisation and impact assessments.

6.2 Baseline Characterisation

The characterisation of the existing offshore environmental will be undertaken to determine the baseline conditions in the area covered by the Project, including relevant receptor specific study areas for those issues scoped in for further assessment as part of the EIAR. This will require review of the potential evolution of the environmental baseline conditions of the study area(s) throughout the lifetime of the Project, such that future impacts can be adequately understood.

Baseline characterisation will involve the following steps:

- Study areas defined for each receptor based on the relevant characteristics of the receptor (i.e., the mobility, range or extent of the receptor);
- Review of available information (both publicly available data and relevant information from site-specific surveys);
- A review of likely potential impacts arising from the Project;
- Determine if there is sufficient data available to make an informed EIA judgement with sufficient confidence;
- Identify the requirement for additional data (including an identification of key data gaps) required to answer outstanding questions or uncertainties from the EIA; and
- Review information gathered as part of the EIA to ensure that the environmental baseline is characterised in sufficient detail to allow the Competent Authority to make an informed decision.

6.2.1 Existing site-specific evidence

Data collection for the Pentland Firth and Orkney Waters leasing round, including site specific data acquired for the former South Westray AfL will be used in informing the EIA for the Project. A summary of relevant information and data is provided in Table 6-1.

Table 6-1 Existing data

SURVEY	SURVEY DATE	COVERAGE
Fisheries Research Services Seabed Survey Work	2006-2008	Pentland Firth and Orkney
Investigation of the Utilisation of Sea Space by Sea Birds	November 2010 - March 2011	Pentland Firth and Orkney
Metocean (currents, wave, turbulence, water level)	November – December 2011	Former Westray AfL
Boat based ESAS and MMO visual surveys of seabirds and marine mammals	January 2012 - March 2014	Former Westray AfL
Analysis of Towed Hydrophone Data	January - August 2012	Three tidal sites including the former Westray AfL
Investigation of the Utilisation of Sea Space by Sea Birds	March - July 2012	Pentland Firth and Orkney

SURVEY	SURVEY DATE	COVERAGE
Geophysical survey	April 2014	Former Westray AfL
Marine wildlife survey, comprising boat-based ESAS and marine mammal observations at approximately monthly intervals	April 2023 – Ongoing	Westray Firth, covering the Westray and EMEC tidal demonstration site
Geophysical survey	June 2023	Approximately 35% of the Westray Tidal Array area

The site-specific boat-based survey between January 2012 and March 2014 was undertaken by National Research Project Limited (NRP) on behalf of SSER. These surveys covered the former Westray AfL with a 4 km buffer upstream and downstream within the Westray Firth. To the sides of the former Westray AfL (i.e., perpendicular to the tidal currents) the buffer was approximately 2 km due to the proximity of several islands (see Plate 6-1). This survey area remains applicable to the Project as the current Westray Tidal Array lies within the former Westray AfL boundary.

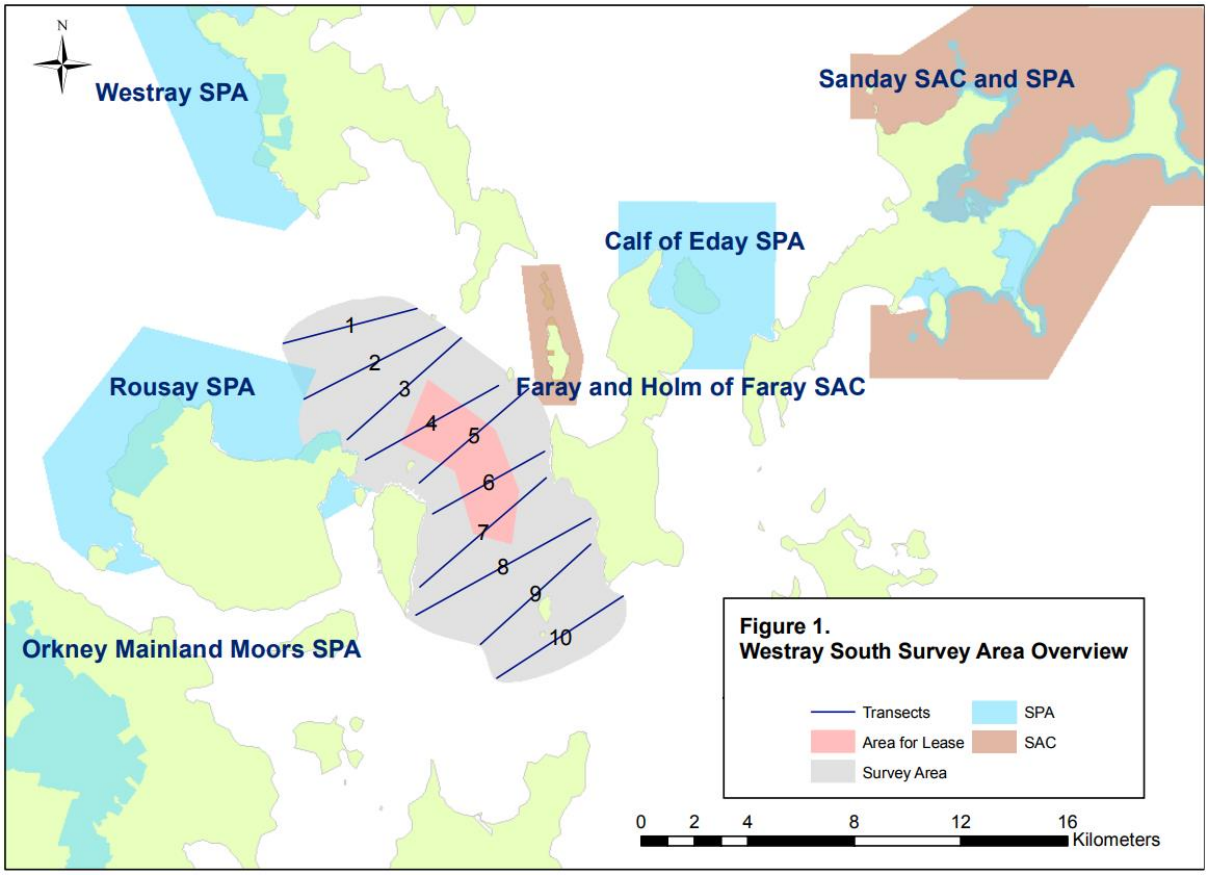

Plate 6-1 NRP survey area overview (source: NRP, 2013)

6.2.2 Existing secondary data sources

In addition to the site evidence available for the Project, additional information will be obtained from secondary data sources relevant to each receptor. More general information and properties for the waters around the Orkney Islands is available from Offshore Energy Strategic Environmental Assessment (SEA) 3 (DECC, 2016a) and Offshore Energy SEA 4 (BEIS, 2022b). The Scoping Assessment presented below, considers further relevant data sources to inform the completed scoping, with the sources also being used to inform the EIAR as appropriate.

6.3 Impact Assessment Methodology

6.3.1 Assessment of effect significance

The approach the EIA team will take to making robust assessments will be guided by EIA and technical specialists using available data, most up-to-date scientific understanding of potential impacts, experience and expert judgement. In order to provide a consistent framework and system of common tools and terms, where appropriate, a matrix approach will be used to frame and present the judgements made. However, it should be noted that for each topic of the EIA, the latest guidance or best practice will be used and, therefore, definitions of sensitivity and magnitude of impact will be tailored to each receptor. As required by the EIA Regulations, only effects that are likely to be significant require detailed assessment.

The impact assessment will consider the potential for impacts during the construction, operation, maintenance and decommissioning of the Westray Project.

Impacts will be assessed for receptors for which screening has determined there to be a plausible impact pathway that could lead to an effect of concern. Receptors for which a potential impact could not plausibly be significant will be screened out. In the case of receptors relating to vertebrate taxa, such as birds and marine mammals, the assessment will consider receptors defined as the populations of a species occurring in an appropriately defined geographic area.

6.3.1.1 Determining receptor sensitivity

The sensitivity of a receptor is determined through its ability to accommodate change and on its ability to recover if it is affected. Receptor sensitivity will be assigned on the basis of species-specific adaptability, tolerance, and recoverability, when exposed to a potential impact. The following parameters will be taken into account:

- Timing of the impact: whether impacts overlap with critical periods of the receptor, e.g., life-stages or seasons for ecological receptors;
- Probability of the receptor-effect interaction occurring (e.g. vulnerability);
- The perceived receptor's 'value'; and
- A receptor's baseline status and condition, for example whether it has a Favourable Conservation Status or not.

The 'value' of the receptor forms an important element and is intrinsic constituent in the determination of the receptor sensitivity within the assessment, for instance, if the receptor is a protected species or habitat or has an

economic value. However, it is important to understand that high value and high sensitivity are not necessarily linked within a particular impact. A receptor could be of high value but have a low or negligible physical/ecological sensitivity to an effect. Similarly, low value does not equate to low sensitivity and is judged on a receptor-by-receptor basis.

The overall receptor sensitivity is, therefore, determined by considering a combination of value, adaptability, tolerance and recoverability as well as applying professional judgement and/or past experience. Expert judgement is particularly important when determining the sensitivity of receptors. For instance, an Annex II species (under the Habitats Directive) would have a high value, but if it was highly tolerant of an effect or had high recoverability it would follow that the sensitivity in this instance should reflect this.

6.3.1.2 Predicting magnitude of impacts

The impact magnitude is determined by the interaction between the scale of the effect in time, area, intensity and the sensitivity of the affected receptor. It is important to note that a change resulting from a proposed development can be positive or negative.

With respect to duration of potential impacts, those associated with construction (and decommissioning) will be considered to be short term, occurring over approximately 18-months. Impacts associated with operation will be considered long term, occurring over the operational lifetime of the Westray Project.

The broad categorisation for the magnitude of change is as follows:

- High: total change of major alteration to key elements or features of baseline conditions;
- Medium: partial change or alteration to key elements or features of baseline conditions;
- Low: a minor shift away from baseline conditions; and
- Negligible: very slight change to baseline conditions.

For topics where there is the potential for both adverse and positive impacts, magnitude of change definitions will be specifically defined for both positive and adverse impacts.

6.3.1.3 Evaluation of Significance

The significance of potential effects will be defined by considering receptor sensitivity in combination with the magnitude of a given impact. Where there is a lack of suitable data to quantitatively assess impacts for the species under consideration, the assessment will be informed by professional experience and judgement.

Subsequent to establishing the receptor sensitivity and magnitude of impact, the effect significance will be predicted by using quantitative or qualitative criteria, as appropriate to ensure a robust assessment. Where possible a matrix such as the one presented in Table 6-2. will be used to aid assessment of effect significance based on expert judgement, latest guidance and any specific input from consultation. The matrix is seen as a framework to aid understanding of how a judgement has been reached from the narrative of each impact assessment and it is not a prescriptive formulaic method.

A description of the approach to impact assessment and the interpretation of significance levels will be provided within each section of the EIA Report. This approach will ensure that the definition of effect significance is transparent and relevant to each topic under consideration.

For the purposes of the EIA, major and moderate adverse impacts are deemed to be significant, and, as such, are likely to require mitigation. Whilst minor impacts are not significant in their own right, these may contribute to significant effects cumulatively or through interactions.

Mitigation (see below) will be proposed for all impacts that are initially assessed to have major or moderate significance with a view to reducing the impact magnitude to minor or negligible. These impacts will then be subject to further assessment that factors in the benefits of the proposed mitigation to determine the residual significance of the impact.

Table 6-2 Significance of effect matrix

		RECEPTOR SENSITIVITY			
		NEGLIGIBLE	LOW	MEDIUM	HIGH
MAGNITUDE OF EFFECT	NEGLIGIBLE	Negligible	Negligible	Negligible	Negligible
	LOW	Negligible	Negligible	Minor	Minor
	MEDIUM	Negligible	Minor	Moderate	Moderate
	HIGH	Negligible	Minor	Moderate	Major

An assessment of the significance of an impact would be made in accordance with the definitions in Table 6-3.

Table 6-3 Indicative definitions of effect significance

SIGNIFICANCE	DEFINITION
NO CHANGE	No change in receptor condition; therefore, no impact
NEGLIGIBLE	No detectable change to the environment or receptor resulting in no significant effect.
MINOR	A detectable but non-material change to the environment or receptor resulting in no significant effect or small-scale temporary changes.
MODERATE	A material but non-fundamental change to the environment or receptor, resulting in a possible significant effect.
MAJOR	A fundamental change to the environment or receptor, resulting in a significant effect.

6.3.2 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.

Where it is practical and reasonable to achieve, and in recognition that any deleterious effects on valuable receptors is undesirable, mitigation will also be identified that could reduce or avoid impacts assessed as having minor or negligible significance. Although this additional mitigation would not be required for the Project to comply with EIA regulations, it is considered best practise to include it in the EIA process.

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 Project design will avoid placing permanent infrastructure or having temporary working areas within sensitive locations (including protected sites), where possible.
2. If avoidance of sensitive locations is not possible, best endeavours will be made to design the Project to avoid direct impact on the specified features of interest within protected sites via specific construction and decommissioning methods, where possible.
3. Where avoidance of features of interest are not possible, mitigation measures will seek to minimise effects, such as work schedule, techniques and working areas.

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.

As introduced in section 4.5, Orbital already deploys the O2 device within the EMEC Fall of Warness tidal demonstration site that would be of ongoing relevance to the Westray Project.

EU Horizon 2020 Fast-tracking Offshore Renewable energy With Advanced Research to Deploy 2030 MW of tidal stream energy before 2030 (FORWARD-2030) project has been established which aims to deliver cost efficient method to reach their goal of 2030 MW of tidal stream energy by 2030. An Integrated Environmental Monitoring System (IEMS) will be delivered under the FORWARD-2030 project, which will incorporate monitoring technologies to help collect data that can be used to improve collision risk estimates and understand how IEMS can integrate with future Orbital device designs. Multibeam sonar is an active acoustic instrument used to monitor the occurrence and behaviour of wildlife (Williamson *et al.*, 2021, Cotter *et al.*, 2020), however, it cannot be used to identify individuals at species level. Therefore, an optical camera would also be required to confirm species and behaviours from an acoustic image. Another advantage of this would be easier manual interpretation by reviewers. Pairing both the multibeam sonar and optical camera together on the IEMS aims to validate acoustic detections. Monitoring as part of the FORWARD-2030 project is to be completed in relation to future deployments of the O2 device within the EMEC Fall of Warness tidal demonstration site.

6.3.3 Inter-related effects

The impact assessment will consider the inter-relationship of impacts on individual receptors. The objective will be to identify where the accumulation of residual impacts on a single receptor, and the relationship between those impacts, gives rise to a need for additional mitigation. When considering the potential for impacts to inter-relate it is assumed that any residual effect determined as having no impact will not result in a significant inter-relationship when combined with other effects on receptors. However, where a series of negligible or greater residual impacts are identified, they will be considered further.

6.3.4 Cumulative effects

The EIA Regulations state that cumulative effects should be addressed within an EIA. Engagement with MD-LOT will identify which plans/projects/on-going activities should be included in the cumulative effects assessment (CEA). MD-LOT guidance (Scottish Government, 2018) states projects for consideration will include those that are:

- Already constructed;
- Under construction;
- Permitted application(s), but not yet implemented;
- Submitted application(s) not yet determined; and
- Plans and projects which are "reasonably foreseeable" (i.e. Developments that are being planned, including, for example, offshore renewable energy projects which have a Crown Estate Scotland AFL and/or offshore renewable energy projects that have been scoped).

Only projects which are reasonably well described and sufficiently advanced to provide information on which to base a meaningful and robust assessment will be included in the CEA.

A screening exercise will be undertaken based on the relevant study area for each receptor (or impact range) and therefore the list of plans and projects screened into the CEA will therefore be established on a topic by topic basis with the relevant consultees as the EIA progresses.

Offshore cumulative impacts may come from interactions with a range of activities and industries, such as:

- Other tidal stream energy projects;
- Offshore wind farms;
- Aggregate extraction and dredging;
- Licensed disposal sites;
- Navigation and shipping;
- Commercial fisheries;
- Sub-sea cables and pipelines;
- Potential port and harbour development; and
- Oil and gas activities.

6.3.5 Transboundary effects

Transboundary effects arise when impacts from a plan or project affects the environment of another European Economic Area (EEA) state(s). The need to consider such transboundary effects in the UK and EEA states has been embodied by the United Nations Economic Commission for Europe Convention on EIA in a Transboundary Context (commonly referred to as the 'Espoo Convention').

As the Project is located approximately 150 km from the UK Exclusive Economic Zone (EEZ) boundary and surrounded by the Orkney Islands, there is no potential for likely significant effects on EEA states. Therefore, it is proposed to scope out transboundary effects for all receptor topics.

7 PHYSICAL ENVIRONMENT

7.1 Marine Physical and Coastal Processes

7.1.1 Study area

The study area applied for this topic is a 25 km buffer around the Project, based on a maximum spring tidal excursion extent of up to 25 km. The applied study area extent is denoted as the "Extended Study Area" in Figure 7-1.

7.1.2 Key data sources

The baseline environment for this Scoping Report has been established following a desk-based analysis of the data and information sources listed in Table 7-1. A summary of the site-specific data is presented below and will also inform the EIA assessment, together with publicly available data sources with relevant coverage of the Project as detailed in Table 7-1.

Available site specific information available for the Project includes:

- Westray AfL Geophysical Survey Orkney Report (Osiris, 2014); and
- Westray Geophysical Survey (June, 2023).

The Westray Project is adjacent to the EMEC Fall of Warness tidal demonstration site, for which there is additional data available as presented in EMEC (2022) and references therein. Due to the proximity of both developments, it is considered that the understanding supporting the nearby EMEC tidal demonstration site is also of relevance to inform the properties within the Westray Project. Available information includes:

- Site specific seabed survey carried out by Aquatera (2005);
- Site specific seabed surveys carried out by Sula Diving and the Coastal and Seabed Processes Review (Aurora, 2005); and
- ReDAPT site specific survey carried out by the University of Edinburgh determining the flow characteristics at the Fall of Warness test site (Energy technologies institute ReDAPT, 2016).

Further publicly available data used to inform this Scoping Assessment and the EIAR are as presented in Table 7-1.

Table 7-1 Summary of key sources of information for physical environment receptors

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
Bathymetry, Geology and Seabed Sediment			
British Geological Survey (BGS) Offshore GeoIndex Map	http://mapapps2.bgs.ac.uk/geoindex_offshore/home.html	2023	BGS

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
Strategic Environmental Assessment Data Portal	https://webapps.bgs.ac.uk/data/sea/app/search	2021	BGS
Marine Scotland Data Portal	https://marine.gov.scot/data/marine-scotland-data-portal	2023	Marine Scotland
UK Hydrodynamic Office (UKHO) Admiralty Chart data & UKHO INSPIRE bathymetric data	https://datahub.admiralty.co.uk/portal/apps/webappviewer/index.html	2023	UKHO
EMODnet Bathymetry	https://www.emodnet-bathymetry.eu/	2023	EMODnet
Metocean (Water Levels, Currents, Waves) and Water Column Properties			
National Tidal and Sea Level Facility- Observational Water Level Records	https://www.ntslf.org/	2020	NTSLF
UK Offshore Energy Strategic Environmental Assessment 3 (OESEA3). Appendix 1D – Water Environment (Regional Sea 8)	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/504541/OESEA3_A1d_Water_environment.pdf	2016	DECC
UK Offshore Energy Strategic Environmental Assessment 4 (OESEA4). Appendix 1D – Water Environment	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1061672/Appendix_1d_-_Water_environment.pdf	2022c	BEIS
Admiralty Total Tide (ATT) tidal prediction software	UKHO Admiralty Maritime Data Solutions	2023	UKHO
Atlas of UK Marine Renewable Energy, Interactive Map	https://www.renewables-atlas.info/explore-the-atlas/	2018a	ABPmer
SEASTATES Metocean Data and Statistics Interactive Map	https://www.seastates.net/explore-data/	2018b	ABPmer
Cefas WaveNet	https://wavenet.cefas.co.uk/map	2023	CEFAS
British Oceanographic Data Centre (BODC) data Centre	https://www.bodc.ac.uk/data/	2022	BODC
UK Climate Projections (UKCP) 18	https://www.metoffice.gov.uk/research/approach/collaboration/ukcp	2018	Met Office
Scottish Shelf Waters Reanalysis Service	https://tinyurl.com/SSW-Reanalysis	2020	Marine Scotland
CEFAS Suspended Sediment Climatologies around the UK (Monthly average non-algal Suspended Particulate Matter concentrations on the UK shelf waters)	CEFAS_2016_Suspended_Sediment_Climatologies_around_the_UK.pdf (publishing.service.gov.uk) http://data.cefas.co.uk/#/View/18133	2016	CEFAS
Climatology of Surface and Near-bed Temperature and Salinity on the North-West European Continental Shelf for 1971–2000 (2009).	https://data.marine.gov.scot/sites/default/files//berx-hughes_2009.pdf	2009	Berx, B., Hughes

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
Coastal Properties			
EMODnet Coastal Type	https://emodnet.ec.europa.eu/geoviewer/	2021	EMODnet
Dynamic Coast 2	https://www.dynamiccoast.com/	2020	CREW
Dynamic Coast – National Coastal Change Assessment: Cell 10 – Orkney	https://www.dynamiccoast.com/files/reports/NCCA%20-%20Cell%2010%20-%20Orkney.pdf	2017	Rennie *et al.*,
General Information			
National Marine Plan interactive (NMPi)	https://marinescotland.atkinsgeospatial.com/nmpi/	2023	NMPi
Sectoral Marine Plan: Regional Local Guidance	https://www.gov.scot/publications/sectoral-marine-plan-regional-locational-guidance/documents/	2020	Scottish Government
Coasts and seas of the United Kingdom, Region 2 Orkney	https://data.jncc.gov.uk/data/6473ed35-d1cb-428e-ad69-eb81d6c52045/pubs-csuk-region-02.pdf	1997	JNCC

7.1.3 Baseline

The Westray Project is entirely offshore with the export cables connecting into EMEC transmission infrastructure. As detailed in section 4.2.4, approximately 5 km will be within the Westray Project and 5 km being with the EMEC Fall of Warness tidal demonstration site and assessed under the ongoing Section 36 application for the EMEC Fall of Warness tidal demonstration site. Therefore, the baseline characterisation here focusses on the offshore components of the Project, i.e. Westray Tidal Array area.

7.1.3.1 Geology, seabed sediment and bathymetry

7.1.3.1.1 Bathymetry

Water depths range from a minimum of 17.1 m below lowest astronomical tide (LAT) along the western edge of the Project area boundary, to a maximum depth of 54.3 mLAT in the northwestern extents of the Project boundary (Osiris, 2014).

7.1.3.1.2 Geology and seabed sediment

The substrate in and around the Project area is composed of rocky or other hard substrata. The BGS offshore bedrock 250k lithostratigraphic map (BGS, 2023) indicates the geology covering the Project is undifferentiated mudstone, siltstone and sandstone. The BGS unit thickness information all indicate that the thickness of exposed bedrock is generally greater than 5 m.

Geophysical survey in 2012 of the former Westray AfL recorded predominantly bedrock and boulders with localised areas of sand and gravel veneer, within the wider AfL area (Osiris, 2014). Whereas, geophysical, ROV and diver surveys of the nearby EMEC Fall of Warness tidal demonstration site (Aquatera, 2005), all indicate the expansive exposures of bedrock, with an absence of mobile sands or gravels.

7.1.3.2 Tidal regime

A key point to note is the differentiation between tidal streams, which originate from astronomical factors, and currents, which are primarily driven by meteorological conditions. The tides across the Orkney Islands are the result of the interaction between the tidal systems in the North Atlantic and the North Sea. Both systems have anti-clockwise rotations and although move in opposition, the systems have similar strengths when they reach Orkney coastline (BGS & Scott Wilson Resource Consultants, 1997). The marine area covering the Project and the Westray Firth is subject to strong tidal streams (Orkney Islands Council, 2020). Due to the interaction of two independent tidal systems, several overfalls are also charted in the region due to opposing wave and tide directions (Aurora, 2005).

Mean spring and neap tidal ranges within the Westray Firth in proximity to the Project is approximately 4 m and 1.7 m respectively, based on field observations by ReDAPT Metocean observations (Energy technologies institute ReDAPT, 2016).

The strong tidal streams characteristic to Westray Firth, comprises peak spring tide velocities of almost 4 m/s, although annual depth-averaged peak spring flow speeds between 2.5 and 4.0 m/s are more characteristic to the Project area (ABPmer, 2008). Figure 7-1 indicates that peak current speeds of mean spring tide within the Westray Tidal Array area is higher in the south east, ranging from between 4.01 – 4.50 m/s, and reducing slightly to below 3 m/s in the northern areas. The general direction of the tidal flow is northwest (ebb) and southeast (flood) with a strong rectilinear flow direction. From ABPmer (2008) a spring tidal excursion extent of around 25 km is considered applicable, due to the fast flow streams that occur through the Westray Firth.

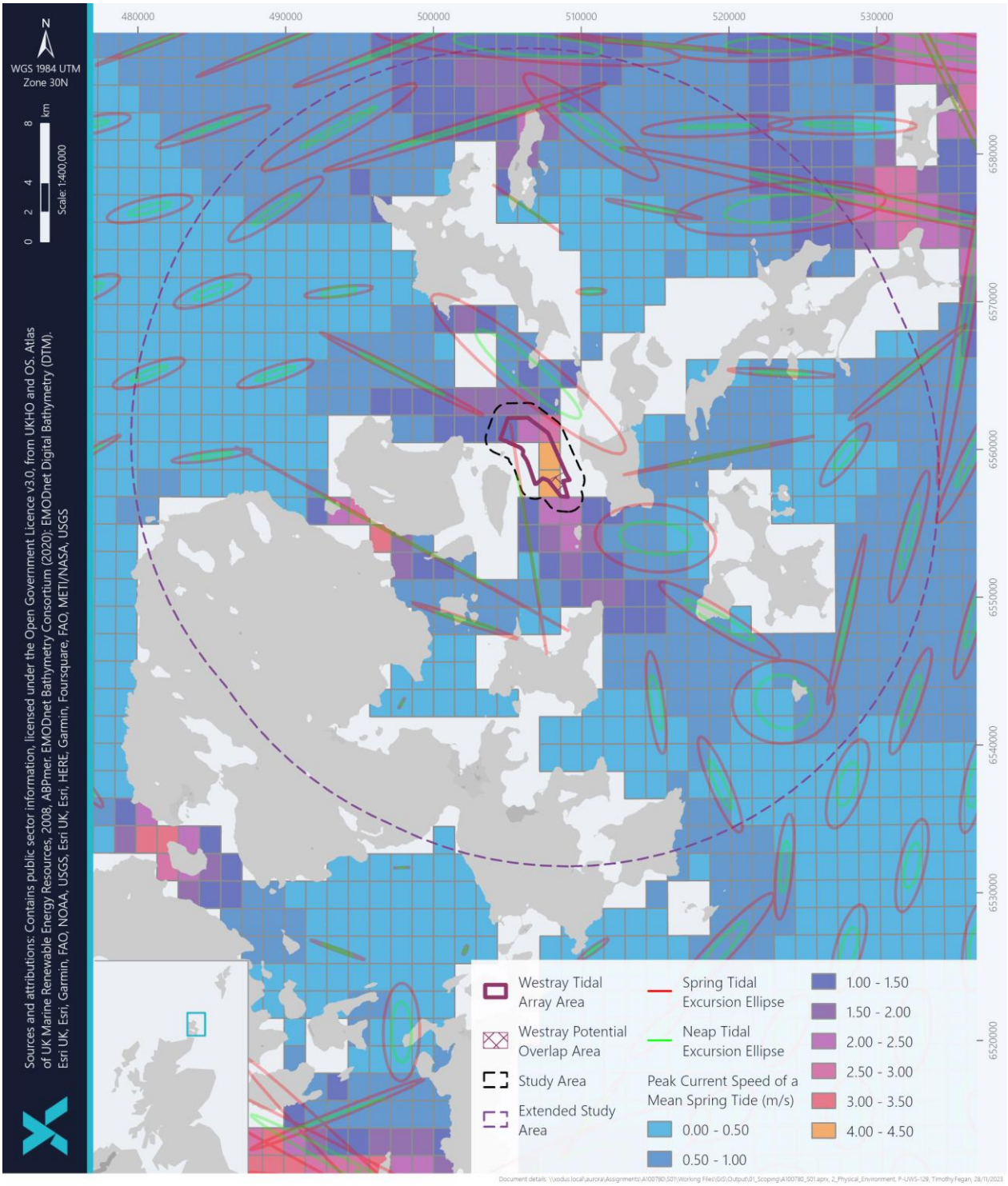

Figure 7-1 Physical environment within and around the Westray Tidal Array area

7.1.3.3 Wave climate

The Westray Project area is subject to high energy. Large swells can build up within the Westray Firth and their size depends upon the direction and strength of the wind and the length of time that wind is blowing. Prevailing winds are from between west and southeast for 60% of the year (Hansom, 2007), with the prevailing wave direction being from the northwest or southeast. Weir Strachan & Henshaw (2005) found that the most frequently occurring wave heights at the EMEC Fall of Warness site, to the south of the Project, were between 0.5 and 1.0 m and that wave heights between 3 and 3.5 m occurred at that site 0.55% of the time. This is further demonstrated in the annual significant wave height across the Project, which ranges between <0.76 and 3 m (ABPmer, 2023).

The extreme wave height for a 200 year return period was predicted to be 10.3 m (Weir Stranchan & Henshaw, 2005). When the tide is running in the opposite direction to the prevailing wave direction, very steep waves are created, which are known locally as 'tide lumps' or 'standing waves'. These waves are hazardous to small craft and difficult to operate in with larger vessels, the waves often reaching heights of over 5 m (Lawrence *et al.*, 2009).

7.1.3.4 Sediment transport

Little sediment transport is expected to occur within the Project extent, due to the general expanse of exposed bedrock described for the Project in section 7.1.3.1. With respect to the coast, Ramsay and Brampton (2000) describes sediment transport in terms of coastal cells, and sub-cells. The coastal processes within the sub-cell in which the Westray Project is located are likely to be wave dominated, although this will depend on the orientation of the beaches and the amount of shelter provided by other islands. Ramsay and Brampton (2000) predicted that there is unlikely to be any significant net longshore drift or interchange of beach sediments. Although tidal currents are very strong on both ebb and flood tides, it is unlikely that such currents directly affect beach areas and there is little long-term erosion within this sub-cell, which is also considered to apply to the offshore area covering the Project. In the offshore marine area overlapping the Project, sediment transport of coarse sediment will be mainly in relation to the tidal flow, due to the flows speeds which occur through the region.

With respect to the suspended sediment concentration (SSC) across the Project area, long-term (1998 to 2015) monthly average concentration of sea surface suspended particulate matter SPM (Cefas, 2016), as a proxy for SSC, indicates concentrations across Westray Firth are low, at below 1 mg/l. This is attributed to a lack of seabed sediment mobility, low levels of coastal erosion and remoteness to any large river or estuary source of fine sediment.

7.1.3.5 Coastal morphology

As the Westray Project is entirely offshore, only the coastal character of the coastline adjacent to the Project is considered, this comprises the coastline of Eday to the east and Egilsay to the west. The EMODnet coastal type characterises both of the coastlines as predominantly comprising "erosion-resistant rock and/or cliff, without loose eroded material in the fronting sea", with infrequent presence of small beaches (EMODnet, 2023). However, the coastal migration properties based on satellite information, from the same dataset indicate stable coastal extents, with localised areas undergoing erosion. Information from the nearby EMEC Fall of Warness tidal demonstration site indicated that the low cliffs along the coastal margin adjacent to the EMEC Fall of Warness site on Eday, are assumed to be undergoing slow erosion, although anecdotal evidence from local sources deem the retreat to be negligible during the Project timescales (Aurora, 2005). Rennie *et al.*, (2017) provides a review of the rate of coastal erosion throughout the Orkney Islands, including at the Sands of Doomy (Eday), approximately 3 km to the

northwest of the Westray array area. In the north of the Sands of Doomy bay there has been up to 12 m of erosion recorded between the 1890s and 1970s, and approximately a further 6 m since the 1970s. In the south of the bay there was sediment accretion of approximately 30 m and limited change in the centre of the bay. The vulnerability of the area to future coastal erosion is deemed to be low due to an absence of built assets in proximity to the coast. Generally the complex pattern of localised erosion and/or accretion are in relation to beaches located within bays. Elsewhere across the Orkney Islands, a more stable coastline occurs, due to the presence of erosion-resistant rock.

7.1.3.6 Protected sites

There are no designated environmental protected sites which are intended to protect and conserve physical marine characteristics (e.g. geology, geomorphology, sedimentology and fronts) that directly overlap with the Westray Project. However, the Project boundary is less than 1 km from the Wyre and Rousay Sounds Nature Conservation Marine Protected Area (NCMPA) (Figure 7-2) which includes marine geomorphology of the Scottish Shelf Bed in its designated features. Protected sites which are within the applied marine physical and coastal processes study area and would be considered accordingly within the EIA include:

- Wyre and Rousay Sounds NCMPA (0.7 km), marine geomorphology of the Scottish shelf seabed and Eday maerl beds;
- Sanday SAC (13.7 km), sandbanks which are slightly covered by seawater all the time and mudflats and sandflats not covered by seawater at low tide;
- Papa Westray NCMPA (14.2 km), marine geomorphology of the Scottish shelf seabed; and
- North-West Orkney NCMPA (24.5 km), marine geomorphology of the Scottish shelf seabed.

The Geological Conservation Review (GCR) is a process used to select geology and geomorphology areas of national and international importance in the UK. The selected GCR sites are an important component of nature conservation in Scotland. There are sixteen GCR sites in Orkney Islands, two of which are located on Eday. The GCR sites that occur within the marine physical and coastal processes study area and would be considered as appropriate within the EIA include:

- Greenan Nev Coast GCR (2.4 km), non-marine Devonian geology and Eday maerl beds;
- South Fersness Bay GCR (5 km), non-marine Devonian geology;
- Central Sanday GCR (16 km), coastal geomorphology, saltmarsh and dunes;
- Den Wick GCR (21.5 km), Quaternary geology; and
- Mill Bay GCR (14.7 km), Quaternary geology.

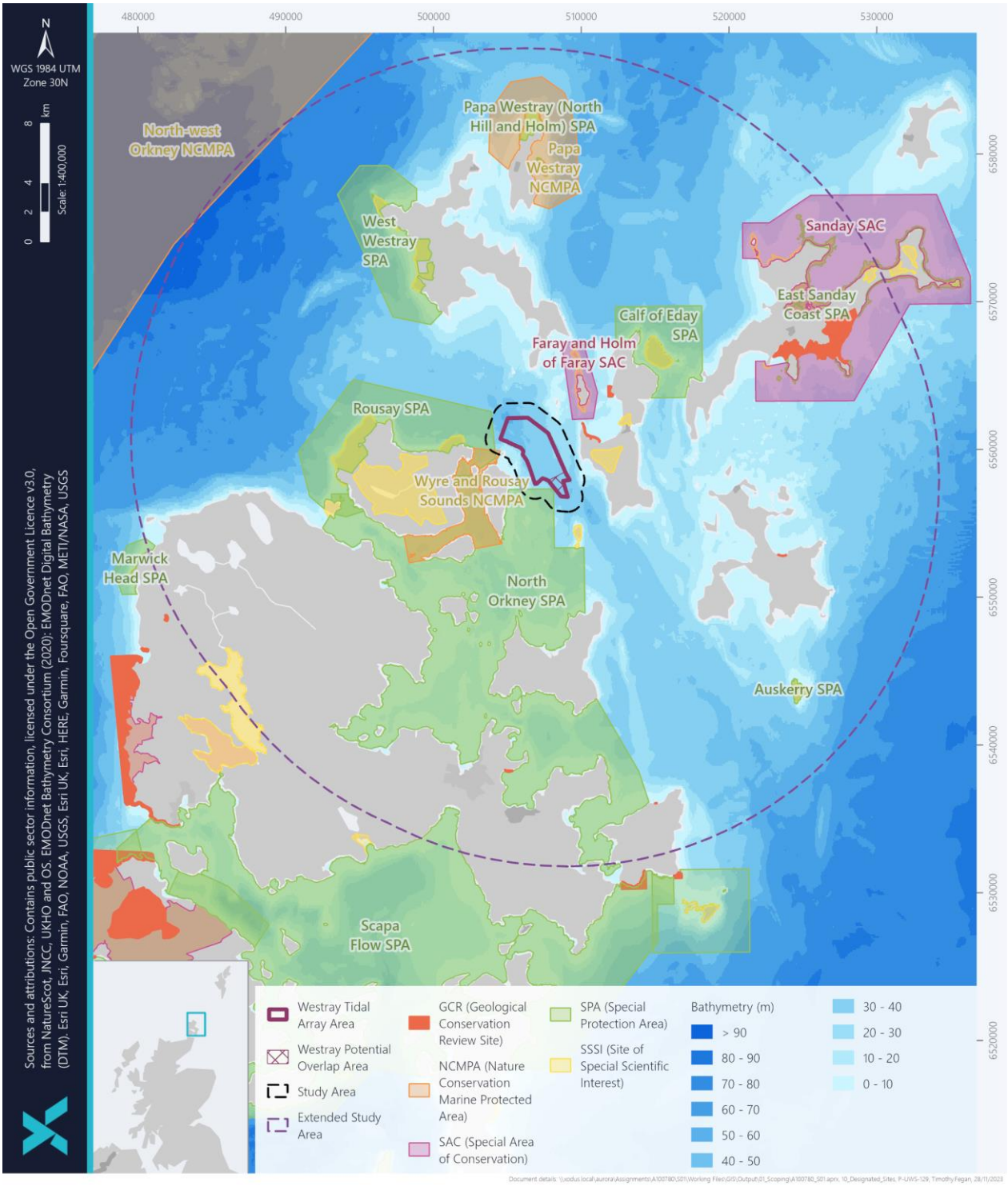

Figure 7-2 Marine protected area (NCMPA, SAC, SPA, SSSI and GCRs) in proximity to the Westray Project, including the applied study areas for the topic receptors

7.1.4 Potential impacts

Scoping of likely significant effects on marine geology and physical processes is provided in Table 7-2 below.

Table 7-2 Likely significant effects on marine geology oceanography and physical processes

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Changes in suspended sediment concentrations due to installation activities	Construction and Decommissioning	No	Localised alterations to sediment are not anticipated as a result of foundation mooring and anchor installation and associated infrastructure, as bedrock material would be the same as any seabed sediment. Installation of anchors, particularly through drilling may result in a small and localised increase in suspended sediment concentrations. However, with a pile diameter of 0.6 m and drill depth of 10 m, equates to a drill volume of 11.3 m^3 per device (based on a maximum of up to four anchors per device) and total of 791 m^3 for all 70 devices. Each anchor would be drilled independently, and with drilling, material would either be disaggregated to its sediment components ranging from coarse to fine grained material or as larger clasts. Coarser material and larger clasts would settle immediately to the seabed, whereas finer sediment of silt size could develop into a plume. Instantaneous SSC increases during drilling could be on the order of thousands of mg/l, but the majority of this would in relation to the larger clasts and coarser sediment, with only a small proportion of sediment developing into a plume with SSC on the order of tens of mg/l. Through dissipation and dispersion, the SSC would continue to reduce to backgrounds levels, estimated at kilometres from the initial disturbance site. Based on the settling velocity of silts, a drill release height of up to 3 m above the seabed and flow speeds that occur across the Project, silt sediment would deposit out in around 8-hours, with an extent of up to 25 km, based on the tidal excursion extent. Minimal coalescence of drill sediment plumes is expected on the basis of timing of operations and the repositioning of vessel for each drill event. Overall, impacts are likely to be minimal due to the small scale of the Project, low drill volumes/ anchor sizes and the dispersive effects of the environment.
Changes in seabed level/morphology due to	Construction and Decommissioning	No	Any sediment plumes will have the potential to become deposited on the seabed at some distance from its point of disturbance as it settles through the water column to the seabed. However, the deposition from any plume would be

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
sediment deposition			on the order of millimetres in line with the low sediment volume developing into a plume. The deposited sediment would be indiscernible from the background seabed levels.
Changes in seabed level/morphology due to placement of Project infrastructure	All	Yes	The placement of Project infrastructure on the seabed (e.g. anchors, cable protection and scour protection) will alter seabed levels locally by up to 2.5 m (associated with the anchor foundation option). This may have a localised effect on seabed morphology, with the potential for effects during the operation stage as assessed further below.
Changes in suspended sediment due to movement of mooring lines	Operation	No	Although sediment veneer (if present) has potential to be disturbed by the catenary mooring lines, all available evidence demonstrates the limited presence of seabed sediment. Devices would be located in areas with the fastest flows, where outcropping bedrock is more likely. The rise and fall of the mooring lines with the tides would be slow and progressive and the associated sedimentation will be highly localised and rapidly dispersed in a tidally active area, and. In the context of the potential for mooring lines to be move on the seabed within the swept area, again seabed sediment disturbance is expected to be minimal, due to the absence of seabed sediment, but also the sweeping process should it occur would only disturb sediment that has been transported in on one tide, to then be transported on with the following tide. Therefore, the increases in SSC associated with the movement of mooring lines is assessed to be minimal, and would be in line with the general suspended sediment concentrations within the Westray Firth.
Changes to hydrodynamic, waves and sediment transport regimes	Operation	Yes	This impact considers the potential for changes due to the presence of structures leading to blockage effects or as a result of energy extraction. The floating structure of the turbines and the introduction of anchors and chains do have the potential to introduce blockage to tide and wave patterns, in terms of a localised disruption to the flows and waves. However, due to the scale of the Project (i.e. 70 floating turbines, associated with 4 mooring anchors) and the offshore location of the site, it is considered that any blockage would be highly localised to within the vicinity of each infrastructure. This will lead to a small, localised effect of each turbine. The tidal and wave regime are governed by much larger, regional scale

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
			oceanographic processes, which would not be disrupted by the presence of the project infrastructure, but the islands providing the greater influence. In terms on the potential for changes due to energy extraction, site monitoring and assessment completed in the adjacent EMEC Fall of Warness tidal demonstration site by Fraser, (2017), identified a limited extent of downstream effects. Although the potential for changes to hydrodynamic, waves and sediment transport regimes are considered to be minimal, this property is nonetheless investigated on the basis that it constitutes a pathway for onward impacts to other ecological receptors over the operational phase of the Project.
Changes to coastal morphology	Operation	No	Evidence from modelling of effects of tidal turbines shows effects are likely to be small scale and localised. In addition, the coast in proximity to the Westray Project area is not sensitive to coastal erosion.
Introduction of scour around anchors	Operation	No	Evaluates for the potential occurrence of scour around anchors. The hard substrate if the seabed will limit the profile to generate scour from the anchoring operations. Prior to installation a scour assessment will be completed to determine the need for protection, and if required, the protection will be installed at construction, thereby negating the potential development of scour. Therefore, due to the mitigation measures, which negates scour developing around anchors and cables, and the limited scope of the proposed Project, the impact is scoped out.
Impacts to designated features	Operation	Yes	Although the Project boundary does not directly overlap any marine protected sites or features, it is in close proximity to the Wyre and Rousay Sounds NCMPA, which is designated for Mearl beds, and Marine Geomorphology of the Scottish Shelf Seabed. Any changes to the hydrodynamic, wave or sediment transport regimes has the potential for onward effects to the nearby protected sites, and as such this impact is scoped in for further assessment.
Cumulative Impacts	All	Yes	Cumulative impacts with EMEC Falls of Warness will be assessed in the EIA. The assessment for cumulative effects will pertain only to the scoped in project alone impacts of: • Changes in seabed level/morphology due to placement of Project infrastructure;

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
			• Changes to hydrodynamic, waves and sediment transport regimes; • Impacts to designated features.

7.1.5 Impact assessment strategy

On the basis of the completed Scoping Assessment in Table 7-2, the only impacts being scoped in for assessment within the EIA relate to:

- Changes in seabed level/morphology due to placement of infrastructure (all Project phases);
- Changes to hydrodynamic, waves and sediment transport regimes (operation Project phase);
- Impacts to designated features; and
- Cumulative effects (all Project phases for the scoped in impacts).

For decommissioning, it is expected that the activities will result in a reduced level of change than that already considered for the construction phase.

The assessment of effects on marine physical and coastal processes will be based 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, and the receptor is the receiving entity. Marine physical processes can also be considered as pathways for impacts to other topic receptors (e.g. ecological or human, which are assessed in other chapters. Therefore, the approach to the marine physical and coastal processes will be two-fold:

- The impact significance on marine physical and coastal processes properties (e.g. the seabed, and currents, waves and sediment transport regimes) will be assessed based on the magnitude of impact and the sensitivity; and
- The characterisation of near-field and far-field effects associated with marine physical and coastal processes will be identified, for which the impact receptors are addressed in another chapter (e.g. marine water and sediment quality and benthic ecology).

It is proposed that the following impact assessment strategy is applied to address the likely significant effects identified. It should also be noted that no numerical modelling is proposed or to be completed, due to the small scale and offshore location of the Project. Instead, the assessment is to be completed using a combination of analytical tools, outputs from existing regional numerical modelling and desk-based reviews. The assessment methodology is summarised in Table 7-3 below.

Table 7-3. Impact assessment strategy for marine physical and coastal processes

POTENTIAL IMPACT	ASSESSMENT TOPICS	ASSESSMENT APPROACH
Changes in seabed level/morphology due to placement of infrastructure	Evaluate for the direct changes to seabed levels based on the presence of Project infrastructure.	Quantify the change in seabed levels and complete the assessment based on qualitative assessment of the differences with respect to the surrounding seabed and presence/absence of seabed morphology. This assessment will draw on the available site-specific geophysics of Osiris (2014).
Changes to hydrodynamic, waves and sediment transport regimes	Investigate the potential for blockage effects associated with infrastructure on the seabed and in the water column. Also evaluate for the potential for changes to the tidal stream energy as a result of energy extraction.	Desk-top semi-quantitative analyses on the potential for blockage to currents and waves and the implications on the regimes. Consideration on the potential for blockage to sediment transport will be completed inline with the results from currents and waves. Review of available monitoring and analyses outputs on the downstream reduction of energy from tidal devices and assessment in the context of the Project and implication of changes to the wider tidal properties, including but not limited to the work by Fraser (2017).
Impacts on designated features	Assess for potential impacts based on the pathways associated changes to hydrodynamic, waves and sediment transport regimes,	Informed by the analyses completed for the changes to hydrodynamic, waves and sediment transport regimes impact assessment to understand the potential extent and duration of any changes (if at all), with respect to the properties of the designated features within the protected sites.
Cumulative effects	Assesses for the potential for cumulative effects based on the scoped in impacts.	Cumulative effects: Marine physical and coastal processes may act cumulatively if in close proximity to other projects. As the EMEC Fall of Warness tidal demonstration site is adjacent to the Project, the assessment will entail semi-quantitative and empirical analyses, as well as draw on existing studies as applied for the Project alone assessment.

7.2 Marine Water and Sediment Quality

7.2.1 Study area

The study area applied for this topic is the same as applied for the marine physical and coastal processes topic and is based a 25 km buffer associated with the estimated maximum spring tidal excursion extent within the Westray Firth. The applied study area is denoted as the "Extended Study Area" in Figure 7-2.

7.2.2 Key data sources

The existing data sets and literature with relevant coverage to the Project, which have been used to inform this Scoping Report and would inform the baseline characterisation for the EIA as appropriate are outlined in Table 7-4.

Table 7-4 Summary of key sources of information for marine water and sediment quality receptors

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
Scotland's Marine Atlas: Overall Assessment	https://marine.gov.scot/information/scotlands-marine-atlas-overall-assessment-2011	2011	Marine Scotland
Waterbody data sheets	https://www2.sepa.org.uk/WaterBodyDataSheets/	2012	Scottish Environment Protection Agency (SEPA)
Monthly average non-algal Suspended Particulate Matter concentrations on the UK shelf waters	https://www.cefas.co.uk/data-and-publications/dois/monthly-average-non-algal-supended-particulate-matter-concentrations/	2016a	Cefas
Suspended Sediment Climatologies around the UK	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/584621/CEFAS_2016_Suspended_Sediment_Climatologies_around_the_UK.pdf	2016b	Cefas
OSPAR Intermediate Assessment 2017 – Contaminant assessments	https://oap.ospar.org/en/ospar-assessments/intermediate-assessment-2017/pressures-human-activities/contaminants	2017	OSPAR
Scotland's water environment 2019: A summary and progress report	https://www.sepa.org.uk/media/490771/191219_scotlands-water-environment-final.pdf	2019	SEPA
Urban Wastewater Treatment Directive Sensitive Areas Map 2019	https://www.gov.scot/binaries/content/documents/govscot/publications/map/2016/01/urban-waste-water-treatment-sensitive-areas-map/documents/urban-waste-water-treatment-sensitive-areas-map-2019/urban-	2020a	SEPA

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
	waste-water-treatment-sensitive-areas-map-2019/govscot%3Adocument/UWWTD%2Bdesignations%2B2019.pdf		
Coastal Water Body Classifications (as per WFD (2000/60/EC)	https://map.environment.gov.scot/sewebmap/?layers=coastalClass	2020b	SEPA
Clean Seas Environmental Monitoring Programme (CSEMP)	https://www.bodc.ac.uk/projects/data_management/uk/merman/assessments_and_data_access/csemp/	2020	British Oceanographic Data Centre (BODC)
Cefas Sediment Management Framework prototype Action Levels Viewer	https://rconnect.cefas.co.uk/action_levels_tool/	2021	Cefas
Water Framework Directive (WFD) River Basin Management Plan (RBMP) Waterbody status	https://www.sepa.org.uk/data-visualisation/water-environment-hub/	2023a	SEPA
Annual updates on the condition of the water environment	https://www.sepa.org.uk/data-visualisation/water-classification-hub	2023b	SEPA
Scotland's Environment data tool for Bathing Waters	https://www2.sepa.org.uk/bathingwaters/	2023c	SEPA
Marine Protected Area (MPA) mapper	https://jncc.gov.uk/our-work/marine-protected-area-mapper/	2023	Joint Nature Conservation Committee (JNCC)
Atlas of UK Marine Renewable Energy, Interactive Map	https://www.renewables-atlas.info/explore-the-atlas/	2018a	ABPmer

7.2.3 Baseline

7.2.3.1 Marine waterbodies and water quality

The water quality of the seas around the Orkney Islands largely reflects the oceanographic regime (i.e. positioned on the edge of the North Atlantic Drift) which assists in the dilution and dispersion of any contaminants or pollutants that enter coastal waters and therefore water quality in the region is generally excellent (Marine Scotland *et al.*, 2010). The chemical composition of the water present in the Project would be expected to be similar to typical unpolluted offshore Atlantic waters (Northern North Sea).

The Westray Project lies entirely within the Westray Firth water body (Water body ID 200243) which is identified as being of high overall status, in 2014, 2021, predicted for 2027 and long term (SEPA, 2023a). The physical condition,

freedom from invasive species and water quality are also all high over the same period (SEPA, 2023b). There are no bathing or shellfish waters in proximity to the Project.

As indicated in Chapter 7.1, the suspended sediment concentrations throughout the project area are 0 to 1 mg/l throughout the year (Cefas, 2016).

7.2.3.2 Seabed sediment and sediment quality

The substrate across much of the site is bedrock and boulder with localised areas of sand and gravel veneer (Section 7.1). The seabed material provides limited potential for sediment contamination as it is generally finer sediments that facilitate the accumulation of contaminants.

There are no known sediment quality issues within the Project area and the wider Westray Firth based on all publicly available information and environmental sampling associated with the Project area. The Marine Scotland assessment of the UK's Clean Seas Environment Monitoring Programme (CSEMP) describes the status and trends of contaminant concentrations and biological effects measurements in biota and sediment at monitoring stations in waters around the UK. The most recent assessment is from April 2020 using data spanning 1999 to 2019 (BODC, 2020). The Project is in the North Scotland Coast CSEMP, within the Scottish Continental Shelf region. There are no fixed CSEMP sites or strata recording sediment contaminants for the North Scotland Coast CSEMP. The closest monitoring sites are located too far away to provide meaningful conclusions on sediment quality based on their available data. Review of available information on contaminants in Scottish waters from the Cefas Sediment Management Framework prototype Action Level viewer, indicated that there were no samples or contaminant information within the Orkney Islands (Cefas, 2021).

7.2.4 Potential impacts

Scoping of likely significant effects on marine water and sediment quality is provided in Table 7-5 below.

Table 7-5 Likely significant effects on marine water and sediment quality

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Potential pollution of the offshore water environment.	All	No	Installation, operation and decommissioning activities may potentially result in reduced water and sediment quality in the vicinity due to accidental discharges from vessels. The risk will be adequately managed through the embedded mitigation measures as stated in Section 4.5, which will reduce the risk of accidental discharges. In addition, implicit vessel and environmental protocols in line with international standards will inherently limit the risk from vessel discharges and any onward impacts to wate rand sediment quality. Therefore, the impacts are likely to be short lived and very localised. The Project is located within the Westray Firth coastal waterbody that has a high status, there are no other
Contamination of Marine sediments	All	No	
Cumulative impacts	All	No	

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
			designated waters in proximity to the Project. The technology associated with the Project will be designed so that no pollutants will be released into the environment. Any accidental spills would be avoided by following industry best practice and in the unlikely event of a spill, contaminants would be rapidly dispersed by the strong tidal flow and will not affect the status of the designated waterbody. There is no evidence to indicate the presence of an contamination within sediments within the Project or elsewhere within Westray Firth. Therefore, the installation works will not be dispersing any contaminants. As described in Table 7-2, any increase in SSC associated with installation Project would be minimal, temporary and within the tidal excursion extent of the flow, estimated to be approximately 25 km, and would not ultimately result in any change to the water or sediment quality.

Based on the completed Scoping Assessment as presented in Table 7-5, an EIA for marine water and sediment quality is not required as any potential impacts of the Project on water and sediment quality have been scoped out.

7.3 Air Quality

7.3.1 Study area

A nominal buffer distance of 1 km around the Westray Project is applied as the study area for this topic. The applied study area is denoted as the "Study Area" in Figure 7-2.

7.3.2 Key data sources

The existing data sets and literature with relevant coverage to the Project, which have been used to inform this Scoping Report and will inform the baseline characterisation for the EIA as relevant are outlined in Table 7-6.

Table 7-6 Summary of key sources of information for air quality receptors

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
Cleaner Air for Scotland (CAFS) The Road to a Healthier Future, 2018/2019 Progress Report	https://www.gov.scot/publications/cleaner-air-scotland-road-healthier-future/	2020	Scottish Government
Offshore Energy SEA 3, Appendix 1E: Air Quality	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/att	2016b	DECC

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
	achment_data/file/504557/OESEA3_A1e_Air_quality.pdf		
Offshore Energy SEA 4, Appendix 1E: Air Quality	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1061520/Appendix_1e_-_Air_quality.pdf	2022d	BEISS
Air Pollutant Inventories for England, Scotland, Wales, and Northern Ireland: 2005- 2019	https://naei.beis.gov.uk/reports/reports?report_id=1030	2021	National Atmospheric Emissions Inventory
Institute of Air Quality Management (IAQM) Guidance on the assessment of dust from demolition and construction V1.1	https://iaqm.co.uk/text/guidance/construction-dust-2014.pdf	2014	Holman *et al.*

No site-specific surveys have been undertaken to inform this Scoping Report for ambient noise, vibration or air quality surrounding the Project.

7.3.3 Baseline

The International Maritime Organisation (IMO) has enacted regulations to reduce vessel emissions under Annex VI of the International Convention for the Prevention of Pollution from Ships (MARPOL). The North Sea, including the waters around the Orkney Islands, is a designated Emission Control Area under MARPOL, and the sulphur content of fuel oil is limited to 0.5%. Furthermore, as of 1 January 2021, vessels operating within the North Sea must comply with the most stringent Nox emission limits to comply with the Emission Control Area requirements.

Air quality in the Orkney Islands is generally good due to a number of factors including low population densities, low volumes of traffic, limited industrial processes and predominance of agricultural land practices, as well as a location generally remote from any significant areas of population density. No areas within Orkney have been identified as "air quality management areas".

7.3.4 Potential impacts

Scoping of likely significant effects on air quality is provided in Table 7-7 below.

Table 7-7 Likely significant effects on air quality

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Vessel emissions, decreasing air quality	All	No	Vessels used will emit particulate matter and gasses such as carbon dioxide, sulphur oxides and nitrogen oxides which will have a localised effect on the atmosphere, but not considered to be significant. All vessels will operate to IMO standards (refer to MARPOL Annex VI).

Based on the completed Scoping Assessment presented in Table 7-7, an EIA for air quality is not required as any potential impacts of the Project on air quality have been scoped out.

7.4 Airborne Noise

7.4.1 Study area

A nominal buffer distance of 1 km around the Westray Project is applied as the study area for this topic. The applied study area is denoted as the "Study Area" in Figure 7-2.

7.4.2 Key data sources

The existing data sets and literature with relevant coverage to the Project, which have been used to inform this Scoping Report and will inform the baseline characterisation for the EIA as relevant are outlined in Table 7-8.

Table 7-8 Summary of key sources of information for airborne noise receptors

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
The Orkney Local Development Plan 2017	https://www.orkney.gov.uk/Files/Planning/Development-and-Marine-Planning/Local-Plan/OLDP_2017/Orkney_Local_Development_Plan_2017_2022.pdf	2017	OIC
Highland-Wide Local Development Plan	https://www.highland.gov.uk/info/178/local_and_statutory_development_plans/199/highland-wide_local_development_plan	2012	The Highland Council (THC)
Highland Coastal Development Strategy	https://www.highland.gov.uk/downloads/file/23371/hwldp2_main_issues_report	2018	THC

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
Highland Coastal Development Strategy	https://www.highland.gov.uk/downloads/file/23371/hwldp2_main_issues_report	2021	THC
Pilot Pentland Firth And Orkney Waters Marine Spatial Plan	https://www.gov.scot/publications/pilot-pentland-firth-orkney-waters-marine-spatial-plan/documents/	2016	Scottish Government

7.4.3 Baseline

Existing airborne noise is likely to be generated by a mix of anthropogenic and natural sources. Wind, wave and precipitation activity offshore would be the primary sources of natural airborne noise. Intermittent noise emitted by vessel traffic is expected to be the main source of anthropogenic noise in the study area.

7.4.4 Potential impacts

Scoping of likely significant effects on airborne noise is provided in Table 7-9 below.

Table 7-9 Likely significant effects on airborne noise

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Airborne noise during construction	Construction and decommissioning	No	Construction activities have the potential to increase airborne noise, e.g. from vessels and drilling activity, however it is highly unlikely that receptors (i.e. coastal recreation users, coastal ecological designated sites and coastal settlements) will be affected by increases in noise in the array areas, in the context of the existing noise sources outlined above.
Airborne noise during operation	Operation	No	Operation of the tidal array and maintenance activities, including vessels are highly unlikely to cause increases in noise that would significantly effect receptors, in the context of the existing noise sources outlined above.

Based on the completed Scoping Assessment in Table 7-9, an EIA for airborne noise is not required as any potential impacts of the Project on airborne noise during construction and operations have been scoped out.

8 BIOLOGICAL ENVIRONMENT

8.1 Benthic Ecology

8.1.1 Study area

This section describes the benthic habitats and species of relevance to the Westray Project and considers the potential impacts from the deployment and operation of devices and testing infrastructure. Based on the Project envelope and the possible effect pathways, the study area is defined as the seabed within and immediately adjacent to the site and includes both intertidal and subtidal zones, based on 1 km buffer around the Project. Based on the pathways for effects associated with the marine physical properties (i.e. such as flow regime), with the potential for onward impacts on benthic receptors, an extended study area (of up to 25 km buffer) is also considered for this topic. Both the study area and extended study areas are illustrated in Figure 8-1.

8.1.2 Key data sources

The baseline environment for this Scoping Report has been established following a desk-based analysis of the data and information sources listed in Table 8-1. A summary of the site-specific data is presented below and will also inform the EIA assessment, together with publicly available data sources with relevant coverage of the Project as detailed in Table 8-1.

Available site specific information available for the Project to characterise the baseline conditions regarding seabed communities for the purposes of the EIA is as follows:

- Westray AfL Geophysical Survey Orkney Report (Osiris, 2014); and
- Westray Geophysical Survey (June, 2023).

The Westray Project is adjacent to the EMEC Fall of Warness tidal demonstration site, for which there is additional data available as presented in EMEC (2022) and references there in. Due to the proximity of both developments, it is considered that the understanding supporting the nearby EMEC site is also of relevance to inform the properties within the Westray tidal test. Information includes:

- Site specific seabed survey carried out by Aquatera (2005); and
- EMEC Fall of Warness commissioned site-specific benthic surveys; Robins (2011).

Further publicly available data used to inform this Scoping Assessment and the EIAR are as presented in Table 8-1.

Table 8-1 Summary of key sources of information for benthic ecology receptors

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
Conservation Areas and Protected Sites			
Marine Protected Area (MPA) mapper	https://jncc.gov.uk/our-work/marine-protected-area-mapper/	2023	JNCC
NatureScot – Scotland's Marine Protected Area Network	https://www.nature.scot/professional-advice/protected-areas-and-species/protected-areas/marine-protected-areas/scotlands-marine-protected-area-network	2023	NatureScot
Scotland's Marine Atlas: Overall Assessment	https://marine.gov.scot/information/scotlands-marine-atlas-overall-assessment-2011	2011	Marine Scotland
National Marine Plan interactive (NMPi)	https://marinescotland.atkinsgeospatial.com/nmpi/	2023	NMPi
Benthic Environment			
British Geological Survey (BGS) Offshore GeoIndex Map	http://mapapps2.bgs.ac.uk/geoindex_offshore/home.html	2023	BGS
Strategic Environmental Assessment Data Portal	https://webapps.bgs.ac.uk/data/sea/app/search	2021	BGS
National Marine Plan interactive (NMPi)	https://marinescotland.atkinsgeospatial.com/nmpi/	2023	NMPi
Scottish Natural Heritage Commissioned Report No. 319.	Preliminary assessment of the conservation importance of benthic epifaunal species and habitats of the Pentland Firth and Orkney Islands in relation to the development of renewable energy schemes.	2009	Moore
Scottish Natural Heritage Commissioned Report No. 446.	An assessment of conservation importance of species and habitats identified during a series of recent research cruises around Scotland.	2011	Moore and Roberts
EMEC Fall of Warness commissioned site-specific benthic survey data	Underwater video survey across Westray Firth commissioned by the Scottish Government.	2009	Moore
EMODnet Bathymetry	https://www.emodnet-bathymetry.eu/	2023	EMODnet

8.1.3 Baseline

The Orkney Islands are located at the transition between the North Atlantic Ocean and the North Sea, producing diverse hydrodynamic conditions (Orkney Islands Council, 2020). This, along with other favourable and varying conditions, helps to develop diverse marine communities.

8.1.3.1 Benthic habitats and species

As discussed in Section 7.1, the substrate in and around the Westray project area is predominantly bedrock and boulders. Based on the EUNIS habitat classification system, the largest part of the Westray Project area is classified as "A4.1 Atlantic and Mediterranean high energy circalittoral rock", followed by "A4.2 Atlantic and Mediterranean moderate energy circalittoral rock" (Figure 8-1– left panel).

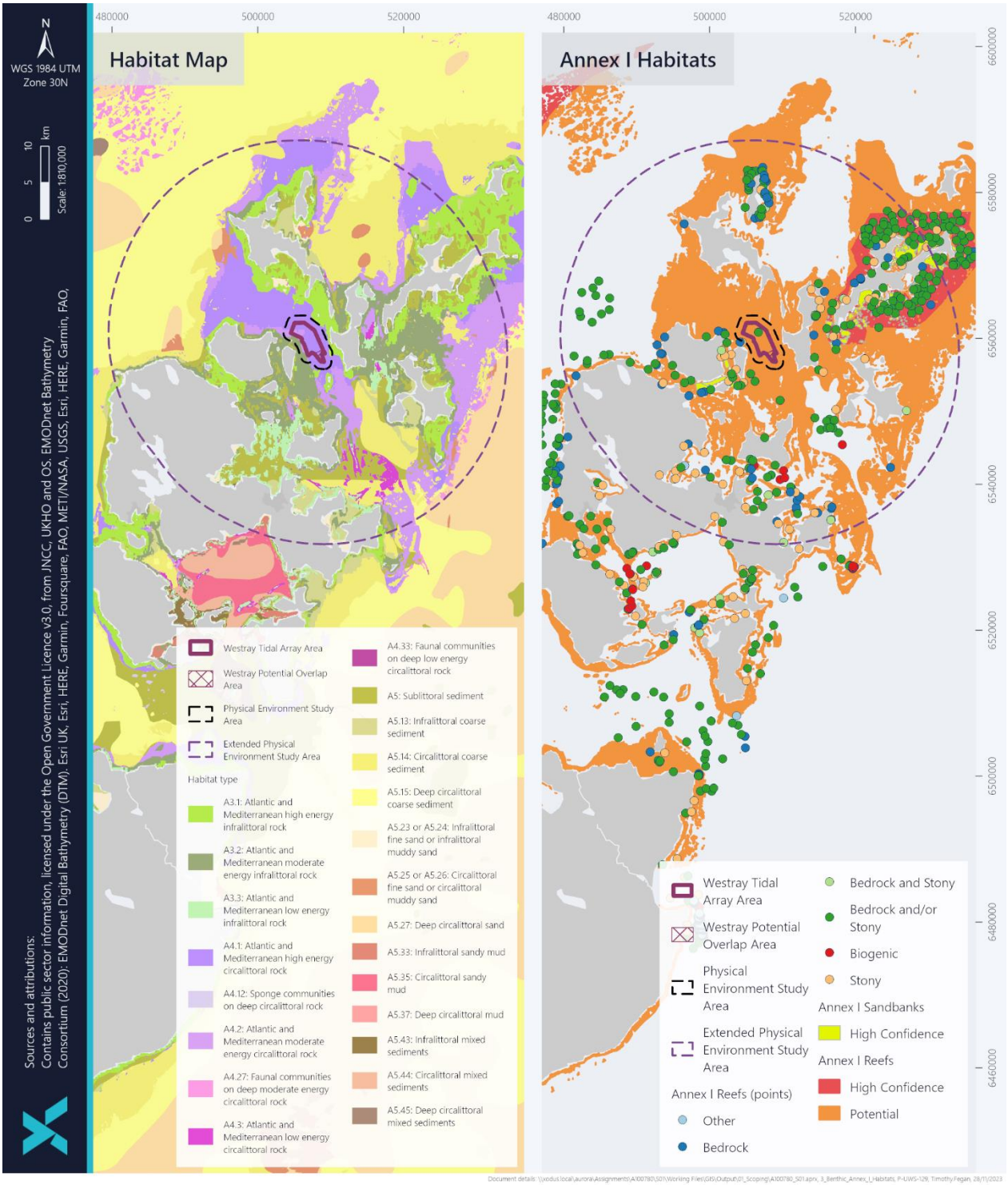

Figure 8-1 EUNIS habitat classification (left panel) and Annex I habitats (right panel) in the Westray Project and the wider Orkney islands area

The seabed survey at the EMEC Fall of Warness subtidal area (Aurora, 2005), located immediately to the southeast of the Westray Project encompasses a similar depth range and hydrodynamic regime as that at the proposed Project. Therefore the subtidal habitats described from this report can be used as a proxy for those present at the Westray Project location. The EMEC Fall of Warness subtidal area consisted largely of scoured and tide-swept bedrock and boulders, with areas of broken bedrock amongst sublittoral morphological bedforms in the shallower eastern and northern margins. The rocky and sedimentary habitats present throughout much of the EMEC site supported communities of species typical of tidally-scoured areas including areas of relatively dense seaweed. Amongst these include potential PMF habitats '*Kelp beds – Laminaria hyperborean with dense foliose red seaweeds on exposed infralittoral rock*', or components of the PMF '*Tide-swept algal communities*' (NatureScot, 2014; Tyler-Walters *et al.*, 2016). In addition to the EMEC Fall of Warness survey, the Westray Firth was subject to a underwater video survey commissioned by Scottish Government to inform potential marine renewables development in Scotland (Moore, 2009). Two video runs were located in the centre of the north-western entrance to the firth and a further sample was located to the south between the Point of Holm and the Point of Ridden.

Analysis of the two northern runs revealed that the channel floor was composed of a mixed substrate of dense cobbles and pebbles, with scattered small boulders on a gravel bed. The stones were densely encrusted with red bryozoans, barnacles and *Pomatoceros* and although the community found here was of fairly low diversity, the stones supported a low density cushion fauna of sponges and the colonial ascidian *Botryllus schlosseri*, while small individuals of the soft coral *Alcyonium digitatum* and the anemones *Urticina feline* and *Sagartia elegans* were common between the stones. Reviews of both video samples allowed the biotope 'circalittoral coarse sediment[4]' to be assigned to the areas surveyed (Moore, 2009).

The southern run showed the substrate consisted of dense boulders and cobbles with a shell gravel infill and small patches of coarse sediment and outcropping bedrock. The rock supported a low-diversity community dominated by crusts of barnacles, coralline algae and red bryozoans, with patches of the hydroid *Tubularia indivisa*, encrusting and cushion sponges, *Alcyonium digitatum* and the bryozoan *Flustra foliacea*. The biotope recorded has been referred to as '*Tubularia indivisa* on tide-swept circalittoral rock' (Moore and Roberts 2011).

The existing survey data described above indicates that the rocky substrates may support faunal turfs on bedrock, boulders and cobbles. In addition, Kelp (*Laminaria* spp.) and the associated red alga *Rhodymenia palmata* have been observed throughout the area although denser in shallower, more sheltered areas. Other common species include various encrusting coralline algal species, sea anemones, sea stars and a variety of crustacean species.

The similarity between the results of the Fall of Warness survey (Aurora, 2005) and Westray Firth (Moore, 2009) suggest that rocky and mixed sediment substrates which are typical of tidally-scoured areas of the north of Scotland can be expected to be present across the Westray Project area.

8.1.3.2 Protected sites and conservation features

The Westray Project is located 0.75 km away from the Wyre and Rousay Sounds Nature Conservation Marine Protected Area (NCMPA). A very small fraction of the NCMPA (northeast side) falls inside the extended study area

[4] *Using Marine Habitat Classification for Britain and Ireland (version 04.05) (Conner* et.al., *2004)*

of the Westray Project (Figure 7-2). The majority of the designated site is separated from the Westray Project area by the island of Egilsay (Figure 7-2). The NCMPA is designated for maerl beds, kelp and seaweed communities on sublittoral sediment and Marine Geomorphology of the Scottish Shelf Seabed. Apart from the Wyre and Rousay Sounds NCMPA there are no other MPAs designated for marine benthic features that fall inside the study area (Figure 7-2). However, as Figure 7-2 illustrates, the extended study area includes the following MPAs designated for marine benthic features:

- Sanday SAC (13.7 km), designated for intertidal mudflats and sandflats; Reefs; Subtidal sandbanks;
- Papa Westray NCMPA (14.2 km), Marine Geomorphology of the Scottish Shelf Seabed;
- East Sanday Coast SSSI (15.2 km) for rocky shore; and
- North-West Orkney NCMPA (24.5 km) for Marine Geomorphology of the Scottish Shelf Seabed, Sandeels (*Ammodytes marinus / Ammodytes tobianus*).

The Annex I habitat "Reef" (bedrock/stony) has been recorded inside the Westray Project area (Figure 8-1-right panel). Apart from the point location shown in Figure 8-1 (right panel), there is also the potential for other locations within the Westray Project area to host Annex I bedrock/stony reef habitat (Figure 8-1-right panel). Annex I bedrock/stony reefs have also been recorded in southwest and northwest locations found outside the Westray study area (Figure 8-1-right panel).

The Orkney Local Biodiversity Action Plan 2018-2022 (OIC, 2017) includes action plans for the following benthic habitats:

- Flame shell *Limaria hians* beds;
- Maerl beds; and
- Seagrass *Zostera* spp. beds.

Data from Marine Scotland's Blue carbon audit of Orkney waters (Porter *et al.*, 2020) suggests that there is moderate possibility that Flame shell and Seagrass beds are present along Egilsay and Eday coasts facing Westray Firth.

With the exception of a possible record of some scattered maerl debris (*Lithothamnion corallioides* or *Phymatolithon calcareum*) (ScotRenewables, 2011), and kelp beds, there have been no records of any benthic species listed as Priority Marine Features (PMF, NatureScot, 2014; Tyler-Walters *et al.*, 2016) on either the rocky or sandy substrates at the Westray Project area. The available evidence to date does not suggest there is a maerl bed present, and no live maerl has been reported.

The Westray Project area may also support PMF habitats "*Kelp beds*" –, and "*Tide-swept algal communities*". Based on available NMPi data layers (MNPi, 2023), there are no records of the PMF habitats "Kelp beds", "Tide-swept algal communities", "Kelp and seaweed communities on sublittoral sediment", or "Seagrass beds" made so far inside the Westray Tidal Array Area. NMPi data show the presence of the PMF habitats "Tide-swept algal communities" and "Kelp beds", between Egilsay east side and Westray southwest side.

8.1.4 Potential impacts

For benthic receptors, the defined potential effect categories are applied to activities/effect pathways relevant to tidal stream energy developments comprising design-types involving the rotation of turbines within natural hydrodynamic conditions. First, potential effects are considered in broad principles. Scoping of likely significant effects on benthic ecology is provided in Table 8-2 below.

Table 8-2 Likely significant effects on benthic ecology

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Substratum / habitat loss / damage from placement of devices and other infrastructure on the seabed, cable laying	All	Yes	The introduction of Project infrastructure on to the seabed, results in a change in the benthic characteristics.
Increased suspended sediment and turbidity from installation of subsea infrastructure, including cable laying, leading to smothering of benthic species	All	No	Localised alterations to sediment suspension are not anticipated as a result of mooring installation and associated infrastructure. These activities may result in a small and localised increase in SSC as discussed in Table 7-2, however increases are temporary, with silt sediment plumes settling within 8-hours and the maximum extent being up to 25 km in relation to the maximum spring tidal excursion, but SSC being only a few milligrams per litre and back at background levels due to dissipation and dispersion by the flow. Therefore, impacts are likely to be minimal due to the small scale of the Project, low drill volumes/ anchor sizes and the dispersive effects of the environment. Due to the strong tidal regime at the project location, it can be expected that any re-suspended sediment will be short lived in the water column and have negligible consequences on the benthos. Therefore, changes in SSC on the benthic environment due to installation activities has been scoped out of this report.
Changes to hydrodynamic regime leading to change in benthic habitat	Operation	Yes	Potential for devices to effect water flow will be considered further
Colonisation of infrastructure	All	No	As the seabed primarily comprises outcropping scoured and tide-swept bedrock the introduction of infrastructure and any associated protection does not alter the sediment characteristics. Instead the

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
			infrastructure provides further surfaces for colonisation in line with the existing species. Therefore, the potential for any changes to species is not considered and as such this impact is scoped out from further assessment.
Introduction of marine non-native species	All	No	The movement of vessels during the operation and maintenance phases of the Operations have the potential to result in the introduction of Invasive Non-Native Species (INNS). A CEMP (such as an INNS Management Plan) and adherence to relevant legislation and guidance will ensure that all required mitigation measures are in place so that the potential for the introduction of INNS are minimised. Through these measures the discharges of ballast waters and biofouling by Project vessels will be controlled. For these reasons, it is considered that there is no potential pathway for significant impacts resulting from the operation and maintenance of the Westray Project. The potential impact is therefore scoped out.
Impact to benthic communities from EMF or thermal load from export and inter array cables	Operational	No. Considered in fish and shellfish (Section 8.2)	Evidence of potential EMF effects relate to shellfish species such as crab and lobster. The potential impact is therefore scoped out.
Cumulative impacts	All	Yes	Cumulative impacts with EMEC Falls of Warness will be assessed in the EIA.

8.1.5 Impact assessment strategy

No further geophysical or benthic habitat surveys are proposed in advance of the Project application. Instead, it is proposed that a targeted preconstruction geophysical and benthic survey will be undertaken post-consent to inform the foundation design and micro-siting. Therefore, due to the scale and location of the Project within Westray Firth, desk-based reviews will be applied to assess the nature and magnitude of potential change on the benthos of the area and the likely significant effect on the benthic receptors. The assessment of the likely significant effects on the benthos will be cross-referenced, where relevant, to the assessments of Marine Physical and Coastal Processes. The assessment methodology is summarised in Table 8-2:

Table 8-3. Impact assessment strategy for benthic ecology

POTENTIAL IMPACT	ASSESSMENT TOPICS	RELEVANT RESEARCH
Substratum / habitat loss / damage	Determine the presence and extent of habitats and species within the study area, including rare, sensitive or protected species. Sensitivity of features will be based on the Marine Evidence-based Sensitivity Assessment (MarESA) framework where possible (MarLIN, 2021)	Moore 2009; Moore and Robertson 2011. NBN (National Biodiversity Network), EMODnet Broad-scale seabed habitat map.
Changes to hydrodynamic regime leading to change in benthic habitat **throughout the operational phase**	Changes in water flow and energy	Outputs from the marine physical and coastal processes topic and available monitoring being completed at the adjacent EMEC Fall of Warness tidal demonstration site.
Cumulative impacts	Assessment of cumulative effects based on the scoped in impacts.	As the EMEC Fall of Warness tidal demonstration site is adjacent to the Project, a cumulative assessment will be completed with respect to information and judgement as applied to the Project alone assessment.

For decommissioning, it is expected that the activities will result in a reduced level of change than that already considered for the construction phase.

8.2 Fish and Shellfish Ecology

8.2.1 Study area

This section of the Scoping Report identifies the fish and shellfish ecology receptors of relevance to the offshore aspects of the Westray Project and considers the potential impacts from the installation, operation and maintenance and decommissioning phases of the Project. Based on the Project envelope, the study area for this topic is considered to be a 50 km buffer around the Westray Project. The study area extent is illustrated Figure 8-3.

8.2.2 Key data sources

The existing data sets and literature with relevant coverage to the Project which have been used to inform this Scoping Report and are proposed to inform the baseline characterisation for the EIA are outlined in Table 8-4.

Available site specific information available for the Project to characterise the baseline seabed conditions for the purposes of the EIA is as follows:

- Westray AfL Geophysical Survey Orkney Report (Osiris, 2014); and
- Westray Geophysical Survey (June, 2023).

Further publicly available data used to inform this Scoping Assessment and the EIAR as relevant are as presented in Table 8-4.

Table 8-4 Summary of key sources of information for fish and shellfish ecology receptors

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
Mapping the spawning and nursery grounds of selected fish for spatial spawning	https://docslib.org/doc/10530704/spawning-and-nursery-grounds-of-selected-fish-species-in-uk-waters	2012	Ellis *et al.*
Fishery sensitivity maps in British waters	https://marine.gov.scot/data/fisheries-sensitivity-maps-british-waters-coull-et-al-1998	1998	Coull *et al.*
Updating fisheries sensitivities maps in British waters	https://data.marine.gov.scot/dataset/updating-fisheries-sensitivity-maps-british-waters	2014	Aires *et al.*
Spawning grounds of Atlantic cod (*Gadus morhua*) in the North Sea	https://academic.oup.com/icesjms/article/73/2/304/2614292	2015	González-Irusta and Wright
Spawning grounds of haddock (*Melanogrammus aeglefinus*)	https://www.sciencedirect.com/science/article/abs/pii/S0165783616301771?via%3Dihub	2016	González-Irusta and Wright
Spawning grounds of whiting (*Merlangius Merlangus*)	https://www.sciencedirect.com/science/article/abs/pii/S0165783617301790?via%3Dihub	2017	González-Irusta and Wright
Landings Data (live weight) by species	https://www.gov.uk/government/statistics/uk-sea-fisheries-annual-statistics-report-2021	2016-2020	MMO
The Marine Life Information Network	https://www.marlin.ac.uk/	2023	MarLIN
National Biodiversity Network (NBN) Atlas	https://nbnatlas.org/	2015	National Biodiversity Network
Survey data/reports available through International Council for the Exploration of the Sea (ICES), including International Herring Larvae Survey (IHLS) and the International Bottom Trawl Survey (IBTS) (North Sea)	https://www.ices.dk/data/data-portals/Pages/Eggs-and-larvae.aspx https://www.ices.dk/data/dataset-collections/Pages/Fish-trawl-survey.aspx	Ongoing Ongoing	ICES ICES

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
The Shark Trust shark sightings database (for elasmobranchs)	https://www.sharktrust.org/sightings-database	Ongoing	Shark Trust
Orkney Biodiversity Records Centre	https://orkneylibrary.org.uk/orkney-wildlife-information-and-records-centre/	Ongoing	Orkney Wildlife Information & Records Centre
Salmon Smolt Surveying on the Sunbeam	https://www.bodc.ac.uk/resources/inventories/cruise_inventory/programmes/1419h.pdf	2018	Marine Scotland
UK Protected Sites	https://jncc.gov.uk/our-work/uk-protected-areas/	2023	JNCC
The International Union for Conservation of Nature (IUCN) Red List of Threatened Species	https://www.iucnredlist.org/en	2023	IUCN
Guidelines for Ecological Impact Assessment in the UK and Ireland Terrestrial, Freshwater, Coastal, and Marine	https://cieem.net/resource/guidelines-for-ecological-impact-assessment-ecia/	2022	CIEEM
A verified distribution model for the lesser sandeel (*Ammodytes marinus*)	https://spatialdata.gov.scot/geonetwork/srv/api/records/Marine_Scotland_FishDAC_12377	2021	Langton *et al.*
A summary of demersal fish tagging data maintained and published by Cefas	www.cefas.co.uk/publications/techrep/tech135.pdf	2006	Burt *et al.*
FishBase, with special emphasis on the fish of Europe	https://fishbase.mnhn.fr/search.php?region=europe	2023	FishBase

8.2.3 Baseline

The Project lies within the ICES rectangle[5] 47E7. Catch data provided by Marine Scotland Analytical Unit provides a good indication of which species are present in commercially exploitable numbers within the Project area. Species (of which more than one tonne) landed from this rectangle in 2018 – 2021 are shown in Table 8-5.

[5] *The International Council for the Exploration of the Sea (ICES) has developed a grid system derived from degrees latitude and longitude that divides the seas into rectangles.*

Table 8-5 Fish and shellfish species caught within ICES rectangle 47E7 between 2018 to 2021 (Marine Scotland, 2022).

DEMERSAL / PELAGIC (LIVE WEIGHT, TONNES)	SHELLFISH (LIVE WEIGHT, TONNES)
Herring *Clupea harengus* (76,676.07)*	Velvet Swimming crab *Necora puber* (961.77)
Mackerel *Scomber scombrus* (401.65)	Unidentified crabs, likely to be mostly edible crabs *Cancer pagurus* (2,340.18)
Horse Mackeral *Trachurus trachurus (10.54)**	Scallops *Pecten Maximus* (1,228.06)
Ling *Molva molva* (13.47)*	Green crab *Carcinus maenas* (154.76)
Haddock *Melanogrammus aeglefinus* (804.33)	Lobster (204.81)
Cod – *Gadus morhua* (168.79)*	Whelks *Buccinum undatum* (902.30)
Hake *Merluccius merluccius* (7.12)	Squid (8.41)
Monks or Anglers (*Lophius piscatorius, Lophius budegassa or similar species)* (52.44)*	Nephrops *Nephrops norvegicus* (4.37)
Whiting *Merlangius merlangus* (94.20)*	Periwinkles *Littorina spp* (3.36)
Saithe *Pollachius virens* (34.62)*	
Megrim *Lepidorhombus whiffiagonis* (9.66)	
Plaice *Pleuronectes platessa* (42.21)	
Red Gurnard *Chelidonichthys cuculus* (5.52)	
Lemon Sole *Microstomus kitt* (13.13)	
Pollack *Pollachius pollachius* (2.31)	
Turbot *Psetta maxima* (1.11)	

* Indicates Priority Marine Features

As shown in Table 8-5, many of the species landed from ICES rectangle 47E7 are Priority Marine Features (PMF) identified as being species that are considered to be marine nature conservation priorities in Scottish waters. Atlantic herring, hake, haddock, plaice, whiting and cod are also listed on The World Conservation Union (IUCN) Red List of Threatened Species.

The State of the Environment Baseline Description (Orkney Islands Council, 2020) identified the key commercial species in Orkney waters were brown crab, velvet crab, king scallops, queen scallops, European lobster, prawns, whelk, mackerel, cod, haddock, herring, saithe, and hake. Non-commercial species present in the Orkney region are Atlantic salmon, sandeels, sea trout, flapper skate, and basking sharks. Potential invasive species were also

identified in the report, including red algae (*Melanothamnus harveyi* and *Bonnemaisonia hamifera*), bryozoan (*Schizoporella japonica*) and Japanese skeleton shrimp (*Caprella mutica*).

8.2.3.1 Spawning and nursery grounds

A summary of the spawning and nursery grounds with respect to the Project area and Westray Firth is summarised in Table 8-6. Sandeels are an important food source for commercial fish species such as cod, haddock and whiting, as well as for seabirds and marine mammals. From the nearby EMEC Fall of Warness tidal demonstration site, the EIAR from 2014 (EMEC, 2014) reasonably assumed that, based on the habitats and the species present in the site, the fish and shellfish species present at the site included diadromous fish (including salmon (*Salmo spp.*), trout (*Salmo spp.*) and eels (*Anguilla spp.*), marine fish (including herring (*Clupea harengus*), mackerel (*Scomber scombrus*), cod (*Gadus morhua*), saithe (*Pollachius virens*), butterfish (*Peprilus triacanthus*), gobies (*Gobiidae spp.*), flatfish, sandeels, common skate (*Dipturus batis*) and spurdog (*Squalus spp.*)) and marine shellfish (including king scallops (*Pecten maximus*), lobsters (*Homarus Scottish*), velvet crab (*Necora puber*), brown crab (*Cancer pagurus*) and squat lobsters (*Galathea spp.*)). Although there is no targeted surveys of fish and shellfish within Westray Firth, there had been anecdotal observations of fish and shellfish during benthic surveys and seabed investigations within the EMEC site, which confirm the nature of the baseline was as expected from the literature for the region.

Table 8-6 Summary of nursery and spawning in the Westray Firth (Coull et al., 1998; Ellis et al., 2014)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
	N	N	N	N	N	N	N	N	N	N	N	N
Blue Whiting	N	N	N	N	N	N	N	N	N	N	N	N
Cod	N	N	N	N	N	N	N	N	N	N	N	N
Common skate	N	N	N	N	N	N	N	N	N	N	N	N
European hake	N	N	N	N	N	N	N	N	N	N	N	N
Herring	N	N	N	N	N	N	N	SN	SN	N	N	N
Lemon Sole	N	N	N	SN	SN	SN	SN	SN	SN	N	N	N
Ling	N	N	N	N	N	N	N	N	N	N	N	N
Mackerel	N	N	N	N	N	N	N	N	N	N	N	N
Norway Pout	N	N	N	N	N	N	N	N	N	N	N	N
Saithe	N	N	N	N	N	N	N	N	N	N	N	N
Sandeels	SN	SN	N	N	N	N	N	N	N	N	SN	SN
Spotted ray	N	N	N	N	N	N	N	N	N	N	N	N
Sprat	N	N	N	N	S*N	S*N	SN	SN	N	N	N	N
Spurdog	N	N	N	N	N	N	N	N	N	N	N	N
	N	N	N	N	N	N	N	N	N	N	N	N
S: Spawning, S*: Peak spawning, N: Nursery Species High nursery intensity as per Ellis *et al.*, 2012												

Spawning and nursery grounds for commercial species have been identified in UK waters (Coull *et al.*, 1998 and Ellis *et al.*, 2012). Figure 8-2 indicates that there are no high intensity spawning grounds within the Westray Project area. Sandeel, spawn on the seabed and is the only species identified with low intensity spawning grounds within and around the Westray Tidal Array area. The Westray Project also lies in wider low intensity nursery grounds for herring, blue whiting, common skate, European hake, ling, sandeel, mackerel, spotted ray, spur dog, cod and whiting (Coull *et al.*, 1998 and Ellis *et al.*, 2012), shown in Figure 8-3a and Figure 8-3b. Anglerfish is the only identified species with high intensity nursery ground within the Project area and the wider 47E7 ICES rectangle. Other fish species, saithe and sprat, have nursery grounds within the Project area.

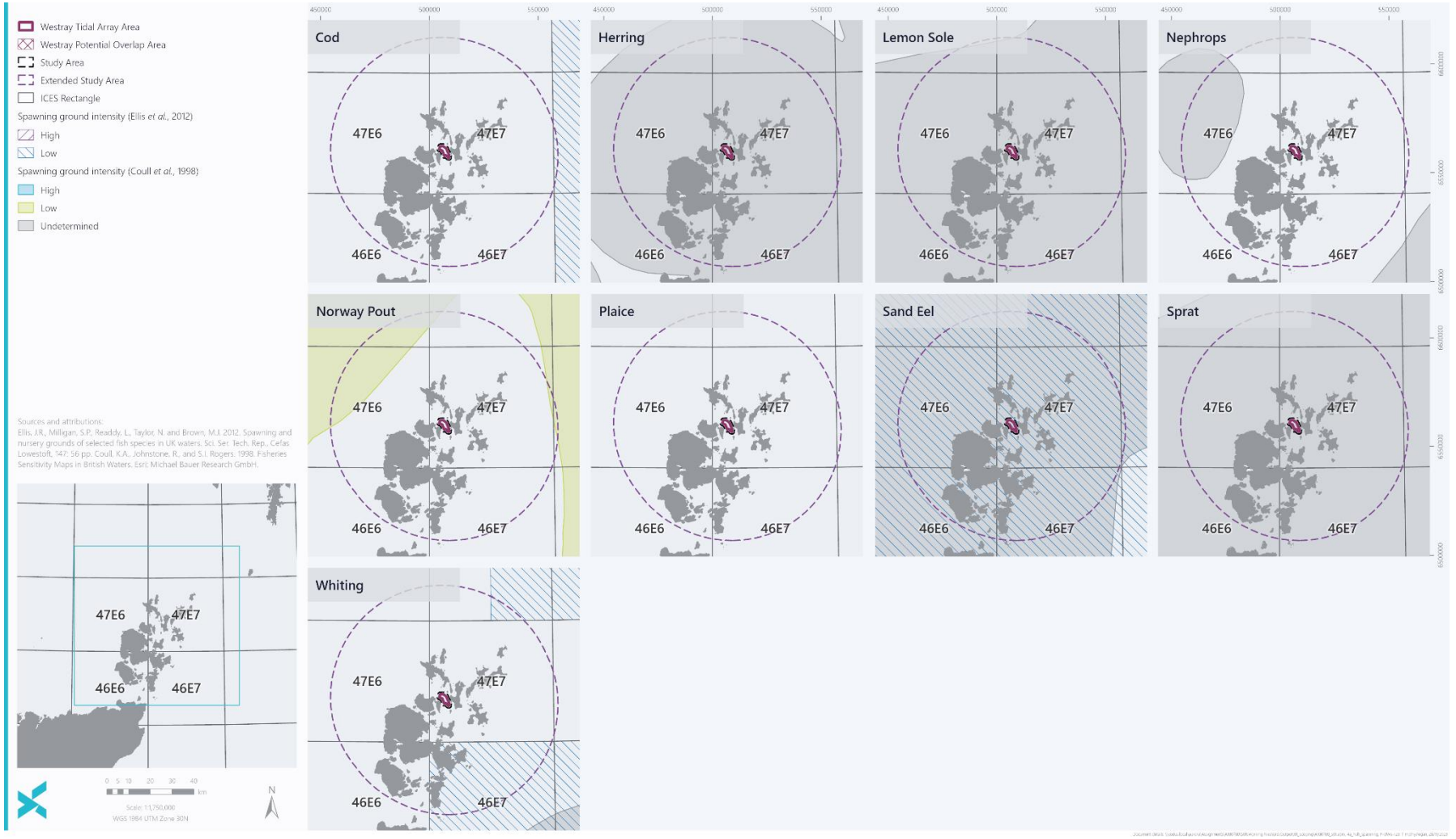

Figure 8-2 Fish spawning grounds in the ICES Rectangles around the Project area

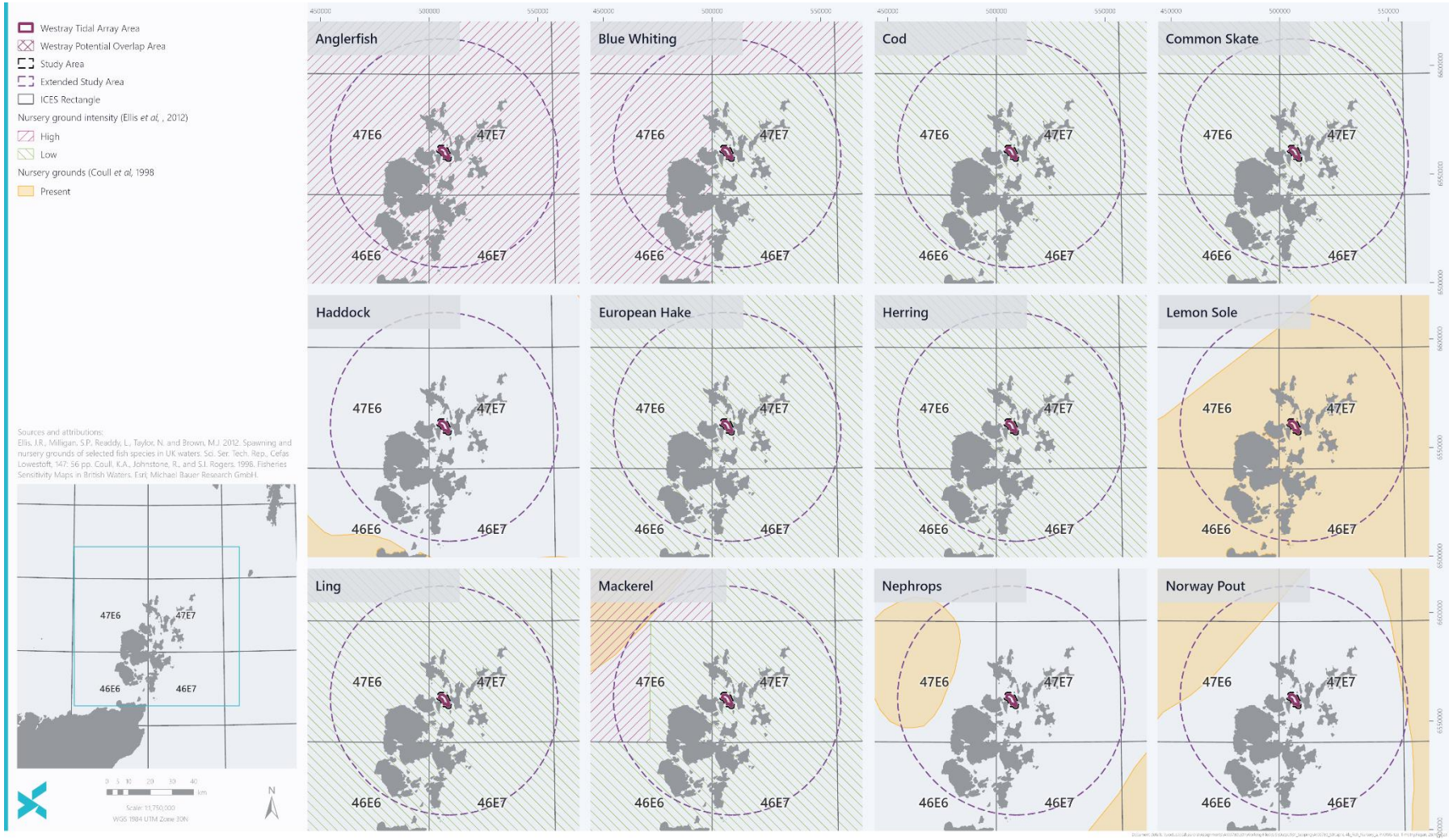

Figure 8-3a Fish nursery grounds in the ICES Rectangles around the Project area

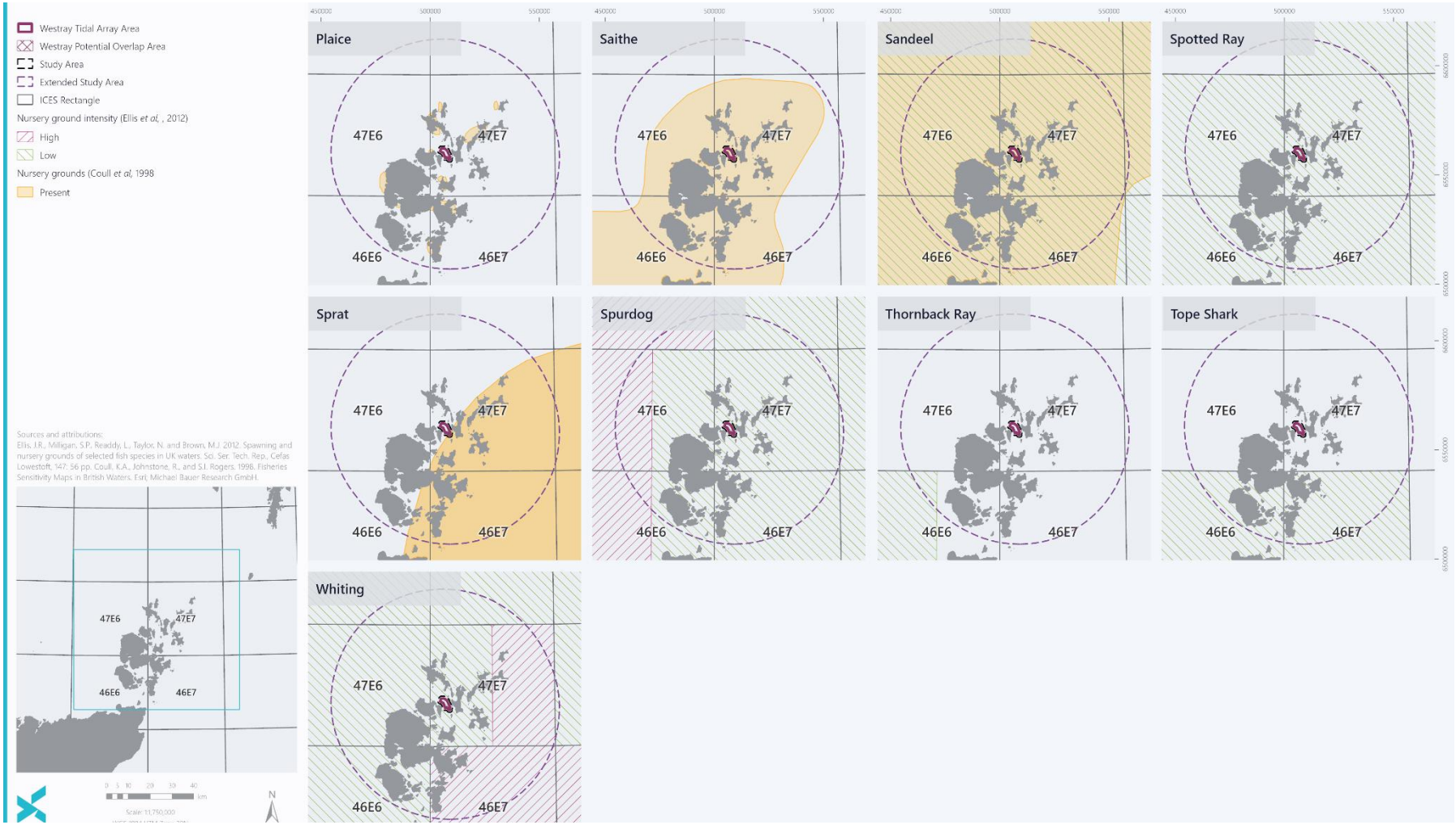

Figure 8-3b Fish nursery grounds in the ICES Rectangles around the Project area

8.2.3.2 Elasmobranchs

One basking shark *Cetorhinus maximus* was sighted in September 2013 during the boat based Marine Mammal Observer (MMO) survey within the Westray AfL. Basking sharks are regularly seen in waters around the Orkney Islands. This species is listed as a PMF and is protected under the Wildlife and Countryside Act 1981 (as amended 1985) and on the OSPAR list of threatened and declining species. Basking sharks are also listed on the IUCN red list as endangered in the north-east Atlantic, and vulnerable worldwide and on Appendix II under CITES.

The Offshore Energy SEA (DECC, 2009) indicates that the following elasmobranch species may also be present within the Project area: flapper skate[6] *Dipturus intermedius*, porbeagle shark *Lamna nasus*, several species of dogfish (e.g. lesser-spotted dogfish *Scyliorhinus canicula* and the spiny dogfish *Squalus acanthias*), skates and rays (e.g. thornback ray *Raja clavata*, cuckoo ray *Leucoraja naevus* and spotted ray *Raja montagui*). Niels et al., (2005), reports that up to 23 species of elasmobranch can be found in Orkney Islands waters.

8.2.3.3 Migratory fish

Several species of diadromous (migratory between fresh and salt waters) fish may potentially migrate through the Westray Firth. A 2010 study commissioned by Marine Scotland concluded that although broad scale patterns of migration can be identified for adult Atlantic salmon and to some extent European eels, no specific migratory routes for either of these species or sea trout can be identified with any certainty, due to a lack of data (Malcolm *et al.*, 2010). Salmon distribution data has been collected since the 1980's, with 2015 data indicating that no salmonid rivers feed into the Westray Firth (Marine Scotland, 2015). The Loch of Swannay and the Loch of Broadhouse, both located on the west coast of mainland Orkney, feed into the sea along the northwest coast, however fish from these rivers are likely to go out to sea and not around the coast into the Westray Firth as migrations patterns are usually in an offshore direction (Malcolm *et al.*, 2010).

There are historical records of the sea lamprey *Petromyzon marinus* in Orkney waters (Barne *et al.*, 1997), however there were no recent records on Orkney, including during the National Lamprey Survey of Scotland 2003 – 2005 (NatureScot, 2020).

8.2.3.4 Protected sites

There are no protected areas designated for finfish or shellfish species within the Project area or wider the Westray Firth region. The only protected site which features fish and shellfish as a qualifying feature and occurs in relation to the Orkney Islands is the North-west Orkney NCMPA, which is approximately 25 km away. The primary qualifying species is sandeels. Due to the distance between the Project area and NCMPA and the non-migratory nature of sandeels, the Project is not expected to interact with the NCMPA. It is also noted that whilst the River Thurso and River Naver SACs are over 70 km and 100 km south and west of the Project, where there is considered to be some evidence of limited movement of Atlantic salmon into Orkney waters. As such, these protected sites will be considered in the forthcoming assessment.

[6] *In 2010, it was found that the fish previously known as 'common skate' is actually two distinct species: flapper skate and blue skate Dipturus flossada. Flapper skate is the largest skate species, reaching lengths of about 2.5 m and is listed as Critically Endangered on the IUCN Red List, and it is also a PMF. The species has been recorded at sites all around the waters of the Orkney Islands, from the shallow coastal areas around the North Isles and in Scapa Flow to the deeper waters off the West Mainland coast (Orkney Islands Marine Region: State of the Environment Assessment, 2020).*

8.2.4 Potential impacts

Scoping of likely significant effects on fish and shellfish is provided in Table 8-7 below.

Table 8-7 Likely significant effects on fish and shellfish ecology

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Effects on herring and sand eel populations from disturbance to spawning grounds	All	Yes	Effects of habitat loss and disturbance to be considered further.
Physical disturbance to crustacean and demersal fish species including changes to hydrodynamic and sediment regime	All	Yes	
Habitat loss	All	Yes	
Underwater noise and vibrations from installation methods and operation of devices	All	Yes	Underwater noise and vibrations from potential anchor drilling and operation of the tidal devices will be considered further.
Collision of slow moving larger species such as basking sharks with the devices	Operation	Yes	Further information needed on presence of basking shark and potential for collision before assessment can be made
Vessel transits leading to disturbance	All	No	Moving vessels are not expected to be sufficiently noisy and activity will be limited in duration. Therefore, it is not anticipated to cause disturbance.
Increased suspended sediment/turbidity	Construction	No	Although some marine fish, such as filter feeders, are sensitive to increased suspended sediment within the water column. The level of importance will depend on the amount of increased sediment and length of time. The fast flow streams through the Westray Firth, the low sediment disturbance volumes and the very short-term nature of any increases in suspended sediment concentrations at less than 8-hours, means there is considered to be little to no impact, so it is scoped out.
Introduction of marine non-native species (MNNS) via vessels,	All	No	It is anticipated that vessels and equipment will be locally sources, therefore, it is unlikely that MNNS will be of concern

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
devices, or other equipment			
Habitat creation and fish aggregation effect	Operation	Yes	Some species may be attracted to and aggregate around the tidal devices and associated infrastructure.
Effects of Electromagnetic fields on Elasmobranchs & potential barrier effects to fish and shellfish populations due to presence of tidal devices	Operation	Yes	Further research on current industry knowledge required in relation to the effect of EMF on fish species. Although the barrier effect is unlikely to impact marine fish and shellfish, migratory diadromous fish may rely on specific migratory routes, when moving in between freshwater and marine water. The extent of the impact will be understood further once migratory routes are identified.
Cumulative impacts	All	Yes	Cumulative impacts with EMEC Falls of Warness will be assessed in the EIA.

8.2.5 Impact assessment strategy

Given that fish are highly mobile, both temporally and spatially, a site-specific survey only provides coverage of the species present in a particular area at a particular time, which has the potential to skew the baseline. Furthermore, given the scale of the Project, it is not considered necessary to conduct site-specific surveys for fish. Considering this, the volume of existing data and the low value of site-specific data, no fish or shellfish surveys will be undertaken for Project. Where appropriate, the assessment of impacts on fish and shellfish ecology will be informed by outputs from the marine physical and coastal processes and benthic ecology assessments, in addition to the available site-specific geophysical data for the Project. The proposed assessment methodology is as summarised in Table 8-8.

Table 8-8. Impact assessment strategy for fish and shellfish ecology

POTENTIAL IMPACT	ASSESSMENT TOPICS	RELEVANT RESEARCH
Effects on herring and sand eel populations from disturbance to spawning grounds	Determine the extent of herring and sand eel spawning/nursery	ICES eggs and larvae surveys in the North Sea; Cefas data; Landings data); Distribution of Spawning and Nursery Grounds as defined in Coull *et al.*, (1998) and in Ellis *et al.*, (2012); and consultation with fisheries organisations.
Physical disturbance to crustacean and demersal fish species including changes to hydrodynamic and sediment regime	Assess the risk of disturbance to crustacean and demersal fish species	

POTENTIAL IMPACT	ASSESSMENT TOPICS	RELEVANT RESEARCH
Habitat loss	Assess risk & extent of resource availability through habitat loss to fish and shellfish species	
Underwater noise and vibrations from installation methods and operation of devices	Investigate the predicted noise output of the array and its construction	Existing noise studies of ambient noise at Falls of Warness and monitoring of underwater turbine devices (e.g. Kvalsund, SeaGen).
Collision of slow moving larger species such as basking sharks with the devices	Collision risk	Studies into collision incidents at established tidal turbine sites and relevant research from other industries.
Habitat creation and fish aggregation effect	Habitat creation and colonisation	Studies into habitat creation and positive impacts from subsea infrastructure.
Effects of Electromagnetic fields on Elasmobranchs & potential barrier effects to fish and shellfish populations.	Electromagnetic effects from subsea cables.	Normandeau *et al.* (2011), Hutchinson (2018, 2020), Love *et al.* (2017)
Cumulative impacts	Assessment of cumulative effects based on the scoped in impacts.	As the EMEC Fall of Warness tidal demonstration site is adjacent to the Project, a cumulative assessment will be completed with respect to information and judgement as applied to the Project alone assessment.

For decommissioning, it is expected that the activities will result in a reduced level of change than that already considered for the construction phase.

8.3 Marine Mammals and Megafauna

8.3.1 Study area

The marine mammal assessment considers cetaceans (whales, dolphins and porpoises), pinnipeds (seals) and otters. Basking sharks and marine turtles have also been considered in this section of the EIA scoping as megafauna species. The marine mammal and megafauna study area encompasses the proposed Project area and a 50 km buffer zone around the Project (Figure 8-4).

8.3.2 Key data sources

The baseline environment for this Scoping Report has been established following a desk-based analysis of the data and information sources listed in Table 8-9. A summary of the site-specific data is presented below and will also inform the EIA assessment, together with publicly available data sources with relevant coverage of the Project Study Area as detailed in Table 8-9.

In line with site specific information obtained for ornithological surveys, data was also acquired for marine mammal species. The existing site specific datasets, which have been used to inform this Scoping Report and are proposed to inform the baseline characterisation for the EIA is as follows:

- Ongoing marine ornithology and mammal surveys across Westray Firth, which commenced in April 2023; and
- 2012 – 2014 European Seabirds At Sea (ESAS) survey for birds and marine mammals across the former Westray AfL and EMEC Fall of Warness tidal demonstration site, commissioned by SSER (NRP, 2012; Jackson and Hulka, 2013a and 2013b; Harding, 2015).

Further publicly available datasets and literature with relevant coverage of the Project, which have also been applied are outlined in Table 8-9.

Table 8-9: Summary of key sources of marine mammal and turtle information for assessment

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
Estimates of cetacean abundance in European Atlantic waters in summer 2022 from the SCANS-IV aerial and shipboard surveys	https://www.tiho-hannover.de/fileadmin/57_79_terr_aqua_Wildtierforschung/79_Buesum/downloads/Berichte/20230928_SCANS-IV_Report_FINAL.pdf	2023	Gilles et al.,
Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys	https://scans3.wp.st-andrews.ac.uk/files/2021/06/SCANS-III_design-based_estimates_final_report_revised_June_2021.pdf	2021	Hammond *et al.*,
Modelled density surfaces of cetaceans in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys	https://scans3.wp.st-andrews.ac.uk/files/2022/08/SCANS-III_density_surface_modelling_report_final_20220815.pdf	2022	Lacey *et al.*,

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
Distribution Maps of Cetacean and Seabird Populations in the North-East Atlantic	https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/1365-2664.13525	2019	Waggitt *et al.*,
Habitat-based predictions of at-sea distribution for grey and harbour seals in the British Isles	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/959723/SMRU_2020_Habitat-based_predictions_of_at-sea_distribution_for_grey_and_harbour_seals_in_the_British_Isles.pdf	2020	Carter *et al.*,
Sympatric Seals, Satellite Tracking and Protected Areas: Habitat-Based Distribution Estimates for Conservation and Management	https://www.frontiersin.org/articles/10.3389/fmars.2022.875869/full	2020	Carter *et al.*,
Scientific Advice on Matters Related to the Management of Seal Populations	http://www.smru.st-andrews.ac.uk/files/2022/08/SCOS-2021.pdf	2021	Special Committee on Seals (SCOS)
Regional Baselines for Marine Mammal Knowledge Across the North Sea and Atlantic Areas of Scottish Waters	https://data.marine.gov.scot/sites/default/files//Scottish%20Marine%20and%20Freshwater%20Science%20%28SMFS%29%20Vol%2011%20No%2012_%20Regional%20baselines%20for%20marine%20mammal%20knowledge%20across%20the%20North%20Sea%20and%20Atlantic%20areas%20of%20Scottish%20waters%20-%20Appendix%201%20Data%20Sources.pdf	2020	Hague *et al.*,
Harbour seal and grey seal distribution maps	Fine grained spatial predication (0.6 km grid) for harbour seals in the waters around the Orkney Islands	2016	Jones *et al.*,
Harbour seal and grey seal distribution maps	Method for analysis of telemetry data and high-level interpretation.	2016	Band *et al.*,
Updated abundance estimates for cetacean Management Units in UK waters (Inter-Agency Marine Mammal Working Group (IAMMWG)	https://hub.jncc.gov.uk/assets/f07fe770-e9a3-418d-af2c-44002a3f2872	2022	Inter-Agency Marine Mammal Working Group (IAMMWG),
SAC Scotland ESRI	https://www.nature.scot/professional-advice/protected-areas-and-species/protected-areas/international-designations/european-sites/special-areas-conservation-sacs	2020	NatureScot
National Biodiversity Network (NBN) Atlas	https://nbnatlas.org/	2015	NBN

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
Seal density estimates	Seal species worst case scenario density estimates.	2014	Royal HaskoningDHV
Orkney Biodiversity Records Centre	https://orkneylibrary.org.uk/orkney-wildlife-information-and-records-centre/	Ongoing	Orkney Wildlife Information & Records Centre
National Biodiversity Network (NBN) Atlas	https://nbnatlas.org/	2015	National Biodiversity Network
Marine Mammal Observations	Information from the MeyGen marine mammal surveys	Ongoing	MeyGen
Joint Cetacean Data Programme (JCDP) data portal	https://www.ices.dk/data/data-portals/Pages/Cetaceans.aspx	Ongoing	Joint Nature Conservation Committee (JNCC)
Basking sharks in the northeast Atlantic: spatio-temporal trends from sightings in UK waters	https://doi.org/10.3354/meps09737	2012	Witt *et al.*

8.3.3 Baseline

8.3.3.1 Protection and protected sites

8.3.3.1.1 Protection

Marine mammal and turtle species in the waters surrounding the Project are protected by national and international legislation. All relevant legislation, policies and plans will be taken into consideration when undertaking the EIA.

All species of cetacean (whale, dolphin and porpoise), otter *Lutra lutra* and marine turtles which are listed in Annex IV(a) of the Habitats Directive are European Protected Species (EPS)[7]. EPS are provided protection, as directed by Article 12 of the Habitats Directive. This protection is afforded in Scottish territorial waters (out to 12 nm) under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). Regulation 39(1) of these Regulations make it an offence to:

a. Deliberately or recklessly capture, injure or kill a wild animal of an EPS;
b. Deliberately or recklessly:
    i. Harass a wild animal or group of wild animals of an EPS;

[7] *https://www.legislation.gov.uk/uksi/2017/1012/schedule/2/made*

ii. Disturb such an animal while it is occupying a structure or place which it uses for shelter or protection;
iii. Disturb such an animal while it is rearing or otherwise caring for its young;
iv. Obstruct access to a breeding site or resting place of such an animal, or otherwise to deny the animal use of the breeding site or resting place;
v. Disturb such an animal in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which it belongs;
vi. Disturb such an animal in a manner that is, or in circumstances which are, likely to impair its ability to survive, breed, or reproduce, or rear or otherwise care for its young; and
vii. Disturb such an animal while it is migrating or hibernating.

Further protection is afforded through an additional disturbance offence given under Regulation 39(2) which states that "*it is an offence to deliberately or recklessly disturb any dolphin, porpoise or whale (cetacean)*".

Grey seal *Halichoerus grypus* and harbour seal *Phoca vitulina* are also protected under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland). Although both species are Annex II species, they are not listed on Annex IV of the Habitats Directive, and as such are not classified as EPS. Both species are listed under Annex II of the EU Habitats Directive and are considered to be Priority Marine Features (PMFs) in Scotland. Both grey and harbour seals are also afforded protection under the Marine (Scotland) Act 2010, which makes it an offence to kill, injure or take a seal, other than under licence or to alleviate suffering. The Protection of Seals (Designation of Haul-Out Sites) (Scotland) Order 2014 also applies, which makes it an offence to intentionally or recklessly harass seals at designated haul-out sites.

8.3.3.1.2 Protected sites

Special Areas of Conservation (SAC) are designated under Regulation 33(2) of the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland). Article 4 of the Habitats Directive sets out the provisions for the selection of SACs for Annex I habitats and Annex II species. Key to the designation of SACs is Article 4(1), the relevant part of which states: "*...for aquatic species which range over wide areas, such sites will be proposed only where there is a clearly identifiable area representing the physical and biological factors essential to their life and reproduction*".

SACs for marine mammals in the Orkney Islands are:

- Faray and Holm of Faray SAC (1.9 km by sea), for grey seal; and
- Sanday SAC (13.7 km by sea), for harbour seal.

These SACs are designated to protect key breeding colonies of seals.

There are no designated sites for cetaceans in the vicinity of the Westray Project. The closest site where cetaceans are a qualifying feature is the Moray Firth SAC (c. 150 km from the Westray Project area by sea) where bottlenose dolphin are a qualifying feature. However, despite photo identification studies, there is no evidence that the Moray Firth bottlenose dolphins use Westray Firth.

The Inner Hebrides and Minches SAC, designated for harbour porpoise, lies c. 190 km from the Westray project area by sea. There is no evidence that Inner Hebrides and Minches harbour porpoises occur in Westray Firth, and the site lies within a different MU.

The North-east Lewis NCMPA, designated for Risso's dolphin *Grampus griseus*, lies c. 200 km from the Westray Project area by sea.

Otters are present as a qualifying feature but not primary reason for designation of the Loch of Isbister SAC on the west of mainland Orkney.

Seal haul-out sites are coastal locations that seals use to breed, moult and rest. Almost 200 seal haul-out sites have been designated through The Protection of Seals (Designation of Haul-Out Sites) (Scotland) Order 2014 which was amended with additional sites in 2017. These haul-out sites are protected under Section 117 of the Marine (Scotland) Act 2010. The Act is designed to assist in protecting the seals when they are at their most vulnerable, and as such provide additional protection from intentional or reckless harassment. Seal haul-out sites in and around Orkney Islands are presented in Figure 8-4.

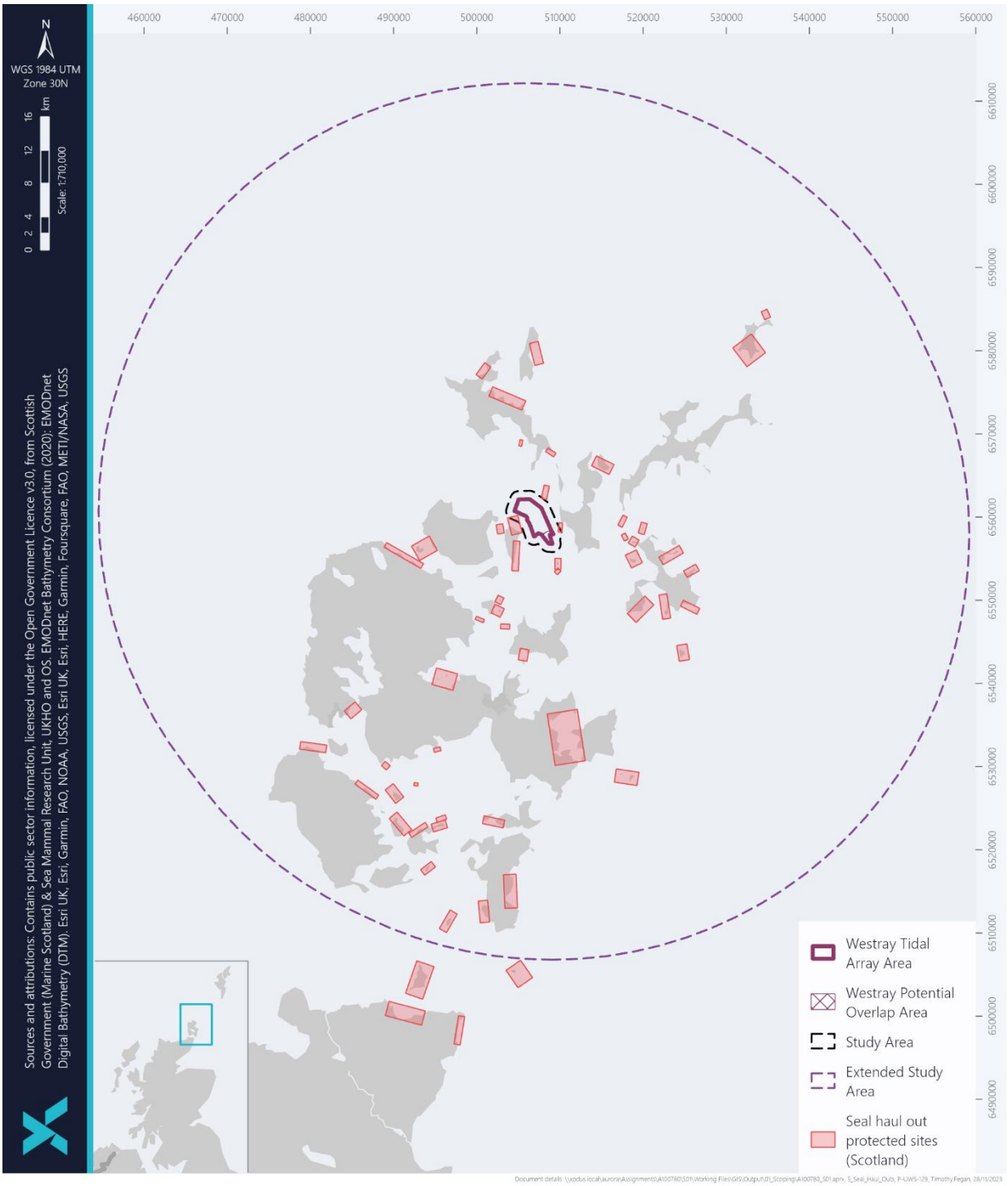

Figure 8-4 Seal haul-out sites within Project Study Area

As any potential effects due to the project activities will be limited to haul-out sites only in the close proximity to the Project the following seal haul-out sites in and around the Westray Firth will be considered in the EIA:

- Skerry of Wastbist;
- S Westray;
- Rusk Holm;
- Seal Skerry (Eday);
- Egilsay North;
- SE Egilsay;
- Muckle Green Holm;
- Little Green Holm; and
- Holm of Scockness.

8.3.3.2 Marine mammal key species

The 2012 – 2014 site-specific boat-based MMO, ESAS visual surveys (see Section 6.2.1) recorded the following species:

- Grey seal;
- Harbour seal; and
- Harbour porpoise *Phocoena phocoena*.

Grey seal were the most frequently sighted species, and harbour seal were also observed. Only three harbour porpoise sightings were made. A density estimate of 0.09 (CV = 24.79%) and abundance estimate of 8 (95% CI = 5-14) was established for grey seal. (Royal HaskoningDHV, 2014)

During the 2012 – 2014 MMO and ESAS survey, Passive Acoustic Monitoring (PAM) was also employed, where animals presence was recorded both visually and with the means of PAM. The PAM detection rates were similar to those of the visual survey, providing support for the low densities and limited species indicated by the visual survey. In addition, one white-beaked dolphin *Lagenorhynchus albirostris* were detected. (Wittich & Gordon, 2013).

A desk-based review (including SCOS, 2021; Carter *et al.*, 2020; Hammond *et al.*, 2021; Gilles *et al.*, 2023, Waggitt *et al.*, 2019; 2020 and Hague *et al.*, 2020) indicates that the following marine mammal species are likely to occur in the general vicinity of the Project Study Area and will therefore be considered further in the EIA:

- Grey seal;
- Harbour seal;
- Harbour porpoise;
- White-beaked dolphin;
- Risso's dolphin *Grampus griseus;*
- Killer whale *Orcinus orca*; and
- Minke whale *Balaenoptera acutorostrata*.

Killer whales, although recorded in low numbers in both SCANS III and IV surveys are occasionally reported around Orkney Islands (NBN Atlas, 2023). Species such as Atlantic white-sided dolphin *Lagenorhynchus acutus* and long-finned pilot whale *Globicephala melas* are typically sighted offshore and have therefore been scoped out of the EIA. A number of other species have been observed in Orkney waters but are considered to be rare or unlikely to be present in and around the Westray Project area, including bottlenose dolphin *Tursiops truncatus*, short-beaked common dolphin *Delphinus delphis*, fin whale *Balaenoptera physalus*, humpback whale *Megaptera novaeangliae*, sperm whale *Physeter macrocephalus*, Sowerby's beaked whale *Mesoplodon bidens*, Cuvier's beaked whale *Ziphius cavirostris* and northern bottlenose whale *Hyperoodon ampullatus*, therefore these species have also been scoped out of further assessment in the EIA.

The marine mammal species list will be reviewed as the EIA progresses and therefore some species maybe scoped back in if there is evidence to indicate the potential to be impacted by the Project based on the ongoing marine wildlife survey across the Project area and the adjacent EMEC Fall of Warness tidal demonstration site (section 6.2.1).

8.3.3.3 Eurasian otter

The Eurasian otter is a semi-aquatic mammal, which is common around the freshwater and coastal areas of Scotland. UK populations are nationally and internationally important, especially since their decline across much of their western European range. The Eurasian otter is a PMF and EPS.

NBN Gateway [8] shows a small number of confirmed records of otter within the Westray Firth. EMEC wildlife observations collected at the EMEC Fall of Warness site over the period of April 2013 to March 2014 recorded a total of 16 otter sightings (EMEC, 2022). Taking above into consideration Eurasian otters have been scoped in for further assessment in the EIA.

8.3.3.4 Marine turtles

Leatherback turtles *Dermochelys coriacea* have been recorded either swimming at sea, entangled in rope or stranded on the shores of Orkney. There are unconfirmed records leatherback turtles around Orkney on NBN Gateway[8]. The NBN Gateway also has a few records of loggerhead turtle *Caretta caretta* and green turtle *Chelonia mydas*. However, marine turtles are typically considered to be rare and occasional visitors, therefore any interaction of marine turtles with the proposed Project is considered unlikely. Therefore, marine turtles have been scoped out of further assessment in the EIA.

8.3.3.5 Basking sharks

Basking sharks are one of the only three species of shark which filter feed and are the second largest fish in the world (Sims, 2008). This species can be found throughout the offshore waters in the UK continental shelf (Sims, 2008) and are considered frequent visitors to the west coast of Scotland (HWDT, 2018; Witt et al., 2012). Basking sharks seasonally arrive in Scottish waters during spring and leave in autumn. They appear to aggregate in summer to breed, with peak sighting densities in the west coast of Scotland occurring in August (Witt et al., 2012). Although Orkney Islands are not a hotspot for this species over the years occasional sightings of basking sharks were

[8] *http://data.nbn.org.uk/*

recorded (Witt *et al.*, 2012, Drewery, 2012, NBN, 2023). Based on above basking sharks have been scoped in for further assessment in the EIA.

8.3.4 Potential impacts

Scoping of likely significant effects on marine mammals and otters is provided in Table 8-10 and for basking sharks in Table 8-11.

Table 8-10: Summary of potential impacts for marine mammals and otters

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Disturbance and barrier effects on marine mammals from underwater sound, including (but not limited to): Potential drilling of tidal devices anchors; Cable laying and other construction or maintenance activities; Vessels (underwater sound); and Operational turbines.	All	Yes	Cetaceans can be sensitive to sound and vibration from foundation installation activities, such as drilling. Importance will depend on species hearing sensitivity, sound type and source levels, sound propagation, frequency and duration – further assessment required. Even where presence is occasional a licence to disturb EPS may be required.
Disturbance at seal haul-out sites, including vessel movements to and from the site and port	All	Yes	Dependent on activity, sound levels and distance from seal haul-out sites – further assessment required
Marine mammal collision risk with vessels	All	No	Marine mammals are likely to be able to detect and avoid vessels, and ship strikes are not likely to occur.
Marine mammal collision risk with operational devices	Operation	Yes	Further assessment required into the potential collision risk for key marine mammal species.
Barrier effects to marine mammals from physical presence of devices	Operation	Yes	Dependent on information on species and behaviour in the vicinity of development, also types, location in water column and spacing of devices – further assessment required
Entanglement with mooring lines and ghost nets	Operation	Yes	Mooring lines and electrical export cables will typically be under tension (due to the weighted chain component of each mooring line) thus the risk of entanglement to marine mammals in the mooring lines itself is highly unlikely, although there is a possibility of entanglement on ghost fishing nets

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
			caught on the mooring lines. Further assessment is needed.
EMF effects	Operation	No	No study has indicated that EMF from marine renewable energy projects would be likely to have an important impact upon marine mammals. Based upon the low likelihood of any ecological effects of EMF on marine mammals, this potential impact has been scoped out of the EIA.
Indirect impacts on marine mammals due to changes in prey availability (based on fish and shellfish ecology assessment, Section 8.2)	All	Yes	The potential for changes to prey availability (as an output from the fish and shellfish chapter) will be used to evaluate for the potential onward impact to marine mammal populations.
Changes in water quality, including (based on marine water and sediment quality assessment, Section 7.2)	All	No	Changes in water quality are scoped out (Section 7.2)
Disturbance/ displacement of otters due to underwater noise	All	No	Sightings of otter in the area are relatively sporadic and the Westray Project area will occupy a small spatial area, approximately 2 km from the shore, which is not likely to be an important foraging area for otters. Additionally, hearing sensitivity in this species is greatly reduced compared to marine mammals (e.g. dolphins, whales and seals). Whilst in-water hearing by European otters is not yet fully understood, studies on the hearing ability of another semi-aquatic carnivore, the sea otter (Enhydra lutris), have shown that hearing levels peak at high frequencies around 8 kHz (NMFS, 2018; Ghoul and Reichmuth, 2014; Au *et al.*, 2000). Evidence also suggests that sea otters, which are likely to have adapted better in-water hearing than European otters which spend 4.5 times more time on land (Nolet and Kruuk, 1989), are poorly equipped at separating acoustic signals from background noise if frequencies are below 2 kHz (Ghoul and Reichmuth, 2014). As project activities will emit sound mostly at low frequencies which are likely to be inaudible to European otters, it is unlikely that these activities will cause a disturbance to otters.
Habitat loss/damage to otters	All	No	Damage to or loss of subtidal foraging habitat by device foundation or cable/infrastructure installation and deployment is unlikely to result in a significant loss of important marine habitat for a predominantly

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
			terrestrial species as the Westray Project area will occupy a small spatial area, approximately 2 km from the shore.
Cumulative impacts on marine mammals in line with the scoped in Project alone impacts.	All	Yes	Cumulative impacts with EMEC Falls of Warness will be assessed in the EIA.

Table 8-11 Summary of potential impacts for basking sharks

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Disturbance due to underwater sound, including (but not limited to): **Potential drilling of tidal devices anchors;** **Cable laying and other construction or maintenance activities;** **Vessels (underwater sound); and** **Operational turbines.**	All	No	Although basking sharks may be able to detect acoustic energy from foundation installation activities, such as drilling, they are not considered to be sensitive to underwater sound. Underwater sound impacts will not be scoped in for basking sharks.
Basking shark collision risk with vessels	All	Yes	Importance will depend on the number of vessels involved during installation and maintenance, collision risk for basking sharks should be considered and further assessment is needed.
Basking shark collision risk with operational devices	Operation	Yes	Potential for impact is poorly understood, but importance may depend upon turbine location and spacing (including water depth), the physical and rotational characteristics of turbines, and the likelihood and fidelity of basking sharks occurring. Even where presence is occasional a licence to disturb basking shark may be required.
Barrier effects from physical presence of devices	Operation	No	Importance will depend upon the spatial occupancy of the channel by tidal devices (in three dimensions), physical characteristics of the devices, the importance of the vicinity for passage of basking sharks and the likelihood of disturbance from operational noise of turbines. Considering the location of the site there is not expected to be any barrier effect. Any effect would

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
			be limited to a short diversion around the site, if it was perceived as a block.
Entanglement with mooring lines and ghost nets	Operation	Yes	Mooring lines and electrical export cables will typically be under tension (due to the weighted chain component of each mooring line) thus the risk of entanglement to basking sharks in the mooring lines itself is highly unlikely, although there is a possibility of entanglement on ghost fishing nets caught on the mooring lines. Further assessment is needed.
EMF effects	Operation	No	Understanding of EMF and animal responses is limited and merits revisiting in the future. While elasmobranch species are typically more sensitive to the electric component of EMF than other fish species, information to date suggests that in water the fields dissipate rapidly. As basking sharks swim in relatively deep water and are unlikely to spend much time close to the seabed at sites with high tidal flows, the likelihood of regular or prolonged exposure to high EMFs is very low.
Changes in water quality, including (based on marine water and sediment quality assessment, Section 7.2)	All	No	Changes in water quality are scoped out (Section 7.2)
Cumulative impacts on basking sharks in line with the scoped in Project alone impacts.	All	Yes	Cumulative impacts with EMEC Falls of Warness will be assessed in the EIA.

8.3.5 Impact assessment strategy

It is proposed that the impact assessment strategy as outlined in Table 8-12 will be applied to address the likely significant effects identified for marine mammals, otters and basking sharks in relation to the scoped in impacts as introduced in Table 8-10 and Table 8-11:

Table 8-12: Proposed impact assessment strategy for marine mammals and megafauna

POTENTIAL IMPACT	ASSESSMENT TOPICS	ASSESSMENT METHOD
Underwater sound	Acoustic signatures of drilling and other construction activities through desk review and sound propagation modelling as appropriate.	Quantitative assessment Number of marine mammals that could be impacted and the types of impacts experienced will be determined based on the maximum predicted impact ranges and species density estimates. The number of marine mammals impacted, and the consequences of those impacts, will be considered in the context of the relevant MU to determine the potential for any population effects. Assessments will take into account whether the impact is permanent or temporary, duration of the sound source and sensitivity of marine mammal species.
Barrier effects from underwater sound	Maximum potential area and duration will be determined for all sound sources that could be active at the same time during construction, operation and maintenance, and decommissioning.	Quantitative assessment (if possible) Number of marine mammals that could be impacted, and the consequences of those impacts, will be determined based on the maximum predicted impact ranges and species density estimates. The number of marine mammals impacted will be considered in the context of the relevant MU to determine the potential for any population effects. Assessments will take into account, where possible, species movements in the area (if relevant information is available) and sensitivity of marine mammal species to underwater sound. Qualitative assessment Based on likelihood for any significant prolonged disturbance, restrictions to movements and any implications for marine mammal populations.
Disturbance at seal haul-out sites	Increased activity (e.g. vessel movements, construction activity) in close proximity to seal haul-out sites, including landfall location and vessels, could have the potential to disturb seals, particularly during sensitive periods, such as the breeding season and moult period. Assessment will be based on distances from haul-out sites and potential impact ranges of activities, including landfall location, vessel movements to and from the site and port.	Quantitative assessment (if possible) Number of seals that could be impacted, based on latest counts for seal haul-out sites (if available). Qualitative assessment Based on likelihood for any significant prolonged disturbance that could disturb seals at haul-out sites and any implication for breeding, pupping, moulting and other sensitive periods. Assessments will take into account the duration of disturbance and sensitivity of seal species at haul-out sites.
Collision risk with operational devices	Collision Risk Modelling (CRM) and Encounter Risk Modelling (ERM) will be undertaken based on the latest information and guidance (SNH, 2016). The modelling will use a precautionary approach to define a realistic scenario for the tidal device parameters to estimate the potential risk to	Quantitative assessment Number of marine mammals that could be at risk will be determined based on a realistic worst-case scenario collision risk modelling. The number of marine mammals will be put into the context of the relevant MU, and where appropriate,

POTENTIAL IMPACT	ASSESSMENT TOPICS	ASSESSMENT METHOD
	marine mammals, with and without mitigation and monitoring. Assessments will take into account the latest Potential Biological Removal (PBR) values for grey and harbour seal, and relevant MU populations for other marine mammal species. Consideration of Potential Biological Removal (PBR) limits for relevant species will be made, and population modelling, such as the use of the interim Population Consequences of Disturbance (iPCoD) model, will also be considered, if risk could be significant.	PBR limits, to determine the potential for any population effects. Assessments will take into account the physical parameters of the tidal devices and parameters for the marine mammal species that could be at risk (with and without mitigation and monitoring).
Barrier effects from physical presence of devices	The presence of the tidal devices and infrastructure could have the potential to create a physical barrier, preventing movement or migration of marine mammals between important feeding and / or breeding areas, or potentially increasing swimming distances if marine mammals circumvent the site. Desk-based review will be conducted to determine the potential impacts for marine mammals.	Qualitative assessment Based on likelihood for any barrier effect and any implication for marine mammal populations. Assessments will take into account the spacing between devices (including any moorings), information on the movement of marine mammals within tidal arrays, based on other tidal array sites (including MeyGen, e.g., Onoufriou *et al.*, 2021) duration of disturbance and sensitivity of seal species at haul-out sites.
Indirect impacts to marine mammals due to changes in prey availability	Maximum potential area and duration will be determined for all prey impacts.	Quantitative assessment The scale of potential impact will be determined based on the number of marine mammals in the maximum potential impact area for any changes in prey availability. The number of marine mammals will be put into the context of the relevant MU to determine the potential for any population effects. Assessments will take into account any permanent or temporary impacts, the extent and duration of any impacts, as well as the sensitivity of marine mammal species to changes in prey availability, including range of prey species and foraging ranges.
Cumulative impacts	Assessment of cumulative effects based on the scoped in impacts.	As the EMEC Fall of Warness tidal demonstration site is adjacent to the Project, a cumulative assessment will be completed with respect to information and judgement as applied to the Project alone assessment.

8.4 Ornithology

The Orkney Islands are important for birds, with a diverse range of habitats and food sources that allow a variety of species to utilise the islands and surrounding waters. These include a mix of resident and migratory species.

Many of the migratory species come to the Orkney Islands in the spring and summer to breed whilst others are winter visitors from more northerly breeding. For the purposes of this report the term 'seabird' is used in its widest sense to refer to all bird species that use the marine environment including those that are generally termed 'true' seabirds (e.g., shearwater, petrel, auk, gannet, cormorant, gull, skua and tern species) together with diver, grebe and seaduck species.

The Project is located approximately centrally in Westray Firth, a relatively restricted area bounded by the islands of Westray, Rousay, Egilsay, and Eday (Figure 7-2). Therefore, the term 'Westray Firth' is used here to refer in a general sense to the area of relevance to the project for baseline ornithological characterisation.

An important characteristic of the biology of seabirds that is relevant to scoping is their propensity for high mobility. Although the pattern and scale of mobility varies greatly between species, and seasonally, all seabird species are mobile to some extent. Colonial breeding seabirds often show very high mobility, for example it is not unusual for some species to forage more than 100 km from their breeding colony.

Another characteristic of the true seabirds that is relevant to scoping is their strong tendency to breed in large colonies. The Orkney Islands have international importance for colonial breeding seabirds, supporting some of the largest colonies in NW Europe. Many of these Orkney seabird colonies are part of the UK's network of designated nature conservation sites, in particular Special Protection Areas (SPAs).

A large body of evidence identifies climate change as a major driver of seabird population demographics (Daunt *et al.*, 2017; Daunt and Mitchell, 2013; Mitchell *et al.*, 2020). Anthropogenic climate change has exposed marine and coastal ecosystems to conditions that are unprecedented over millennia, with significant impacts on marine wildlife including seabirds (IPCC, 2022). In the UK, and particularly in the northern North Sea, seabird populations are generally undergoing substantial declines, which have been occurring for at least two decades (Grandgeorge *et al.*, 2008; JNCC, 2020; Mitchell *et al.*, 2020). Whilst there are exceptions (for instance gannet), the wider population trend is negative. This is reflected in the fact that according to the UK Marine Strategy, UK breeding seabirds have not achieved good environmental status (DEFRA, 2019). Since 2021, Highly Pathogenic Avian Influenza (HPAI) has caused widespread mortality of several seabird species in the UK and is an additional negative pressure on populations. In particular gannet, great skua and some gulls and tern species, have been seriously impacted (Pearce-Higgins *et al.*, 2023).

8.4.1 Study area

The ornithology study area encompasses the proposed Project area and a 50 km buffer zone around the Project (Figure 8-4).

8.4.2 Key data sources

Following a review of existing bird survey information and consultation with NatureScot (Table 1-1), the baseline characterisation of ornithology interests is based on a combination of existing data from various sources and newly commissioned site-specific work. Therefore, a number of key data sources that have informed the baseline characterisation for this Scoping Assessment and will also support the EIA are outlined in the following sections.

8.4.2.1 Existing site-specific data

Existing site-specific datasets which have been used to inform this Scoping Report and that are proposed to inform the baseline characterisation for the EIA is as follows:

- 2012 – 2014 European Seabirds At Sea (ESAS) survey for birds and marine mammals across the previous Westray AfL and EMEC Fall of Warness tidal test site, commissioned by Scottish and Southern Energy Renewables (SSER) (NRP, 2012; Jackson and Hulka, 2013a and 2013b; Harding, 2015) and described further in section 8.4.3.1.2; and
- Ongoing seabird and mammal surveys across Westray Firth, which commenced in April 2023 (described further in section 8.4.2.2 below).

8.4.2.2 New baseline survey of Westray Firth

Orbital Marine Power Ltd and EMEC Ltd have jointly commissioned new boat-based survey work that aims to collect up-to-date information on the seasonal distribution and behaviour of seabirds and marine mammals across a defined survey area centred on their respective sites in in Westray Firth (as introduced in section 6.2.1). The survey is designed to collect baseline site-specific information required to inform the impact assessments for the project and EMEC's Fall of Warness tidal demonstration site. NatureScot have been consulted over the survey design and methods. A summary of the survey programme is provided below.

The survey campaign commenced in April 2023 and is proposed to last for one year, during which it is intended to make 12 visits at approximately monthly intervals. The survey builds on the lessons learnt from the previous boat-based survey of Westray Firth commissioned by SSER and undertaken between 2012 and 2014 (NRP, 2012). The survey programme includes three main activities:

- Visual transect surveys of seabirds and marine mammals using the European Seabirds at Sea (ESAS) survey method (Camphuysen, 2014);
- Focal watches of selected diving seabird species; and
- Passive Acoustic Monitoring (PAM) survey, undertaken simultaneously to ESAS (see Chapter 8.3: Marine mammals and turtles).

The ESAS survey design consists of 19 parallel transect lines 0.5 km apart covering a survey area consisting of the Westray Project area, the EMEC Fall of Warness tidal demonstration site and a buffer surrounding the two sites of up to 2 km. The survey is conducted from a 22 m survey vessel that gives surveyors an eye height of around 5 m. A team of surveyors records birds (and marine mammals) using the standard ESAS method, recording data on bespoke forms using standard codes. Ordinarily the survey vessel motors along transect lines at approximately 9 knots and the lines are surveyed in alternate order (i.e. odd numbers followed by even numbers). ESAS survey work is restricted to suitable conditions, in particular there needs to be relatively calm conditions (sea state 4 or less) and good visibility. The ESAS data is suitable for statistical analysis (e.g. distance analysis and surface density modelling) are intended to provide new estimates of seasonal density and investigate how density changes with tide state.

For the selected species, the focal watches aim to determine the proportion of birds present that are actively diving, and thus enable robust estimates of the proportion of time spent underwater to be calculated. This is

required to estimate underwater density, a parameter used in models to calculate collision risk and encounter rate. The focal watch surveys are undertaken as a separate exercise to ESAS/PAM and involve watching individual birds for a fixed period of two minutes during and noting whether the select bird dives. The focal watches are only undertaken in parts of the study area where tidal turbines are anticipated to be deployed. The target species are common guillemot, razorbill, puffin, black guillemot, European shag, red-throated diver and great northern diver. The PAM survey uses a towed hydrophone to systematically detect vocalisations of cetacean species and is being undertaken opportunistically, taking advantage of the ESAS boat charter. The PAM results are not relevant to the characterisation of ornithological baseline conditions.

8.4.2.3 Secondary data sources

An important data source informing the Scoping Assessment for this receptor topic is the Scoping Opinion received for the adjacent EMEC Fall of Warness tidal demonstration site (MD-LOT, 2022). Further publicly available datasets and literature with relevant coverage of the Project, which have also been applied are outlined in Table 8-13: Summary of key sources of ornithology information for assessment.

Table 8-13: Summary of key sources of ornithology information for assessment

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
Seabird foraging ranges			
Seabird foraging ranges	Published reviews summarising breeding seabird foraging ranges in the UK	2019	Woodward *et al.*
Seabird tracking studies	BirdLife International Seabird Tracking Database	Ongoing	BirdLife International
Orkney bird tagging studies	Orkney tagging data sets	Ongoing	RSPB
Seabird distribution at sea (Published reports summarising the at-sea distribution and utilisation of marine habitats by seabirds in Scottish waters)			
Distribution maps of cetacean and seabird populations in the North-East Atlantic	https://doi.org/10.1111/1365-2664.13525	2020	Waggit *et al.*,
Combining habitat modelling and hotspot analysis to reveal the location of high density seabird areas across the UK	https://www.rspb.org.uk/globalassets/downloads/documents/conservation-science/cleasby_owen_wilson_bolton_2018.pdf	2018	Cleasby *et al.*,
Breeding density, fine-scale tracking, and large-scale modelling reveal the regional distribution of four seabird species	https://doi.org/10.1002/eap.1591	2017	Wakefield *et al.*,
An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs	https://hub.jncc.gov.uk/assets/7db38547-5074-4136-8973-fd7d97666120#:~:text=This%20report%20describes%20an%20analysis,over%20more%20than%2030%20years.	2010	Kober *et al.*,

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
Seabird receptor population size estimates, trends and conservation status			
JNCC Seabird Monitoring Programme database	https://app.bto.org/seabirds/public/index.jsp	Ongoing	JNCC
Seabirds Count – the fourth Breeding Seabird Census	*Seabirds Count: A census of breeding seabirds in Britain and Ireland (2015–2021)*' Summary of the recently completed national census of seabird colonies (https://jncc.gov.uk/our-work/seabirds-count/)	2023	Burnell *et al.*,
Seabird 2000 (1998 to 2002)	*Seabird populations in Britain and Ireland: results of the Seabird 2000 census (1998-2002)*'. Summary of the Seabird 2000 national census of seabird colonies (https://hub.jncc.gov.uk/assets/1dae7357-350c-483f-b14d-7513254433a5)	2004	Mitchell *et al.*,
Non-breeding season populations of seabirds in UK waters	https://publications.naturalengland.org.uk/publication/6427568802627584	2015	Furness
Birds of Conservation Concern 5	https://www.bto.org/sites/default/files/publications/bocc-5-a5-4pp-single-pages.pdf	2021	Stanbury *et al.*,
Seabird species susceptibility to potential effects from tidal stream developments			
Assessing the sensitivity of seabird populations to adverse effects from tidal stream turbines and wave energy devices	https://doi.org/10.1093/icesjms/fss131	2012	Furness *et al.*,
Birds and wave and tidal stream energy: an ecological review	https://bou.org.uk/wp-content/uploads/2020/06/2012-Marine-Renewables-mccluskie-et-al.pdf	2013	McCluskie *et al.*,
Assessing vulnerability of marine bird populations to offshore wind farms	http://dx.doi.org/10.1016/j.jenvman.2013.01.025	2013	Furness *et al.*,
Vulnerability of Scottish Seabirds to Offshore Wind Turbines	https://www.gov.scot/binaries/content/documents/govscot/publications/impact-assessment/2012/09/vulnerability-scottish-seabirds-offshore-wind/documents/00401641-pdf/00401641-pdf/govscot%3Adocument/00401641.pdf	2012	Furness and Wade,
Scaling possible adverse effects of marine wind farms on seabirds: developing and applying a vulnerability index	https://doi.org/10.1111/j.0021-8901.2004.00918.x	2004	Garthe and Huppop,
Short-term Behavioural Responses of Wintering Waterbirds to Marine Activity: Quantifying the Sensitivity of Waterbird Species during the Non-Breeding Season to Marine Activities in Orkney and the Western Isles	https://data.marine.gov.scot/dataset/short-term-behavioural-responses-wintering-waterbirds-marine-activity-quantifying	2018	Jarrett *et al.*,

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
Seaweed hand-harvesting: literature review of disturbance distances and vulnerabilities of marine and coastal birds	https://www.nature.scot/sites/default/files/2019-04/Publication%202019%20-%20SNH%20Research%20Report%201096%20-%20Seaweed%20hand-harvesting%20-%20literature%20review%20of%20disturbance%20distances%20and%20vulnerabilities%20of%20marine%20and%20coastal%20birds.pdf	2019	Goodship and Furness,
Analysis of the possible displacement of bird and marine mammal species related to the installation and operation of marine energy conversion systems	https://www.nature.scot/sites/default/files/2017-06/Publication%202017%20-%20SNH%20Commissioned%20Report%20947%20-%20Analysis%20of%20the%20possible%20displacement%20of%20bird%20and%20marine%20mammal%20species%20related%20to%20the%20installation%20and%20operation%20of%20marine%20energy%20conversion%20systems.pdf	2017	Long
Seabird diving behaviour			
Seabird diving behaviour	Published studies on diving behaviour of relevant seabird species using telemetry tags. Too many studies to list individually. A desk review of relevant literature will be conducted to inform parameter value choice for collision/encounter rate modelling studies.		

8.4.3 Baseline

8.4.3.1 Protection and protected sites

8.4.3.1.1 Protection

The national and international legislation relevant to ornithology summarised in Table 8-14. Legislation of relevance to ornithology will be taken into consideration when undertaking the EIA.

Table 8-14. Legislation of relevance to ornithology

LEGISLATION	RELEVANT MEASURES
Birds Directive - Council Directive 2009/147/EC on the Conservation of Wild Birds	This Directive provides a 'General System of Protection' for all species of naturally occurring wild birds in the EU. The most relevant provisions of the Directive are the identification and classification SPAs for rare or vulnerable species listed in Annex I of the Directive and for all regularly occurring migratory species (required by Article 4). It also establishes a general scheme of protection for all wild birds (required by Article 5). The Directive requires national Governments to establish SPAs and to have in place mechanisms to protect and manage them. The SPA protection procedures originally set out in Article 4 of the Birds Directive have been replaced by the Article 6 provisions of the Habitats Directive.
Wildlife and Countryside Act 1981, as amended	The Wildlife and Countryside Act 1981 (as amended) is the principal mechanism for the legislative protection of wildlife in Great Britain. It provides protection for all species

LEGISLATION	RELEVANT MEASURES
	of wild birds and their nests and establishes the system of Sites of Special Scientific Interest (SSSI).
Habitats Regulations'	The Habitats Regulations transpose the Birds Directive and the Habitats Directive into national law in the onshore environment and territorial waters out to 12 nautical miles, operating in conjunction with the Wildlife and Countryside Act 1981. The Habitats Regulations place an obligation on 'competent authorities' to carry out an appropriate assessment of any proposal likely to affect a SPA, to seek advice from NatureScot, and to not approve an application that would have an adverse effect on the integrity of a SPA (except under very tightly constrained conditions).

8.4.3.1.2 Protected sites

This section examines the potential for seabirds using the Project area and its nearby surroundings (i.e. Westray Firth) to have connectivity with designated sites that have ornithological interests.

The high mobility of seabirds means there could be connectivity between Westray Firth and designated sites at some considerable distance away, for example, as determined by seabird mean maximum foraging range metrics of Woodward *et al.*, (2019). The account below focusses on the potential for connectivity with designated sites within 30 km of the Project area (Figure 7-2). However, some breeding seabird species commonly forage further that 30 km from their colony (Woodward *et al.*, 2019), and therefore the account is not a comprehensive examination of the potential for connectivity with all designated sites. For this reason, the information in this section should not be regarded as the equivalent to the screening of sites that forms the first stage of the HRA process. Rather, it is intended to demonstrate that for several of the species provisionally identified as having high or very high importance for the project (see below) there is an expectation of connectivity with nearby SPAs, and for others to SPAs that are further afield.

A HRA screening report will be produced as part of the EIA process. The aim of the HRA screening report will be to identify which designated sites (for ornithology interests these are SPAs and Ramsar Sites) could be potentially affected by the Project. The HRA screening report will present a high-level evaluation aimed at identifying qualifying interests of designated sites for which a Likely Significant Effect (LSE) (as defined by NatureScot guidance) from the Project cannot be ruled out. In the case of breeding seabirds, NatureScot advise that HRA screening is based on a species foraging range metrics as determined from tagging studies (e.g., Woodward *et al.*, 2019); the mean maximum range plus one standard deviation is advised as the appropriate metric for most species (MS-LOT, 2022b).

Eight SPAs with seabird qualifying interests are located within 30 km of the Project area. These are listed below together with the closest distance to the project area (for seabird breeding colonies this distance of the shortest sea route measured from the closest terrestrial part of the SPA) and the qualifying interests.

- North Orkney (marine) SPA, 0 km (Project boundary has minor overlap with SPA):
  - Shag (non-breeding);
  - great northern diver (non-breeding);
  - red-throated diver (breeding, marine foraging grounds);

    - Slavonian grebe (non-breeding); and
    - Velvet scoter (non-breeding).
- Rousay SPA, 2 km to land, 0.4 km to marine extension:
    - Fulmar (breeding);
    - Kittiwake (breeding);
    - Common guillemot (breeding);
    - Arctic skua (breeding); and
    - Arctic tern (breeding).
- West Westray SPA, 8 km:
    - Fulmar (breeding);
    - Kittiwake (breeding);
    - Common guillemot (breeding);
    - Razorbill (breeding);
    - Arctic skua (breeding); and
    - Arctic tern (breeding).
- Calf of Eday SPA, 11 km:
    - Fulmar (breeding);
    - Kittiwake (breeding);
    - Common guillemot (breeding);
    - Cormorant (breeding); and
    - Great black-backed gull (breeding).
- Orkney Mainland Moors SPA, 15 km.
    - Red-throated diver (breeding);
    - Hen harrier (breeding and non-breeding);
    - Short-eared owl (breeding); and
    - Hen-harrier and short-eared owl are terrestrial species that are not relevant to the Project.
- Auskerry SPA, 20 km:
    - European storm-petrel; and
    - Arctic tern (breeding).
- Copinsay SPA, 30 km:
    - Fulmar (breeding);
    - Kittiwake (breeding);
    - Common guillemot (breeding); and
    - Great black-backed gull (breeding).
- Marwick Head SPA, 29 km:
    - Kittiwake (breeding); and
    - Common guillemot (breeding).

Other designated sites of relevance in proximity to Westray Firth, which include ornithological protected species includes:

- Doomy and Whitemaw Hill SSSI, 2 km;
    - Arctic skua (breeding); and
    - Whimbrel *Numenius phaeopus* (terrestrial species, not applicable to the Project).

In the breeding season, a high proportion of the seabirds using Westray Firth are likely to be from one of the nearby SPA seabird breeding colonies listed above, where they may or may not be qualifying interests (e.g., large numbers of gannet now breed at Westray SPA but they are not a qualifying species of this SPA). Other individuals will be from equally close colonies that lack SPA or Ramsar designation (e.g., storm petrels, puffins and terns breeding on Muckle Green Holm).

For seabird species with large foraging ranges, individuals from other breeding seabird colonies located more than 30 km away, many of which are SPA designated, may also use Westray Firth. For example, fulmar, razorbill, common guillemot, puffin, gannet, kittiwake and great skua all sometimes forage up to at least 100 km form their breeding colony (Woodward *et al.*, 2019). Therefore, for these species individuals from breeding colonies located up to at least 100 km away (i.e., colonies distributed across the north of Scotland) could potentially use Westray Firth for foraging. These include the following SPA colonies: Hoy SPA, North Caithness Cliffs SPA, East Caithness Cliffs SPA, and Fair Isle SPA, in addition to the relatively close SPAs listed previously.

The various designated sites where breeding red-throated diver is a qualifying interest merit additional discussion. During the breeding season, The North Orkney (marine) SPA, together with Scapa Flow (marine) SPA, protects the marine feeding grounds of the red-throated divers that breed across much of Orkney (red-throated diver breed on freshwater lochs and forage at sea). This includes the red-throated divers breeding within the Orkney Mainland Moors SPA, where this species is a qualifying interest. Although the Project area lies well beyond the foraging range (approximately 10 km) of the Orkney Mainland Moors SPA red-throated divers, this SPA, together with North Orkney SPA, are relevant to the EIA because of the potential for project vessels using the ports of Kirkwall and Hatson to disturb birds when foraging in in marine areas. Vessels transiting between the Project area and these ports would inevitably pass through the North Orkney (marine) SPA including areas potentially used by Orkney Mainland Moors SPA red-throated divers. Breeding red-throated diver are also a noted feature of Mill Loch Site of Special Scientific Interest (SSSI) on Eday and these birds are likely to forage in Westray Firth.

The North Orkney (marine) SPA encompasses approximately 212 km^2 of inshore marine habitat to the north and east of the Orkney mainland including much of the coast of Shapinsay, Rousay and Egilsay (Figure 7-2), The SPA includes the south-western periphery of the inner parts of Westray Firth, and in places slightly overlaps (by up 250m) the Project area (Figure 7-2). In addition to the breeding red-throated diver qualifying interest already discussed, North Orkney (marine) SPA is designated for three species of non-breeding waterbird: great northern diver, Slavonian grebe and velvet scoter. Due to the very close proximity of the Project area to parts of this SPA (minor overlap in parts), it is assumed there is potential for connectivity In the scoping response to the EMEC Fall of Warness tidal demonstration site, NatureScot advised that features of marine SPAs do not generally have connectivity to developments/activities operating outwith the SPA boundary (MS-LOT, 2022). However they drew attention for the potential for connectivity to arise from the vessels operating between the EMEC Fall of Warness tidal demonstration site and ports of Kirkwall and Hatson because they could pass through marine SPAs with wintering waterfowl interests, in particular North Orkney SPA. On the basis of this NatureScot advice, it is assumed that the Project has no potential for connectivity with Scapa Flow (marine) SPA (this is designated for various species of wintering divers, seaducks and grebes and breeding red-throated diver.

Black guillemot, is not a qualifying interest at any SPA. However this species is a qualifying feature of the Papa Westray Marine Protected Area (MPA), which lies approximately 14 km north of the Project site. Black guillemot has relatively short foraging range (maximum range 8 km, Woodward *et al.*, 2019). Therefore it is unlikely that

there is more than negligible connectivity with this MPA. In the scoping response to the EMEC Fall of Warness tidal demonstration site, NatureScot advised that they would not anticipate activities at the EMEC Fall of Warness demonstration test site to impact on this MPA (MS-LOT, 2022).

It is also relevant to mention here the apparent lack of potential, or only low potential, for connectivity to SPAs where European shag and puffin are qualifying interests. Both these species are provisionally identified as having high relevance to the Project (see Section 8.4.1.4.2 and Table 8.10). European shag has a relatively short foraging range (maximum range 46 km, Woodward *et al.*, 2019). There are no SPAs within the maximum foraging range distance where this species is a qualifying interest. Therefore, in the breeding season, the shags using Westray Firth are not likely to have connectivity with any SPA.

Puffins have a large foraging range sometimes flying over a 100 km from their colony to forage (Woodward *et al.*, 2019). On this basis there is potential for connectivity with several SPAs located more than 50 km away where this species is a qualifying species (e.g., Hoy SPA, North Caithness Cliffs SPA, East Caithness Cliffs SPA, and Fair Isle SPA). However, puffins breed at a number of non-SPA colonies that are far closer to the Project area, including several small colonies within Westray Firth itself. Most notably they breed on the Muckle Green Holm and Little Green Holm, two uninhabited islands approximately 2 km south of the Project area and which are SSSI designated for their nationally important breeding colony of grey seals. Whereas there is theoretical connectivity for puffins to the SPA colonies listed above, it is more likely that the puffins using Westray Firth in the breeding season are from the much closer non-SPA local colonies.

In addition to Mill Loch SSSI already discussed, there is one other SSSI local to the Project area with noted ornithology interests and that is not also designated SPA. This is Doomy and Whitemaw Hill SSSI, approximately 3 km east of the Project area and designated for breeding Arctic skua and whimbrel *Numenius phaeopus* (a terrestrial wader species, not relevant to the Project). This SSSI is protects heath and blanket bog habitat in the interior part of Eday where the two species breed. The Arctic skua from this SSSI are likely to forage in Westray Firth.

8.4.3.2 Existing survey information

In 2012 SSER commissioned Natural Research (Projects) Ltd (NRP) to undertake a two-year programme of baseline boat-based visual surveys of seabirds (and marine mammals) designed to provide appropriate baseline information for the former Westray AfL tidal stream development (NRP, 2012). The survey used the European Seabirds at Sea (ESAS) survey method (Camphuysen, 2004).

The survey design was based on 10 transects covering the original SSER lease site and a buffer of up to 4 km, an area that included the both the Project area and the EMEC Fall of Warness tidal demonstration site. The survey programme commenced in January 2012 and ended in March 2014. During this period a total of 19 visits were achieved. Prolonged periods of poor weather led to some gaps in planned coverage in the autumn and winter months.

Two interim reports summarising the visual observation data on seabirds and marine mammals were produced and shared with SNH and MMS. The first interim report summarised survey work undertaken between January and August 2012 (Jackson and Hulka, 2013a). The second interim report summarised survey work undertaken between September 2012 and February 2013 (Jackson and Hulka, 2013b). No final report was produced as the development

was put on hold in 2014. However, a statistical analysis of the ESAS results was undertaken by Caloo Ecological Services before the project was suspended (Harding, 2015).

8.4.3.2.1 Seabird densities

Summary information on bird species using the former Westray AfL site derived from the 2012-14 ESAS survey data are summarised in Table 8-15. Table 8-15 includes estimates of the average density of each species present during the breeding season and non-breeding period (Harding, 2015). Density estimates are presented for the former Westray AfL, and the former Westray AfL buffered to 2 km. The densities derived by this analysis take into account the potential for distance-related detection bias of birds on the sea. In keeping with the information of greatest relevance for impact assessment, the densities presented for surface diving species (auk, diver, cormorant and seaduck species) are derived from the in-transect records of birds seen on the sea (i.e. birds seen in flight are excluded). For other seabird species (i.e., gulls, terns, and skua species, gannet and fulmar) the density estimates are derived from both in-transect records of birds seen in flight and on the sea.

The Westray Project area is largely within the former Westray AfL (Figure 1-1). The Project area has similar marine environments to the original former Westray AFL site within which it is contained, therefore the seabird densities and patterns of seasonal usage determined for the larger former Westray AfL site (and 2 km buffer) in Table 8-15 are likely to also accurately reflect the situation in the Project area (and buffer).

8.4.3.2.2 Key seabird species

Table 8-15 also includes a provisional indication of the anticipated importance of each seabird species to the Project's EIA and HRA assessments. This provisional indication is based on the densities derived from the 2012-14 ESAS data and species-specific information on the susceptibility to the various potential impacts of the tidal stream developments as reported in published literature (e.g., Furness *et al.*, 2012; McCluskie *et al.*, 2013). The indication of species importance identifies the species that have greatest potential for adverse impacts on receptor populations, and therefore help identify critical information requirements. The preliminary indication of species importance presented in Table 8-15 is also intended to help inform screening as to which species receptors will merit detailed impact assessment in the project's EIA.

Black guillemot is provisionally categorised as a species of high importance on account of the high densities recorded year round and the potential susceptibility to turbine collision (Furness *et al.*, 2012; McCluskie *et al.*, 2013) (Table 8-15).

European shag is also provisionally categorised as a species of high importance on account of the high densities recorded in the breeding season and potential susceptibility to turbine collision strike (Furness *et al.*, 2012; McCluskie *et al.*, 2013) (Table 8-15).

Common guillemot, razorbill and puffin are all provisionally categorised as a species of high importance on account of the high densities recorded in the breeding season (colony attendance months only) and potential susceptibility to turbine collision strike (Furness *et al.*, 2012; McCluskie *et al.*, 2013) (Table 2). The common guillemots and razorbills (but less so the puffins) using Westray Firth are likely to have strong connectivity to one or more of the nearby breeding seabird SPA where these species are qualifying interests (see section 8.4.3.1.2).

Red-throated and great northern diver are also provisionally categorised as species of high importance. Although the densities of these species are likely to be very low, both species have relatively small regional population sizes, are considered to have relatively high susceptibility to both collision and vessel disturbance (Furness *et al.*, 2012; McCluskie *et al.*, 2013; Jarrett *et al.*, 2018).) and potentially have connectivity to SPAs (see section 8.4.3.1.2).

Gannet and cormorant are provisionally categorised as species of medium priority. Although the estimated densities of gannet using Westray Firth are very low (Table 8-15) these species are considered to be at some risk of turbine collision (Furness *et al.*, 2012; McCluskie *et al.*, 2013).

Fulmar and gull, tern, skua, and sea duck species are all provisionally categorised as species of low or very low importance for the project on account either of very low or low densities (Table 8-15) and/or anticipated low vulnerability to potential impacts (Furness *et al.*, 2012; McCluskie et al., 2013; Jarrett *et al.*, 2018). However, seaduck species can be vulnerable to vessel disturbance (Jarrett *et al.*, 2018) and therefore the potential disturbance to seaduck species from project vessels in transit to/from Westray Firth is relevant to impact assessment studies.

Although not recorded in the 2012-2014 ESAS survey, it is relevant to also note here the use of Westray Firth by European storm petrel. This nocturnal species breeds in small numbers on uninhabited islands in Westray Firth and is vulnerable to the effects of lighting and the (inadvertent) introduction of non-native rodent species to breeding islands. For these reasons this species is provisionally categorised as a species of high importance for the project (Table 8-15).

Table 8-15. Average seasonal densities of seabirds in the SSER former Westray AfL, and the former Westray AfL plus a 2 km buffer, derived from ESAS surveys undertaken between January 2012 and March 2014 (Harding, 2015). The provisional indication of the importance of each species to the Project's EIA/HRA assessments is based on combination of a species occurrence and susceptibility to collision with tidal devices and vessel disturbance. Three species that were not recorded in the 2012-14 surveys but that are known to occur locally are also included for completeness.

SPECIES NAME *SCIENTIFIC NAME*	BEHAVIOUR USED TO ESTIMATE DENSITY	TIME OF YEAR	DENSITY (BIRDS/KM^2)		SUSCEPTIBILITY		PROVISIONAL IMPORTANCE TO EIA	COMMENTS
			FORMER WESTRAY AFL ONLY	FORMER WESTRAY AFL PLUS 2 KM BUFFER	COLLISION WITH TIDAL DEVICES[9]	VESSEL DISTURBANCE[10]		
Red-throated diver *Gavia stellata*	On sea only	Breeding	0	0.1	High	Very high	High (year round)	Not recorded in lease site. Very low densities in buffer area in breeding season and winter. Small population size in Orkney. Some potential for SPA connectivity and vulnerable to vessel disturbance, including along vessel transit routes to ports.
		Non-breeding	0	0.1				
Great northern diver *Gavia immer*	On sea only	Breeding	0	0	High	High	High (non-breeding)	Low densities in winter and spring months, absent in summer months Densities similar in lease site and buffer. Potential for SPA connectivity and vulnerable to vessel disturbance, including along vessel transit routes to ports.
		Non-breeding	0.2	0.2				

[9] *Based on Furness et al., (2012), which scored potential for collision risk with tidal devices on a three point ordinal scale interpreted here as High, Moderate and Low.*

[10] *Based on Furness et al., (2012) and Jarrett et al., (2018). Vessel disturbance scoring is based on a five point ordinal scale interpreted here as Very High, High, Moderate, Low and Very low. Where appropriate this is modified by the Jarrett et al.(2018) Orkney study of vessel disturbance of wintering seabirds.*

SPECIES NAME *SCIENTIFIC NAME*	BEHAVIOUR USED TO ESTIMATE DENSITY	TIME OF YEAR	DENSITY (BIRDS/KM^2)		SUSCEPTIBILITY		PROVISIONAL IMPORTANCE TO EIA	COMMENTS
			FORMER WESTRAY AFL ONLY	FORMER WESTRAY AFL PLUS 2 KM BUFFER	COLLISION WITH TIDAL DEVICES[9]	VESSEL DISTURBANCE[10]		
Cormorant ***Phalacrocora x carbo***	On sea only	Breeding	0	0	High	Moderate	Medium (year round)	Not recorded in lease site or 2 km buffer (probably because they favour relatively shallow inshore waters). Cormorants roost and breed elsewhere in Westray Firth and these birds sometimes fly over lease site.
		Non-breeding	0	0				
European shag ***Gulosus aristotelis***	On sea only	Breeding	2.3	5.8	High	Moderate	High (year round)	Breeding season densities high, non-breeding densities moderate. Strong tendency for lower density in lease site *cf* to buffer (likely to be a reflection of water depth) .
		Non-breeding	0.2	2.8				
Common guillemot ***Uria aalge***	On sea only	Colony period	3.7	2.8	High	Moderate	High (colony period)	Moderate densities in colony attendance period, very low densities at other times. Slight tendency for higher density in lease site *cf* to buffer.
		Chicks on sea[11]	0	0				
		Non-breeding	0.2	0.2				
Razorbill ***Alca torda***	On sea only	Colony period	0.6	1.1	High	Moderate	High (colony period)	Moderate densities in colony attendance period, absent at other times. Tendency for lower density in lease site *cf to* buffer.
		Chicks on sea	0	0				

[11] *The 'chicks on sea' period refers to the latter part of these species' breeding season (August and September), this period is when these species have deserted their breeding colony and are rearing their chicks on the sea.*

SPECIES NAME *SCIENTIFIC NAME*	BEHAVIOUR USED TO ESTIMATE DENSITY	TIME OF YEAR	DENSITY (BIRDS/KM^2)		SUSCEPTIBILITY		PROVISIONAL IMPORTANCE TO EIA	COMMENTS
			FORMER WESTRAY AFL ONLY	FORMER WESTRAY AFL PLUS 2 KM BUFFER	COLLISION WITH TIDAL DEVICES[9]	VESSEL DISTURBANCE[10]		
		Non-breeding	0	0				
Black guillemot ***Cepphus grylle***	On sea only	Breeding	13.8	9.1	High	Low	Very high (year round)	Very high densities present year-round in lease site and buffer. Moderate tendency for higher density in lease site *cf* to buffer.
		Non-breeding	9.0	7.2				
Puffin ***Fratercula arctica***	On sea only	Breeding	2.4	3.6	Moderate	Low	High (colony period)	Moderate densities in colony attendance period, very low densities during non-breeding period. Slight tendency for lower density in lease site *cf* to buffer.
		Non-breeding	0.0	0.1				
Fulmar ***Fulmarus glacialis***	On sea & flying	Breeding	1.6	1.8	Low	Very low	Low (year round)	Moderate densities present year-round in lease site and buffer. Declining species with high connectivity to SPA colonies.
		Non-breeding	0.6	1.8				
Gannet ***Morus bassanus***	On sea & flying	Breeding	0	0.6	Low	Low	Medium (year round)	Not recorded in lease site. Low densities in buffer area in breeding season and very low densities in winter. Recent large population decline due to avian flu.
		Non-breeding	0	0.2				
Arctic skua ***Stercorarius parasiticus***	On sea & flying	Breeding	0	0	Low	Very low	Low (breeding)	No recorded at any time in lease site or 2 km buffer, but potentially present as small numbers breed locally
		Non-breeding	0	0				

SPECIES NAME *SCIENTIFIC NAME*	BEHAVIOUR USED TO ESTIMATE DENSITY	TIME OF YEAR	DENSITY (BIRDS/KM^2)		SUSCEPTIBILITY		PROVISIONAL IMPORTANCE TO EIA	COMMENTS
			FORMER WESTRAY AFL ONLY	FORMER WESTRAY AFL PLUS 2 KM BUFFER	COLLISION WITH TIDAL DEVICES[9]	VESSEL DISTURBANCE[10]		
Great skua *Stercorarius skua*	On sea & flying	Breeding	0.05	0.1	Low	Very low	Low (breeding)	Very low densities in lease site and buffer area in breeding season. Absent outside breeding season. Recent large population decline due to avian flu.
		Non-breeding	0	0				
Herring gull *Larus argentatus*	On sea & flying	Breeding	0	0	Low	Low	Very low	Not recorded in lease site. Low densities in buffer area in breeding season and very low densities in winter
		Non-breeding	0	0.3				
Great black-backed gull *Larus marinus*	On sea & flying	Breeding	0.2	0.2	Low	Low	Very low	Low densities present year-round in lease site and buffer
		Non-breeding	0	0.4				
Kittiwake *Rissa tridactyla*	On sea & flying	Breeding	0.5	1.0	Low	Low	Very low	Low densities in breeding season and very low densities during non-breeding period. Tendency for lower density in lease site *cf* buffer.
		Non-breeding	0	0.1				
Arctic tern *Sterna paradisaea*	On sea & flying	Breeding	0.9	1.6	Low	Low	Low (breeding season)	Low densities in lease site and moderate densities in buffer area in breeding season. Absent outside breeding season.
		Non-breeding	0	0				
Common eider *Somateria mollissima*	On sea only	Breeding	0	0.9	Moderate	Moderate	Medium (non-breeding)	Not recorded in lease site. Low densities in buffer area in breeding season. Winters locally in large numbers. Potentially
		Non-breeding	0	0				

SPECIES NAME *SCIENTIFIC NAME*	BEHAVIOUR USED TO ESTIMATE DENSITY	TIME OF YEAR	DENSITY (BIRDS/KM^2)		SUSCEPTIBILITY		PROVISIONAL IMPORTANCE TO EIA	COMMENTS
			FORMER WESTRAY AFL ONLY	FORMER WESTRAY AFL PLUS 2 KM BUFFER	COLLISION WITH TIDAL DEVICES[9]	VESSEL DISTURBANCE[10]		
								susceptible to vessel disturbance along vessel transit route to ports.
Long-tailed duck ***Clangula hyemalis***	On sea only	Breeding	0	0	Moderate	High	Medium (non-breeding)	Not recorded in lease site or buffer area. Winters locally in small numbers. Potentially susceptible to vessel disturbance along vessel transit route to ports.
		Non-breeding	0	0				
Velvet scoter ***Melanitta fusca***	On sea only	Non-breeding	0	0	Moderate	Very high	Medium (non-breeding)	Not recorded in lease site or buffer area. Winters locally in small numbers. Potentially susceptible to vessel disturbance along vessel transit route to ports.
Slavonian grebe ***Podiceps auritus***	On sea only	Non-breeding	0	0	Moderate	Very high	Medium (non-breeding)	Not recorded in lease site or buffer area. Winters locally in small numbers. Potentially susceptible to vessel disturbance along vessel transit route to ports.
European storm petrel ***Hydrobates pelagicus***	At colony	Breeding	Not recorded	Not recorded	Low	Very Low	High (breeding)	Not recorded by 2012-2014 ESAS survey. This nocturnal species breeds in small numbers on islands in Westray Firth and is vulnerable to the effects of

SPECIES NAME *SCIENTIFIC NAME*	BEHAVIOUR USED TO ESTIMATE DENSITY	TIME OF YEAR	DENSITY (BIRDS/KM^2)		SUSCEPTIBILITY		PROVISIONAL IMPORTANCE TO EIA	COMMENTS
			FORMER WESTRAY AFL ONLY	FORMER WESTRAY AFL PLUS 2 KM BUFFER	COLLISION WITH TIDAL DEVICES[9]	VESSEL DISTURBANCE[10]		
								lighting and (inadvertent) introduction of non-native rodent species.

8.4.4 Potential impacts

Based on the baseline characterisation for the Project area, the scoping of likely significant effects on ornithology is provided in Table 8-16:

Table 8-16. Possible impacts on ornithology receptors

IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Disturbance by vessels due to airborne noise and visual disturbance	All	Yes	Vessel activity may result in localised displacement and can temporarily affect birds' time/energy budgets. Vessel activity during construction is expected to be more intense than during the operational phase. The significance of the effect will depend on the importance of the Project area to a receptor population and the strength of any response shown by a species to vessels. Bright vessel work lights have potential to cause disturbance of some nocturnally active bird species, leading to disorientation. Vessel and marker buoy navigation lighting is not likely to be bright enough to cause a disturbance response of concern.
Displacement from marine structures (e.g., floating or surface piercing tidal devices)	All	Yes	The presence of tidal devices may displace birds from feeding and resting areas. Displacement is akin to habitat loss Displacement from the vicinity of turbines could have the side-effect of reducing a species activity in vicinity of turbines and thereby reducing the potential for collision risk.
Attraction to marine structures	All	Yes	Attraction is the opposite of displacement. The tidal stream devices and other installed project infrastructure potentially provide birds new perching and feeding opportunities and thereby may attract some species. This is especially the case for devices that float or have with surface piercing elements. Subsurface infrastructure including device bottom foundations may provide artificial reef habitat and be attractive to fish which are the prey of birds. Attraction in this way is akin to habitat enhancement and therefore is potentially beneficial to birds. Attraction could have a negative side effects if it increased bird activity in the close vicinity of turbines as this could increase collision risk.
Collision risk from underwater turbines	Operation	Yes	The potential for tidal devices to pose a harmful collision risk is only expected to affect diving seabird species, in particular the four auk species, shag, cormorant and diver species. It is known from previous surveys in Westray Firth that moderate to high densities of diving seabird species use the project Lease Area.
Entanglement with moorings	Operation	No	Entanglement of seabirds in mooring lines is highly unlikely. Presence of however ghost fishing gear could pose an

IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
			entanglement risk to seabirds, but no more so than under baseline conditions.
Direct loss of supporting habitat	All	No	The mooring anchors of the (floating) turbines will result in small-scale seabed habitat loss, potentially affecting seabirds that target benthic and demersal prey. This is anticipated to be offset to some extent by the incidental creation of artificial reef habitat that would potentially provide new feeding opportunities. Given the small size of area of potential loss, the high mobility of seabirds, and the high availability locally of alternative foraging habitat, it is considered that the potential impact of loss of supporting habitat would be trivial for all seabird species.
Indirect impacts on birds due to changes in prey availability (based on fish and shellfish ecology assessment, Section 8.2)	All	Yes	Impacts on seabirds due to changes to prey resource will be assessed further based on the results of the fish and shellfish ecology assessment. The creation of artificial reef habitat may lead to localised increases in some prey fish species. Although such increases in prey availability could be positive for birds, it could also be negative if it increased turbine collision risk through attraction.
Changes in water quality (based on marine water and sediment quality assessment, Section 7.2)	All	No	Changes in water quality are scoped out (section 7.2)
Pollution	All	No	Embedded mitigation will ensure compliance with MARPOL regulations.
Cumulative impacts on ornithology inline with the scoped in Project alone impacts.	All	Yes	Cumulative impacts with EMEC Falls of Warness will be assessed in the EIA.

8.4.5 Impact assessment strategy

It is proposed the baseline ornithology interests for the Project area will be defined using the three years worth of available baseline ESAS data (i.e., the previous 2012 - 2014 survey campaign and the new 2023 - 2024 campaign). An initial comparison between the breeding season results from the two survey campaigns shows a high degree of similarity for almost all species, though there are of course some year-to-year differences. The results of the ongoing 2023 – 2024 surveys and the similarity to the previous 2012 – 2014 survey campaign are periodically consulted with NatureScot.

It is proposed that the impact assessment strategy outlined in Table 8-17 is applied to address the likely significant effects scoped into the EIA, as summarised in Table 8-16. The assessment will consider the impact of a potential effect on geographically defined species receptor populations. For HRA assessment the receptor population considered will be the most recent count data for the SPA under consideration. For EIA assessments of breeding seabird receptors, species' Mean Maximum Foraging Range metrics are considered to provide an appropriate basis for defining geographic extent of receptor breeding populations. For EIA assessments of non-breeding seabirds, the receptor populations will be defined according to BDMPS criteria (Furness, 2013) or, for seaduck and grebe species, the Orkney non-breeding population.

Due to the relatively large number of bird species receptors that use the Project area and the number of potential effects identified, the EIA process will include a screening stage to determine which receptor species /effect combinations merit in-depth assessment. In this way in-depth, assessments for a particular effect will be limited to receptors for which an impact of at least minor magnitude is plausible. This screening exercise will be informed by the most up-to-date information available, including the results of 2023/24 baseline ESAS survey and outputs from predictive models.

The CEA as part of the topic chapter will consider the impacts from the Project alongside other marine projects in the Orkney Islands waters. In particular CEA will assess whether impacts determined to be minor in isolation, and therefore deemed not significant under EIA regulations in their own right, could contribute to significant effects cumulatively with other developments. Impacts on receptors that in isolation are negligible will not ordinarily be considered in in CEA, they will only be included in CEA if there is a clear and plausible potential to for the Project impact to materially contribute to the cumulative regional impact. In this way the CEA will retain focus on impacts and receptors of potential importance.

Table 8-17 Impact assessment strategy for ornithology

POTENTIAL IMPACT	ASSESSMENT TOPICS	ASSESSMENT METHOD
Disturbance/ displacement due to airborne noise and visual disturbance	Vessel activity Lighting Infrastructure	Quantify numbers of individuals of vulnerable species predicted to be affected by disturbance sources considering the type, intensity, duration and frequency of anticipated disturbance events. Informed by monitoring results from other projects where possible.
Displacement from marine structures (e.g., floating or surface piercing tidal devices)	Infrastructure	Quantitative assessment based on worst realistic case of loss of foraging/loafing habitat and based on species susceptibility, and the availability of alternative habitat.
Attraction to marine structures	Infrastructure	Qualitative assessment informed by evidence of attraction to marine structures from other projects.

POTENTIAL IMPACT	ASSESSMENT TOPICS	ASSESSMENT METHOD
Collision risk from underwater turbines	Encounter rate/ collision risk modelling. Population viability analysis	Quantitative collision risk modelling (ERM and/or CRM) will be undertaken in accordance with NatureScot guidance (Band, 2016). Evidence from other tidal developments and studies e.g. Sparling *et al.* (2020) Collision Risk for Animals around Turbines will be used in reaching conclusions. If modelling indicates there's potential for a non-trivial collision risk consideration will be given to the value of undertaking Population Viability Analysis (PVA) ((Searle *et al.* , 2019) to better understand the population level impact CRM/ERM will be limited to species for which there is a plausible significant collision risk. These species provisionally identified as most likely to merit such modelling are the four breeding auk species, great northern diver and European shag.
Change in prey availability	Impacts on fish and shellfish	Qualitative assessment based on expert judgement, interpreting the results of the fish and shellfish ecology impact assessments and potential consequences on ornithology receptors.
Cumulative impacts	Assessment of cumulative effects based on the scoped in impacts.	As the EMEC Fall of Warness tidal demonstration site is adjacent to the Project, a cumulative assessment will be completed with respect to information and judgement as applied to the Project alone assessment.

9 HUMAN ENVIRONMENT

9.1 Commercial Fisheries

This section describes the commercial fisheries impacts of relevance to the Westray Project and considers the potential impacts from the deployment and operation of devices. Commercial fisheries are defined for the purpose of this report as activity by licensed fishing vessels undertaken for legitimate capture and sale of finfish and shellfish in the marine environment. Recreational fishing and fishing activities in rivers are not considered within this section; other sea users are considered in Section 9.7.

Issues relating to navigation safety are covered by the Navigational Risk Assessment (NRA) and are not discussed herein.

9.1.1 Study area

The study area for this topic is defined as a 1 km buffer around the Project as this is considered the region within which commercial fisheries could be mostly impacted as a result of the Project. The applied study area is illustrated in Figure 9-1.

9.1.2 Key data sources

The existing data sets and literature with relevant coverage to the Westray Project which have been used to inform this Scoping Report and would inform the baseline characterisation for the EIA as relevant are outlined in Table 9-1.

Table 9-1 Summary of key sources of information for commercial fisheries receptors

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
Project specific survey data, including benthic, geophysical and geotechnical survey reports as available	Various	2022-2023	Various
Vessel Monitoring System (VMS) values by fishing method (average)	https://marine.gov.scot/information/average-intensity-hours-fishing-using-ices-vms-data-sets?order=field_map_type&sort=desc&qt-menu_selection=1	2016-2020[12]	MMO
Fisheries statistics per ICES rectangle	https://www.gov.uk/government/statistics/uk-sea-fisheries-annual-statistics-report-2021	2016-2020	MMO

[12] *The 2021 data has not been considered in here due to differences in data formatting, although it is not expected that this year of data differs from the general annual trends.*

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
Average intensity (hours) of fishing with bottom trawls, dredges, and for *Nephrops* and crustaceans	https://marine.gov.scot/information/average-intensity-hours-fishing-using-ices-vms-data-sets	2009-2016	ICES
National Biodiversity Network (NBN) Atlas	https://nbnatlas.org/	2015	NBN
AIS data of fishing vessel tracks	Various	TBD	N/A
ScotMap – Inshore Fisheries Mapping Project in Scotland	https://data.marine.gov.scot/dataset/scotmap-inshore-fisheries-mapping-scotland-recording-fishermen%E2%80%99s-use-sea	2014	Kafas *et al.*
Marine Scotland Salmon and Sea Trout Fishery Statistics and other associated reports	https://www.gov.scot/publications/salmon-fishery-statistics-2020/	Various	Marine Scotland
Creel Fishing Study	https://www.gov.scot/publications/creel-fishing-effort-study/pages/1/	2017	Marine Scotland
Further commercial fisheries understanding acquired through consultation	Various agencies	Ongoing	Various

9.1.2.1 Data Limitations

Automatic Identification System (AIS) and Vessel Monitoring System (VMS) are legal requirements for vessels over 15 m and 12 m respectively. There are no legal requirements for smaller fishing vessels to use these tracking systems, though a limited number of smaller vessels may have opted in. This results in a large data gap for smaller vessels, which is addressed through consultation with the local fishing industry. Legislation, expected to come into force by the end of 2023, makes it a legal requirement for all vessels registered in England and under 12 m in length to have an inshore vessel monitoring system (I-VMS) installed (UK Government, 2022) and consultation is underway to consider this for Scotland.

9.1.3 Baseline

A desk study and review of existing data is used to characterise the baseline conditions regarding commercial fisheries for the purposes of the EIA and contributes to the understanding as appropriate.

9.1.3.1 Commercial fishing

Landings data shows that the average landings value between 2018 – 2022 from ICES rectangle 47E7 is mainly from pelagic trawlers over 40 m targeting herring. Less than a quarter of the average landings data can be attributed to smaller vessels (< 15 m) targeting lobster and crab with pots and traps. Pots and traps are, however, the 2nd most used gear type within ICES rectangle 47E7, followed by demersal trawlers.

The VMS data shows that the average value of UK vessels between 2017 and 2020 was minimal (between £0 and £100) within and around the Project area for vessels using pelagic and dredge gears. For demersal vessels, the average value on the Project area is also minimal (between £0 and £100), though the area bordering the Project area on the east was of slightly higher average VMS value, between £1,000 and £5,000. Passive gears are the most used gears in the area according to the VMS data, with an average VMS value of between £100 and £500 in the Project area, an average VMS value of between £500 and £1,000 in the area bordering the Project area on the north, an average VMS value of between £1,000 and £5,000 in the area bordering the Project area on the east and an average VMS value of between £10,000 and £50,000 in the area bordering the Project area on the south.

The number of active fishing vessels based in the Orkney Islands was 128 in 2020, of which the majority (93) are 10 m and under, the additional 35 vessels are over 10 m (Orkney Islands Marine Region: State of the Environment Assessment, (2020)). The adjacent EMEC Fall of Warness tidal site concluded in their EIAR from 2014 that 14 fishing vessels regularly fish on the southwest coast of Eday within the wider Westray Firth region. Input was sought on the 2014 EIAR through the Orkney Fisheries Association (OFA) and Orkney Fishermen's Society (OFS) who confirmed that, as long as the EMEC Fall of Warness project followed the 30-metre water depth contour line, fishing could continue in these shallower waters (EMEC, 2014a). The Westray Project area is only located in deeper waters (i.e. in water depths between 30 mLAT and 45 mLAT) and thus will not block creel fishing in shallower waters. Due to the location of the Project, with outcropping bedrock, the seabed area is not considered to be unsuitable for any kind of trawling.

The peripheral areas around the Project area are more regularly used by creel fishermen for lobster (generally in waters shallower than 20 m) and for crabs (generally shallower than 50 m). These fishermen are based in several different areas of the Orkney Islands including Rousay, Eday, Westray and Tingwall (Mainland).

Additional consultation was undertaken for EMEC Fall of Warness tidal test site with the OFA in March 2022 to inform the EMEC Fall of Warness tidal test site Scoping Report (EMEC, 2022). The OFA concluded that it would be highly unlikely that any vessel would fish within the EMEC Fall of Warness site itself, although the wider area may be used to transit through (EMEC, 2022). Further input for the Westray Project was requested from OFA in July 2023, where no one indicated to be fishing in the Project area, with the recognition that devices would be within confined consented boundaries (OFA, 2023).

Hand gathering of scallops by divers also takes place around the edge of tidal streams such as the Westray Firth. It is assumed that scallop diving does not occur within the Westray project area itself (Marine Scotland Science, 2017).

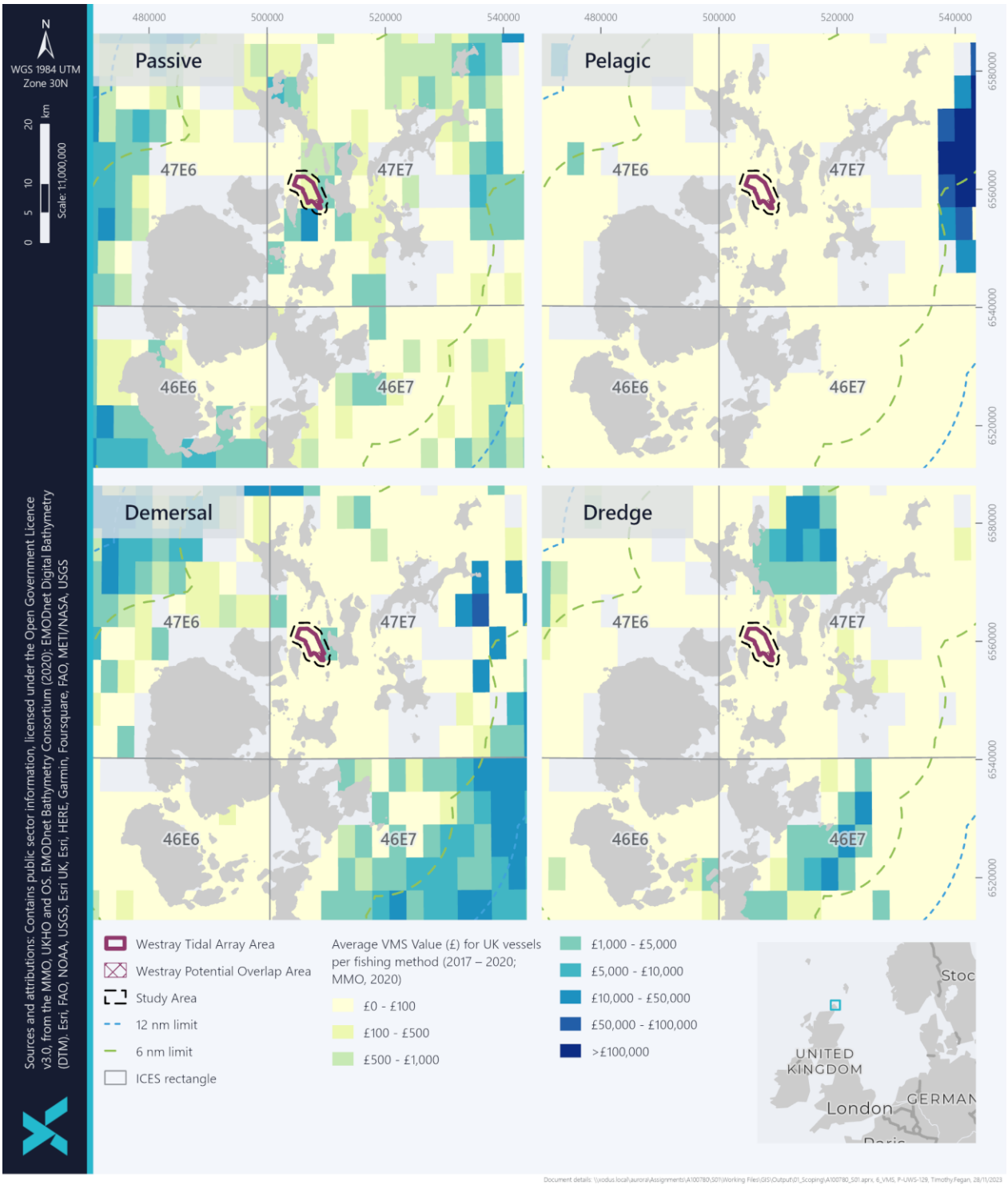

Figure 9-1 Average VMS value for UK vessels per fishing method 2017 – 2020 (MMO, 2020)

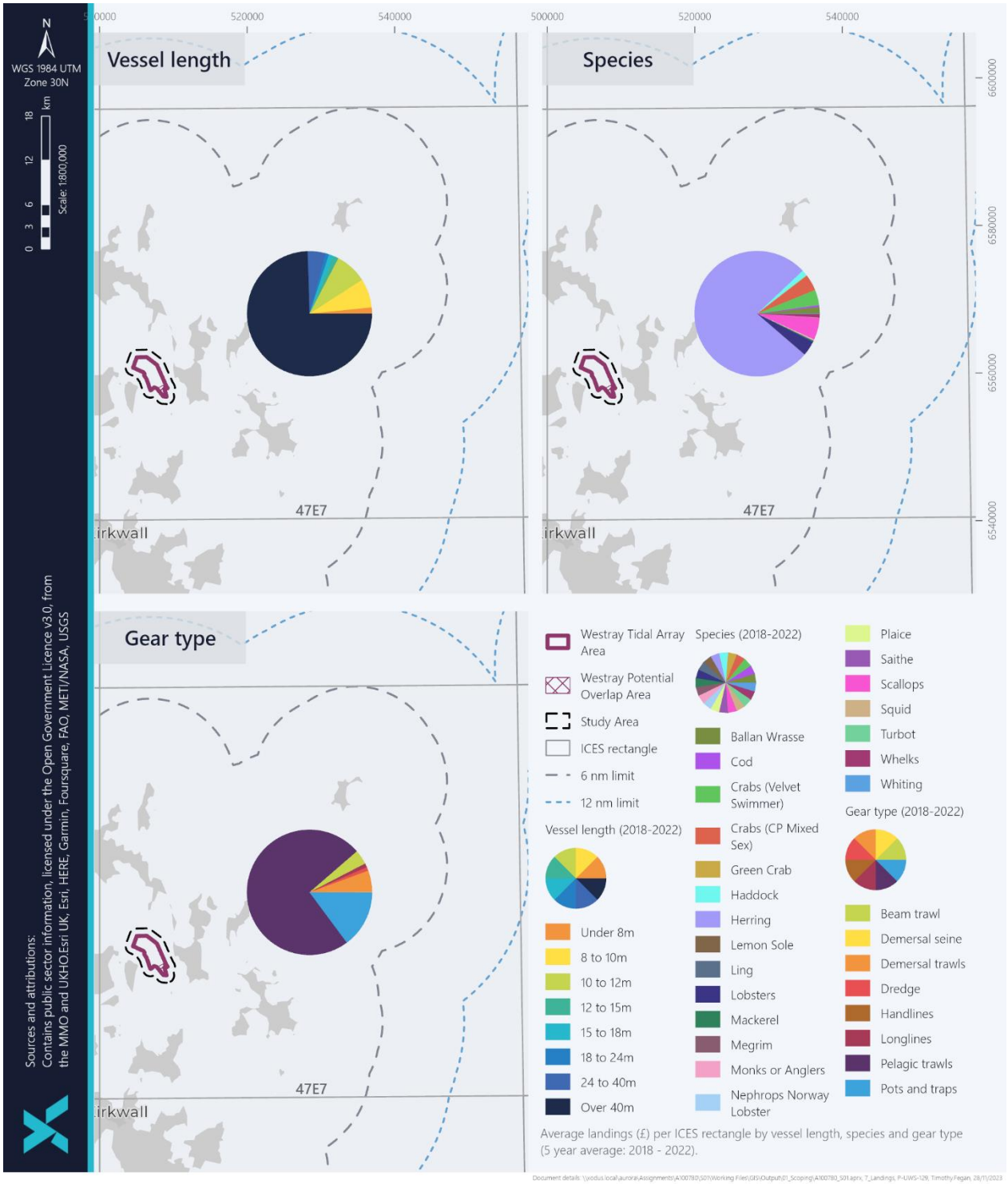

Figure 9-2 Average Landings data for ICES rectangle 47E7 from– 2018 - 2022(MMO, 2023)

9.1.3.2 Aquaculture

The nearest active aquaculture farm is on the other side of Eday, the Noust Geo site owned by Scottish Sea Farms Ltd. Additionally, there are four active farms between Egilsay, Wyre and Rousay, which are between 3 and 5 km from the nearest points of the Project area: Bay of Ham, Kirk Noust and Bay of Vady from Cooke Aquaculture Scotland and Wyre, owned by Scottish Sea Farms Ltd. The Shapinsay farm close to Shapinsay, also owned by Scottish Sea Farm Ltd., distances approximately 9.5 km from the Westray Project area.

Given the distance to the nearest sites of aquaculture activity, as described above, there is considered to be no relevant impact pathway and impacts on aquaculture are scoped out of further consideration.

9.1.4 Potential impacts

Scoping of likely significant effects on commercial fisheries is provided in Table 9-2 below. Impacts that may affect the commercial fishing industry indirectly, including a change in abundance of targeted species, will be assessed further in the fish and shellfish ecology assessment, Section 8.2.

Table 9-2. Possible impacts along with the potential significance on commercial fisheries

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Loss of access to fishing grounds	All	No	There has been no fishing activity identified within the Project boundaries.
Obstruction to regular fishing vessel transit routes	All	No	Temporary loss or restricted access to the project area and increased vessel traffic may result in a requirement for vessels to alter transit routes to fishing grounds and potentially increase steaming times. It is expected that the increase in these steaming times will be minimal.
Cumulative impacts	All	No	As there are no impacts scoped in for assessment for the Project or the adjacent EMEC site, there is not considered to be the potential for cumulative impacts.

Based on the completed Scoping Assessment as presented in Table 9-2, an EIA for commercial fisheries is not required as any potential impacts of the Project on commercial fisheries have been scoped out or assessed elsewhere.

9.2 Shipping and Navigation

This shipping and navigation section should be read in conjunction with the following linked topics:

- Section 9.1 Commercial Fisheries;
- Section 9.6 Tourism and Recreation;
- Section 9.8 Military; and
- Section 9.9 Aviation.

9.2.1 Study area

Due to the fairly constrained nature of Westray Firth for navigation, the study area for this topic primarily covers the Project area, with the potential for a buffer of up to three nautical miles around the Project.

9.2.2 Key data sources

Existing data sources to characterise the baseline environment for shipping and navigation are outlined in Table 9-3. Completed consultation with respect to the Westray Project, which has also been used to inform this assessment is described in Table 1-1.

Table 9-3 Summary of key sources of information for shipping and navigation receptors

NAME OF SOURCE	DESCRIPTION / LINK	YEAR	AUTHOR
AIS Data	AIS data including all large commercial vessels (including passenger vessels), large fishing vessels and some recreational vessels allowing preliminary review of primary vessel routes.	2019	Various
Royal National Lifeboat Institution (RNLI) Call-out Data	All RNLI call outs, for any purpose, within the study area.	2008 to 2017	RNLI
Marine Accident Information Board (MAIB) incident data	This data includes the locations and details of all marine incidents within the study area informing the baseline risk profile.	2020	MAIB
Marine Management Organisation (MMO) Vessel Monitoring Systems (VMS) data	UK fishing monitoring data utilised by environmental and regulatory organisations to monitor commercial fishing vessel activities. Displayed by fishing effort per International Council for the Exploration of the Sea (ICES) rectangles.	2019	MMO
Consultation	As introduced in Table 1-1, meetings have been held with key shipping and navigation stakeholders, including the MCA, NLB, Orkney Fisheries, RYA Scotland, RNLI, Orkney Marinas, Orkney Fisheries, Orkney Harbours (in March 2023), Orkney Ferries (in April 2023) and MCA, NLB, Chamber of Shipping (in October 2023).	March, April and October 2023	Various

9.2.3 Baseline

The Orkney Islands Council is the Competent Harbour Authority (CHA) responsible for 29 piers and harbours throughout the Orkney Islands. The nearest ports to the Project area are Kirkwall and Hatston, located approximately 10 nautical miles (nm) south of the Project scoping boundary. Charted depths are approximately between 27 m and 38 m within the Project area.

The Westray Firth is an important navigation channel between the North Isles and the Orkney mainland and between the Atlantic and the North Sea. It is particularly important for ferries transiting from Kirkwall to the North Isles, and for vessels supporting tidal stream energy deployments in the Fall of Warness. Vessels using the Westray Firth and its approaches include:

- Passenger vessels (including ferries and cruise liners);
- Fishing vessels (of all classes);
- Cargo vessels;
- Recreational craft;
- Support vessels and port service craft; and
- Other vessels for example: dredgers, search and Rescue (SAR) vessels and law enforcement vessels.

The waters around Orkney (excluding the Pentland Firth and Scapa Flow) are categorised by the IMO as an Area to be Avoided. All vessels over 5,000 GT carrying oil or other hazardous cargoes in bulk are required to avoid this area. As such, no tankers are noted transiting the Westray Firth in 2019 open source AIS data[13]. Pilotage is compulsory within the CHA area for all vessels over 65 m length overall (LOA), all other vessels over 80 m overall length, all vessels under tow where the combined overall length of the towing vessel and the vessel being towed is over 65 m, all vessels over 300 GRT carrying oils in bulk.

The Westray Firth is utilised by inter-island ferries. The Orkney inter-island ferry fleet totals 13 vessels which operate almost daily to remote island facilities in the north and south isles. These ferries not only provide lifeline services for residents but also contribute towards trade and tourism benefiting the local economy. The Rapness Terminal on Westray, used by Orkney Ferries, is located approximately 3 NM north of the Westray Project area. Mainland ro-ro ferry services occur out of the major ports to the south of the study area (Kirkwall, Hatston and Stromness). Passenger vessels represent the most common vessel type transiting the Westray Firth. An illustration of non-commercial vessel traffic intensity is illustrated in Figure 9-5 (in section 9.7.2.), which shows that vessels transit through the south of the Westray Project, travelling between Kirkwall and Westray. The AIS data also indicates that other vessels travel through the Westray Firth in between the islands out in to the open sea.

There are marinas located in Westray, Kirkwall and Stromness and a commercial inshore fishing fleet which operates throughout the islands, however, Vessel Monitoring Services (VMS)[14] data indicates that fishing effort and total landings (for vessels >15 m LOA) are low. The nearest RNLI lifeboat station is located in Kirkwall which operates one 17.3 m LOA Severn-class lifeboat.

The Westray Firth is a particularly dynamic environment and is renowned for its tidal currents and rough conditions in certain areas, during certain tidal states and weather conditions. No Maritime Accident Investigation Branch (MAIB) incidents occurred within the Westray Firth in 2020 (latest year for which there is data at the time of writing). One MAIB incident occurred within 10 NM, a grounding of a <15 m fishing vessel resulting in loss of the vessel. There were eight navigationally significant RNLI callouts between 2008 and 2017, four responding to commercial fishing vessels,

[13] *MMO (2019) Anonymised AIS derived Track Lines*
[14] *MMO (2015) Vessel Monitoring Systems GPS Derived Data.*

three to recreational vessels (two yachts and one angling power boat) and one to a work vessel. The most common reason for call out was machinery failure.

The EMEC Fall of Warness tidal demonstration site is located immediately to the southeast, passed by vessels operating between Muckle Green Holm and Eday. The site has eight grid-connected test berths ranging from 12 – 50 m depth.

9.2.4 Potential impacts

Scoping of likely significant effects on shipping and navigation is provided in Table 9-4 below:

Table 9-4. Possible impacts along with the potential significance on shipping and navigation

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Impact on collision risk	All	Yes	Project vessels will provide an obstacle during installation, maintenance and decommissioning. The presence of project infrastructure will reduce the navigable sea room between Eday and Egilsay.
Impact on contact (allision) risk	All	Yes	Project vessels and project infrastructure will provide an obstacle during installation, maintenance and decommissioning.
Impact on vessel routeing (including poor weather routeing)	All	No	Temporary loss or restricted access to the project area and increased vessel traffic may result in a requirement for vessels to alter transit routes. However, it is expected that the re-routing and increased steaming times will be minimal.
Impact on Under Keel Clearance (UKC)	Construction and operation	Yes	Underwater turbines may pose a hazard to vessels passing nearby. Mooring systems may reduce the navigable depth in vicinity of the devices. Dynamic draught modelling in relation to charted water depth should be undertaken to ascertain safe clearance.
	Decommissioning	No	The removal of infrastructure will return under keel clearance to the baseline conditions
Impact on anchor / fishing gear snagging risk	Construction and operation	Yes	Cables / mooring systems may pose a snagging risk to vessel anchors and mobile fishing gear.
	Decommissioning	No	The removal of infrastructure will return snagging risk to the baseline conditions
Impact on search and rescue	All	Yes	Consideration regarding search and rescue must be given to layout to ensure continued safe transit of search and rescue vessels.

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Impacts on radar, communications and vessel navigation equipment	All	Yes	The profile and size of the devices does not suggest significant impacts to radar and communications, however, this cannot be ruled out.
Cumulative effects	All	Yes	Assessment of cumulative effects based on scoped in impacts.

9.2.5 Impact assessment strategy

In addition to the baseline understanding as presented in section 9.2.3, above, further understanding will be acquired to inform the EIA baseline characterisation. It is proposed that baseline conditions regarding shipping and navigation are further defined to sufficient detail by completing the tasks outlined in the Table 9-5, with the acquired understanding also informing the impact assessment.

Table 9-5 Baseline characterisation strategy for shipping and navigation

DATA GAP	METHODOLOGY	EXAMPLE DATA SOURCES
Vessel traffic surveys, up to date AIS data.	Undertake MGN 654 compliant vessel traffic surveys with a minimum of 28 days. A survey strategy will be agreed with the MCA but this is anticipated to include: 1 x summer survey (14 days); and 1 x winter survey (14 days) At the time of writing the summer survey has been completed between 16 August and 1st September 2023, with the winter survey planned for winter 2023/2024	Undertaking dedicated vessel or shore based survey to collect visual, radar and AIS information with the Study Area. Option to provide one year of supporting AIS data.
UKHO Admiralty Charts.	N/A	UK Hydrographic Office
Fishing data	Consultation with local fishermen and national consultees. Interrogation of radar data collected as part of the vessel traffic surveys. Collection of additional data.	VMS data
Recreational boating data	Local and national consultation, collection of additional data.	RYA UK Coastal Atlas of Recreational Boating
Incident data	Collection of historic MAIB data to analyse trends and supplement RNLI callout data.	MAIB (1992-2021)

In relation to the impacts scoped in for assessment in Table 9-4, Table 9-6 below, sets out the proposed strategy for assessing the potential effects on shipping and navigation. A Navigational Risk Assessment (NRA) will be undertaken to inform the EIA process. The key guidance document that will be considered within the NRA will be MGN 654 including Annex 1, Methodology for Assessing Marine Navigational Safety and Emergency Response. The NRA will be undertaken in accordance with IMO Formal Safety Assessment (FSA) methodology (2018) as required by the MCA, to inform impact identification within the EIAR.

Table 9-6 Impact assessment strategy for shipping and navigation

POTENTIAL IMPACT	ASSESSMENT METHOD	RELEVANT RESEARCH
Impact on collision risk	Undertake full NRA Traffic survey Collision / allision modelling Consultation	Incident rates/ failure rates in vessels
Impact on contact (allision) risk		Incident rates / failure rates in vessels
Impact on vessel routeing (including poor weather routeing)	Undertake full NRA Deviation modelling Consultation	Identification of poor weather routeing Ferry routes/ timetables
Impact on UKC	Undertake full NRA Traffic survey Assessment of UKC	Bathymetry Vessel types / sizes
Impact on anchor / fishing gear snagging risk	Undertake full NRA Consultation Traffic survey	Bathymetry Fishing effort
Impact on search and rescue	Undertake full NRA Consultation Traffic survey	Incident rates/ failure rates in vessels RNLI callouts Local SAR capabilities
Impacts on radar, communications and vessel navigation equipment	Undertake full NRA	Latest industry research

9.3 Archaeology and Cultural Heritage

9.3.1 Study area

This section considers the potential effects of construction, operation, and maintenance, and decommissioning of the Project on marine archaeology and cultural heritage receptors, as well as setting impacts on terrestrial heritage assets. The study area for this topic is defined as a 5 km buffer around the Project, which is considered sufficient to capture all receptors marine archaeology and cultural heritage receptors that could potentially experience significant effects as a result of the Project. The applied study area is illustrated in Figure 9-3.

9.3.2 Key data sources

The data sources that have been used to characterise the historic environment with respect to marine archaeology and cultural heritage are set out in Table 9-7 below.

Table 9-7 Summary of key sources of information for archaeology and cultural heritage receptors

NAME OF SOURCE	DESCRIPTION/ LINK	DATE	AUTHOR
The National Record of the Historic Environment (NRHE) of Scotland	Canmore (https://canmore.org.uk/) and Pastmap database (http://pastmap.org.uk/) Maritime records, including documented losses of vessels, and records of terrestrial monuments and findspots, including the archaeological excavation index.	Ongoing	Historic Environment Scotland (HES)
Historic Environment Record	Aberdeenshire HER (https://online.aberdeenshire.gov.uk/smrpub/)	Ongoing	Aberdeenshire Council Archaeology Service
Orkney Historic Environment Record (HER) and the Highland Historic Environment Record	Contains data on all recorded non-designated heritage assets, held by the Highland and Orkney Islands Councils. The data includes archaeological, historic landscape and historic building information. Information on previous events (archaeological surveys and investigations) was also obtained.	Ongoing	Orkney Islands Council
UKHO wreck register & nautical charts	https://www.admiralty.co.uk/digital-services/data-solutions/admiralty-marine-data-portal Wreck register and obstructions data including 'dead' and salvaged wrecks that are no longer charted as navigational hazards.	2023	UKHO
Statutory lists, registers and designated areas, including Lists of Scheduled Monuments, Listed Buildings and Historic Marine Protected Areas	The Historic Environment Scotland (HES) Data Portal https://portal.historicenvironment.scot/ Records of designated heritage assets within Scotland, maintained by Historic Environment Scotland. GIS data for all Protected Wrecks, Scheduled Monuments, Listed Buildings, Registered Parks and Gardens and Registered Battlefields.	ongoing	HES
Off Scotland: a comprehensive record of maritime	Edinburgh: C-Anne Publishing.	1998	Whittaker, I.G.

NAME OF SOURCE	DESCRIPTION/ LINK	DATE	AUTHOR
and aviation losses in Scottish waters			
'Europe's Lost Frontiers: Volume 1	https://www.archaeopress.com/Archaeopress/download/9781803272689	2022	Gaffney, V., and Fitch S.
British Geological Survey (BGS) Borehole Records	https://www.bgs.ac.uk/information-hub/borehole-records/?viewFullSite=yes Historic borehole logs and the wider geological background for the region	Ongoing	British Ecological Survey
Scottish Archaeological Research Framework (ScARF)	The primary resource for Scottish archaeology, one which provides an overview of the subject and a set of relevant research questions to guide assessment.	Ongoing	ScARF
Existing archaeological studies and published sources	Background information on the archaeology of the North Sea, including the results of nearby projects including, The European Marine Energy Centre, West of Orkney Wind Farm Project and the MeyGen Tidal stream energy Project	Ongoing	Various

9.3.3 Baseline

9.3.3.1 Seabed Prehistory

There is potential for submerged landscapes (archaeological sites on the seabed following sea level rise since the last ice age) to persist within Orkney waters, particularly in coastal regions.

The Orkney Islands are well known for their remarkable preservation of archaeology which includes the stone-built houses, tombs, and monuments such as Skara Brae, Maeshowe and the Ring of Brodgar. These make up the World Heritage Site the Heart of Neolithic Orkney (Wickham-Jones *et al.*, 2009). Waters around the Orkney Islands also have the potential for the preservation of submerged landscapes, where human beings and early hominids previously lived or hunted on terrain which was at that time dry land, or where they exploited fish and shellfish on the coast which is now submerged.

At various times in the past the North Sea and North Scotland continental shelf has been exposed as dry land including the Westray Firth, within which the Project is located, which was submerged sometime after c.16,000 BC (World Ocean Review, 2017). Buried sediments related to this may contain, not only direct archaeological evidence of the human occupation of the area, but also palaeo-environmental data. This can be used to develop an understanding of the wider natural environment within which early humans lived.

Although in general terms, the potential for submerged prehistoric archaeology and landscapes across wide areas of the UK continental shelf is high, the potential for site preservation in areas of the shelf deeper than 80 m is low (Flemming, 2003).

The Westray Project area is within Zone 4 of the SEA of the Continental Shelf (Flemming, 2003). Flemming notes the potential for the survival of submerged landscapes and prehistoric sites in the study area is influenced by various physical factors, processes, and topography. Sheltered areas with lower seabed water movements, deep sediment deposits in rocky gullies and depressions and sea caves often provide conditions suitable for good site preservation (Flemming, 2003). Within the coastal areas of the Orkney Islands, a number of prehistoric site have been recorded, approximately 40 sites date to the 1st millennium BC, 20 to the 2nd millennium, 70 to the 3rd millennium, and 20 to the 4th millennium. Inferences can be made on the potential for the survival of prehistoric deposits in the Project area from seabed geophysical surveys, which demonstrate that the seabed predominantly consists of scoured and tide-swept bedrock and boulders with isolated locations of mobile sands and gravels veneer. Therefore, the potential for survival of prehistoric deposits is considered to be very low or negligible across the Project area. Similar understanding has been developed for the nearby EMEC Fall of Warness tidal test site, whereby a baseline archaeological study (comprising survey and interpretation) was completed for the EIAR and reported in Aurora (2005), EMEC (2009) and EMEC (2022).

Furthermore, the Rising Tide Project, set up in 2005, seeks to provide information on Holocene relative sea-level change around the Orkney Islands through the analysis of sediment cores (Wickham-Jones *et al*, 2009). Investigations to date have occurred in the more sheltered locations of the Bay of Firth and Bay of Ireland, both to the south of the Westray Project. Investigations comprised geophysical and seismic survey in addition to core sampling. Outputs from completed investigations provide detail on successive recession and submergence of the Orkney Islands, evidenced through the deposits of peats and clays in the analysed locations. However, in the context of the Westray Project, located within the Westray Firth, the dominant presence of outcropping scoured and tide-swept bedrock, indicates little to no potential for prehistoric archaeological landscapes in the Project area.

9.3.3.2 Marine archaeology

Within the Westray Project area there are no Historic Marine Protected Areas (MPAs), protected under Part 5 of the Marine (Scotland) Act 2010, which protect 'marine historic assets' of national importance which survive in Scottish territorial waters. Marine historic assets are defined in law and include a wide variety of man-made structures, including wrecked vessels and aviation crash sites. They can also include more scattered remains such as groups of artefacts on the seabed or submerged prehistoric landscapes (Historic Environment Scotland, 2019).

In terms of other wreck remains, there are no UKHO records within the Westray Project area. There is however, the potential for one obstruction based on the CANMORE records, noted as a 20th century Vickers Supermarine Spitfire (ID 269666) (Figure 9-3). Given the concentration of UKHO and CANMORE records within the Westray Firth and near the Project area as illustrated in Figure 9-3, there is potential for wreck or wreck related remains to be present within the Project area. As introduced in section 9.3.3.1, an archaeological study was completed for the nearby EMEC Fall of Warness site, which noted that although seven ships have been recorded as wrecked in the general vicinity of the both the Westray and EMEC Fall of Warness sites, no actual wreck sites are known or identified within the EMEC Fall of Warness sites. As presented in the EMEC Fall of Warness Scoping Report (EMEC, 2022), it is not expected that any wreckage would still be present due to the strong tidal streams through this region of the Westray Firth.

With the strong seas in the area, there is a high probability for unknown, unrecorded vessels to have sunk in the waters around the Orkney Islands over the centuries. If these have not been destroyed by the marine environment, the remains of such vessels and their associated artefacts may be buried beneath the surface of the seabed. However,

based on results from the surveys conducted and the nature of the seabed as shown by the surveys at the Westray Project area and the EMEC Fall of Warness site (i.e. comprising scoured and tide-swept bedrock and boulders), it is considered extremely unlikely that any unknown archaeological remains will be located within the Project area.

The Modern period of World War 1 (WW1) and World War 2 (WW2) has the greatest potential for the preservation of wrecks and aircraft sites. Not only is this due to their size, relative age and their metal construction but that the area around northern Scotland, Orkney and Shetland was an active battlefield. During WW1 and WW2 the blockade of Germany was maintained by major elements of the Royal Navy using the base at Scapa, Orkney and squadrons based in Shetland (Nutt, 2017). This blockade in turn was contested by Germany using surface raiders, U-Boats and mines. Famously, the *HMS Hampshire* was sunk by German mine during WW1 off Orkney, while the *HMS Royal Oak* was sunk by a German U-Boat during WW2.

In terms of aviation remains, a Spitfire was recorded as abandoned off Eday in 1942, identified within the CANMORE records as introduced above. However, it is noted that the crash site or wreckage have never been found associated with the loss. Additionally, the Luftwaffe undertook many raids over the Orkney Islands, mainly to target the Scapa Flow Naval Base (Taylor, 2010). As such, there is potential for further aircraft remains to be present in submerged locations across the Islands. Any aircraft remains found are automatically protected under the Protection of Military Remains Act 1986 if lost on active service.

9.3.3.3 Onshore Heritage

The Project also has the potential to affect the setting of terrestrial heritage assets, during its construction and operation.

There are over 900 Listed Buildings across the Orkney Islands and some 370 Scheduled Monuments. These assets, largely comprise of prehistoric sites, adding to the Islands importance as a prehistoric centre. However, as the Westray Project area is surrounded by the Islands of: Eday, Westray, Faray, Rusk Holm, Egilsay, Muckle Green Holm, Wyre, Egilsay and Rousay, it is anticipated that only heritage assets within the coastal regions of these islands may be affected.

Across the islands listed above, within the coastal regions, there are five Listed Buildings and 30 Scheduled Monuments. The Listed Buildings are summarised as:

- Windmill Stump, Rapness, Helzie, Westray (LB47995) – Category C;
- Eday Church, Eday (LB6195) – Category C;
- Sourin, Nethermill, Rousay (LB18642) – Category B;
- Howan, Egilsay (LB19664) – Category B; and
- House, Rusk Holm, Westray – Category C.

The Scheduled Monuments are summarised in Table 9-8.

Table 9-8: Scheduled Monuments

ID	DESCRIPTION	LOCATION	PREHISTORIC RITUAL AND FUNERARY: CHAMBERED CAIRN
SM10134	Faraclett Head, chambered tombs	Rousay and Egilsay	Prehistoric ritual and funerary: mound (ritual or funerary)
SM10169	Faraclett Head, mound, 856 m WNW of Faraclett	Rousay and Egilsay	Prehistoric ritual and funerary: stone setting
SM10189	Faraclett Head, stone setting, 670 m NW of Faraclett	Rousay and Egilsay	Prehistoric ritual and funerary: chambered cairn
SM10196	Bigland, round chambered tomb, 400 m N of Bigland	Rousay and Egilsay	Prehistoric ritual and funerary: cairn (type uncertain)
SM1286	Loch of Knitchin, cairn 230 m N of Brinvar	Rousay and Egilsay	Prehistoric ritual and funerary: standing stone
SM1356	Burn of Mussetter, standing stone on E side Burn	Eday	Ecclesiastical: church; Prehistoric ritual and funerary: chambered cairn
SM1252	The Manse, chambered cairn and church 330 m WNW of Eday	Eday	Prehistoric ritual and funerary: chambered cairn
SM1261	Eday Church Hall, chambered cairn 260 m WNW of Eday Church	Eday	Prehistoric ritual and funerary: chambered cairn
SM1321	Mill Hill, chambered cairn, Millbounds	Eday	Prehistoric ritual and funerary: standing stone
SM1381	Southside, standing stone 130 m SW of Southside	Eday	Prehistoric domestic and defensive: burnt mound
SM1375	Sandhill, burnt mound 200 m SE of Sandhill	Eday	Secular: castle
SM5944	Stackel Brae, castle, Maltbarn, Eday	Eday	Ecclesiastical: church
SM90137	St Magnus Church, Egilsay	Rousay and Egilsay	Prehistoric ritual and funerary: chambered cairn
SM3549	Onziebust, chambered cairn 440 m SSE of Onziebust, Egilsay	Rousay and Egilsay	Prehistoric ritual and funerary: chambered cairn
SM1254	Cub'ie Roo's Burden, chambered cairn, Rousay	Rousay and Egilsay	Prehistoric ritual and funerary: chambered cairn
SM1291	Knowe of Craie, chambered cairn 380 m NNW of Curquoy, Rousay	Rousay and Egilsay	Secular: battery
SM13421	Point of Avelshay, coastal battery, Rousay	Rousay and Egilsay	Prehistoric ritual and funerary: mound (ritual or funerary)
SM1241	Bay of London, mound 290 m SE of Youth Hostel, Eday	Eday	Prehistoric ritual and funerary: chambered cairn
SM3535	Sandhill, chambered cairn 300 m W of Sandhill, Eday	Eday	Prehistoric domestic and defensive: burnt mound

ID	DESCRIPTION	LOCATION	PREHISTORIC RITUAL AND FUNERARY: CHAMBERED CAIRN
SM1257	Dale, burnt mound 380 m NW of Dale, Eday	Eday	Prehistoric domestic and defensive: settlement
SM2292	Braes of Rinyo, settlement 180 m NE of Bigland, Rousay	Rousay and Egilsay	Prehistoric ritual and funerary: enclosure (ritual or funerary)
SM1441	Fold of Setter, enclosure, Eday	Eday	Prehistoric domestic and defensive: enclosure (domestic or defensive); Prehistoric ritual and funerary: standing stone
SM4299	Stone of Setter, standing stone and enclosure, Eday	Eday	Prehistoric ritual and funerary: chambered cairn
SM1250	Huntersquoy, chambered cairn 480 m SW of Carrick Farm, Eday	Eday	Prehistoric domestic and defensive: burnt mound
SM1287	Greentoft, burnt mound 350 m SSW of Eday	Eday	Prehistoric domestic and defensive: broch
SM1377	Lock of Scockness, broch, Rousay	Rousay and Egilsay	Prehistoric ritual and funerary: standing stone
SM1416	Yatenes Stone, standing stone 180 m NNE of Faraclett, Rousay	Rousay and Egilsay	Prehistoric domestic and defensive: enclosure (domestic or defensive)
SM3864	Skirmie Clett, enclosures 740 m SE of Onziebust, Wyre	Rousay and Egilsay	Prehistoric ritual and funerary: cairn (type uncertain)
SM1251	Carrick Farm, chambered cairn and cairn 500 m SSW of Carrick Farm	Eday	Prehistoric ritual and funerary: chambered cairn
SM1440	Chambered cairn, 280 m NW of Quoy, Faray	Eday	Prehistoric ritual and funerary: chambered cairn

As well as the listed Scheduled Monuments and Listed Buildings above, there are three identified CANMORE sites located on the small island of Kili Holm, which is linked north of Eday and south of the Project area boundary. The CANMORE located further north on Kili Holm (ID 2702, site number HY43SE 6) is believed to be a prehistoric house. The second, presumed to be a possible prehistoric settlement (ID 2700, site number HY43SE 4), is located in the middle of the island. The third (ID 194668, site number HY43SE 8001) located furthest south on Kili Holm is classified as a 20th century steam trawler. All three CANMOREs are within 1 km from the southern margin of the Project boundary. Another two CANMOREs are located north of the Westray Project boundary on Rusk Holm. The CANMORE located on the south of the island (ID 229640, site number HY53NW 22) is located approximately 1.9 km from the Project boundary and is classified as a house, or building designed for human habitation. The CANMORE located on the north of Rusk Holm (ID 182058, site number HY53NW 17), approximately 2.2 km from the array site boundary, is classified as a sheepfold (HES, 2023).

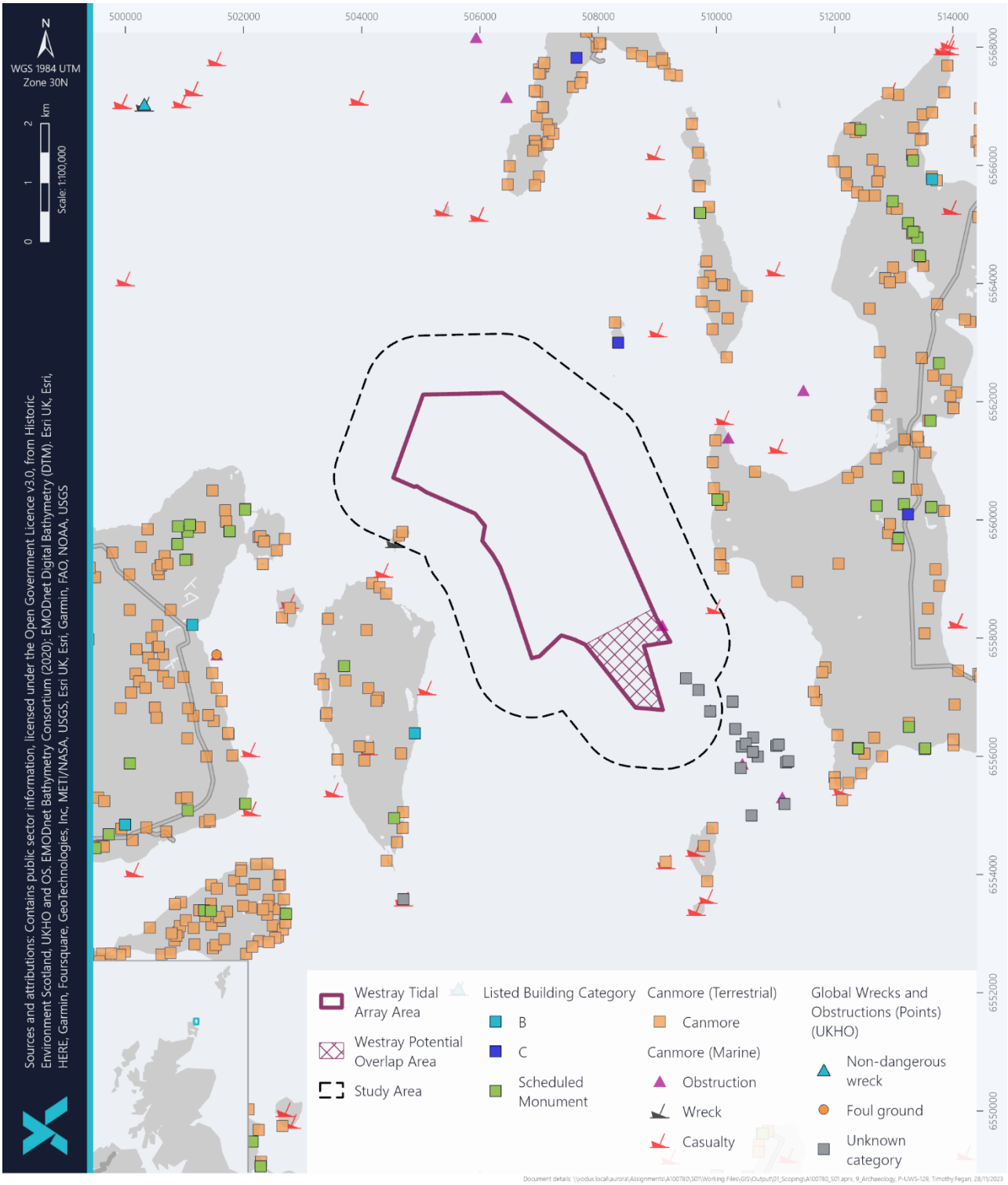

Figure 9-3 Marine and terrestrial archaeology in the vicinity of the Westray Project site

9.3.4 Potential impacts

The scoping of likely significant effects on archaeology and cultural heritage is provided in Table 9-9 below.

Table 9-9 Likely significant effects on archaeology and cultural heritage

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Direct impacts to heritage assets.	All	No	Impacts to heritage assets present on the seafloor or buried under the seabed, may result in damage to, or the destruction of any archaeological material. Based on the baseline characterisation and seabed surveys, there are no known marine historic assets within or in the vicinity of the Project area. Furthermore, there is considered to be little to no potential for archaeological remains (prehistoric landscapes or maritime heritage assets). This is mainly due to the presence of outcropping scoured and tide-swept bedrock and boulders across the Project area and where sands and gravels are present, these occur as isolated pockets and as a thin veneer. The tidal streams through this region of the Westray Firth also makes the preservation of heritage assets very unlikely. In the unlikely event that any such assets are discovered, management and mitigation processes are in place to ensure that they would not be damaged or lost, as summarised in section 9.3.5.
Indirect impacts to heritage assets associated with changes to marine physical processes.	Operation	No	Operation of the Project has potential to directly and indirectly change the local hydrodynamic and sedimentary processes. Changes to the local and regional hydrodynamic and sedimentary process regimes can lead to the re-distribution of erosion and accretion patterns. Similarly, changes in tidal currents may affect the stability of nearby morphological and archaeological features. However, based on the limited potential for archaeological remains, the seabed properties and the tidal regime across the Project area and this region of Westray Firth, it is assessed that the potential for this impact to occur is limited. In the unlikely event that any such assets are discovered, management and mitigation processes are in place to ensure that they would not be damaged or lost, as summarised in section 9.3.5.
Change to the setting of heritage assets, which could affect their heritage significance	All	No	Impacts to the significance of a heritage asset may also occur if a development changes the setting of the asset (the surrounding in which the heritage assets is located, experienced, and appreciated). Such impacts may occur to onshore heritage assets from the presence of construction vessels and offshore infrastructure. As discussed above, there are five Listed Buildings and 30 Scheduled Monuments on the coasts adjacent to the Project, whose setting may be affected. However, in terms of the archaeological study completed for the nearby EMEC Fall of Warness tidal demonstration site, it found that no onshore sites of archaeological interests would

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
			be impacted by the development and operations at the site, which is considered to also be applicable to the Westray Project.
Cumulative impacts	All	No	Individual heritage assets would not be subject to cumulative direct impacts from other known plans or projects as they are discrete and there would be no physical overlap of different infrastructure. However, although individual assets are discrete, taken together they could have collective heritage significance. With respect to the Westray Project and the nearby EMEC Fall of Warness site acting cumulatively within Westray Firth, it is again noted that both sites (or operational areas of both sites) are located in the region with the fastest flows, closely associated with outcropping scoured and tide-swept bedrock and boulders. It is also in these locations where there is considered to be little to no potential for archaeological remains. Therefore, there is considered to be little to no potential for cumulative impacts on archaeology and cultural heritage assets.

Based on the completed Scoping Assessment as presented in Table 9-9, an EIA for archaeology and cultural heritage is not required as any potential impacts of the Project on archaeology and cultural heritage have been scoped out.

9.3.5 Marine archaeology reporting protocol

No further geophysical surveys are proposed in advance of the Project application. Instead, it is proposed that a targeted preconstruction geophysical will be undertaken post-consent to inform the foundation design and micro-siting. It is proposed that the acquired geophysical information is reviewed for maritime archaeological or aircraft wreckage to avoid any potential impact, as it is recognised that (impact on planes lost on military service automatically contravenes the Protection of Military Remains Act 1986, even if they were unknown prior to the impact). Furthermore, as presented in Table 9-9, in the very unlikely event that any such assets are discovered, management and mitigation processes are in place to ensure that they would not be damaged or lost. Reporting protocols are to form part of the construction environmental management plan. Should any archaeology or cultural heritage features be discovered during marine works, installation activities would avoid these sites and the County Archaeologist will be contacted and The Crown Estate (2014) reporting protocol for the discovery of previously unknown marine cultural material would be followed as described in section 4.5.2.

9.4 Seascape, Landscape and Visual

This section considers the potential impacts of the Project on the seascape, landscape and visual environment. Seascape, landscape and visual impact assessment (SLVIA) considers effects on:

- Seascape/landscape as a resource in its own right (caused by changes to its constituent elements, its specific aesthetic or perceptual qualities and/or its character); and
- Views and visual amenity as experienced by people (caused by changes in the appearance of the seascape/landscape).

Cultural heritage forms an important aspect of the Orkney landscape. The heritage value and setting of archaeological features is discussed in Section 9.3.

This section was prepared by Chartered Members of the Landscape Institute (CMLI) at LUC (Land Use Consultants Ltd).

9.4.1 Study area

The study area for this topic is defined as a 3 km buffer around the Westray Tidal Array area, which is considered sufficient to capture all landscape and visual receptors that could potentially experience significant effects as a result of the Project. This judgement is based on the nature and scale of the Project, particularly the low height of surface-piercing elements (maximum 1.6 m), as well as the location of the Project in relation to potentially sensitive receptors, as set out in this section of the Scoping Report. The SLVIA study area is shown in Figure 9-4.

9.4.2 Key data sources

The existing data sets and literature with relevant coverage to the Project, which have been used to inform this Scoping Report and would inform the baseline characterisation for the EIA as appropriate are outlined in Table 9-10. This table also includes relevant guidance that will be referred to in undertaking the SLVIA.

Table 9-10 Summary of key sources of information used to inform the SLVIA

NAME OF SOURCE	DESCRIPTION/ LINK	DATE	AUTHOR
Orkney and North Caithness Coastal Character Assessment, Scottish Natural Heritage	https://www.webarchive.org.uk/wayback/archive/20210630103026mp_/https://www.nature.scot/sites/default/files/2018-11/Coastal%20Character%20Assessment%20-%20Orkney%20and%20North%20Caithness.pdf	2016	LUC
Offshore Renewables: Guidance on assessing the impact on coastal landscape and seascape	https://tethys.pnnl.gov/sites/default/files/publications/SNH_2012_Guidance.pdf	2012	Scottish Natural Heritage
Visual Representation of Development Proposals	https://landscapewpstorage01.blob.core.windows.net/www-landscapeinstitute-org/2019/09/LI_TGN-06-19_Visual_Representation.pdf	2019	Landscape Institute
Guidelines for Landscape and Visual Impact Assessment – 3rd edition (GLVIA3)	https://www.landscapeinstitute.org/technical/glvia3-panel/	2013	Landscape Institute and Institute of Environmental Management

NAME OF SOURCE	DESCRIPTION/ LINK	DATE	AUTHOR
			and Assessment
National Landscape Character Assessment	https://www.nature.scot/professional-advice/landscape/landscape-character-assessment/scottish-landscape-character-types-map-and-descriptions	2019	NatureScot
Orkney Landscape Character Assessment. Scottish Natural Heritage Review No.100	https://www.nature.scot/sites/default/files/2018-01/Publication%201998%20-%20SNH%20Review%20100%20-%20Orkney%20landscape%20character%20assessment.pdf	1998	LUC
Local Landscape Area Statements	https://www.orkney.gov.uk/Files/Planning/Development-and-Marine-Planning/North%20Isles%20LLA.pdf	n.d.	Orkney Islands Council
Orkney Local Development Plan	https://www.orkney.gov.uk/Files/Planning/Development-and-Marine-Planning/Local-Plan/OLDP_2017/Orkney_Local_Development_Plan_2017_2022.pdf	2017	Orkney Islands Council
Ordnance Survey mapping	https://www.bing.com/maps	2023	Ordnance Survey
Aerial and street-level photography available online	https://www.google.co.uk/maps	2023	Various
Ferry routes	Various ferry service providers.	Ongoing	Orkney Ferries
Marine Recreation and Tourism Survey	https://marinescotland.atkinsgeospatial.com/nmpi/default.aspx?layers=1041	2015	LUC

Other information was obtained through consultations, including with IOC and NatureScot to inform the use of a zone of theoretical visibility (ZTV) to identify representative viewpoints and any requirements for visualisation.

9.4.3 Baseline

The Westray Tidal Array area is located in the waters between the islands of Egilsay to the west and Eday to the east. Eday is around 1.2 km from the array area, with the uninhabited islands of Faray and Rusk Holm to the north-east. Egilsay is around 1.2 km from the array area, with the island of Rousay beyond, around 2 km from the array area. To the north, Westray is around 3.2 km distant. To the south the uninhabited Muckle Green Holm is 2 km from the array area, with Shapinsay beyond at over 7 km.

The southern part of Eday, close to the Project area, has an interior of moorland hills rising to 102 m at Ward Hill. Although there are cliffs at the south end of the island, closer to the array area the land slopes gently down to a rocky shore. A single road links the few houses on the west coast of the island with the main settlements and ferry terminal,

on the east coast. Egilsay is lower-lying, having a 'whaleback' shape. Settlement on Egilsay is scattered across the island, and St Magnus' Church forms a landmark feature. There is limited settlement within the small area of Rousay that falls within the 3 km SLVIA study area.

Ferry routes pass through the array area and SLVIA study area, linking Kirkwall, Westray and North Ronaldsay. Other marine users including recreational users are likely to pass through the SLVIA study area. People on the adjacent islands of Eday, Egilsay and Rousay can view the array area as part of the channel between the islands. Visual receptors will include small numbers of residents, and visitors to the islands. The existing marine view includes the Fall of Warness test site, where a range of tidal stream energy devices have been deployed, and where service boats are often present, as well as ferries, fishing craft and other boats moving through the area.

The coastal character of Orkney is defined in the Orkney and North Caithness Coastal Character Assessment (LUC, 2016), which was undertaken at both regional and local scales. Regional coastal character areas (RCCA) and local coastal character areas (LCCA) are defined as lengths of coast, with the descriptions for each area broadly indicating its offshore and onshore extent. At a regional scale, the coasts within the SLVIA study area fall within:

- RCCA 5: Eday to the north-east and east;
- RCCA 12: Egilsay and Wyre to the west; and
- Small areas of RCCA 10: Rousay North and RCCA 11: Rousay South.

At a local scale the Eday RCCA is divided into several LCCAs, of which only one, LCCA 5e: Fersness to Warness, faces towards the array area.

The onshore landscape character of Orkney is described in the National Landscape Character Assessment of Scotland, published online by NatureScot (NatureScot, 2019). The landscape character types (LCTs) closest to the site reflect the agricultural and coastal nature of the islands, and include:

- LCT 295: Holms, covering several small islets;
- LCT 296: Whaleback Islands, covering Egilsay and Faray;
- LCT 298 Low Island Pastures on Rousay;
- LCT 302: Inclined Coastal Pasture, along the west coast of Eday;
- LCT 307: Cliff Landscapes, at the southern tip of Eday; and
- LCT 314: Moorland Hills – Orkney, covering the Eday interior.

Key characteristics and sensitivities for both the coastal character areas and LCTs are provided in the relevant reports (LUC, 2016; NatureScot, 2019). RCCAs and LCTs are illustrated on Figure 9-4.

There are no nationally protected landscapes (e.g. National Scenic Areas or Wild Land Areas) in proximity to the site. The Orkney Local Development Plan 2017 (OIC, 2017) makes reference to Local Landscape Areas (LLAs), and a background paper lists the 'Bay of Fersness, Eday' among a number of LLAs across the North Isles (OIC, n.d.). However, these LLAs are not mapped and their status is unclear.

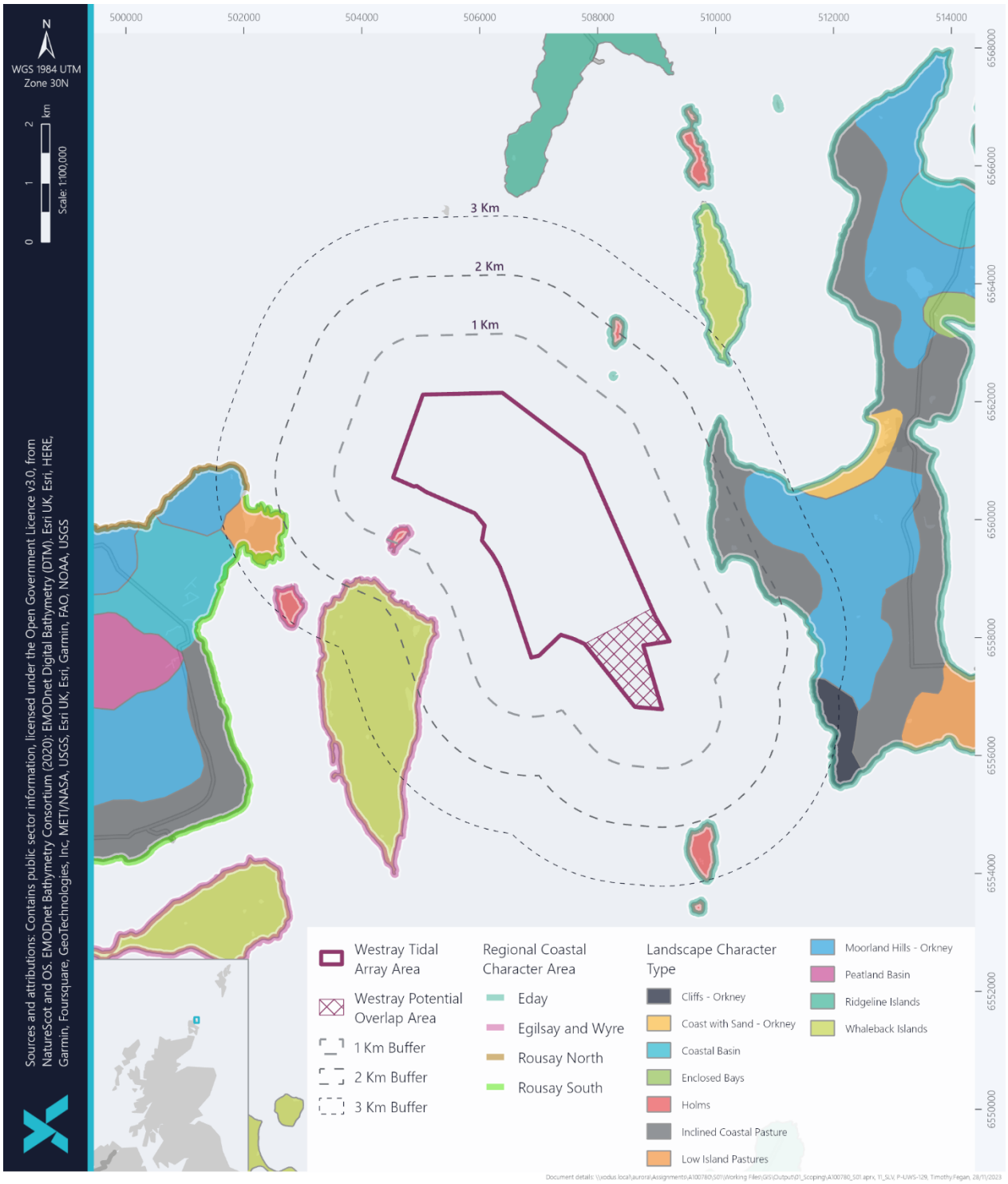

Figure 9-4 Coastal and onshore landscape character surrounding the Westray Project site

9.4.4 Potential impacts

The Project will consist of up to 70 Orbital O2 tidal stream energy devices. These devices float in the water around surface level, with moving parts being submerged. Each device comprises a floating cylinder of 82 m in length and 3.8 m in diameter.

Rotors are mounted on hinged legs which would only be lifted to the surface for maintenance. A deck structure is fitted to the top of the device, with a communication mast that extends to a maximum of 1.6 m above the water line. The device will be painted yellow and will carry navigation marker lights. When in operation, the devices may generate a visible wake.

The introduction of these devices to the seascape is fully reversible. All other elements of the project (cables, moorings, etc) will be under water and so will have no effect on seascape, landscape and visual receptors. No onshore works are included in the project.

Scoping of likely significant effects on seascape, landscape and visual receptors is provided in the Table 9-11 below.

Table 9-11. Possible impacts along with the potential significance on seascape, landscape and visual

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Changes to landscape character	All	No	The presence of offshore infrastructure and installation/maintenance activity is unlikely to affect the experience of onshore landscape character. Even when coastal views are a key component of landscape character, the introduction of low-lying structures and occasional activity is unlikely to change this to a degree where a significant effect would be likely.
Changes to coastal character	All	No	The presence of offshore infrastructure and installation/maintenance activity associated with the project has the potential to alter coastal character locally. However, given the low-lying nature of the devices, and the existing use of the wider area for tidal testing and boat traffic, changes to the baseline by day and night are unlikely to give rise to effects that would be considered significant.
Changes to visual amenity	All	Yes	The devices and lighting, as well as installation/maintenance activity, may form noticeable features in views experienced by people at sea and on land in the area around the array area. Although low-lying, the devices will be painted yellow, and will be lit at night. In elevated views this may draw the attention of the observer, in addition to the existing activity visible within the view. Effects on receptors of higher sensitivity may have potential to be considered significant.

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Cumulative impacts	All	Yes	Cumulative impacts with EMEC Falls of Warness will be assessed in the EIA.

9.4.5 Impact assessment strategy

It is proposed that the impact assessment strategy outlined in Table 9-12 is applied to address the likely significant effects scoped into the EIA, as summarised in Table 9-11.

Table 9-12 Impact assessment strategy for SLVIA

POTENTIAL IMPACT	ASSESSMENT TOPICS	RELEVANT RESEARCH AND GUIDANCE
Changes to visual amenity	Consideration of effects of the project on views experienced by receptors including local residents, recreational visitors to the islands, ferry passengers, and other boat users, within approximately 3 km of the array area.	Landscape Institute and Institute of Environmental Management and Assessment (2013) Guidelines for Landscape and Visual Impact Assessment, 3rd edition.
Cumulative impacts	Assessment of cumulative effects based on the scoped in impacts.	As the EMEC Fall of Warness tidal demonstration site is adjacent to the Project, a cumulative assessment will be completed with respect to information and judgement as applied to the Project alone assessment.

9.5 Local Communities and Socio-economics

9.5.1 Study area

The study area for this topic includes the Orkney Islands, within which the Project is located.

9.5.2 Key data sources

The existing data sets and literature with relevant coverage to the Project, which have been used to inform this Scoping Report and would inform the baseline characterisation for the EIA as appropriate are outlined in Table 9-13.

Table 9-13 Summary of key sources of information for tourism and socio-economic receptors

NAME OF SOURCE	DESCRIPTION/ LINK	DATE	AUTHOR
Regional Gross Value Added (balanced) by industry: all NUTS level regions	https://www.ons.gov.uk/economy/grossvalueaddedgva/datasets/nominalandrealregionalgrossvalueaddedbalancedbyindustry	2019	Office of National Statistics (ONS)
Working age population: local authorities	https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/articles/populationprofilesforlocalauthoritiesinengland/2020-12-14	2020	ONS Mid-Year Population Estimates
Sectoral Marine Plan for Offshore Wind Energy: Social and Economic Assessment report	https://www.gov.scot/publications/sectoral-marine-plan-offshore-wind-energy-encompassing-deep-waterplan-options/	2019	Scottish Government
Orkney Islands Council Area population statistics	https://www.nrscotland.gov.uk/files/statistics/council-area-data-sheets/orkney-islands-council-profile.html	2022	National Records of Scotland
Labour Market Profile - Orkney Islands	https://www.nomisweb.co.uk/reports/lmp/la/1946157427/report.aspx	2022	ONS
Orkney Islands Key statistics	https://www.hie.co.uk/media/6343/orkneypluskeypluusstatisticsplus2019.pdf	2019	Highland and Islands Enterprise (HIE)
Highlands And Islands Area Profiles 2020 Orkney	https://www.hie.co.uk/media/10595/orkney-area-profile-2020.pdf	2020	HIE
Scottish House Condition Survey: Local Authority Analysis 2017-2019	https://www.gov.scot/publications/scottish-house-condition-survey-local-authority-analysis-2017-2019/	2021	Scottish Government
Orkney Local Development	https://www.orkney.gov.uk/Files/Planning/Development-and-Marine-Planning/Local-Plan/OLDP_2017/Orkney_Local_Development_Plan_2017_2022.pdf	2017	OIC

9.5.3 Baseline

9.5.3.1 Population

Between 2011 and 2019, Orkney experienced an increase in population, however, it is predicted to decline by 2043 (HIE, 2020). The National Records of Scotland estimates Orkney's population in mid-2021 as 22,540. This is an increase of 0.6% from the mid-year estimate in 2020. Orkney's population continues to account for 0.41% of the total population of Scotland (National Records of Scotland, 2022).

9.5.3.2 Employment

The percentage of the Orkney population who are economically active (87.7%), in other words, either in employment or actively seeking employment, tends to be consistently higher than both the Scotland (74.7%) and Great Britain averages (71.2%) (ONS, 2023). The Orkney Islands unemployment rate has been below that of the Highlands and Islands and Scotland over the period 2015-2019. The latest figures for January-December 2022 show that the Orkney Islands had an unemployment rate of 2%, lower than the rates in Scotland (3.5%). The top three employment sectors in the Orkney Islands are agriculture, forestry and fishing (19.2%), human health and social work (15.4%) and wholesale and retail (11.5%), in total accounting for 6,000 jobs across the Islands (HIE 2020). The Orkney Islands also had a higher share of employment by occupation in managers, directors and senior officials; skilled trades and elementary occupations compared to the Highlands and Islands and Scotland in 2018 (HIE 2019). Overall, this shows the high economic activity of the Orkney Islands, showing positive figures above regional and national statistics.

9.5.3.3 Income

Data from the Office for National Statistics shows that income levels in Orkney are 15% lower than Scottish mean levels and 5% lower than Scottish median levels (Office for National Statistics, 2020). Note that mean and median figures for Scotland are lower than those for the UK.

9.5.3.4 Fuel poverty

The Scottish Government undertook a Local Authority Analysis for 2017 to 2019 to understand the fuel poverty rates. In the Orkney Islands, the climate, high fuel costs and low incomes mean that 31% of households are in fuel poverty compared with the Scottish average figure of 24% (Scottish Government, 2021).

9.5.3.5 Education

There are approximately 3,000 pupils enrolled in schools in Orkney (OIC, 2023). Academic standards are above the national average and teacher/pupil ratios are among the lowest in Scotland. The Orkney Islands also has amongst the highest proportion of school leavers going into higher and further education in Scotland.

9.5.3.6 Public services

Orkney enjoys good levels of public services, many of them provided and managed by Orkney Islands Council.

9.5.4 Potential impacts

Scoping of likely significant effects on local communities and socio-economics is provided in Table 9-14 below.

Table 9-14. Possible impacts along with the potential significance on local communities and social economics

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Local employment, business	All	No	There may be opportunities for local residents and businesses to become involved at various stages of the Project. Local content in contracts

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
opportunities and economic output			will help to ensure that opportunities are maximised. This includes economic contributions to the supply chain during all Project phases.
Population changes, including increase and distribution	All	No	Jobs created by the project may cause an influx of workers into the Orkney Islands if not recruited locally, however this is unlikely to lead to a significant population increase. Workers associated with the Project may wish to live close to the Project area, which could cause a change in the distribution of population. Although, this is again not considered to result in a significant change. The skilled workforce, would be in keeping, with the general employment characteristics of a higher share of senior and skilled roles.
Pressure on demand for housing and local service	All	No	Workers associated with the project could lead to an increase in demand for housing and local services. However, the demand increase is unlikely to be significant, as the greatest demand would be associated with the construction phase, which would be short-term, estimated to be up to 18-months.

Based on the completed Scoping Assessment as presented in Table 9-14, an EIA for local communities and socio-economics is not required as any potential impacts of the Project on local communities and socio-economics have been scoped out or assessed elsewhere.

9.6 Tourism and Recreation

9.6.1 Study area

The study area for this topic includes the Orkney Islands, within which the Project is located.

9.6.2 Key data sources

The existing data sets and literature with relevant coverage to the Project, which have been used to inform this Scoping Report and would inform the baseline characterisation for the EIA as appropriate are outlined in Table 9-15.

Table 9-15 Summary of key sources of information for tourism and recreation receptors

NAME OF SOURCE	DESCRIPTION/ LINK	DATE	AUTHOR
Scottish Marine Recreation and Tourism Survey	http://marine.gov.scot/information/scottish-marine-recreation-tourism-survey-2015	2015	Marine Scotland
Orkney Islands Visitor Survey 2019	https://www.visitscotland.org/binaries/content/assets/dot-org/pdf/research-insights/orkney-islands-visitor-survey-2019.pdf	2020	VisitScotland & Orkney Islands Council
Orkney Tourism Strategy 2020-2030	https://c.orkney.com/assets/files/15000/orkney_tourism_strategy_2020-2030.pdf	2020 (reviewed 2022)	Orkney Islands Council
Tourism employment in Scotland data	https://www.visitscotland.org/binaries/content/assets/dot-org/pdf/research-insights/tourism-employment-in-scotland.pdf	2018	VisitScotland
The Marine Scotland National Marine Plan Interactive (NMPi) Maps	https://marinescotland.atkinsgeospatial.com/nmpi/	2023	Marine Scotland
RYA Coastal Atlas of Recreational Boating	https://marine.gov.scot/information/rya-coastal-atlas-recreational-boating?order=title&sort=desc	2019	RYA
MMO AIS Derived Track Lines	https://www.data.gov.uk/search?filters%5Bformat%5D=&filters%5Bpublisher%5D=Marine+Management+Organisation&filters%5Btopic%5D=&q=AIS&sort=best	2022/23	Various

9.6.3 Baseline

Tourism is a vital to the local economy of Orkney, with over 288,000 visitors in 2017 drawn to the historic environment, along with beautiful coastal environment and wildlife-watching opportunities (OIC, 2020a; 2020b). The Economic Impact of Tourism to Orkney in 2019 was estimated at over £95 million (including transport, accommodation, shopping, food and drink, and recreation), declining to £35.5 million in 2020 following the global pandemic (OIC, 2020c).

In 2019, approximately 190,000 visitors came to Orkney, 58% of them being 'first-time' visitors, with an average spend per visit at £350 (OIC, 2020b). Figures for cruise liner visitors were not included in the scope of this survey, yet the significant growth of tourism largely comes from increases in cruise passenger numbers. It is estimated that Kirkwall

received around 124,064 cruise liner visitors in 2018, accumulating gross harbour revenue of an estimated £2,000,000 (McGeoch et al., 2020). Overall, the number of cruise vessels visiting the Orkney Islands has more than doubled between 2010-2019 (IOC, 2020c).

This mainstay industry employs a significant number of local people. In 2018, tourism facing industries in Orkney employed around 1,250 people, representing more than 10% of all employment (VisitScotland, 2018). This compares with 8.3% for Scotland as a whole.

The Marine Recreation and Tourism Survey 2015 (Scottish Government, 2016) is the most recent survey completed to provide baseline information for marine planning and fill the data gaps on marine recreation and tourism. The combination of all activities reported on in survey including the following; general marine and coastal recreation, general marine and coastal tourism, visits to historic sites and attractions, walking at the coast, long-distance swimming, birds and wildlife watching, coastal climbing, bouldering, coasteering, land yachting, power kiting, kite buggying at the coast, SCUBA diving, surfing, surf kayaking, paddleboarding, windsurfing, kite surfing, canoeing, rowing, sculling, water-skiing, wakeboarding, dinghy racing, yacht racing, sailing and cruising at sea, motor cruising, power boating, personal watercraft, sea angling from shore, sea angling from boats, wildfowling and other unclassified activities. A range of 5 to 6 combined activity reports are exhibited within the Westray Project area, moderately low in comparison to the Orkney Islands Marine Region with maximum values of 31 combined activity reports. Within the Westray Firth, recreational activity is primarily recreational boating (considered further in Section 9.2). The adjacent EMEC Fall of Warness tidal demonstration site was in operation at the time of the Marine Recreation and Tourism Survey in 2015, therefore, a large degree of recreation and tourism activities already actively avoid this area.

9.6.4 Potential impacts

Scoping of likely significant effects on tourism and recreation is provided in the Table 9-16 below.

Table 9-16. Possible impacts along with the potential significance on tourism and recreation

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Obstruction of tourism and recreational activities	All	No	Increased vessel activity and infrastructure within the Project area, in the context of existing shipping and marine energy related vessel activity in the area, is unlikely to have a significant effect. There is already significant interest in the renewables industry in the Orkney Islands and it is reasonable to assume that the industry may be a key area of interest for some visitors to the Islands. A Project of this scale may contribute to this effect.
Impacts on the economic value of tourism and recreation activities	All	No	Construction is very time limited, at only 18-months, so disruption during the construction (and decommissioning) would be limited. During the operation phase Project activities would only be offshore

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
			within the Project area, without any disruption to tourism. It is recognised that the archaeology and cultural heritage on the Orkney Islands is a key tourism attraction. However, as assessed in relation to the archaeology and cultural heritage (Table 9-9), the Project is not determined to impact the heritage setting based on assessments completed for the adjacent EMEC Fall of Warness tidal demonstration site.

Based on the completed Scoping Assessment as presented in Table 9-16, an EIA for tourism and recreation and is not required as any potential impacts of the Project on tourism and recreation have been scoped out or assessed elsewhere.

9.7 Other Sea Users

9.7.1 Study area

The study area for this topic includes the Orkney Islands, within which the Project is located.

9.7.2 Key data sources

The existing data sets and literature with relevant coverage to the Project, which have been used to inform this Scoping Report and would inform the baseline characterisation for the EIA as appropriate are outlined in Table 9-17.

Table 9-17 Summary of key sources of information for other sea users receptors

NAME OF SOURCE	DESCRIPTION/ LINK	DATE	AUTHOR
Scotland's National Marine Plan	https://www.gov.scot/publications/scotlands-national-marine-plan/	2015	Marine Scotland
Cables – power and telecoms	https://kis-orca.org/subsea-cables/	2020	KIS-ORCA
The North Sea Transition Authority Interactive Maps	https://nstauthority.maps.arcgis.com/apps/webappviewer/index.html?id=cb3474a78df24139b1651908ff8c8975	2023	North Sea Transition Authority
The Marine Scotland National Marine Plan Interactive (NMPi) Maps	https://marinescotland.atkinsgeospatial.com/nmpi/	2023	Marine Scotland

NAME OF SOURCE	DESCRIPTION/ LINK	DATE	AUTHOR
UK Offshore Energy SEA 3 – Appendix 1H – Other Users	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/504567/OESEA3_A1h_Other_users.pdf https://www.gov.uk/government/consultations/uk-offshore-energy-strategic-environmental-assessment-3–oesea3 - full-publication-update-history	2016c	DECC
UK Offshore Energy SEA 4 – Appendix 1H – Other Users	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1061598/Appendix_1h_-_Other_users.pdf	2022e	BEIS
Energy and Infrastructure Spatial Data	https://www.crownestatescotland.com/resources/documents	2022	Crown Estate Scotland
Aquaculture Spatial Data	https://www.crownestatescotland.com/resources/documents	2022	Crown Estate Scotland
Scotland's Marine Atlas: Information for the National Marine Plan	https://marine.gov.scot/sma/content/scotlands-marine-atlas-information-national-marine-plan#:~:text=Scotland%27s%20Marine%20Atlas%3A%20Information%20for%20The%20National%20Marine,The%20Scottish%20Government%20%205%20more%20rows%20	2011	Baxter *et al.*
Draft Regional Locational Guidance	https://marine.gov.scot/information/regional-locational-guidance	2019	Marine Scotland
Cables	https://www.escaeu.org/	2023	ESCA

9.7.3 Baseline

9.7.3.1 Oil and gas

Oil and gas economic activities are in a declining trend in the Orkney Islands as the UK continues to decarbonise and move towards renewable energy generation and associated alternative fuel production. Oil and gas infrastructure is non-existent in the Westray Firth, with the Flotta Marine Oil Terminal and connected PL11 P/C Tee to Flotta oil pipeline being the closest infrastructure at over 30 km away.

9.7.3.2 Renewable energy

There is a significant amount of renewable energy resources (comprising offshore wind, wave and tidal) within the Orkney Islands marine region with a lot of scope for future commercial scale marine renewable energy projects, particularly tidal stream energy. The closest renewable energy infrastructure is the EMEC Fall of Warness tidal test site, which lies southeast to the Westray Project. There are further EMEC tidal test sites at Shapinsay Sound, Scapa Flow and Billia Croo. Other commercial tidal projects include the operational MeyGen tidal turbine in the Inner Sound, the Orbital Projects tidal array in the Ness of Duncansby (an in-development site with an agreement to lease secured), and the Ayre Offshore Wind Farm, a 1,000 MW in-development project with an agreement to lease secured off the east coast of Orkney.

The Westray Project is adjacent to the EMEC Falls of Warness site and the two projects have entered into a co-operation agreement to share information and transmission infrastructure in order to minimise impacts on the physical, biological and human environment (see section 4.5.4).

There is no pathway for effect on other Renewables projects in the Pentland Firth and Orkney waters such as the West of Orkney Wind Farm Project and MeyGen, and therefore other Renewables are scoped out of the EIA.

9.7.3.3 Cables and interconnectors

The Orkney Islands is connected to the national grid via two 33kV AC subsea cables across the Pentland Firth. The northern isles are connected via a 33kV loop which connects Rousay, Westray, Eday, Sanday, Stronsay and Shapinsay. Existing infrastructure in the Westray Firth includes EMEC Falls of Warness tidal project and power cables connecting Rousay to Westray, and Westray to Eday. As described in section 1.3, the EMEC Fall of Warness tidal demonstration site is adjacent to the Westray Project (Figure 1-1). The Rousay to Westray to power cable intersects the Westray Project area as the cable passes through the north west of the site. A cable from Rousay to Westray installed in 2016 by Scottish and Southern Electricity Networks (SSEN) is c. 1.2 km to the north of the Westray array area. A cable from Eday to Westray is c. 3 km to the north east of the Westray array area, installed in 2002 by SSEN. The existing cables and interconnectors are shown in Figure 9-5.

9.7.3.4 Aquaculture

Aquaculture projects are as described in section 9.1.3.2, with the closest being approximately 3 km from the closest point in the northwest of the Project area, which area separated by islands. There is no relevant impact pathway, so impacts on aquaculture are scoped out of further consideration.

9.7.3.5 Other

Of the two disposal sites closest to the Project, one is disused and the other is closed, with both disposal sites being over 10 km away.

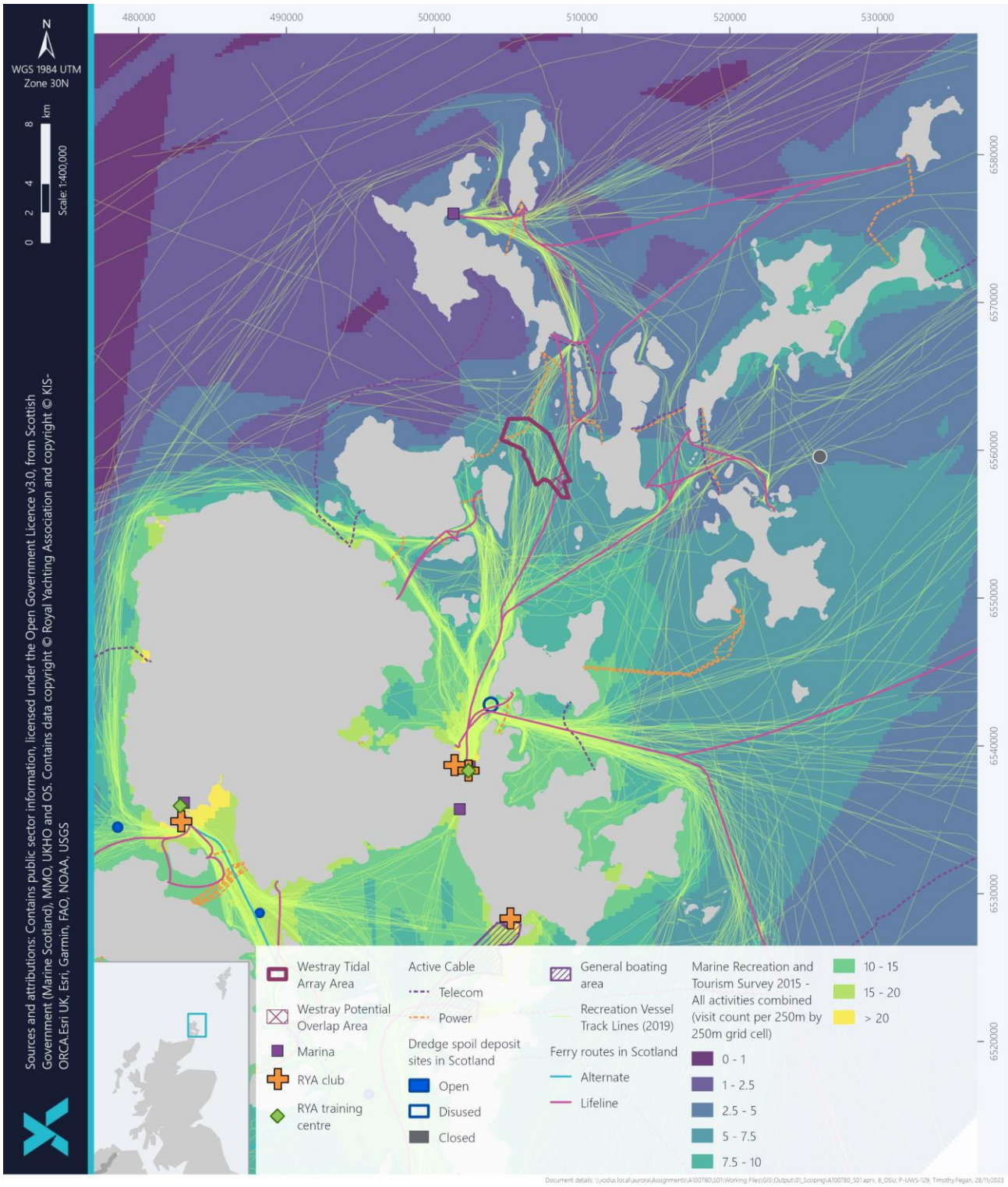

Figure 9-5 Other sea users activity in the vicinity of the Westray Project

9.7.4 Potential impacts

Possible impacts on the other users as a result of the Project are considered in Table 9-18 below.

Table 9-18. Possible impacts along with the potential significance on existing infrastructure

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Potential disruption to existing electrical grid cables	All	No	The installation of infrastructure and implementation of safety distances around installation vessels is not predicted to obstruct activities associated with subsea cable installation, operation and maintenance. No cables intersect or fall within close proximity of the Westray Project area.
Potential disruption to disposal site	All	No	The installation of infrastructure and implementation of safety distances around installation vessels is not predicted to obstruct activities associated with spoil disposal. Of the 2 nearest dredge spoil disposal sites, one is disused and the other is closed. Both are over 10 km away from the Westray Project area.
Potential disruption to oil and gas activities	All	No	The installation of infrastructure and implementation of safety distances around installation vessels would be too far away to obstruct activities associated with the oil and gas activities within Scapa Flow, including those associated with the Flotta Oil Terminal.
Disruption to renewable energy lease sites	All	No	The site will not intersect any active or planned renewable energy sites and is not predicted to obstruct any short-term accessibility to other sites in the Orkney Islands marine region.
Temporary obstruction to renewable energy lease sites	All	No	The Westray Project area does not overlap with the existing EMEC Falls of Warness tidal project.

Based on the completed Scoping Assessment as presented in Table 9-18, an EIA for other sea users is not required as any potential impacts of the Project on other sea users have been scoped out or assessed elsewhere.

9.8 Military

9.8.1 Baseline

Scotland's coastal areas and seas are used for military training, surveillance and monitoring of potential threats, locating bases as well as testing and evaluation activities. The closest defined Ministry of Defence (MoD) Air Force Practice and Exercise Area (PEXA) is c. 24 km to the southwest of the Westray Project area.

9.8.2 Potential impacts

Scoping of likely significant effects on military activities is provided in the Table 9-19 below.

Table 9-19. Possible impacts along with the potential significance on military activities

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Potential disruption to existing MoD activity	All	No	There are no PEXAs in the vicinity of the Westray Project area likely to be affected by the Project.

An EIA for military receptors is not required as any potential impacts of the Project have been scoped out.

9.9 Aviation and Radar

9.9.1 Baseline

Flights into most of the major Scottish city airports are available from Kirkwall Airport, c. 20 km from the Westray array areas. There are also inter-island flights to the Northern Isles of Orkney including: Stronsay, Sanday, Eday, North Ronaldsay, Westray and Papa Westray. These are lifeline services for remote communities that are supported by regular ferry transport.

9.9.2 Potential impacts

Scoping of likely significant effects on aviation and radar is provided in Table 9-20 below.

Table 9-20. Possible impacts along with the potential significance on aviation and radar

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Disruption to aviation	All	No	The O2 device extends approximately 1.6 m above the water surface and therefore is no pathway for impact on aviation arising from the Project.

An EIA for aviation and radar receptors is not required as any potential impacts of the Project have been scoped out.

10 ADDITIONAL EIA MATTERS

10.1 Human Health

10.1.1 Baseline

Under the EIA Regulations the EIA must identify, describe and assess the direct and indirect significant effects of a proposed development (including any operational effects if appropriate) on a number of factors which now includes human health.

Following best practice, health impact assessments typically use the World Health Organization's (WHO) definition, which states that health is:

"A state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity" (World Health Organization, (1948), Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946)."

In this context, the main determinants of human health are made up of:

- Employment and income;
- Community severance or cohesion;
- Social networks and connectivity; and
- Community identity.

The EIA Regulations also state that any risks to human health, for example, due to accidents or disasters, must be considered. The approach for the consideration of major accidents or disasters is provided in Section 10.2.

Millard *et al.* (2016) identified a number of indicators of human health and wellbeing used for Scottish local authorities. The key indicators of relevance to the Project are:

- Mental health;
- Education; and
- Economic deprivation.

With regards to these indicators, human health and wellbeing in Orkney is above the national levels for Scotland.

10.1.1.1 Mental health

The percentage of people in Orkney on prescribed medication for anxiety, depression or psychosis in 2014/15 was 15% (lower than the average for Scotland of 17%).

The rate for psychiatric hospitalisations in Orkney in 2011 to 2013 was 128, which was lower than the Scottish rate of 292.

The five year average suicide rate (2009 to 2013) was 13.2, similar to the Scottish average of 14.5.

10.1.1.2 Education

In 2012/13 the mean tariff score, a measure of exam success rates, was 197, higher than the Scotland mean of 193.

In 2010/11, the percentage of attendance at primary school in Orkney Islands was 95.4%, similar to Scotland overall (94.8%) and the secondary school attendance (90.8%) was also similar to the national average for Scotland at 91.1%.

In 2012, some 9% of working-age adults had low or no educational qualifications, in comparison with 13% in Scotland.

10.1.1.3 Economic deprivation

Economic deprivation indicators mostly suggested that the level of deprivation in Orkney Islands was lower than the level for Scotland overall.

In 2014, the percentage who were income deprived in Orkney Islands was 7% for all ages, lower than the 13% for Scotland.

7% were employment deprived, lower than the 12% for those employment deprived in Scotland. In 2014, the percentage who claimed out-of-work benefits in Orkney was 6%, lower than the 12% average across Scotland.

In 2014, the percentage of young adults who were outside employment, education or training was 3%, which was lower than the 7% average for Scotland.

In 2012, the percentage of children living in poverty was 6%, lower than the 15% average for Scotland.

The percentage of people aged 60 years and over who claimed pension credits in 2014 was 5% in Orkney, lower than the 7% for Scotland.

10.1.2 Potential impacts

Scoping of likely significant effects on human health is provided in Table 10-1 below.

Table 10-1 Likely significant effects on human health

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Effects on mental health	All	No	Due to the low levels of inhabitants and users in proximity to the Project area, significant effects on mental health are unlikely.
Effects on education	All	No	Orbital is open to supporting local education initiatives. Effects on education indicators (such as school attendance and adults with low or no qualifications, Millard *et al.*, 2016) are unlikely to be significant as there is not considered to be an impact pathway.

POTENTIAL IMPACT	PHASE	SCOPED IN?	JUSTIFICATION
Effects on economy	All	Addressed in Section 9.5	

10.2 Accidents and Disasters

The EIA Regulations require significant risks to the receiving communities and environment, for example through major accidents or disasters, to be considered. Similarly, significant effects arising from the vulnerability of the project to major accidents or disasters should be considered.

A major accident, as defined in the Control of Major Accident Hazards (COMAH) Regulations 2015 (as amended), is "*an occurrence such as a major emission, fire, or explosion resulting from uncontrolled developments in the course of the operation of any establishment to which these Regulations apply, and leading to serious danger to human health or the environment (whether immediate or delayed) inside or outside the establishment, and involving one or more dangerous substances*".

Tidal stream energy developments have an intrinsically low risk of causing major accidents. The tidal turbines and associated cabling have an excellent safety record. As discussed in Section 4.3 the operation of the system will be monitored and controlled remotely via a SCADA system. This SCADA system will be able, amongst other things, to show the instantaneous state of each device, and acknowledge warnings and alarms.

A NRA will be undertaken to assess the safety of the project for sea users in the study area, including due to increased vessel movement to and from the project area and the presence of offshore infrastructure during the life cycle of the project.

Whilst exposed power cables on the seabed can pose a snagging risk to shipping and fishing vessels, the project's export and array cables will be buried where possible to protect the cables and remove the snagging risk. Where burial is not possible, cables will be covered by cable protection. This will also be assessed in the NRA.

Geophysical pre-construction surveys will be analysed to identify the presence of any unexploded ordnance (UXO). Based on geophysical survey data to date (Osiris, 2014), no UXO is expected within the Westray project area. If required, controlled UXO clearance operations will be undertaken prior to construction and would be subject to further agreement with Marine Scotland.

The lubricants, fuel and cleaning equipment required within the project will be stored in suitable facilities designed to the relevant regulations and policy design guidance.

Orbital recognises the importance of the highest performance levels of health and safety to be incorporated into the project and will enact minimum safety, health and environmental requirements on all suppliers, contractors and subcontractors. Orbital will also ensure that employees that are going to work for them have undergone necessary health and safety training. With a commitment to the highest health and safety standards in design and working practises enacted, none of the anticipated construction works or operational procedures is expected to pose an appreciable risk of major accidents or disasters. In conclusion, the risk of 'major accidents and/or disasters' occurring

associated with any aspect of the project are scoped out, with the exception of navigational safety which will be assessed further through the NRA.

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