Fall of Warness Scoping Report

May 2022

Document History

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Disclaimer

Contents

List of Figures

List of Tables

1 Introduction

1.1 Purpose

This Environmental Impact Assessment (EIA) Scoping Report has been prepared in support of a future application for consent under Section 36 of the Electricity Act 1989 submitted by the European Marine Energy Centre (EMEC) for the tidal test site at Fall of Warness, Orkney and represents a formal request for a Scoping Opinion by EMEC. This EIA Scoping Report provides information on the sources of data that will be used for site characterisation within the Project Envelope, identifies potential impacts that will need to be considered as part of the EIA process and describes how these impacts will be assessed and what information will be required to carry out the impact assessment. Where additional information is required, a proposed strategy for obtaining that information has also been provided.

In order to ensure that the EIA for the Project Envelope fully takes into account all potential impacts, EMEC requests:

- Feedback on the information presented in this Scoping Report and confirmation that the proposed approach to the assessment of impacts is appropriate; and
- Any further advice on particular environmentally or socially important issues associated with the Project Envelope that will require consideration in the EIA.

1.2 Scope

The Section 36 consent application, supported by this Scoping Report and a subsequent Environmental Statement (ES) and associated appraisals/assessments does not relate to a new project, but rather is a proposed change to the existing Fall of Warness site, Orkney to extend and expand the existing Section 36 consent for the site to allow a project duration to 2040 (in line with the site lease) and a site generating capacity up to 50 MW.

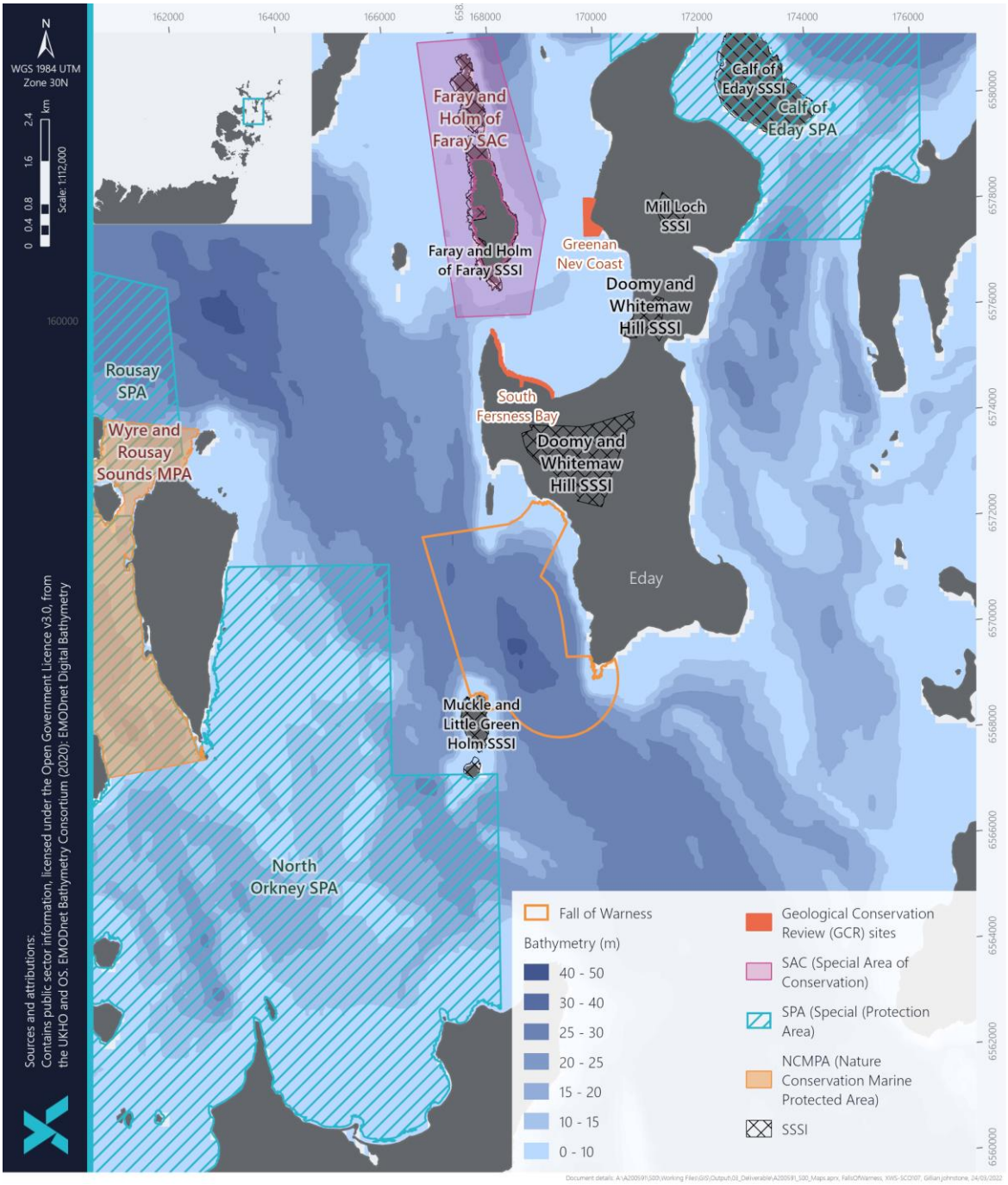
The Scoping Report is submitted to Marine Scotland Licencing Operations Team (MS-LOT) and circulated thereafter to NatureScot and other key stakeholders to confirm with the regulator and their advisors that the proposed approach to the assessment is appropriate, agree the key sensitivities and issues / impacts, make an initial conclusion on the potential significance of the potential impacts, and to determine if any additional surveys, assessments and studies are required to inform the EIA. The Scoping Report takes account of feedback received during a joint Marine Scotland / NatureScot meeting held in April 2022.

This application relates to infrastructure and assets below the Mean High Water Spring (MHWS). The Project Envelope does not include any potential future onshore works, which would require consideration under the Town and Country Planning (Scotland) Act 1997.

1.3 Project Background

EMEC's grid-connected tidal energy test site is located at the Fall of Warness, just west of the island of Eday in the Orkney Islands. The site sits in a narrow channel between the Westray Firth and Stronsay Firth where tidal flow accelerates as water flows through the inter-island constriction on its way from the North Atlantic Ocean to the North Sea. The location of the EMEC tidal energy test site is shown in Figure 1-1.

Figure 1-1 **Location of the Fall of Warness site**



The site was chosen for its high velocity marine currents which can reach almost 4 m/sec (7.8 knots) at spring tides. It currently provides eight tidal test berths at depths ranging from 12 m to 50 m in an area 2 km across and approximately 4 km in length. 11 kV sub-sea cables extend to the middle of the tidal stream from an electricity substation on the island of Eday which houses the main switchgear, backup generator and communications room. The substation controls the supply from each tidal device and includes connection to the National Grid. An adjacent laydown area provides developers with space to place their power conditioning equipment, required to convert electricity from the level at which it is generated to grid-compliant electricity. EMEC sells generated electricity on behalf of the developers, who receive a return. In addition to transporting electricity, the subsea cables also contain a fibre-optic core which allows developers to communicate with their devices and transmit data back to the EMEC data centre and office facilities in Stromness.

To permit the current, ongoing exploitation of the seabed that EMEC lease from Crown Estate Scotland, a series of applications for energy generation have been made to MS-LOT in preceding years; key environmental documents from these applications are summarised in Table 1-1. The forthcoming Section 36 application will draw upon these documents as far as is appropriate.

Table 1-1 Key environmental documents prepared to date

DOCUMENT	PURPOSE
EMEC Tidal Test Facility Fall of Warness Environmental Statement (EMEC, 2005)	This document was produced in June 2005 to report the findings of the EIA carried out for establishing the Fall of Warness site.
EMEC Fall of Warness Navigational Risk Assessment (Marine and Risk Consultants, 2019)	This document reports the findings of an NRA initially carried out in May 2005 to support the establishment of the Fall of Warness site. This NRA was updated in November 2010 and then August 2019 to take into account the latest vessel activity data and guidance/experience available since the original NRA. On the advice of MCA, vessel traffic surveys are carried out every two years in order to confirm no substantial change to vessel usage of the site.
EMEC Fall of Warness Test Site Environmental Appraisal (EMEC, 2014a) and Environmental Statement (EMEC, 2014b)	Building upon the 2005 EIA, this set of documents supported an application to pre-appraise developments within the test site, such that individual deployments did not need to make their own Section 36 and Marine Licence applications.

1.4 Need for the Project

There are four key drivers for the shift in energy production toward low carbon sources, including renewable energy, in the UK, and Scotland:

- The need to address climate change;
- The need to secure energy supply;
- The need for new energy infrastructure; and
- The need to maximise economic opportunities.

Tidal energy is a form of low carbon electricity generation benefitting from a predictability of generation as it is powered by the tides which, unlike other forms of renewable energy production, are not affected by weather conditions. Tides are generated by the combined effects of gravitational forces exerted by the moon and the sun and the rotation of the earth, therefore making the energy generation predictable centuries in advance unlike other weather-dependant renewables. Tidal energy schemes will be a significant contribution to the mix of energy sources. To enable commercial scale generation from tidal resources, there remains a need for scalable testing facilities at which developers can deploy and refine their tidal devices. As the development of the devices moves us closer to commercialisation, the specific needs of test facilities changes. In the case of the Project, facilities capable of handling larger individual devices, and small arrays of such devices, instead of small, standalone devices become critical to more rapid commercialisation. It is this need that underpins EMEC's current application.

1.5 Stakeholder Consultation

Stakeholder engagement is a key part of the EIA process. The aim of stakeholder engagement is to facilitate two-way communications about the Project with all relevant stakeholders. This allows any environmental concerns to be identified at an early stage and provides the opportunity for the EMEC team to ensure that these concerns can be adequately addressed during the EIA process. This Scoping Report is a key part of this process of facilitating early stakeholder engagement.

EMEC has already undertaken extensive stakeholder engagement in relation to the Fall of Warness site and an overview of consultation to date is presented in Table 1-2.

Table 1-2 Consultation related to the current project

CONSULTEE	DESCRIPTION OF ENGAGEMENT
Marine Scotland	Summer 2021: Update meeting to introduce the proposed changes to the Fall of Warness site. Pre-scoping meeting, 14/04/2022: The results of the scoping work to date were presented to Marine Scotland, and feedback on the receptors that has been scoped in and out was sought. The initial approach to EIA and HRA was also presented, and similar feedback requested. The outcome of the engagement has shaped this Scoping Report, and led to ongoing engagement on certain technical topics (e.g. collision risk assessment).
NatureScot	Summer 2021: Update meeting to introduce the proposed changes to the Fall of Warness site. Pre-scoping meeting, 14/04/2022: As above for Marine Scotland.
Orkney Fisheries Association	Brief meeting to discuss current fishing activity within and around the Fall of Warness site (see summary in Section 13).
Maritime and Coastguard Agency, Northern Lighthouse Board, Royal Yachting Association, Orkney Marinas, Orkney Ferries, Chamber of Shipping, Orkney Fisheries Association, Scottish Fisheries Federation	A series of conversations have been held to support the NRA. The focus has been on understanding existing activity, and identifying risk and control measures.

Consultation with regards to the new Section 36 application will continue following the submission of this Scoping Report. EMEC has, or will, set up meetings with key stakeholders to discuss elements of the EIA and HRA; this will include collision risk modelling for ornithology and marine mammal assessments, and the extent of fieldwork to be conducted for the seascape and landscape and visual impact assessment.

Details of all stakeholder activities and responses / feedback from those activities are recorded in a stakeholder database. The ES will also include a specific section on stakeholder engagement which will provide more information on the stakeholder engagement activities carried out as part of the EIA process, information / feedback received from these activities and details of how concerns or issues raised have been taken into account in the EIA process.

Consultation will continue beyond the submission of the ES. Assuming successful award of consent, licence condition implementation, including the development of appropriate environmental monitoring protocols, will generally require continuing engagement and consultation with the regulators and their statutory consultees.

2 Planning, Legislation, Regulation, Policy and Guidance

This section provides an overview of the planning policy, guidance, leasing requirements and legislation which have a bearing on or relationship with aspects of the Project.

2.1 Energy and Climate Change Legislation and Policy

The United Kingdom (UK) is a signatory to the Kyoto Protocol, which commits state parties to reduce greenhouse gas emissions. The protocol came into effect in 2005 and 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.

The Paris Agreement Under the United Nations Framework Convention on Climate Change (Paris Agreement) is the first-ever universal, legally binding global climate change agreement, adopted at the Paris climate conference (COP21). The international treaty aims to reduce the emission of gases that contribute to global warming by limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C. The Paris Agreement set out to improve upon the Kyoto Protocol and aims to strengthen countries' ability to deal with the impacts of climate change and support them in their efforts.

The Climate Change Act 2008 set a legally binding target for the UK to reduce its greenhouse gas emissions from 1990 levels by at least 80% by 2050. This target is supported by a system of legally binding five-year 'carbon budgets' and an independent body to monitor progress, the Climate Change Committee (CCC). The UK carbon budgets restrict the amount of GHG emissions the UK can legally emit in a defined five-year period. The UK Parliament announced a climate emergency in May 2019, publicly declaring concern over the findings around climate change and its consequences. The Climate Change Act 2008 (2050 Target Amendment) Order 2019 revised the 80% reduction target and introduced a legally binding commitment that the net UK carbon account for the year 2050 must be at least 100% lower than the 1990 baseline i.e. 'net zero'.

The Climate Change (Scotland) Act 2009 created the statutory framework for greenhouse gas emission reductions. The Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 sets targets for the reduction of greenhouse gases emissions. The Act will allow Scotland to contribute to the global effort in delivery on the Paris Agreement. In Scotland the Emissions Reductions Targets include a reduction of all greenhouse gases to net-zero by 2045 with interim targets for reductions of at least 75% by 2030 and 90% by 2040.

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 Scottish Marine Policy and Regulation

2.2.1 National Marine Plan

In March 2015, the Scottish Government published 'Scotland's National Marine Plan – a Single Framework for Managing our Seas' (the NMP). The National Marine Plan 2015 sets out strategic policies for the sustainable development of Scotland's marine resources out to 200 nm. It is required to be compatible with the UK Marine Policy Statement and existing marine plans across the UK.

2.2.2 Regional Marine Plan

Regional marine plans are currently in the process of being prepared within those Scottish Marine Regions where there is an established Regional Marine Planning Partnership. The planning competence of these Regional Marine Planning Partnerships extends out to 12 nm. Regional marine plans are required to be developed in accordance with the National Marine Plan (unless relevant considerations indicate otherwise).

Orkney Islands Council received the delegate functions from Scottish Ministers to develop a regional marine plan for Orkney and has set up the Orkney Marine Planning Advisory Group (OMPAG) to provide expert advice and guidance during the plan-making process.

2.2.3 National Planning Framework 3

Published in June 2014, National Planning Framework 3 (NPF3) provides a statutory framework for Scotland's long-term spatial development priorities for the next 20 to 30 years. Statutory development plans must have regard to the NPF, and Scottish Ministers expect planning decisions to support its delivery.

Orkney, Pentland Firth and North Caithness is identified as an area of coordinated action in NPF3; a location of particular significance to the delivery of the Scottish Government's low carbon strategy. NPF3 states that the area is an internationally renowned historic and natural environment, with significant future prospects for growth and innovation. There are unparalleled opportunities for marine renewable energy development, generating significant new business and employment opportunities for the surrounding coastal and island communities.

The delivery of the next version of the NPF (NPF4) commenced in 2018. NPF4 differs from previous NPFs in that it incorporates Scottish Planning Policy and the NPF into a single document and will form a part of the statutory development plan. The Planning (Scotland) Act 2019 came into force on the 25th July 2019. Early engagement for the NPF4 was undertaken with public engagement on a "call for ideas" concluding on 30 April 2020. The Analysis of Responses to the Call for Ideas was published in August 2020. Consultation on the draft National Planning Framework ran until the end of March 2022. Once approved by the Scottish Parliament and adopted by the Scottish Ministers (expected during 2022), this plan will become part of the statutory development plan and will directly influence planning decisions.

2.2.4 Scottish Planning Policy

On 23rd June 2014, the Scottish Government published the Scottish Planning Policy (SPP). SPP sets out Scottish Government policy on how nationally important land use matters should be addressed and outlines Governmental priorities for land use planning. SPP should therefore be afforded significant weight in the determination process for planning applications, however SPP acknowledges that "it is for the decision-maker to determine the appropriate weight in each case". SPP 2014 sits alongside other key Scottish Government documents including the National Planning Framework 3 and associated planning 'Circulars'. The SPP emphasises the merits of sustainable development and the need to deliver heat and electricity in a low carbon manner through supportive policies in Development Plans. For example, the SPP (paragraphs 152 to 192) details how the Scottish Government expects the planning system to facilitate the delivery of a low carbon economy, specifically through the development of electricity generation technologies which will help contribute to reducing greenhouse gas emissions.

2.3 Consenting Legislation

2.3.1 Section 36 of the Electricity Act 1989

To construct, extend or operate an electricity generating station with a capacity greater than 1 MW in Scottish Territorial Waters, consent is required under Section 36 of the Electricity Act 1989 (as amended). An application for consent under Section 36 in Scottish Territorial Waters is made to MS-LOT on behalf of the Scottish Ministers.

The application shall be for the construction and operation of a number of tidal turbines with a generating capacity up to 50 MW, within Scottish Territorial Waters. The application shall be supported by a single ES, prepared in accordance with the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended). Section 36 consent will allow for the installation, operation and maintenance of tidal turbines and export cables as described within the Project Envelope.

2.3.2 Marine Licence

The Marine (Scotland) Act 2010 which applies to Scottish Territorial Waters (between 0 and 12 nm from MHWS) states that a Marine Licence is required to construct, alter or improve any works, or deposit any object in or over the sea, or on or under the seabed. Developers accessing the test site will apply for marine licences to install, operate and decommission their device / component at the site as it lies is seaward of the MHWS and lies within 12 nm of the coast.

As with the Section 36 application above, Marine Licence applications will be made to MS-LOT in due course. This ES shall also therefore be prepared in accordance with the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended).

2.3.3 Environmental Impact Assessment Legislation

Electricity generation projects requiring consent under Schedule 36 of the Electricity Act 1989 may require an EIA under the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended). Marine licensing may require an EIA under The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended). Both sets of Regulations set out the statutory process and minimum requirements for EIA.

The purpose of the EIA is to ensure that the potential effects of a project on the environment are taken in consideration before development consent is granted. If a development is deemed to have potential to cause a significant effect on the environment by virtue of its scale, size and location, then an EIA is required, the results of which must be provided by the developer to the decision maker in the form of an ES. The competent authority cannot grant consent for an EIA development without considering the ES in due course.

2.3.4 Habitats Regulations

The ‘Habitats Regulations’, namely The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) and The Conservation of Habitats and Species Regulations 2017 aim 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 European Sites and European Protected Species (EPS). The ‘Habitats Regulations’ also provide a framework for the conservation and management of wild birds. They afford rare and vulnerable species, and regularly occurring migratory species, protection through the identification and designation of Special Protection Areas (SPAs).

The Habitat Regulations require that where a plan or project that is not directly connected with, or necessary to the management of a national site network site, but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives.

Marine Scotland (as the 'Competent Authority') must consider whether the Project is likely to have significant effects on the conservation objectives of the sites considered in the Habitats Regulations Appraisal (HRA), and, where Likely Significant Effects (LSE) cannot be excluded at the screening stage, and in the absence of mitigation measures, an 'Appropriate Assessment' of the implication of the plan or project must be undertaken by the Competent Authority before consent may be given for the Project.

The ES will be accompanied by a separate, shadow HRA report. The outcome of any Appropriate Assessment would be determined by the Competent Authority and would be produced prior to determination of the application.

The Habitats Regulations present a different legal test to the EIA Regulations. As a result, the HRA will be screened separately from this Scoping Report, however the European sites which at this point are considered likely to require further assessment are discussed throughout the assessment chapters, and feedback is sought on whether or not this covers all sites that stakeholders would expect to see assessed.

3 Project Description

3.1 European Marine Energy Centre

Established in 2003, EMEC is the first and only centre of its kind in the world, providing developers of both wave and tidal energy systems with purpose-built, United Kingdom Accreditation Service accredited open-sea testing facilities.

Orkney, with its excellent oceanic wave regime, strong tidal currents, grid connection and sheltered harbour facilities, is an ideal base for EMEC. Orkney also boasts significant renewable, maritime and environmental expertise within its local community, all of which play a key role in supporting activities at EMEC. Developers are attracted from around the globe to use the facilities to prove what is achievable in some of the harshest marine environments, whilst in close proximity to Orkney's sheltered harbours. EMEC also operates non-grid-connected test sites where developers can test smaller scale devices, or those at an earlier stage in their development, gaining real sea experience in less challenging conditions than those experienced at the grid-connected wave and tidal test sites.

Beyond device testing, EMEC provides independently-verified performance assessments and a wide range of consultancy and research services, as well as providing consenting support to developer clients.

3.2 Site Selection and Alternatives

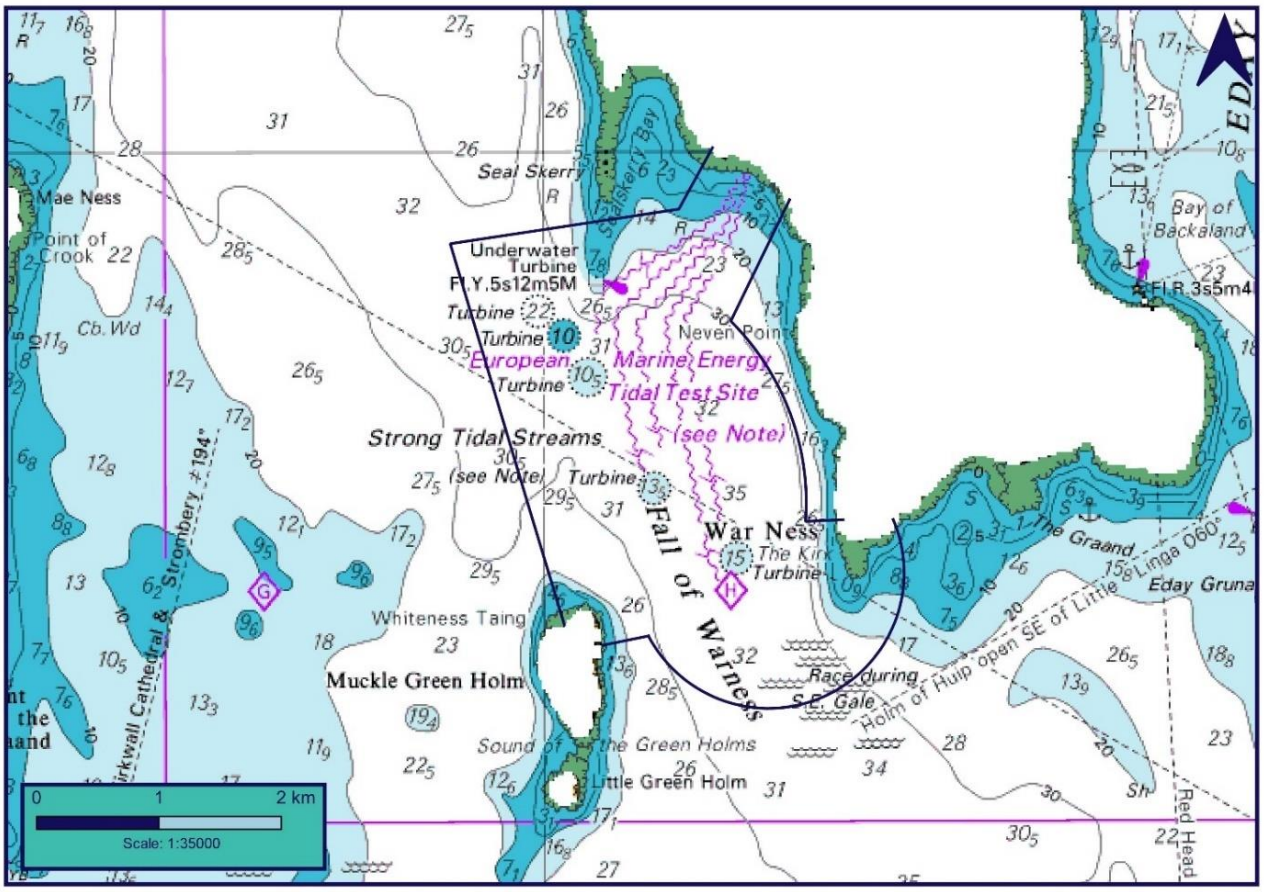
When EMEC was formed in 2003, Highlands and Islands Enterprise (HIE) commissioned a study to determine the optimum site for a tidal test centre. Following an initial screening exercise of eight potential sites, the three most favourable sites were identified based primarily on physical resource and distance from EMEC. The Fall of Warness site, with its high velocity marine currents which reach almost 4 m/s at spring tides, emerged as the most preferred site based on these criteria and was therefore selected as the most suitable option for establishing the tidal test site.

The Fall of Warness site has been established and operating since 2005. As discussed in Section 1.2, the Section 36 consent application does not relate to a new project, but rather to an extension of the project duration to 2040 (date selected to align with the site lease) and an expansion of the site generating capacity up to 50 MW in line with the drivers described in Section 1.4. Although the test site may be offered for testing components and mooring/foundation systems for a wider range of renewable energy devices than previously, no new types of activities are proposed at the site and therefore no further assessment of alternatives is required.

3.3 Fall of Warness Site

Figure 3-1 provides an overview of the Fall of Warness site; the black lines show the approximate routes of the EMEC subsea cables, and the blue points show the approximate location of test berths. The red line shows the site boundary. Essentially the shoreward site boundary corresponds to the 30 m depth contour as far as is practicable and safe.

Figure 3-1 **Existing Fall of Warness site**



Each of the seven berths occupies a circular area of approximately 200 m radius from the cable end, within which developers can install their device(s) and undertake testing activities. The berths can accommodate single devices or small arrays as well as individual components or mooring structures. Each test berth is individually connected to EMEC's shore-based substation at Caldale in Eday via an 11 kV armoured subsea cable, allowing onward transmission of the energy generated by the devices to the National Grid.

At the time of writing, the test site has 4 MW export capacity under the existing Embedded Generation Connection Agreement, which will increase in 2022 to 7.2 MW total export capacity to support the testing of multiple longer-term demonstrations on site.

3.4 Project Envelope

As the precise activities at the Fall of Warness site up until 2040 cannot be fully predicted or defined in the EIA, a Project Envelope has been developed to describe the worst-case scenarios and provide a scope for the assessment. This section provides an overview of the infrastructure and activities included in the Project Envelope, which each appraisal will consider when appraising potential impacts and importance.

The test site will be operated with a maximum of 20 berths, accommodating up to 50 MW of tidal energy devices at any one time, thereby supporting the testing of small arrays. The test site will also allow for the testing of non-grid-connected devices, although such testing will limit the number of grid-connected devices able to test on the site due to available sea space.

The following activities and deployments are included within the Project Envelope:

- Testing activities associated with single device and array deployments, including regular installation, maintenance and decommissioning works;
- Testing of mooring systems and foundation arrangements (e.g., tripod support structures or individual stand-alone components of devices);
- Installation, maintenance and testing of subsea cables;
- Deployment of scientific instrumentation and associated cabling;
- Testing of buoys (maximum of two simultaneous tests); and
- Potential for simultaneous operations, i.e., installation or maintenance activities, at more than one berth at the same time.

The following activities are ***not*** covered by the Project Envelope and would require further consultation and assessment:

- All onshore works (above MHWS) including installation of energy storage devices;
- Seabed preparation (e.g., seaweed clearance, rock grinding/blasting);
- Geotechnical and geophysical surveys (these are considered and, where necessary, licensed through the Notification of Site Survey procedures);
- Use of acoustic deterrent, active acoustic or acoustic communication devices; and
- Deployment and operational activities outside the parameters defined in the Project Envelope.

Table 3-1 provides an overview of the technologies and activities to be considered in the EIA and Table 3-2 details the maximum parameters for which potential impacts and importance will be assessed in the EIA.

Table 3-1 Overview of technologies and activities included in the Project Envelope

DEVICE CATEGORIES AND OTHER POSSIBLE STRUCTURES	FOUNDATION AND MOORING METHODS	LIKELY MARINE WORKS AND CABLING	TYPICAL VESSELS	TYPICAL SCIENTIFIC INSTRUMENTS/TESTING
Device characteristics ○ Blades with exposed tips (may include multiple rotors, on single or multiple axles, horizontal and vertical); ○ Blades with enclosed tips (may include multiple rotors, on single or multiple axles, horizontal and vertical), including 'annular' and 'venturi' style devices); ○ Blades with contra-rotating mechanism (may include multiple rotors, on single or multiple axles, including horizontal and vertical); ○ Single or multiple Archimedes rotors; ○ Tethered tidal kite; and ○ Reciprocating hydrofoil (attached to an oscillating arm). Device structures ○ Floating surface structure; ○ Subsurface floating (neutrally buoyant) structure; ○ Seabed mounted subsurface structure; and ○ Seabed mounted structure with surface-piercing elements. Array configurations ○ Minimum spacing between devices notionally set at 50 m within a radius of the centre point of the device.	○ Mono/twin-pile(s) fixed into the seabed (non-percussive drilling only – no hammer piling); ○ Tripod structure, pinned to the seabed (non-percussive drilling only); ○ Foundation structure held on to the seabed by gravity; ○ Gravity-based anchors with mooring lines attached; ○ Rock anchors/bolts with mooring lines attached; ○ Embedment anchors with mooring lines attached; and ○ Other mooring structure pinned to the seabed (non-percussive drilling only) or held on the seabed by gravity.	Pre-installation† ○ ROV/diver surveys; ○ ADCP deployment/retrieval; Installation ○ Drilling and grouting; ○ Lowering foundation/anchors/nacelle; and ○ Cable works and connection to device. Testing of nacelle, gravity foundations, anchors or scientific equipment ○ ADCP deployments. Inspection & maintenance of devices ○ ROV inspection; ○ Diver activities; ○ Repairs below/above surface on site; and ○ Biofouling removal. Temporary retrieval & redeployment of nacelle, gravity foundations, anchors or scientific equipment Inspection, maintenance and replacement of cables and protection ○ ROV inspection; ○ Diver activities; ○ Cable lifting/laying; and ○ Placement of mattressing/rock armouring.	○ Tug; ○ Workboat; ○ Workboat Cat 2; ○ Workboat (Cat 2) with dive support capability; ○ Dive support boat; ○ Survey vessel (ROV compatible); ○ Multicat workboat (Class 1); ○ Jack-up barge; ○ Crane barge; ○ DP Class II Anchor Handler Tug; and ○ Specialist cable-laying vessel.	○ ADCPs - various types may be deployed; ○ Wave measurement buoys - e.g. waverider buoys, triaxis buoys (combined wave and current measurement); ○ Passive acoustic measurement devices - may be seabed mounted, mid-water moored buoys, device-mounted, or drifting hydrophones and associated equipment; ○ Marine robotics, including but not limited to, remotely operated autonomous underwater vehicles and drop camera surveys; ○ Testing of anti-fouling systems, biofouling and corrosion tests – this may be on static frames mounted on devices or on specific frames deployed for such tests; ○ Underwater cameras including baited cameras – this may be static, towed, or device-mounted; ○ Conductivity, temperature and depth (CTD) measurement instruments; and ○ Integrated monitoring pod which houses an array of the above instrumentation, including associated cabling or battery, to allow deployment across the test site.

DEVICE CATEGORIES AND OTHER POSSIBLE STRUCTURES	FOUNDATION AND MOORING METHODS	LIKELY MARINE WORKS AND CABLING	TYPICAL VESSELS	TYPICAL SCIENTIFIC INSTRUMENTS/TESTING
Temporary floating platforms ○ Possibility of temporary floating platforms for testing of device components, moored using clump weights only. Electrical hubs ○ Possibility of installing, testing, operating and decommissioning electrical hubs, particularly associated with device arrays, as an alternative to cabling devices back to shore individually.				

† Geophysical and geotechnical surveys are out-with the scope of the Project Envelope

Table 3-2 Maximum parameters relevant to appraisals

PROJECT ELEMENT/ACTIVITY	MAXIMUM PARAMETER
Device characteristics	
Number of simultaneous devices	35 devices
Maximum swept area of each device	5,000 m^2
Rotor depth	Minimum 2.5 m clearance from sea surface
Device structures	
Total materials and weight used in device and substructure, excluding moorings/foundation	Total weight of material used per device: ○ Concrete/densecrete – 2,000 tonnes. ○ Steel/carbon steel – 2,000 tonnes. ○ Plastic/synthetic – 100 tonnes.
Distance above sea surface for surface-piercing elements	Maximum distance protruding from sea surface should not exceed 18 m (at MLWS), excluding navigational and communication equipment.
Length and width of floating structures	The sea surface area for surface piercing elements, when in operational mode, should be no greater than 780 m^2. For example, a permitted device could have a length of 100 m and width of 7 m or a length of 20 m and width of 39 m.
Subsea cables to shore[1]	
Cable length	Maximum of 5 km per berth
Number of connected cables	Maximum of 20
Electrical hub parameters	
Total materials and weight used in electrical hub	Total weight of material used per hub: ○ Concrete/densecrete – 500 tonnes. ○ Steel/carbon steel – 1,000 tonnes. ○ Plastic/synthetic – 100 tonnes.
Total direct seabed coverage	Maximum total area of 500 m^2 per hub, with a maximum of eight installed
Distance above sea surface for surface-piercing electrical hub	Maximum distance from sea surface should not exceed 18 m at MLWS, excluding navigational and communication equipment.
Mooring parameters	
Total weight of mooring mechanism	Maximum of 4,000 tonnes per device
Total materials and weight used in mooring weights/anchors/pins	Total weight of material used per device: ○ Concrete/densecrete – 4,000 tonnes. ○ Steel/carbon steel – 4,000 tonnes. ○ Plastic/synthetic – 100 tonnes.
Total mooring footprint	Maximum total area of 0.1 km^2 per array
Total direct seabed coverage	Maximum total area of 3,000 m^2 per device
Foundation parameters	
Total weight of seabed attachment mechanism excluding foundation substructure	Maximum of 4,000 tonnes per device
Total materials and weight used in foundation structure	Total weight of material used per device: ○ Concrete/ densecrete – 4,000 tonnes. ○ Steel/carbon steel – 4,000 tonnes.

[1] Inter-array/umbilical cables are not included within the scope of this Project, and will be dealt with on a device specific basis

PROJECT ELEMENT/ACTIVITY	MAXIMUM PARAMETER
Total direct seabed coverage	Maximum total area of 750 m^2 per device
Frequency of marine works per berth	
Pre-installation activities	Typical duration of up to 1 week
Installation activities	Typical duration of up to 1 month per device (maximum of 7 days of drilling per device)
Inspection and maintenance activities	At regular intervals over 3-12 months
Temporary retrieval and redeployment of nacelle, gravity foundations, anchors or scientific equipment	Typical duration of up to 1 month
Inspection, maintenance and replacement of cables and protection	Typical duration of up to 1 week
Vessel specifications	
Tugs, workboats, dive support vessels, survey vessels	Maximum length 17 - 32 m depending on type Maximum speed 8 - 13 knots depending on type
DP Class II Anchor Handler Tug	Maximum length 94 m Maximum speed 18 knots
Jack-up barge, crane barge	Maximum length 48 m
Specialist cable-laying vessel	Maximum length 130 m Maximum speed 12.5 knots
Simultaneous marine works	
Simultaneous noisy installation activities	Maximum of four berths simultaneously
Simultaneous inspection/maintenance activities*	Maximum of four berths simultaneously
Vessels operating within whole site simultaneously	Maximum of 15 vessels
Testing of device components	
Deployment of temporary floating platforms	Maximum of five on the whole site at the same time

4 Approach to Scoping and EIA

4.1 Scoping (this Document)

The first step in the scoping of environmental impact is to set out the definitions and categories of the potential effects to be considered. The proposed categories of potential importance (Table 4-1) will be applied to all receptor types and be used to identify which activities/effects require further assessment within the EIA, based on the latest Project Envelope at the time the assessments are undertaken. Where impact mechanisms are not fully understood, there will be a preference at this stage for precautionary categorisation of 'potentially important'. Consequently, that category not only addresses issues for which the importance is dependent on particular details of the proposal or site, but also those issues for which there is currently insufficient understanding of the potential impact mechanism.

Table 4-1 Proposed definitions

POTENTIAL IMPORTANCE OF EFFECT	EFFECTS (POSITIVE AND/OR NEGATIVE) [1]	FURTHER ASSESSMENT REQUIRED?
Important	○ Likely Significant Effect on European site(s); ○ Impact on European Protected Species; ○ Impact on the integrity of a Site of Special Scientific Interest (SSSI) or damage to natural features of a SSSI; ○ Impacts on the protected features of a Marine Protected Area (MPA); ○ Impacts on a Priority Marine Feature (PMF); and ○ Impacts on other sensitive natural heritage and human features (e.g. visual amenity) at a population/habitat scale of concern.	Yes
Potentially important	○ Potential Likely Significant Effect on European site(s); ○ Potential impact on European Protected Species; ○ Potential impact on the integrity of a SSSI or damage to natural features of a SSSI); ○ Potential impacts on the protected features of an MPA; ○ Potential impacts on a PMF; and ○ Potential impacts on other sensitive natural heritage and human features (e.g. visual amenity) at a population/habitat scale of concern.	Yes (further information will assist determination of importance, including consideration of uncertainties)
Not important	Negligible effects on natural heritage or human features of interest.	No
No effect	No effects on natural heritage or human features of interest.	No

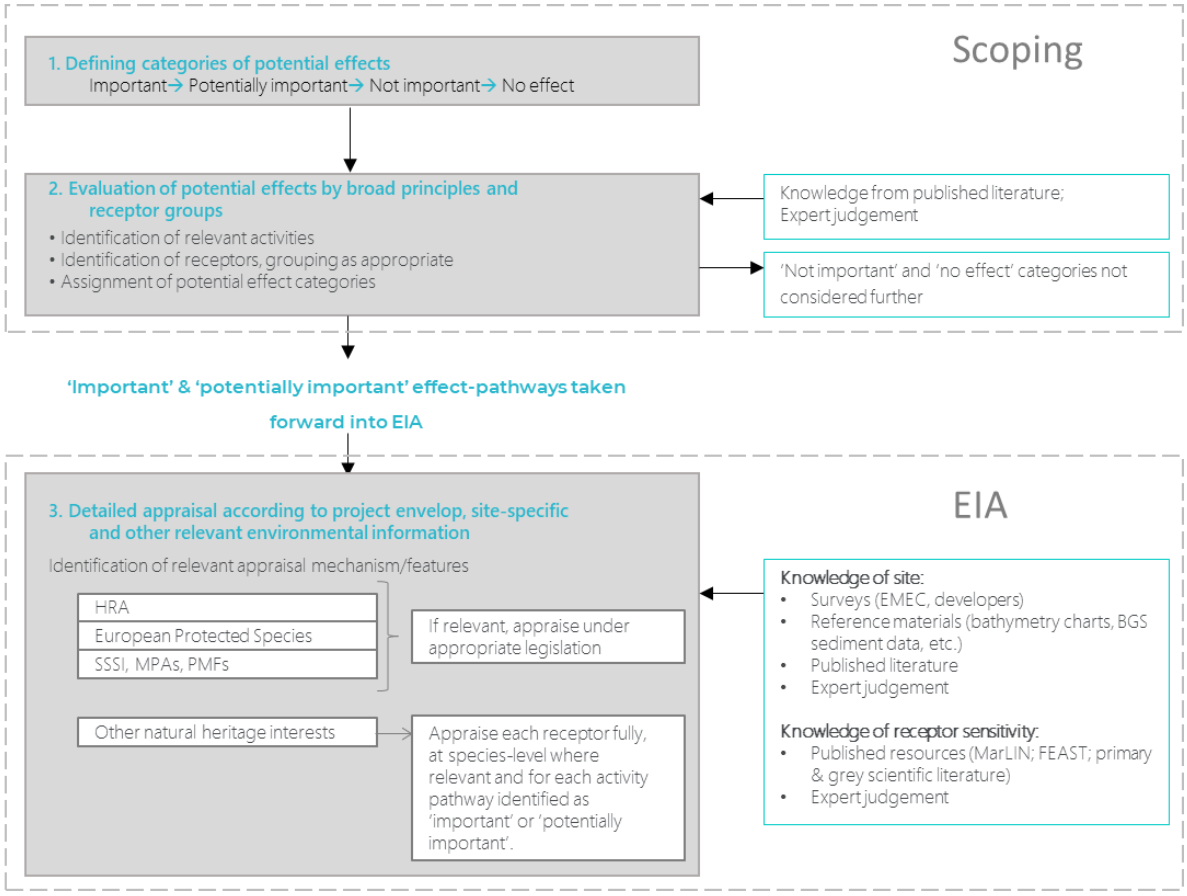
The second step will be to summarise potential effects in broad principles. Deployment installation and decommissioning effects will in most cases be addressed separately to operational and maintenance effects, as they broadly represent categories of activities with differing nature of potential effect. The results of this broad scale assessment will be summarised in tabular format for each receptor. This step will draw on the environmental assessment work undertaken to date for the Fall of Warness site, including the 2014 assessments, and, where applicable, the 2019 assessment undertaken for the Billia Croo wave test site, whilst also taking into account:

- The differences in potential effects between tidal and wave technology;
- More recent and site-specific environmental data e.g. recently designated or proposed conservation sites and tidal test site-specific survey e.g. seabed surveys and marine wildlife; and
- Most recent research / data on impacts from tidal technologies (and wave where relevant).

Following identification of the potential effects and their importance, a description of the relevant natural heritage and human environment features that could be impacted by, and set the context for, the impact assessment for activities at the Fall of Warness site will be provided. Inputs to this description are expected to include site-specific data available from EMEC and its developers and published data sources. Indicative data sources are listed within each receptor chapter.

The process to be followed, which reflects how the environmental assessment work undertaken in support of the Fall of Warness site has been approached to date, is summarised in Figure 4-1.

Figure 4-1 Overview of the scoping and EIA process



4.2 EIA Method

The EIA will undertake a full, detailed assessment of potential activities/effect-pathways regarded to be 'important' or 'potentially important' (Figure 4-1) and therefore scoped into the EIA. Whereas the scoping steps will have evaluated potential effects only in broad principles, at this next EIA stage, site-specific knowledge of species, habitats and development details (as per the Project Envelope) at the Fall of Warness site will be taken into consideration. This allows the types of device, subsea cabling, and installation and retrieval methods associated with the site to be accounted for. Furthermore, whilst receptors will have been previously grouped, they will be considered individually (i.e. to species-level), where appropriate.

This impact appraisal takes account of a maximum-case scenario based on the Project Envelope described in Section 3, updated as appropriate. It will address the differing consenting and licensing regimes and will inform the consenting process for both Section 36 and Marine Licence consent applications. However, it should be noted that, if there are key deviations in the device design or in installation or maintenance activities, further appraisal work may be required. Any

additional appraisal work required will be undertaken by the individual developer (although EMEC will provide further advice in the first instance).

Each detailed assessment will, where applicable, involve the following:

- Assessment and conclusion for each receptor/receptor group or impact type, including outcomes for protected sites and species – this assessment will be informed in part by the Marine Scotland's Feature Activity Sensitivity Tool (FEAST);
- Any species licensing needs; and
- Potential mitigation and monitoring measures.

Over recent years there has been an increasing number of publications and research projects investigating the potential environmental impacts from marine energy. Those relevant to the Fall of Warness site assessment will be accessed and referenced as appropriate.

As noted in Section 1.2, the assessment will exclude any onshore ancillary developments and infrastructure (e.g. substation maintenance).

4.2.1 Data Gaps and Uncertainties

As part of the EIA process it is necessary to identify where data gaps and uncertainties remain even after detailed site characterisation studies (and impact assessments) have been completed as these can influence the results of the EIA. Due to the nature of the marine environment in particular it can often be challenging to establish an exact understanding of the key characteristics of certain aspects of the environment. This is due to a number of reasons - mainly the relative inaccessibility of the marine environment in comparison to terrestrial environments. This makes it difficult to establish exactly what receptors are present within the area that is to be developed (ranging from wildlife through to fishermen), how the area is being used by the different receptors and therefore the importance of the area.

While site characterisation and impact assessment work carried out as part of the EIA will be based on best practice and robust scientific data, it is acknowledged that some data gaps and uncertainties may still exist. Where possible, necessary measures will be taken in order to minimise these data gaps and uncertainties to ensure that they do not affect the robustness of the impact assessment. Where data gaps and uncertainties remain these will be identified, and their implications for the assessment discussed, in the ES.

4.2.2 HRA Approach

This EIA Scoping Report also incorporates initial HRA Screening activity in support of the consent application. Within each receptor topic, a short discussion on the context around protected sites is provided, and those for which likely significant effect (LSE) cannot be excluded are noted as requiring further assessment. This screening step will be documented in full, alongside the subsequent steps, in the HRA Report that will accompany the consent application. The EIA will also consider the potential impact on protected sites (and species).

4.2.3 Mitigation, Monitoring and Research

Where potentially significant impacts are identified, mitigation measures will be considered. The intention is that such measures should remove, reduce or manage the impacts to a point where the resulting residual significance is at an acceptable or insignificant level. The main types of mitigation considered as part of the EIA process are described below:

- Standard practice measures based on specific standards, guidance and recognised industry good practice that are put in place to ensure significant impacts do not occur; and
- Additional impact-specific mitigation measures identified either to reduce, remove or manage potentially significant impacts identified during the impact assessment, or required to ensure that impacts identified as not being significant remain insignificant. This could include for example development of monitoring programmes, further research or on-going consultation etc.

All developers using the Fall of Warness site are required to submit a project-specific Environmental Monitoring Programme (PEMP) as part of their Marine Licence application. This is essentially a project-specific document, in which the client proposes methods for monitoring their device/component in respect of the issues of concern identified in the appraisal.

4.2.4 Residual Impacts

Residual impacts are those that remain once all options for removing, reducing or managing potentially significant impacts have been taken into account. Ideally, taking into account relevant mitigation, the resulting significance of any residual impact should no longer be significant (i.e. reduced to an acceptable or insignificant level).

4.2.5 Cumulative Impacts

Cumulative impact assessment forms an important part of the EIA process. This Scoping Report covers, and the subsequent ES will cover, projects which are “reasonably foreseeable” such as:

- Existing development either built or in construction;
- Approved development, awaiting implementation; and
- Proposals awaiting determination within the planning process with design information in the public domain.

This approach accords with Scottish Natural Heritage (now NatureScot) Guidance: Assessing the cumulative impact of onshore wind energy developments (SNH, 2012) and the Renewable UK Cumulative Impact Assessment Guidelines (RUK, 2013).

Once the relevant projects (sources) and receptors have been identified, possible pathways linking the two will be identified. Where no pathway exists between a source (other than the Project) and a receptor, cumulative impacts can be ruled out. This screening process will help to refine the relevant projects and receptors and inform the spatial extent of the cumulative impact assessment.

The identities of relevant projects to be taken into consideration as part of the cumulative impact assessment will vary from receptor to receptor, and key projects for which there may be cumulative impact are highlighted within each of the relevant sections of this Scoping Report. The developments listed in Table 4-2 below are indicative of the type of plans or projects that will be included within the scope of the cumulative impact assessment.

Table 4-2 Indicative developments considered for cumulative impact assessment with the Project

DEVELOPMENT DESCRIPTION	STATUS	DISTANCE (KM)	START DATE	DURATION OF PROJECT
EMEC - Billia Croo (wave test site)	Consented	34.7	2003 (Construction)	2040
EMEC - Scapa Flow (wave test site)	Consented	26.4	2011 (Construction)	2025
EMEC - Shapinsay Sound (tidal test site)	Consented	14.0	2011 (Construction)	2025
ScotRenewables (now Orbital Marine Ltd) - Lashy Sound Tidal Farm	Planned – Agreement/Option for Lease	5.7	Unknown	Unknown
MeyGen - Inner Sound (Tidal Farm)	Consented	54.1	2015 (Construction)	2047
Orbital Marine Ltd - Seabed at Deer Sound, Orkney (Tidal)	Consented	18.2	N/A	2039
Highland Wind Limited - Pentland Floating Offshore Wind Demonstrator	Consented (although potentially subject to a section 36 variation)	77.8	2023 (Construction)	2048
Offshore Wind Power - West of Orkney Wind Farm (Option N1)	Planned	65.5	Estimated 2024	Unknown
Falck Renewables Wind - Wind Farm (Option NE3)	Planned	66.8	Unknown	Unknown
DEME Concessions Wind NV – Wind Farm (Option NE2)	Planned	34.3	Unknown	Unknown
Aquaculture site (finfish) - OR-20-7	Active	6.4	Unknown	Unknown
Aquaculture site (finfish) - OR-30-8	Active	7.1	Unknown	Unknown
SHEFA (Cable)	Agreement – Option for Lease	30.9	Unknown	Unknown
SHET Orkney (Cable)	Planned – Agreement/Option for Lease	34.6	Unknown	Unknown
OR-48-15 (Cable)	Occasional Licence/MOA	2.1	Unknown	Unknown
SH-64-17 (Cable)	Occasional Licence/MOA	25.9	Unknown	Unknown
Shetland HVDC Link	Consented	Unknown	2020	Unknown

DEVELOPMENT DESCRIPTION	STATUS	DISTANCE (KM)	START DATE	DURATION OF PROJECT
Orkney-Mainland Cable Link	Planned	Unknown	Unknown	Unknown
Other cables	Disused / Active	>2.0	N/A	N/A
Hatston Pier	Active	17.0	2002	Unknown
Kirkwall Port	Active	17.6	Unknown	Unknown
Lyness	Active	39.0	Unknown	Unknown
Port of Stromness	Active	32.5	Unknown	Unknown
Scrabster Harbour	Active	71.0	Unknown	Unknown
Scapa Flow Deep Water Quay	In Planning	24.0	Estimated 2023 – 2025	Unknown
Flotta Oil terminal	Active	37.0	1977	Unknown

4.2.6 Transboundary Impacts

Given the small scale of the proposed project, transboundary impacts will not be considered further in the assessment.

5 Hydrodynamic & Physical Processes

5.1 Introduction

This section of the Scoping Report identifies the hydrodynamic and physical processes of relevance to the Project (including at the coastline) and considers the potential impacts from the construction, operation and maintenance and decommissioning of Project. To inform that, it provides an overview of the hydrodynamic, sediment, geological and coastal environment including water and sediment quality associated with the study area.

5.2 Baseline Overview

5.2.1 Key Data Sources

Table 5-1 shows the key data sources used to inform assessment of hydrodynamic and physical processes.

Table 5-1 Data sources relevant to the scoping and EIA process

TOPIC	DATA TYPE	MAIN DATA SOURCES
Conservation areas and protected sites	○ Special Protection Areas (SPAs) and Special Areas of Conservation (SACs) including those with proposed, candidate or draft status; ○ Nature Conservation Marine Protected Areas (NCMPAs), including those with possible status; ○ Ramsar Sites; ○ Sites of Special Scientific Interest (SSSIs); ○ National Nature Reserves (NNRs); ○ Marine Consultation Areas; ○ Local Nature Conservation Sites; ○ National Scenic Areas (NSAs); and ○ Geological Conservation Review (GCR) sites.	○ Joint Nature Conservation Committee (JNCC); ○ NatureScot; ○ Marine Scotland; and ○ Orkney Island Council (OIC).
Metocean	○ Tides, tidal stream, currents, water depths, wave heights, salinity.	○ EMEC metocean data; ○ 35 years of weather parameters from the European Centre for Medium-Range Weather Forecasts (ECMWF) weather forecast model; ○ Local tide gauges; and ○ Admiralty Tidal Stream Atlas.

5.2.2 Natural Heritage Context

An initial desk-based review of literature and available data sources has been undertaken to support this Scoping Report. The findings of this research are presented below in order to provide an understanding of the Project environment and inform the Scoping process. The key features of

marine physical processes which will inform this Scoping Report and subsequent EIA are as follows:

- Geology;
- Bathymetry and morphology;
- Seabed sediment and sediment transport regime;
- Wind regime; and
- Hydrodynamics (including wave regime, currents, water levels, tidal flows, fronts and stratification).

The results of the seabed survey carried out by Aquatera (2005), subsequent seabed surveys carried out by Sula Diving and the Coastal and Seabed Processes Review (HR Wallingford, 2005) have been used to inform this section.

5.2.2.1 Geology

The shoreline near the landfall areas compromises low sandstone/mudstone cliffs fronted by a storm beach made up of cobbles and small boulders. The main beach comprises superficial sand overlying rocky outcrops, constrained to the north and south by rocky headlands at Sandybank and Neven Point (Aurora, 2005). The intertidal bedrock forms a series of parallel ridges, with sand filling the intervening gullies. The ridges are orientated in the general direction of the cable route (approximately 30° south of beach normal), providing an opportunity to bury the cable within a gully to provide protection and stability.

The low cliffs are assumed to be undergoing slow erosion however evidence from local sources suggests it is at a rate that isn't sufficient to present an issue over the lifetime of the Project.

5.2.2.2 Bathymetry

Water depths at each berth in the Fall of Warness site range from around 12 to 50 m.

5.2.2.3 Seabed Sediment and Sediment Transport Regime

The extent of beach drawdown and rates of longshore drift has not been determined or modelled. In comparison with other similar locations, extreme drawdown during storm period may deplete most of the sand across the middle and upper beach, exposing large areas of rock. On the other hand, low swell conditions may move sand up the beach face, causing the lower beach and nearshore levels to drop.

5.2.2.4 Wind Regime

Strong winds and gales are very common in Orkney, with winds principally from the west to the south and south-southeast. In the spring and early summer there is a marked increase in the frequency of easterly winds (Plant & Dunsire, 1974).

5.2.2.5 Hydrodynamics

Tides and Currents

It should be noted a distinction is drawn between tidal streams which are astronomical in origin and currents which are independent of astronomical conditions and result mainly from meteorological conditions.

The interaction of two independent tidal systems, in the North Sea and the North Atlantic, results in the tides around Orkney. The tidal waves of both systems have anti-clockwise rotations and they both reach Orkney's coastline with similar strengths but moving in opposition. The northward Atlantic wave peak arrives roughly 2-3 hours earlier than the southward travelling North Sea wave,

producing a net flow of water from east to west and interactions among the island sounds (BGS & Scott Wilson Resource Consultants, 1997).

The Fall of Warness area is subject to strong tidal streams, with peak spring tide velocities almost reaching 4 m/s. It is also exposed to high-energy waves from the southeast and the northwest. The main channel has a water depth of over 50 m, and the bed is rocky, with surface sediment along the coastal fringe. The surrounding shorelines are mainly rocky, with pocket beaches. The area is affected by tidal surges, with the 50-year return period surge level given as about 1.35 m.

Wave Regime

Winds are predominantly from the west or south, with the most frequent strong winds arriving from the west, which develop over the North Atlantic. This in combination with ocean swell can give rise to severe wave conditions for the west coast of Orkney. Predicted 1 year return period wave heights are 10 m (Hs over 3-hour periods) and 100-year heights are 15 m, with an annual 10% exceedance height of 3 m. On the east coast waves from the south can be large but will not reach such extremes. Fetch lengths over which the waves can develop are limited to the North Sea. The 10% exceedance significant wave height for the exposed east side of Orkney is 1.5 m.

The test facility area is directly exposed to wind and sea swell from the northwest and the southeast due to the orientation of the channel and the shelter derived from the surrounding islands. Waves from other directions can reach the area due to diffraction and refraction, making the area very dynamic. Overfalls, due to opposing wave and tide directions, are common in the area of the test bays.

Shelter is provided to the landfall from the westerly sector is provided by the intertidal rock out crop at Seal Skerry, but wind, sea and swell can still reach the nearshore from Stronsay Firth and beyond. Locally generated waves from the south are also significant (HR Wallingford, 2005).

The mean significant wave height in the months of December-March is 2.5-3 m in the surrounding waters of Orkney. Wave heights in these waters are similar throughout the year, with 2-2.5 m in April and September- November, and 1.5-2 m in May-August (British Oceanographic Data Centre, 1998).

5.2.3 Protected Sites

There are no environmental protected sites which are designated for the protection and conservation of physical marine characteristics (e.g. geology, geomorphology, dunes etc.) that overlap with the Fall of Warness site.

Geological Conservation Review (GCR) sites have been identified as sites of national and international importance regarding British geology. The Greenan Nev Coast and South Fersness Bay are GCR sites with non-marine Devonian geology are located approximately 2.2 km and 5.1 km away from the Fall area respectively. However, it is unlikely that there would be any connectivity with the Fall of Warness site as sediments wouldn't be transported such a distance.

The Wyre and Rousey sounds NCMPA is located approximately 5.6 km from the Fall of Warness site. The site has been designated for three functionally linked protected features; the maerl bed, kelp and seaweed communities which thrive on sublittoral sandy sediment in the tide-swept channels. The maerl beds also form an integral part of the Orkney carbonate production system, a component of the Marine Geomorphology of the Scottish seabed geodiversity feature (Brooks *et al.*, 2013).

5.3 Effect Pathways

The potential effect-pathways assessed on the baseline environment include:

- Changes to sedimentary processes;
- Changes to erosive forces and patterns; and
- Changes to biological productivity or feeding opportunities through alteration of the tidal or wave regime.

Table 5-2 **Potential effects on sedimentary processes, erosive forces and patterns and alteration of the tidal or wave regime during the deployment phase, identifying activities/effect pathways and receptors for further assessment**

POTENTIAL EFFECTS FROM DEVICE DEPLOYMENT (AND DECOMMISSIONING[2])		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
Changes to sedimentary processes (suspended sediment, sediment transport pathways and subsequent deposition) from foundation, mooring or cable installation.	Benthic environment	***Potentially important*** – Changes to sediment processes through the release of drill cuttings or dredge material during construction, and sediment deposition particularly, may affect the benthic environment but is likely to be temporary in area local to the devices. Effects outside of the immediate vicinity of the devices may be longer-lasting, but will be limited by the dispersal of material that is generated during installation activities. Importance will depend upon the sensitivity of the receiving environment to deposited sediment, local hydrodynamics, the physical characteristics of released sediment and the volume of sediment released.
	Pelagic environment	*Not important* – in strong tidal streams, any changes to sedimentary processes in the pelagic environment during construction are expected to be very short-term in the near-field and negligible in the far-field.
	Littoral Fringe	***Potentially important*** – increased sediment deposition to the coastal environment may occur as a result of release of drill cuttings or dredge materials during construction. The initial sensitivity and rate of recovery will be greater for some coastal habitats than others. Importance will also depend on the orientation and proximity of seabed works to sensitive coastal areas, local hydrodynamics and the volume and physical characteristics of released material.

[2] To save unnecessary repetition, decommissioning impacts will be considered alongside installation impacts, highlighting where necessary impacts specific to decommissioning only.

Table 5-3 **Potential effects on sedimentary processes, erosive forces and patterns and alteration of the tidal or wave regime during the operations and maintenance phase, identifying activities/effect pathways and receptors for further assessment**

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
Changes to erosive forces/patterns and sedimentary processes (suspended sediment, sediment transport pathways and subsequent deposition) from presence/operation of devices & infrastructure.	Benthic environment	***Potentially important*** **–** altered hydrodynamics in the immediate vicinity of turbines may result in increased scouring and loss/release of sediment (if present). Far-field effects on the distribution and transport of sediment to and the benthic environment may be difficult to predict, but could include increased sedimentation if energy has been removed from the system. Importance will depend upon the sensitivity of the surrounding benthic environment, changes in sediment dynamics, local hydrodynamics, the arrangement/spacing of devices and the level of energy extraction in the context of local conditions.
	Pelagic environment	*Not important* – increases in suspended sediment are expected to be a result of scouring and therefore highly localised and rapidly dispersed in a tidally active area. The extraction of energy may result in higher rates of deposition/settlement of sediment over a wider area. This is unlikely to be of concern to the pelagic environment in a tidally active area.
	Littoral fringe	***Potentially important*** **–** extraction of energy from the tidal area may result in increased sediment deposition downstream (near and far field effects). Current speed may increase adjacent to devices/arrays, with a resultant increased likelihood of sediment entrainment. The presence of cabling and protection may alter patterns of scour and deposition in the near-shore and intertidal environments. Sensitivity will be greater for some coastal habitats than others. Importance will also depend on local hydrodynamic conditions, the availability of sediment, the physical arrangement/spacing of devices and the level of energy extraction in the context of local conditions.
Changes to biological productivity or feeding opportunities through alteration of the tidal or wave regime.	Benthic environment	***Potentially important*** **–** most arrangements of tidal devices that extract energy through rotating turbines are unlikely to alter hydrodynamics sufficiently to affect biological productivity or feeding opportunities in the benthic environment. Importance will depend upon the level of energy extraction in the context of local conditions, and the sensitivity & functional role of affected benthic habitats.
	Pelagic environment	***Potentially important*** **–** only for very large arrays or deployments in areas of strong functional importance for mixing of nutrient rich waters (i.e. sea fronts) is it possible that there will be measurable effects in this regard. Such areas typically have high primary and secondary productivity and attract predatory fish, birds and mammals in large numbers.
	Littoral fringe	***Potentially important*** **–** most arrangements of tidal devices that extract energy through rotating turbines are unlikely to alter hydrodynamics sufficiently to affect biological productivity or feeding opportunities in the coastal environment. However, developments with connectivity to sensitive estuarine or lagoon systems could have important effects in this regard. Importance will depend upon the level of energy extraction in the context of local conditions, and the sensitivity & functional role of affected benthic habitats.

5.4 Appraisal Mechanisms

Table 5-4 presents the relevant legislation and any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features.

Table 5-4 Relevant legislation including applicable appraisal reasons

FEATURE TYPE	APPRAISAL MECHANISM/RELEVANT LEGISLATION	APPLICABLE	REASONING
Qualifying feature of European sites	The Conservation of Habitats and Species Regulations 2017 The Conservation (Natural Habitats &c.) Regulations 1994 (as amended)	No	No connectivity with SACs with benthic qualifying features.
Notified features of SSSIs	Nature Conservation (Scotland) Act 2004 (as amended)	No	No measurable impacts of relevance to nearby SSSIs.
Protected features of NCMPAs	The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) Marine and Coastal Access Act 2009 (if relevant)	No	The Wyre and Rousey NCMPA is designated for marine geomorphology of the Scottish Seabed, however due to intervening distance connectivity is unlikely.
Other sensitive natural heritage features	Appraisal of other features under: ○ The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore) ○ The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 ○ Marine (Scotland) Act 2010 ○ Geological Conservation Review sites	Yes	Captures assessment of all other sensitive natural heritage features at a scale of concern

5.5 Cumulative Impacts

Hydrodynamic and coastal processes may act cumulatively if in close proximity to other projects which may impact sedimentary and erosive processes. Sediment concentrations are a particular concern for cumulative impacts, predominantly caused through the construction and installation activities for any marine and coastal projects near the Fall of Warness site. Although there are a number of nearby projects in the area, no projects are located within 1 km of the Fall site. Given the localised nature of suspended sediment impacting the water column, this distance is sufficiently great that no cumulative impact is expected.

5.6 Summary and ES appraisal

A number of potential impacts on hydrodynamic and physical process receptors have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. Hydrodynamic and physical processes are primarily considered as pathways rather than receptors themselves. However, whilst the processes are largely pathways, there are nonetheless some features that can be considered as hydrodynamic and physical receptors and in relation to the Project (Section 3) these include:

- The coast and coastal designated sites with geomorphological features; and
- Morphological features associated with Wyre and Rousey sounds NCMPA and associated features beyond the extent of the NCMPA.

As pathways, hydrodynamic and physical processes have the potential to lead to changes with onward impacts to receptors associated with other EIA topics, including but not limited to:

- Benthic ecology;
- Fish and shellfish ecology;
- Commercial fisheries; and
- Other sea users.

The scoping of impacts associated with changes to hydrodynamic and physical process pathways on other environmental receptors will be assessed within the relevant EIA topic chapters. With respect to hydrodynamic and physical processes as receptors, a number of impacts are proposed to be potentially important for assessment. These impacts are outlined, together with a justification for their scoping decision in Table 5-5.

Table 5-5 Summary overview of topics scoped into ES

ACTIVITY POTENTIAL/EFFECT PATHWAY	BENTHIC ENVIRONMENT	PELAGIC ENVIRONMENT	LITTORAL FRINGE
INSTALLATION AND DECOMMISSIONING			
Changes to sedimentary processes	Potentially important	Not important	Potentially important
OPERATION AND MAINTENANCE			
Changes to erosive forces/patterns and sedimentary processes (suspended sediment, sediment transport pathways and subsequent deposition) from presence/operation of devices & infrastructure.	Potentially important	Not important	Potentially important
Changes to biological productivity or feeding opportunities through alteration of the tidal or wave regime.	Potentially important	Potentially important	Potentially important

The assessment of impacts arising from the Project on hydrodynamic and physical receptors will utilise site-specific and publicly available data including existing baseline data, monitoring data and published literature that will be augmented by consultation during the EIA phase. No site-specific modelling or surveys are proposed to be conducted. The baseline data will help to develop a conceptual understanding of the key physical processes and sediment regime within both a regional and site level. Analytical spreadsheet-based tools are proposed in order to assess the nature and magnitude of any impacts.

6 Benthic Environment

6.1 Introduction

This section describes the benthic habitats and species of relevance to the Fall of Warness site 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.

6.2 Baseline Overview

6.2.1 Key Data Sources

Table 6-1 shows the key data sources used to inform assessment of the benthic environment.

Table 6-1 Data sources relevant to the scoping and EIA process

TOPIC	DATA TYPE	MAIN DATA SOURCES
Conservation areas and protected sites	○ Special Areas of Conservation (SACs) including those with proposed, candidate or draft status; ○ NCMPAs, including those with possible status; ○ Ramsar Sites; ○ Sites of Special Scientific Interest (SSSIs); ○ National Nature Reserves (NNRs); ○ Marine Consultation Areas; and ○ Local Nature Conservation Sites.	○ JNCC; ○ NatureScot; ○ Marine Scotland; and ○ OIC.
Benthic environment	○ Potential Areas of Annex I Habitat (e.g. reefs); ○ Priority Marine Features (PMF); ○ OSPAR habitats and species; ○ UK Biodiversity Action Plan (BAP) and Orkney Local BAP habitats and species; and ○ EUNIS biotopes.	○ EMEC Fall of Warness commissioned site-specific benthic survey data (e.g. EMEC, 2009; Robbins, 2011); ○ Marine Scotland National Marine Plan Interactive (NMPi) maps; ○ JNCC; ○ NatureScot; ○ OSPAR Commission; ○ EMODnet Broad-scale seabed habitat map for Europe (UKSeaMap); and ○ BGS Digital GIS data and maps (for currently unsurveyed areas).

6.2.2 Natural Heritage Context

Site-specific baseline data on the intertidal and subtidal benthic species and habitats at the Fall of Warness site is available from a coastal habitats and communities survey and a preliminary seabed survey commissioned by EMEC in 2005. The coastal habitats and communities survey

used transect lines, quadrats and cores to survey the Eday shoreline where accessible and representative of the whole shore. The subtidal seabed survey used an ROV to obtain still photographs and video footage, with further photography, observations and sampling conducted by divers, and covered water depths from the shoreline to the deepest berth at 51 m. Both surveys are reported in the first Environmental Statement (Aurora, 2005). There have also been a series of developer-specific benthic ROV surveys, typically focussing on more discrete areas of seabed around berth locations.

6.2.2.1 Substrate/geogenic habitats

Intertidal area

The 2005 coastal habitats and communities survey (Aurora, 2005) found that the west coast of Eday, south of Fer Ness in the northern part of the survey area, generally has large expanses of bedrock platforms with boulders, and a series of gullies and geos filled with boulders and occasionally sand. A sandy bay is formed at Seal Skerry, backed by shingle and vegetated dunes.

Low bedrock ridge cliffs (5-20 m) become more common south of Seal Skerry Bay, fronted by boulder/shingle beaches or smooth bedrock wave-cut platforms. In places, sand collects in the gullies and forms a clean, sandy bank on low-lying bedrock reefs. There is also an area of sand dunes between Sandybank and Cauldale, in the test site area. The coastline from Newbigging south to Warness is characterised by bedrock ridge cliffs (20 m) which often plunge straight into the sea no bedrock ridge shore. The shore is very exposed at certain locations and as such is characterised with a fucoid-dominated intertidal zone.

Subtidal area

The 2005 seabed survey (Aurora, 2005) showed the Fall of Warness subtidal area to consist largely of scoured and tide-swept bedrock and boulders, with areas of broken bedrock amongst sublittoral sandbanks in the shallower eastern and northern margins. Although the seabed in the deeper areas consisted largely of bedrock and boulders, areas of shell-sand were common in between boulders from depths of 34-40 m. The rocky and sedimentary habitats present throughout much of the site supported communities of species (see below) typical of tidally-scoured areas.

The predicted EUNIS habitat classification within the Fall of Warness site consists of infralittoral rock and circalittoral rock, with the potential for Annex 1 rocky reef habitat to occur throughout the area (NMPi, 2021).

6.2.2.2 Benthic species

Intertidal area

The 2005 coastal habitats and communities survey and an associated desk study (Aurora, 2005) found the shores around Eday to follow the typical pattern of an exposed to moderately exposed rocky shore, with no unusual species or species of particular interest being recorded.

The intertidal flora was considered typical of a rocky shore with *Fucus* spp., particularly the serrated wrack *F. serratus*, and the knotted wrack *Ascophyllum nodosum* dominating. The typical sequence from upper to lower shore occurs: channel-wrack *Pelvetia canaliculata*, spiral-wrack *F. spiralis*, bladder-wrack *F. vesiculosus*, *A. nodosum*) and finally *F. serratus*. The predominant red algae found under these canopies are usually *Mastocarpus stellatus*, *Laurencia pinnatifida, Corallina officinalis* and *Palmaria palmata* which tend to grow over a crust of pink coralline algae. Toward the upper shore at all of the less exposed survey sites there was a dense coverage of

green seaweed, *Enteromorpha* spp. The sublittoral fringe is dominated by extensive *Laminaria* forests, particularly around Seal Skerry and further south to War Ness (OIC, unpublished data).

The fauna present on the shore represents those commonly found on rocky shores, including barnacles (*Balanus balanoides*) and limpets (*Patella vulgata*) (OIC, unpublished data). In exposed areas of the shore species such as dog whelk *Nucella lapillus* are found in cracks and crevices. The flat periwinkle *Littorina obtusata*, the edible periwinkle *L. littorea*, the common shore crab *Carcinus maenas*, the common starfish *Asterias rubens* and gammarid amphipod species are also likely to be present.

Subtidal area

The 2005 seabed survey (Aurora, 2005) in Section 4.2 showed the benthic species associated with bedrock and boulder areas at the Fall of Warness site to be typical of this substrate type in tidally-scoured areas of the north of Scotland, with some areas of rock being relatively bare of flora and fauna.

Information from developer-specific surveys of berths indicates that the southern and eastern berth sites may exhibit slightly denser faunal turfs on top of bedrock, boulders and cobbles. Kelp (*Laminaria* spp.*)* and the associated red alga *Rhodymenia palmata* are present 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.

Benthic infaunal species associated with sedimentary substrates are also typical, including common polychaetes, amphipods and bivalves. The infauna is relatively sparse within the mobile sandy substrates in some margins of the site.

With the exception of a possible record of some scattered maerl debris (*Lithothamnion corallioides* or *Phymatolithon calcareum*) (ScotRenewables, 2011), 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 Fall of Warness site. Evidence to date does not suggest there is a maerl bed present, and no live maerl has been reported.

Predictive modelling conducted by Thomson (Thomson *et al.*, 2014) indicates an area of high probability of seagrass (*Zostera*) habitat in the nearshore area of part of the site, but no sampling was undertaken there as part of the study.

6.2.2.3 Biogenic habitats

Areas of relatively dense seaweed at the Fall of Warness site, including *Laminaria* spp., will provide biogenic habitat that supports a higher diversity and biomass of biota than areas of bare rock or mobile sand. These patches of biogenic habitat appear to be increasingly sparse with distance from the shore. Although no formal biotope classification has been completed for the site, this habitat may represent the PMF '*Kelp beds – Laminaria hyperborea with dense foliose red seaweeds on exposed infralittoral rock*', or a component of the PMF '*Tide-swept algal communities*' (NatureScot, 2014; Tyler-Walters *et al.*, 2016). However, the NMPi maps (Marine Scotland, 2022) do not indicate the presence of these or any other PMFs within the Fall of Warness site.

With the exception of seaweed habitats, there have been no records to date from the EMEC surveys of 2005, the developer-specific benthic monitoring programmes or wider resources of species that would form subtidal biogenic habitats at the Fall of Warness site. Given the tidally-scoured nature of the seabed, areas of seaweed habitat are likely to be sparse except in some of the relatively sheltered sublittoral margins of the site.

6.2.3 Protected Sites

The Fall of Warness site does not sit within or directly adjacent to any SACs, NCMPAs or SSSIs designated for the protection of benthic habitats or species. The closest protected site with benthic protected species is the Wyre and Sound NCMPA which lies over 4.5 km west of the Fall of Warness site boundary, between the islands of Rousay, Egilsay and Wyre (Figure 1-1). It has been designated for the protection of two types of benthic habitat: kelp and seaweed communities on sublittoral sediment, and maerl beds.

6.3 Effect Pathways

For benthic receptors, the defined potential effect categories are applied to activities/effect pathways relevant to tidal energy developments comprising design-types involving the rotation of turbines within natural hydrodynamic conditions. First, potential effects are considered in broad principles. Deployment/installation effects (Table 6-2) are addressed separately from those during the operational and maintenance phases (Table 6-3).

The potential effect-pathways assessed on the baseline environment include:

- Habitat loss/damage;
- Smothering by resettlement of disturbed sediments or drill cuttings;
- Habitat creation;
- Introduction of marine non-native species;
- Changes to hydrodynamic and sediment regime;
- Electromagnetic field effects; and
- Thermal loading from cabling.

Table 6-2 **Potential effects on substrate integrity, benthic species and benthic habitats during the deployment phase, identifying activities/effect pathways and receptors for further assessment**

POTENTIAL EFFECTS FROM DEVICE DEPLOYMENT (AND DECOMMISSIONING[3])		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
Habitat loss/damage	Substrate/geogenic habitats	***Potentially important*** – some mooring/foundation designs, cable protection options and installation techniques result in loss/damage to larger areas than others. Effects range from the short- to long-term, partly due to the relative recoverability of substrate types. Importance will depend upon the ecological value of the affected substrate/habitat for biota, its recoverability and the overall footprint in the context of the wider availability of the substrate/habitat.
	Benthic species	***Potentially important*** - some mooring/foundation designs, cable protection options and installation techniques result in loss/damage to larger areas than others. Sensitivity (including recoverability) of benthic species is often linked to their natural resilience to disturbance events, with species associated with mobile substrates recovering relatively quickly. However, importance will also depend upon the scale of the impact in the context of the local and regional distribution of species, and the conservation value of the species concerned.

[3] To save unnecessary repetition, decommissioning impacts will be considered alongside installation impacts, highlighting where necessary impacts specific to decommissioning only.

POTENTIAL EFFECTS FROM DEVICE DEPLOYMENT (AND DECOMMISSIONING[3])		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
	Biogenic habitats	***Potentially important*** – most biogenic habitats are highly sensitive and slow to recover from loss or damage. Such habitats are also typically of high conservation value, supporting high biodiversity and ecological functionality. Importance will depend upon the extent and quality of biogenic habitats, and upon the scale of loss/damage in the context of the habitat locally/regionally.
Smothering by re-settlement of disturbed sediment or drill cuttings.	Substrate/geogenic habitats	*Not important* – while some settlement of disturbed sediment or drill cuttings may be expected, due to the high tidal flow of locations for tidal energy projects it is considered that any settlement will be temporary (limited to a period of slack tide) with no lasting effect on local substrate types.
	Benthic species	***Potentially important*** – in most tidally active areas, redistribution of such material is likely to be sufficient for smothering impacts on benthic species to be negligible. However, some potential for important effect remains for highly sensitive species – importance will depend upon the species present, their abundance and local/regional importance, the hydrodynamic conditions and the volume of suspended material above natural background levels.
	Biogenic habitats	***Potentially important*** - in most tidally active areas, redistribution of such material is likely to be sufficient for smothering impacts on biogenic habitats to be negligible. However, some potential for important effect remains for highly sensitive habitats – importance will depend upon the habitats present, their extent, quality and local/regional importance, the hydrodynamic conditions and the volume of suspended material above natural background levels.
Introduction of marine non-native species (via vessels, devices or other equipment)	Substrate/geogenic habitats	*No effect* – non-native species are unlikely to affect the physical nature of a substrate.
	Benthic species	*Not important* – the effect of a proliferation of a MNNS on benthic species has the potential to be important, should it occur. Proliferation of a MNNS depends on both the introduction of a MNNS, its ability to establish itself and its tendency to become invasive. A monitoring programme for marine and brackish NNS has been initiated by OIC but species posing a risk to the Orkney marine environment are yet to be identified (OIC, 2020). Most of the vessels working at the site are expected to be small, local vessels and the tidal devices for testing will also originate from similar locations in the UK. EMEC has processes in place to manage the risk of introduction of MNNS. With these management processes in place, the risk of introduction of any MNNS via the test site is extremely low
	Biogenic habitats	*Not important* **–** the effect of a proliferation of MNNS on biogenic habitats is difficult to predict but has the potential to be important, particularly given the typical ecological value of biogenic habitats such as kelp beds. Most of the vessels working at the site are expected to be small, local vessels and the tidal devices for testing will also originate from similar locations in the UK. EMEC has processes in place to manage the risk of introduction of MNNS. With these management processes in place, the risk of introduction of any MNNS and subsequent effects on marine habitats via the test site is extremely low.

Table 6-3 **Potential effects on substrate integrity, benthic species and benthic habitats during the operations and maintenance phase, identifying activities/effect pathways and receptors for further assessment**

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
Habitat creation	Substrate/geogenic habitats	***Potentially important*** – devices, their foundations/mooring systems and other infrastructure will introduce a new substrate that will differ from the natural state. The difference is less notable on hard geogenic substrates; artificial structures will alter the local environment more significantly when placed on sedimentary substrates. Importance will also depend upon the scale of new structures in the context of the local environment.
	Benthic species	***Potentially important*** – sessile species may colonise new structures, while more mobile species may aggregate around structures that provide some protection or feeding opportunities. Effects may be positive or neutral over hard substrates, where artificial structures may help offset lost habitat. Effects may be negative or neutral where hard structures are introduced to a sedimentary environment. Importance will also depend upon the scale of devices, foundations and infrastructure in the context of the local environment.
	Biogenic habitats	***Potentially important*** – biogenic habitats may form on new structures. Effects may be positive or neutral over hard substrates, where artificial structures may help offset lost habitat. Effects may be negative or neutral where hard structures are introduced to a sedimentary environment, but potentially also positive due to the functional value of biogenic habitats that may be depleted elsewhere. Importance will also depend upon the scale of devices, foundations and infrastructure in the context of the local environment.
Introduction/facilitation of marine non-native species (MNNS) (via vessels, devices, other equipment, or by provision of device and infrastructure as a stepping-stone in MNNS range expansion).	Substrate/geogenic habitats	*No effect* – non-native species are unlikely to affect the physical nature of a substrate.
	Benthic species	*Not important* – the effect of a proliferation of a MNNS on benthic species has the potential to be important, should it occur. Proliferation of a MNNS depends on both the introduction of a MNNS, its ability to establish itself and its tendency to become invasive. A monitoring programme for marine and brackish NNS has been initiated by OIC but species posing a risk to the Orkney marine environment are yet to be identified (OIC, 2020). Most of the vessels working at the site are expected to be small, local vessels and the tidal devices for testing will also originate from similar locations in the UK. EMEC has processes in place to manage the risk of introduction of MNNS. With these management processes in place, the risk of introduction of any MNNS via the test site is extremely low.
	Biogenic habitats	*Not important* **–** the effect of a proliferation of MNNS on biogenic habitats is difficult to predict but has the potential to be important, particular given the typical ecological value of biogenic habitats such as kelp beds. Most of the vessels working at the site are expected to be small, local vessels and the tidal devices for testing will also originate from similar locations in the UK. EMEC has processes in place to manage the risk of introduction of MNNS and the risk of devices and infrastructure being stepping stones in MNNS expansion. With these management processes in place, the risk of introduction

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
		of any MNNS and subsequent effects on marine habitats via the test site is extremely low.
Changes to hydrodynamic and sediment regime (including scour around devices and cables).	Substrate/geogenic habitats	***Potentially important –*** arrays of devices could theoretically alter hydrodynamic processes to a degree that would influence scouring and sediment processes and thereby alter benthic substrates. More obvious, however, is the potential for changes in the immediate vicinity of devices or infrastructure. Importance will depend upon natural hydrodynamic conditions, substrate types, the value placed on their integrity and the design and layout of devices, foundations and infrastructure.
	Benthic species	***Potentially important –*** arrays of devices could theoretically alter hydrodynamic and sediment processes that could affect benthic species over a wide area. More obvious, however, is the potential for effects upon benthic species in the immediate vicinity of devices or infrastructure. Importance will depend upon natural hydrodynamic conditions, the conservation value and sensitivity of species and the design and layout of devices, foundations and infrastructure in the context of the distribution of important species***.***
	Biogenic habitats	***Potentially important*** – arrays of devices could theoretically alter hydrodynamic and sediment processes that could affect biogenic habitats over a wide area. More obvious, however, is the potential for effects in the immediate vicinity of devices or infrastructure. Importance will depend upon natural hydrodynamic conditions, the conservation value and sensitivity of habitats and the design and layout of devices, foundations and infrastructure in the context of the distribution of important habitats***.***
Electromagnetic Field (EMF) effects.	Substrate/geogenic habitats	*No effect*
	Benthic species	*Not important* – although the evidence base is limited, current physiological knowledge provides the expectation that only a limited range of benthic fish species are expected to be of particular sensitivity to EMF. These are addressed in Section 7 of this document.
	Biogenic habitats	*Not important* – as above for benthic species.
Thermal loading from cabling	Substrate/geogenic habitats	*No effect*
	Benthic species	*Not important* – although the evidence base is limited, thermal loading from export and intra-array and export cables is expected to be so low and localised as to be almost immeasurable (BERR, 2008). Any effects on benthic species will be highly localised.
	Biogenic habitats	*Not important* – as above for benthic species.

6.4 Appraisal Mechanisms

Table 6-4 presents the relevant legislation and any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features.

Table 6-4 Appraisal mechanism for benthic species and habitats

FEATURE TYPE	APPRAISAL MECHANISM/RELEVANT LEGISLATION	APPLICABLE	REASONING
Qualifying feature of European sites	The Conservation of Habitats and Species Regulations 2017 The Conservation (Natural Habitats &c.) Regulations 1994 (as amended)	No	No connectivity with SACs with benthic qualifying features
European Protected Species (EPS)	The Conservation (Natural Habitats &c.) Regulations 1994 (as amended)	No	No benthic species are listed as EPS
Notified features of SSSIs	Nature Conservation (Scotland) Act 2004 (as amended)	No	No connectivity with SSSI with benthic qualifying features
Protected features of NCMPAs	Marine (Scotland) Act 2010 Marine and Coastal Access Act 2009 (if relevant)	No	No NCMPAs with protected benthic features will be impacted
PMFs	Marine (Scotland) Act 2010	Yes	Benthic PMFs might be present within the area of influence
Other sensitive natural heritage features	Appraisal of other features under: o The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore); o The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; o Marine (Scotland) Act 2010; and o Wildlife and Countryside Act 1981.	Yes	Captures assessment of all other sensitive natural heritage features at a population/habitat scale of concern

6.5 Cumulative Impacts

Given the highly localised nature of the potential impacts on benthic habitats and species, there is little potential for them to impact cumulatively with other projects, plans and activities. Section 4.2.5 of this document provides an indicative list of the developments to be considered in the cumulative impact assessment. The key focus for the benthic environment will be on the PMFs that potentially occur at the Fall of Warness site as described in Section 6.2.2 and which may also be impacted by other projects, plans and activities in Orkney waters. The approach will be to identify the other threats to the PMFs to enable the cumulative impacts to be assessed. A key resource for the assessment will be the National Marine Plan Interactive web portal (NMPi) and the State of the Environment Assessment for the Orkney Islands Marine Region (OIC, 2020).

6.6 Summary and ES appraisal

Given the natural heritage features and effect pathways assessed in Section 6.3 and the appraisal mechanisms identified in Table 6-4, the ES will appraise the effects of the Project Envelope on benthic PMFs and other sensitive natural heritage features, as shown in Table 6-5. The ES will also identify any monitoring or mitigation required.

Table 6-5 Summary overview of topics scoped into ES

EFFECT PATHWAYS	SUBSTRATE /GEOGENIC HABITATS	BENTHIC SPECIES	BIOGENIC HABITATS
INSTALLATION AND DECOMMISSIONING			
Habitat loss/damage	Potentially important	Potentially important	Potentially important
Smothering by re-settlement of disturbed sediment or drill cuttings	Not important	Potentially important	Potentially important
OPERATION			
Habitat creation	Potentially important	Potentially important	Potentially important
Changes to hydrodynamic and sediment regime (including scour around devices and cables)	Potentially important	Potentially important	Potentially important

The ES will focus on the site-specific hydrodynamic, benthic and intertidal characteristics of the Fall of Warness site and how the Project Envelope may impact these. It will provide a broad-scale characterisation of benthic features and appraisal of any sensitivities identified including but not limited to the presence of PMFs and Annex 1 habitats. This will be informed by the data summarised in Section 6.2 including existing site-specific survey data.

7 Fish and Shellfish

7.1 Introduction

This section describes the fish and shellfish species of relevance to the Fall of Warness site 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.

7.2 Baseline Overview

7.2.1 Key Data Sources

Table 7-1 shows the key data sources used to inform assessment of fish and shellfish.

Table 7-1 Data sources relevant to the scoping and EIA process

TOPIC	DATA TYPE	MAIN DATA SOURCES
Conservation areas and protected sites	○ Special Areas of Conservation (SACs) including those with proposed, candidate or draft status; ○ NCMPAs, including those with possible status; ○ Sites of Special Scientific Interest (SSSIs); ○ National Nature Reserves (NNRs); and ○ Local Nature Conservation Sites.	○ JNCC; ○ NatureScot; ○ Marine Scotland; and ○ Orkney Island Council (OIC).
Fish and shellfish	○ Fish spawning and nursery grounds; ○ Migratory and sensitive fish distribution and migration routes.	○ Fisheries Sensitivity Maps in British Waters (Coull *et al.*,1998) (Cefas data); ○ Spawning and nursery grounds of selected fish species in UK waters (Ellis *et al.*, 2012) (Cefas data); ○ Shark Trust sightings for elasmobranchs; ○ Updated fisheries sensitivity maps in Scottish Waters (Aires *et al.*, 2014) (Marine Scotland Science data); ○ Pilot Pentland Firth and Orkney Waters Marine Spatial Plan (Scottish Government); ○ State of the Environment Assessment: A Baseline Assessment of the Orkney Islands Marine Region (Scottish Government); ○ The Marine Life Information Network (MarLIN); ○ Fish tagging and genetic studies and reviews on migratory fish published by Marine Scotland (various, including Malcom *et al.*, 2010, Godfrey *et al.*, 2014, Cauwelier *et al.*, 2015, Downie *et al.,* 2018 and Armstrong *et al.,* 2018); ○ Publications available through the

TOPIC	DATA TYPE	MAIN DATA SOURCES
		Caithness District Salmon Fishery Board; ○ Survey data / reports available through ICES, including International Herring Larvae Survey (IHLS) and the International Bottom Trawl Survey (IBTS) (North Sea) (ICES); ○ Orkney Biodiversity Records Centre; ○ National Biodiversity Network (NBN); and ○ Protected Sites (NatureScot).

7.2.2 Natural Heritage Context

The Fall of Warness ES from 2014 (EMEC, 2014a) 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 sp.*), trout (*Salmo sp.*) and eels (*Anguilla sp.*), marine fish (including herring (*Clupea harengus*), mackerel (*Scomber scombrus*), cod (*Gadus morhua*), saithe (*Pollachius virens*), butterfish (*Peprilus triacanthus*), gobies (*Gobiidae sp.*), flatfish, sandeels, common skate (*Dipturus batis*) and spurdog (*Squalus sp.*)) and marine shellfish (including king scallops (*Pecten maximus*), lobsters (*Homarus gammarus*), velvet crab (*Necora puber*), brown crab (*Cancer pagurus*) and squat lobsters (*Galathea sp.*)). At the time, there had been no targeted surveys of fish and shellfish at the test site, but there had been anecdotal observations of fish and shellfish during benthic surveys and seabed investigations which confirm the nature of the baseline was as expected from the literature.

Spawning and nursery grounds have been identified in British waters (Coull *et al.*, 1998; Ellis *et al.*, 2012). There were no high intensity spawning grounds found within the Project Envelope, and sandeel was the only species with low intensity spawning grounds within the Project Envelope (Table 7-2). Anglerfish (*Lophiiformes sp*) was the only identified species with a high intensity nursery ground within the Project Envelope. Sandeel, blue whiting (*Micromesistius poutassou*), cod, common skate, European hake (*Merluccius merluccius*), herring, ling (*Molva molva*), mackerel, spotted ray (*Aetobatus narinari*), spurdog and whiting (*Merlangius merlangus*) were found to have low intensity nursing grounds within the Project Envelope (Coull *et al.*, 1998; Ellis *et al.*, 2012).

Table 7-2 Summary of nursery and spawning in the wider Fall of Warness area (Coull *et al.*, 1998; Ellis *et al.*, 2014)

SPECIES	SPAWNING	INTENSITY	NURSERY	INTENSITY
Sandeel	Y	Low	Y	Low
Anglerfish	N	-	Y	High
Blue Whiting	N	-	Y	Low
Cod	N	-	Y	Low
Common Skate	N	-	Y	Low
European Hake	N	-	Y	Low
Herring	N	-	Y	Low
Ling	N	-	Y	Low
Mackerel	N	-	Y	Low
Spotted Ray	N	-	Y	Low
Spurdog	N	-	Y	Low

SPECIES	SPAWNING	INTENSITY	NURSERY	INTENSITY
Whiting	N	-	Y	Low

The key commercial species identified in the Orkney region (State of the Environment Baseline Description, 2020), were brown crab, velvet crab, king scallops, queen scallops (*Aequipecten opercularis*), European lobster, prawns (*Nephrops norvegicus*), whelk (*Buccinum undatum*), mackerel, cod, haddock (*Melanogrammus aeglefinus*), herring, saithe, and hake. Non-commercial species found in Orkney waters are Atlantic salmon, sandeels, sea trout (*Salmo trutta trutta*), flapper skate (*Dipturus batis*) and basking sharks (*Cetorhinus maximus*). The report also identified potential invasive species, including red algae (*Melanothamnus harveyi* and *Bonnemaisonia hamifera*), bryozoan (*Schizoporella japonica*) and Japanese skeleton shrimp (*Caprella mutica*).

7.2.3 Protected Sites

The only protected site which features fish and shellfish as a qualifying feature and occurs in the vicinity of the Fall of Warness site is the North-west Orkney NCMPA, which is approximately 32 km away. The primary qualifying species is sandeels. Due to the distance between the Project area and MPA and the non-migratory nature of sandeels, the Project is not expected to interact with the NCMPA.

It is noted that whilst the River Thurso and River Naver SACs are approximately 70 km and 100 km south and west of the Fall of Warness, 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.

7.3 Effect Pathways

For fish and shellfish receptors, the defined potential effect categories are applied to activities/effect pathways relevant to tidal energy developments as described in Section 3. First, potential effects are considered in broad principles. Deployment, installation and decommissioning effects (Table 7-3) are addressed separately from those during the operational and maintenance phases (

Table 7-4). The potential effect-pathways assessed on the baseline environment include:

- Installation vessel transits and manoeuvring leading to disturbance;
- Underwater noise from foundation/mooring installation methods and vessels leading to auditory injury, death or disturbance;
- Increased suspended sediment/turbidity (including release of drill cuttings);
- Smothering because of drill cuttings or re-settlement of sediment;
- Benthic habitat loss;
- Introduction of MNNS via vessels, devices or other equipment;
- Vessel transits and manoeuvring as part of maintenance activities, leading to disturbance;
- Habitat creation and fish aggregation effect;
- Underwater noise from tidal devices operation;
- Changes to sediment and hydrodynamic regime;
- Introduction of MNNS;
- EMF effects; and
- Presence of tidal devices and associated infrastructure leading to a barrier effect.

Table 7-3 **Potential effects on fish and shellfish receptors during the deployment phase, identifying activities/effect pathways and receptors for further assessment**

POTENTIAL EFFECTS FROM DEVICE DEPLOYMENT (AND DECOMMISSIONING[4])		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
Installation vessel transits and manoeuvring leading to disturbance	Diadromous fish	*Not important* – Vehicle transits are not anticipated to be sufficiently noisy to have an important effect. Vehicle transiting activity will also be limited in duration and geography.
	Marine fish	
	Marine shellfish	
Underwater noise from foundation/mooring installation methods and vessels leading to auditory injury, death or disturbance	Diadromous fish	***Potentially important*** **-** different species show varying levels of sensitivity to noise and vibration. Additionally, importance will relate to background noise, the range and frequency of noise sources and the duration and proximity of activities. Migration routes will also determine importance.
	Marine fish	***Potentially important*** **-** different species exhibit different sensitivity to noise and vibration. Additionally, importance will relate to background noise, the range and frequency of noise sources and the duration and proximity of activities to fish species. Distance to important locations/routes for sensitive species will also influence importance.
	Marine shellfish	*Not important* - detailed species-specific knowledge is lacking in relation to the effects of anthropogenic noise in relation to shellfish and there is considerable debate about the hearing capabilities of aquatic invertebrates. No physical structures have been discovered in aquatic invertebrates that are stimulated by the pressure component of sound. However, vibrations (i.e., mechanical disturbances of the water) are also characteristic of sound waves. Rather than being pressure-sensitive, aquatic invertebrates appear to be most sensitive to the vibrational component of sound. There is also evidence that some aquatic invertebrates display a level of sensitivity to underwater noise especially at the larvae recruitment stage. However, any possible effects are expected to be minor, highly localised and unimportant at a population level.
Increased suspended sediment/turbidity (including release of drill cuttings)	Diadromous fish	*Not important* **–** any increase in suspended sediment is predicted to be dispersed widely and quickly into the wider marine environment and diadromous fish by their nature are highly mobile and accustomed to a range of sedimentary conditions from transiting between various habitats.
	Marine fish	***Potentially important*** **–** some marine species are sensitive to increased suspended sediment in the water column. This is particularly relevant to filter feeding species. The level of importance will be dependent on several factors including the level and nature of increased suspended sediment, the duration of any increase which will in turn be dependent on tidal conditions and the distribution of sensitive species in the vicinity.
	Marine shellfish	
Smothering because of drill cuttings or re-settlement of sediments	Diadromous fish	*Not important* – diadromous fish are highly mobile and cover large areas when present in the marine environment. They will therefore move away from potential impacts caused by resuspension.
	Marine fish	***Potentially important*** **–** some benthic finfish may be vulnerable to smothering. This is applicable to species of low mobility or those which lay their eggs on the seabed. The level of importance will be dependent on the type of sediment, the volume of sediment,

[4] To save unnecessary repetition, decommissioning impacts will be considered alongside installation impacts, highlighting where necessary impacts specific to decommissioning only.

POTENTIAL EFFECTS FROM DEVICE DEPLOYMENT (AND DECOMMISSIONING[4])		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
		dispersive properties of the locality and the distribution of sensitive species in the vicinity.
	Marine shellfish	***Potentially important –*** some shellfish may be vulnerable to smothering. This is applicable to species of low mobility or those which filter feed. The level of importance will be dependent on the type of sediment, the volume of sediment, dispersive properties of the locality and the distribution of sensitive species in the vicinity.
Benthic habitat loss/damage	Diadromous fish	*Not important* – diadromous fish are highly mobile and cover large areas when present in the marine environment.
	Marine fish	***Potentially important*** – certain species have a reliance on the benthic environment for feeding and egg laying. Certain operations associated with the Project Envelope have the potential to impact the benthic environment. The level of importance will depend on the extent of the impact, the availability of the same habitat in the wider environment, the duration of the impact and the recoverability of the habitat.
	Marine shellfish	***Potentially important*** – the majority of shellfish species have a reliance to some extent on the benthic environment. Certain operations associated with the Project Envelope have the potential to impact the benthic environment. The level of importance will depend on the extent of the impact, the availability of the same habitat in the wider environment, the duration of the impact and the recoverability of the habitat.
Introduction of marine non-native species (MNNS) via vessels, devices or other equipment	Diadromous fish	*Not important* **–** the proposed vessels and equipment will presumably be locally sourced and larger vessels in need to swap ballast aren't predicted to be necessary, therefore non-native species are not likely to pose a significant threat.
	Marine fish	
	Marine shellfish	

Table 7-4 **Potential effects on fish and shellfish receptors during the operations and maintenance phase, identifying activities/effect pathways and receptors for further assessment**

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
Vessel transits and manoeuvring as part of maintenance activities, leading to disturbance	Diadromous fish	*Not important* – activities will not be sufficiently noisy to cause disturbance. Activities will also be limited in geography and duration; therefore, the activity is not considered potentially important.
	Marine fish	
	Marine shellfish	
Habitat creation and fish aggregation effect	Diadromous fish	*Not important* **–** diadromous fish are not generally considered to aggregate around structures at sea with any regularity as their time at sea is generally considered to be transitional. Therefore, any aggregation potential is considered not to be important.
	Marine fish	***Potentially important –*** there is the potential for some species to be attracted and aggregate around the tidal devices and other infrastructure. This phenomenon is poorly understood and is likely to be dependent on the benefits which aggregating behaviour will offer (reproductive, predator avoidance etc).
	Marine shellfish	

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
Underwater noise from tidal devices operation	Diadromous fish	***Potentially important –*** although certain species are sensitive to noise, the nature of diadromous fish means that they are unlikely to be in the vicinity of any noise for any extended periods of time. Importance will be dependent on the distance of the tidal devices to known migration routes, the noise characteristics of the operating tidal devices and natural and manmade noise in the marine environment.
	Marine fish	***Potentially important –*** most marine species are of a highly mobile nature which means they can move away from noisy activities. However, some species do utilise low frequency sound for communication. The implications of the sound generated from tidal devices on marine species of fish is poorly understood but importance is likely to be dependent on the noise characteristics of the tidal devices, the life stage of the fish and natural and manmade noise in the marine environment.
	Marine shellfish	*Not important* **–** it is not considered that shellfish species are sensitive enough to noise for the predicted noise from the tidal devices to be important.
Changes to sediment and hydrodynamic regime	Diadromous fish	*Not important* **-** any increase in suspended sediment is predicted to be dispersed widely and quickly into the wider marine environment and diadromous fish by their nature are highly mobile and accustomed to a range of sedimentary conditions from transiting between various habitats.
	Marine fish	***Potentially important*** **-** certain species have a reliance on the benthic environment for feeding and egg laying. Other species which feed pelagically could also be impacted by changes in hydrodynamic and sediment regimes. Importance will be dependent on the duration of change, the nature and severity of change and the presence of sensitive species in the vicinity.
	Marine shellfish	
Introduction of marine non-native species (MNNS)	Diadromous fish	*Not important* – most of the vessels working at the site are expected to be small, local vessels and larger vessels that require ballast water changes aren't predicted to be necessary, therefore non-native species are not likely to pose a significant threat.
	Marine fish	
	Marine shellfish	
Electromagnetic Field (EMF) effects	Diadromous fish	***Potentially important –*** diadromous species utilise magnetism on their migration routes, they are therefore susceptible to EMF. The importance will be dependent on the level of EMF emitted which in turn will be dependent on the cable type and size. Importance will also be dependent on proximity to migration routes and rivers.
	Marine fish	***Potentially important –*** species of shark, skates and rays are sensitive to EMF. The importance will be dependent on the level of EMF emitted which in turn will be dependent on the cable type and size. Importance will also be dependent on the proximity to migration routes and relevant rivers.
	Marine shellfish	***Potentially important*** – shellfish species have shown to be affected by EMF (Hutchison *et al* (2020)). The importance will depend on the species present in the Project area.
Collision with turbine blades leading to injury or death.	Diadromous fish	***Potentially important –*** diadromous and marine fish will pass through the site, potentially in close proximity to the operating devices. Depending on individual behaviour, prevailing tidal and other environmental conditions at the time of any use of the site, and conflicting other pressures such as predator avoidance, some fish may approach the devices close enough such that collision with moving blades is possible.
	Marine fish	

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
	Marine shellfish	*Not important* **–** given the limited mobility of the majority of shellfish species, and their limited use of the water column, collision with operating turbines is not considered to be important.
Presence of tidal devices and associated infrastructure leading to a barrier effect	Diadromous fish	***Potentially important* –** migratory diadromous fish may rely on narrow migration routes when moving between fresh and marine water. The potential importance will be dependent on the location of the Project in relation to any migratory routes and the spatial extent of the Project in relation to any such routes.
	Marine fish	*Not important* **–** marine finfish are unlikely to be exclusively dependent on the area of the Project and therefore barrier effects are not considered to be important.
	Marine shellfish	*Not important* **–** given the limited mobility of the majority of shellfish species, barrier effects are not considered to be important.

7.4 Appraisal Mechanisms

Table 7-5 presents the relevant legislation and any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features.

Table 7-5 Appraisal mechanism for fish and shellfish species and habitats

FEATURE TYPE	APPRAISAL MECHANISM/RELEVANT LEGISLATION	APPLICABLE	REASONING
Qualifying feature of European sites	The Conservation of Habitats and Species Regulations 2017 The Conservation (Natural Habitats &c.) Regulations 1994 (as amended)	Yes	Potential connectivity with SACs with Atlantic salmon as qualifying feature
European Protected Species (EPS)	The Conservation (Natural Habitats &c.) Regulations 1994 (as amended)	No	No fish or shellfish species present in the site are listed as EPS
Notified features of SSSIs	Nature Conservation (Scotland) Act 2004 (as amended)	No	No SSSIs with fish or shellfish features will be impacted
Protected features of MPAs	The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) Marine and Coastal Access Act 2009 (if relevant)	No	No MPAs with fish or shellfish features will be impacted
PMFs	Marine (Scotland) Act 2010	Yes	Fish and shellfish PMFs (e.g. sea trout) might be present within the area of influence
Other sensitive natural heritage features	Appraisal of other features under: ○ The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore); ○ The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; ○ Marine (Scotland) Act 2010; and ○ Wildlife and Countryside Act 1981.	Yes	Captures assessment of all other sensitive natural heritage features at a population/habitat scale of concern

7.5 Cumulative Impacts

There is the potential for the potential impacts from the Project to interact with impacts from other projects, plans and activities, resulting in a cumulative effect on fish and shellfish ecology receptors. The majority of potential cumulative impacts on fish and shellfish are likely to be considered localised and will be most likely only occur where other projects / plans are located in habitats with similar ecology to those within the Project area. Migrating species, non-stationary species as well as species that reproduce by releasing their reproductive cells freely into the water column should especially be considered when assessing cumulative impacts.

7.6 Summary and ES appraisal

Given the effect pathways assessed in Section 7.3 and the appraisal mechanisms identified in Section 7.4, the ES will appraise the effects of the Project Envelope as shown in Table 7-6. The ES will also identify any monitoring or mitigation required.

Table 7-6 Summary overview of topics scoped into ES

INSTALLATION AND DECOMMISSIONING ACTIVITY TO BE CONSIDERED	GROUP TO BE CONSIDERED
Underwater noise from foundation/mooring installation methods and vessels leading to: auditory injury, death or disturbance	Diadromous fish
	Marine fish
Increased suspended sediment/turbidity (including release of drill cuttings)	Marine fish
	Marine shellfish
Smothering because of drill cuttings or re-settlement of sediments	Marine fish
	Marine shellfish
Benthic habitat loss/damage	Marine fish
	Marine shellfish
Introduction of marine non-native species (MNNS) via vessels, devices or other equipment	Marine fish
	Marine shellfish
OPERATION AND MAINTENANCE ACTIVITY TO BE CONSIDERED	**GROUP TO BE CONSIDERED**
Habitat creation and fish aggregation effect	Marine fish
	Marine shellfish
Underwater noise from tidal devices operation	Diadromous fish
	Marine fish
Changes to sediment and hydrodynamic regime	Marine fish
	Marine shellfish
Electromagnetic Field (EMF) effects	Diadromous fish
	Marine fish
	Marine shellfish
Presence of tidal devices and associated infrastructure leading to a barrier effect	Diadromous fish

The ES will focus on the site-specific fish and shellfish characteristics of the Fall of Warness site and how the Project Envelope may impact these. It will provide a broad-scale characterisation of

fish and fish ecology and appraisal of the sensitivities identified above. This will be informed by the data summarised in Section 7.2, and studies to inform collision risk and noise emissions.

The noise assessment will be a desk-based exercise utilising published data on fish sound detection, available and or provided data on sound associated with vessels, installation activities and device operation, and will be qualitative in nature (i.e. noise modelling is not proposed).

Given the size of populations that fish found in the vicinity of the turbines will originate, specific collision risk modelling for most fish species is not proposed. Instead, a qualitative assessment will be undertaken, looking at the potential magnitude of collision risk and relating that to the potential for population level impacts. However, recognising potential use of the site by Atlantic salmon, and the small and protected populations from which Atlantic salmon found at site may belong (e.g. potentially the Thurso and Naver River SACs), collision risk modelling will be undertaken for this one species.

It is proposed that modelling will examine a number of scenarios with respect to device surface clearance and operating depth, the number of devices (or number of turbines for multi-turbine device designs) and the diameter of rotors (i.e. the assessment will consider a range of devices that may be installed, and consider a mix of those different devices, rather than a single design across the entirety of the site). NatureScot will be consulted with regard to the choice of scenarios examined, and it is anticipated that the scenarios proposed for Atlantic salmon will align with those proposed for ornithology, basking shark and marine mammal features (as described later in this Scoping Report).

8 Offshore Ornithology

8.1 Introduction

This section describes the ornithology interests of relevance to the Fall of Warness site 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 marine areas within the site and immediately adjacent marine areas within 1 km.

The offshore elements/activities of the tidal test facility are not considered likely to have more than negligible effects on any land bird species and therefore land birds are not considered in this report.

8.2 Baseline Overview

8.2.1 Key Data Sources

Table 8-1 shows the key data sources available to inform assessment of offshore ornithology.

Orkney's seabirds and have been the subject of numerous research and monitoring studies over recent decades, mainly aimed at understanding their population processes, ranging behaviour and habitat utilisation. Indeed, generally speaking, they are amongst the most studied seabirds in the world. Despite this there remain many unknowns and uncertainties, such as the reasons why some species have declined and as to how birds might be affected by new marine technologies, including tidal stream devices.

Site-specific survey data have been collected previously for the Fall of Warness site by the EMEC Wildlife Observation Programme (Robbins, 2011). The Fall of Warness Site also lies within Westray South tidal array bird survey area, where monthly boat-based ESAS surveys were conducted between 2012 and 2014. The results of these previous surveys are now more than five years old and may not necessarily be representative of current ornithology baseline at the site, especially for species that have undergone changes to population size over that period. Seabird population sizes are determined by the Seabird Monitoring Programme using period coordinated censuses covering the whole of the UK, typically approximately 15 years apart. The most recent census of Orkney colonies was completed in 2021 and these census data provide up-to-date information on recent population trends for species. This population trend information provides a reasonable way to adjust the abundance estimates from the survey results previously collected at the Fall of Warness site to take account of recent population changes, and this is the proposed basis of the assessment to be conducted.

Table 8-1 Data sources relevant to the scoping and EIA process

TOPIC	DATA TYPE	MAIN DATA SOURCES
Conservation areas and protected sites	○ Special Protection Areas (SPAs) including those with proposed, candidate or draft status; ○ NCMPAs, including those with possible status; ○ Ramsar Sites; ○ Sites of Special Scientific Interest (SSSIs);	○ JNCC; ○ NatureScot; ○ Marine Scotland; ○ OIC; and ○ RSPB.

TOPIC	DATA TYPE	MAIN DATA SOURCES
	○ National Nature Reserves (NNRs); ○ Marine Consultation Areas; and ○ Local Nature Conservation Sites.	
Site importance for seabirds and wintering Waterbirds	○ At-sea seabird abundance and distribution.	○ EMEC Wildlife Observation Programme Fall of Warness commissioned shore-based bird survey data (e.g. Robbins, 2011); and ○ Westray South tidal array site ESAS data (subject to permissions being made available).
Regional context information	○ At-sea seabird abundance and distribution; ○ Location and size of seabird breeding colonies; ○ Breeding seabird foraging ranges; and ○ Distribution and abundance of wintering waterfowl in Orkney	○ European Seabirds at Sea (ESAS) Database JNCC (e.g., Kober *et al.* 2010); ○ JNCC Seabird Monitoring Programme national online database; ○ Future of the Atlantic Marine Environment (FAME) online database – data on seabird tagging undertaken in Orkney; ○ Seabird habitat utilisation maps (Cleasby *et al*. 2012); ○ Seabird density distribution maps (Waggitt *et al*., 2020); ○ Seabird foraging ranges, Woodward *et al.*, 2019; ○ NatureScot commissioned surveys of wintering waterfowl in Scapa Flow pSPA (Jackson, 2018) and North Orkney pSPA (Upton *et al.*, 2018); ○ Non-breeding season populations of seabirds in UK (Furness, R.W., 2015); and ○ Wetland Bird Survey data (WeBS) - National database of waterbird counts coordinated by BTO.

8.2.2 Natural Heritage Context

Data from the EMEC Wildlife Observation Programme and from boat-based surveys commissioned by SSER to inform a prospective tidal stream array between Westray and Rousay provides the principal sources of site-specific ornithological information available for the Fall of Warness site and nearby surrounding waters. These data confirm that the use of the site by marine bird species is in line with expectations based on published general accounts of Orkney's marine bird life. The Fall of Warness site (and its nearby vicinity) forms a small part of the extensive inshore waters around Orkney and as such is likely to contribute, approximately in proportion to its areal extent, to supporting the many bird populations that rely on the islands' marine environment.

The seas around Orkney provide rich feeding grounds for internationally important number of seabirds year-round. This is particularly so in the spring and summer months when large numbers

of 15 species of seabird breed at colonies in Orkney, together with smaller numbers of several other species.

Orkney's inshore marine waters also have high importance for several bird species that migrate from Arctic and sub-Arctic breeding grounds to spend the winter months in Orkney. Some of these species are known to frequent the vicinity of the Fall of Warness site and could therefore be potentially affected by activities there, in particular the great northern diver (*Gavia immer*) and long-tailed duck (*Clangula hyemalis*).

The status of each bird species that regularly uses the Fall of Warness site and its immediate vicinity is summarised in Table 8-2 based on existing survey information. Table 8-2 also provides summary information for each species on foraging behaviour and habitat choice, whether a species has enhanced legal protection and whether it is a qualifying interest at any local Special Protection Area (this topic is examined in more detail in the next section).

Several of the species that occur at the Fall of Warness site currently have a poor regional or national conservation status following long-term population decline, and this adds to their conservation importance (JNCC, 2021). Numbers of Arctic skua (*Stercorarius parasiticus*(, black-legged kittiwake (*Rissa tridactyla*) and Arctic tern (*Sterna paradisaea*) breeding in Scotland have all declined by more than 50% over the past three decades, and numbers of breeding fulmar (*Fulmarus glacialis*), herring gull (*Larus argentatus*), European shag (*Gulosus aristotelis*) and great skua (*Stercorarius skua*) have shown declines of approximately 25% or more. Several species are listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) and/or Annex I of the EU Birds Directive, and as such these species have enhanced levels of legal protection.

For the purposes of characterising the ornithology of the Fall of Warness site and discussing potential impacts, it can be useful to group species that share broadly similar life history and behavioural traits; to a large extent birds within a group will have broadly similar vulnerabilities to potential impacts (see '

Effect Pathways' section below).

These groups are:

- Surface feeding species. All these species search for food in flight and take food either from the sea surface or make typically shallow dives that rarely exceed 10 m depth. These species include gannet, fulmar, gulls, terns and skua species;
- Species that dive from the surface for fish or invertebrate prey on or near the seabed. These species include European shag, cormorant, black guillemot, diver species and seaduck species. These species rarely forage in areas where the seabed exceeds 30m depth, (less for some species) and thus tend to be restricted to inshore areas;
- Species that dive from the surface for fish prey located at mid-water depths. These species include common guillemot, razorbill and puffin; they typically forage in water of all depths and thus may forage at both inshore and offshore locations; and
- Species that are nocturnally active at their colony and surface feed offshore by day. European storm petrel is the only species in this group relevant to the tidal test site.

In undertaking ornithological impact assessment it is useful to decide which species have greatest relevance and why; identifying such priority species helps ensure they receive an appropriate level of scrutiny. It is considered that the priority species are those that commonly use the site, have high conservation importance and are known (or assumed) to have high vulnerability to one or more of the potential effects of the tidal test site (see 'Effect Pathways' section below). Species that

have been provisionally identified as priority species are common guillemot, razorbill, European shag, common eider, red-throated diver, great northern diver and European storm petrel.

Table 8-2 **Summary of the occurrence of seabird and waterfowl species at the Fall of Warness site, information on their foraging behaviour and conservation status, and whether they are qualifying interest of regional SPAs**

SPECIES	BREEDING SEASON	WINTER PERIOD	OTHER INFORMATION	SPA INTEREST
Red-throated diver	○ Scarce. Breeds locally in small numbers on hill lochans, and forages in inshore waters.	○ Uncommon.	○ Listed on Schedule 1 and Annex I. Forages by surface diving, usually where seabed depth <30m. ○ Wintering birds are unlikely to be from the local breeding population.	○ Yes.
Great northern diver	○ Scarce. Does not breed in UK. Small numbers of non-breeding birds spend the summer in Orkney.	○ Uncommon.	○ Listed on Schedule 1 and Annex I. Forages by surface diving in inshore waters, usually where seabed depth <30m.	○ Yes.
Fulmar	○ Very common. Large numbers breed at local and regional colonies.	○ Present, but in reduced numbers compared to summer.	○ Surface foraging in mainly offshore waters but sometimes inshore waters.	○ Yes.
Manx shearwater (*Puffinus puffinus*)	○ Likely absent. Very rare breeding bird in Orkney. Rarely forages in inshore waters.	○ Absent.	○ Although within foraging range, Orkney waters have low importance for foraging birds from the large colonies along the west coast of Scotland.	○ Yes.
European storm-petrel (*Hydrobates pelagicus*)	○ Uncommon, visits colonies at night. Breeding colonies on small uninhabited islands locally and regionally.	○ Absent.	○ Listed on Annex I. Small breeding colonies on Little Green Holm and Muckle Green Holm islands adjacent to Fall of Warness site. Visit colonies at night. Forages at sea surface in waters well offshore.	○ Yes.
Northern gannet (*Morus bassanus*)	○ Very common. Small local colony on Westray cliffs, and several large colonies in wider region.	○ Present, but in reduced numbers compared to summer.	○ Forages mainly by plunge diving in offshore and inshore waters; dive depth seldom exceeds 15 m below surface.	○ Yes.
European shag	○ Very common. Moderate numbers breed at local and regional colonies.	○ Common, similar numbers year-round.	○ Forages by surface diving to seabed in inshore waters, usually where seabed depth <30m. Largely non-migratory. Up to large numbers roosts on rocky islands, including on Muckle Green Holm.	○ Yes.
Arctic skua	○ Uncommon. Breeds in relatively small numbers locally and	○ Absent.	○ Poor conservation status following long-tern declines. Surface foraging, including	○ Yes.

SPECIES	BREEDING SEASON	WINTER PERIOD	OTHER INFORMATION	SPA INTEREST
	regionally, including on Rousay.		kleptoparisitism of terns and gull species.	
Great skua	○ Common. Breeds in moderate numbers locally and regionally on moorland, especially on Hoy.	○ Absent.	○ Poor conservation status. Surface foraging, including kleptoparisitism and predation of other seabird feeds inshore and offshore. Orkney supports a high proportion of global population.	○ Yes.
Herring gull	○ Common, multiple breeding colonies locally and regionally.	○ Present, but in reduced numbers compared to summer.	○ Poor conservation status following long-tern declines. Surface foraging, along coast and in inshore waters.	○ Yes.
Great black-backed gull (*Larus marinus*)	○ Common, multiple colonies locally and regionally.	○ Present, but in reduced numbers compared to summer.	○ Poor conservation status following long-tern declines. Surface foraging along coast, and at inshore and offshore waters.	○ Yes.
Glaucous gull (*Larus hyperboreus*)	○ Absent.	○ Uncommon.	○ Surface foraging on coast, and at inshore and offshore waters.	○ No.
Common gull (*Larus canus*)	○ Common, multiple inland breeding colonies locally and regionally.	○ Present, but in reduced numbers compared to summer.	○ Surface foraging, mainly on coast and inland, but sometimes on inshore waters also.	○ Yes.
Kittiwake	○ Very common, multiple breeding colonies locally and regionally.	○ Uncommon.	○ Surface foraging, in mainly offshore waters but sometimes inshore waters also Poor conservation status following long-tern declines.	○ Yes.
Arctic tern	○ Common, multiple breeding colonies locally and regionally.	○ Absent.	○ Listed on Annex I. Surface foraging in inshore waters. Poor conservation status following long-tern declines.	○ Yes.
Sandwich tern (*Sterna sandvicensis*)	○ Scarce. Uncommon but increasing breeding bird in Orkney.	○ Absent.	○ Listed on Annex I. Surface foraging in inshore waters.	○ No.
Common guillemot (*Uria aalge*)	○ Common. Large numbers breed at local and regional colonies.	○ Present, but in reduced numbers compared to summer.	○ Forages by surface diving in mainly offshore but also in inshore waters. Typically dives to greater depths than other species, with dives commonly exceeding 30m, and sometimes exceeding 50m.	○ Yes.

SPECIES	BREEDING SEASON	WINTER PERIOD	OTHER INFORMATION	SPA INTEREST
Razorbill (*Alca torda*)	○ Common. Large numbers breed at local and regional colonies.	○ Uncommon.	○ Forages by surface diving in offshore and inshore waters, dives seldom reach more than 25m below surface.	○ Yes.
Black guillemot (*Cepphus grille*)	○ Common breeding species at cliff colonies locally and regionally. Forages inshore waters only.	○ Common, similar numbers year-round.	○ Forages at seabed by surface diving in inshore waters, usually where seabed depth <30m.	○ No (MPA).
Puffin (*Fratercula arctica*)	○ Uncommon. Large numbers breed at regional colonies.	○ Absent.	○ Forages by surface diving in mainly offshore waters, dives seldom reach more than 25m below surface , usually where seabed depth <30m.	○ Yes.
Little auk (*Alle alle*)	○ Absent.	○ Scarce.	○ Forages by surface diving mainly in waters.	○ No.
Common Eider (*Somateria mollissima*)	○ Common, breeds along rocky coasts.	○ Common, similar numbers year-round.	○ Forages at seabed by surface diving in inshore waters, usually where seabed depth <20m.	○ Yes.
Slavonian grebe (*Podiceps auratus*)	○ Absent.	○ Uncommon.	○ Listed on Schedule 1 and Annex I. Forages by surface diving in inshore waters, usually where seabed depth <15m.	○ Yes.
Long-tailed duck (*Clangula hyemalis*)	○ Absent.	○ Uncommon.	○ Forages at seabed by surface diving in inshore waters, usually where seabed depth <20m.	○ Yes.
Red-breasted merganser (*Mergus serrator*)	○ Uncommon. Breeds locally in small numbers on freshwater lochs and sheltered coastlines.	○ Uncommon.	○ Forages at seabed by surface diving in inshore waters, usually where seabed depth <15m.	○ Yes.

8.2.3 Protected Sites

The importance of Orkney's seabird populations is recognised by the numerous nature conservation site designations that have been established to protect the breeding sites and marine areas utilised by seabird and wintering waterfowl species. In particular sites designated as Special Protection Area. Many of these Special Protection Areas are also designated (wholly or in part) as Ramsar sites and/or Sites of Special Scientific Interest (SSSIs). When breeding, seabirds travel to foraging areas that can be up to considerable distance from their breeding site (Woodward *et al.*, 2019). The actual distances travelled by breeding seabirds to foraging areas vary greatly between species. At one extreme are species like European shag, cormorant, red-throated diver and black guillemot that seldom travel more than approximately 10 km, whilst at the other are species such as fulmar, gannet and great skua that commonly travel distances in excess of 100 km and sometimes more than 500 km. As a consequence of their generally large foraging ranges there is theoretical potential for seabirds and relatively faraway designated breeding sites (as well as more local sites) to forage within the Fall of Warness site, and thus providing a theoretical pathway for

impacts on these sites. The potential for connectivity between the Fall of Warness site and the qualifying interest species of Special Protection Areas within 100 km is examined in Table 8-3.

The categories of theoretical potential connectivity (High, Moderate, Low and None) used for breeding seabirds are based on the summary foraging metrics derived by Woodward *et al.* (2019) and follow NatureScot guidance (SNH, 2012). The wintering waterfowl qualifying species (divers, grebes and sea ducks) are all considered likely to be relatively sedentary through their winter stay, and for these the categories of theoretical potential connectivity are based on expert judgement. For the purposes of scoping it is considered that the potential for an EMEC tidal test site to have potential for a Likely Signiant Effect (LSE) on a SPA qualifying species is limited to those where Moderate or High connectivity is indicated in Table 8-3. Thirteen (of 15) of the SPAs examined herein have at least one qualifying species where the theoretical strength of potential connectivity is categorised as either Moderate or High, and are therefore provisionally identified as having potential for an LSE.

The potential strength of connectivity with the Fall of Warness site indicated for SPA qualifying species in Table 8-3 is considered provisional; the strength of connectivity between the site and individual SPAs will be examined in greater detail in the EIA taken into consideration additional information. The EIA will also examine if there is potential for more than negligible connectivity between the Fall of Warness site and breeding seabird SPAs located more than 100 km away. Although methods to estimate the strength of connectivity based on foraging range may indicate there is a theoretical potential for moderate of even high connectivity to sites over 100 km away, in reality the actual strength of connectivity between these SPAs and the Fall of Warness site is likely to be negligible to its small size and inshore location. Therefore, although the examination of potential connectivity presented in Table 8-3 is restricted to SPAs within 100 km, it is not likely that there are SPAs more than 100 km away where the actual strength of connectivity with the Fall of Warness site is sufficient to lead to more than negligible adverse impacts on SPA interests.

Orkney has high importance for black guillemot, supporting approximately 15% of the UK population (Mitchell *et al.*, 2004), but as a non-migratory bird, they are not a qualifying interest of any SPA. However it *is* a qualifying interest at the Papa Westray Marine Protected Area (designated under the Marine (Scotland) Act 2010), located 19 km away (at closest) from the Fall of Warness site.

Table 8-3 **Theoretical potential connectivity for seabird and waterfowl qualifying species between the Fall of Warness site and Special Protection Areas within 100km**

SPA NAME	CLOSEST DISTANCE DIRECT(KM)	CLOSEST DISTANCE BY SEA (KM)	QUALIFYING SPECIES	QUALIFYING SEASON	THEORETICAL POTENTIAL CONNECTIVITY[1]
North Orkney SPA	1	1	Great northern diver	Non-breeding	High
			Slavonian grebe	Non-breeding	High
			European shag	Non-breeding	High
			Common eider	Non-breeding	High
			Long-tailed duck	Non-breeding	High
			Velvet scoter	Non-breeding	High
			Red-breasted merganser	Non-breeding	High
Rousay SPA	5	5	Northern fulmar	Breeding	High
			Arctic skua	Breeding	Moderate
			Black-legged kittiwake	Breeding	High
			Arctic tern	Breeding	High
			Common guillemot	Breeding	High

SPA NAME	CLOSEST DISTANCE DIRECT(KM)	CLOSEST DISTANCE BY SEA (KM)	QUALIFYING SPECIES	QUALIFYING SEASON	THEORETICAL POTENTIAL CONNECTIVITY[1]
Calf of Eday SPA	8	12	Northern fulmar	Breeding	High
			Great cormorant	Breeding	Moderate
			Great black-backed gull	Breeding	High
			Black-legged kittiwake	Breeding	High
			Common guillemot	Breeding	High
West Westray SPA	14	14	Northern fulmar	Breeding	High
			Arctic skua	Breeding	Probably low
			Black-legged kittiwake	Breeding	High
			Arctic tern	Breeding	Moderate
			Common guillemot	Breeding	High
			Razorbill	Breeding	High
Auskerry SPA	16	16	European storm-petrel	Breeding	(High)[5]
			Arctic tern	Breeding	Moderate
Papa Westray SPA	20	20	Arctic skua	Breeding	Probably low
			Arctic tern	Breeding	Moderate
Scapa Flow SPA	21	25	Red-throated diver	Breeding	Low
			Great northern diver	Non-breeding	Low
			Slavonian grebe	Non-breeding	Low
			European shag	Non-breeding	Low
			Common eider	Non-breeding	Low
			Long-tailed duck	Non-breeding	Low
			Common goldeneye	Non-breeding	Low
			Red-breasted merganser	Non-breeding	Low
Copinsay SPA	26	26	Northern fulmar	Breeding	(High)[5]
			Great black-backed gull	Breeding	Moderate
			Black-legged kittiwake	Breeding	High
			Common guillemot	Breeding	High
Marwick Head SPA	28	32	Black-legged kittiwake	Breeding	High
			Common guillemot	Breeding	High
Hoy SPA	34	55	Red-throated diver	Breeding	None
			Northern fulmar	Breeding	(High)[5]
			Arctic skua	Breeding	Probably low
			Great skua	Breeding	High
			Great black-backed gull	Breeding	Moderate
			Black-legged kittiwake	Breeding	Moderate
			Common guillemot	Breeding	Moderate
			Atlantic puffin	Breeding	High
Pentland Firth Islands SPA	44	55	Arctic tern	Breeding	None
North Caithness Cliffs	58	82	Northern fulmar	Breeding	(High)[5]
			Black-legged kittiwake	Breeding	Moderate
			Common guillemot	Breeding	Moderate

[5] The potential connectivity values shown in parentheses are almost certainly overestimates of actual connectivity as these species are unlikely to travel to inshore waters to forage.

SPA NAME	CLOSEST DISTANCE DIRECT(KM)	CLOSEST DISTANCE BY SEA (KM)	QUALIFYING SPECIES	QUALIFYING SEASON	THEORETICAL POTENTIAL CONNECTIVITY[1]
SPA			Razorbill	Breeding	Moderate
			Atlantic puffin	Breeding	Moderate
East Caithness Cliffs SPA	73	82	Northern fulmar	Breeding	(High)[5]
			Great cormorant	Breeding	None
			European shag	Breeding	None
			Black-legged kittiwake	Breeding	Moderate
			Herring gull	Breeding	Low
			Great black-backed gull	Breeding	Low
			Common guillemot	Breeding	Moderate
			Razorbill	Breeding	Moderate
			Atlantic puffin	Breeding	Moderate
Fair Isle SPA	77	77	Arctic skua	Breeding	Probably low
			Arctic tern	Breeding	None
			Atlantic puffin	Breeding	Moderate
			Black-legged kittiwake	Breeding	Moderate
			Common guillemot	Breeding	Low
			European shag	Breeding	None
			Great skua	Breeding	Moderate
			Northern gannet	Breeding	High
			Razorbill	Breeding	Moderate
Sule Skerry and Sule Stack SPA	89	91	Northern gannet	Breeding	High
			European storm-petrel	Breeding	(High)[5]
			Leach's storm-petrel	Breeding	(High)[5]
			European shag	Breeding	None
			Common guillemot	Breeding	Low
			Atlantic puffin	Breeding	Moderate

8.3 Effect Pathways

A number of studies have considered how tidal stream projects may affect marine birds (e.g., Furness *et al.*, 2012; McCluskie *et al.*, 2012). Based on the findings of these review studies it is concluded that activities at the Fall of Warness site could affect bird receptor in the following ways:

- Collision risk to diving birds;
- Disturbance (visual, noise and lighting);
- Habitat loss and change;
- Displacement and attraction effects; and
- Marine pollution.

From an ornithological perspective, the various designs of tidal stream energy converters are best considered as novel technologies as there is currently a paucity of information (for example in comparison to offshore wind turbines) as to their impacts on marine birds. This is particularly so for the question of whether the moving components of tidal stream device (e.g., turbine rotor blades) pose a material collision risk to diving birds. It is generally agreed that this is a potential issue that could lead to bird mortality, in a way that is analogous to the increasingly well-understood risk posed by wind turbine rotors to flying birds. Until studies are able to accurately observe how diving

birds respond to operational tidal stream devices and measure actual collision rates and their effect on birds, the basis for predicting collision risk will necessarily be theoretical and subject to uncertainty. For example, there is currently no information about the abilities of diving birds to avoid collision through avoidance behaviour, and regarding the proportion of collisions that result in injury or death.

There is less uncertainty regarding the impacts on marine birds from the other potential effects of installing and operating tidal stream devices. For these it is reasonable to make inferences from the experience gained with other types of development, where the nature of the potential effect is the same or similar. For example, bird responses to vessel activity, lighting and displacement from (or attraction to) fixed structures. In this respect the seabird monitoring information now available from operational offshore wind farms provides a considerable amount of relevant evidence.

The potential for the various effects of the tidal test site to impact on different bird species is examined in Table 8-4. In Table 8-4 a provisional high level reasoned consideration is made with as to whether a particular effect could have potentially important impacts on a species (or species group) or not. Where an effect is rated as potentially important it is considered that detailed examination and assessment is likely to be required in the EIA.

Table 8-4 **Potential effects of the Fall of Warness site on bird receptors during the deployment phase, identifying activities/effect pathways and receptors for further assessment**

POTENTIAL EFFECTS FROM DEVICE DEPLOYMENT (AND DECOMMISSIONING[6])		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
Disturbance	Auk, diver, cormorant and seaduck species	***Potentially important*** **-** These species are considered to have moderate vulnerability to visual and noise disturbance from vessels and other project activities (Furness *et al.*, 2012). Disturbance of these species has potential to cause displacement from marine habitat and effect birds' time and energy budgets. Common guillemot and razorbill with attendant dependent young (June - August) have additional vulnerability
	Shearwater, petrel, gannet, gull, tern and skua species	*Not important* **-** These species are not likely to be experience more than negligible disturbance effects (Furness *et al.*, 2012).
Bright lighting .	European storm petrel (fledglings) and seaduck species (especially in winter)	***Potentially important*** **-** Nocturnal petrel species and wintering seaduck species are vulnerable to disorientation due to high intensity work lights on project vessels, leading to increased risk of collision with vessels and surface-piercing infrastructure and increased predation risk, especially during conditions of low visibility. Fledgling storm petrels from breeding colonies within 10 km of light sources are at particular risk. There are at least two small colonies within 10 km of tidal test site.
	All other species	*Not important* **-** These species are unlikely to show a response to bright lights.
Navigation lighting	All species	*Not important* **-** Navigation lighting is not likely to be of a high enough intensity to have adverse effects on any bird species.

[6] To save unnecessary repetition, decommissioning impacts will be considered alongside installation impacts, highlighting where necessary impacts specific to decommissioning only.

POTENTIAL EFFECTS FROM DEVICE DEPLOYMENT (AND DECOMMISSIONING[6])		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
Seabed habitat loss	Diving species that forage at the seabed (European shag, black guillemot, seaduck species, great northern diver)	*Not important* **-** Direct localised loss of seabed to device foundations and localised potential for habitat change through scour effects and potentially leading to small-scale reductions in benthic/demersal seabird prey species. Although these species commonly forage at the seabed, the footprint of the areas potentially affected (e.g., device foundations) are negligible in the context of the area of seabed at the tidal test site and locally. Effects of seabed habitat loss may be offset by positive effects of creation of artificial reef habitat.
	All other species (i.e., surface feeding and shallow/mid-water diving species)	*Not important* **-** unlikely to be affected by small scale changes to seabed habitat (Furness *et al.*, 2012).
Marine pollution	All species	*Not important* **-** Accidental release of contaminants such as vessel fuel and device gear oil. Potential to harm and kill seabirds through plumage fouling or poisoning. Although all species of seabirds and waterfowl are vulnerable to pollution from contaminants and marine litter in practise the strong embedded mitigation and requirement to comply with MARPOL regulations mean that incidents are likely to be very rare, of a small scale only and would quickly be contained and cleaned up and/or dispersed to harmless concentrations. For these reasons it is considered that the risk to all bird receptors is negligible.

Table 8-5 **Potential effects of the Fall of Warness site on bird receptors during the operations and maintenance phase, identifying activities/effect pathways and receptors for further assessment**

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
Disturbance	Auk, diver, cormorant and seaduck species	***Potentially important*** **-** These species are considered to have moderate vulnerability to visual and noise disturbance caused by vessel and other project activities (Furness *et al.*, 2012). Disturbance of these species has potential to cause displacement from marine habitat and effect birds' time and energy budgets. Common guillemot and razorbill with attendant dependent young (June - August) have additional vulnerability
	Shearwater, petrel, gannet, gull, tern and skua species	*Not important* **-** These species are not likely to experience more than negligible disturbance effects (Furness *et al.*, 2012).
Collision with tidal devices	Diving species that forage deeper than 5 m below the sea surface, i.e., auk, diver, cormorant and	***Potentially important*** **-** These species have potential vulnerability to collision with tidal stream devices (Furness *et al.*, 2012). Potential for injury or death of these species through collision with moving components of tidal stream devices (e.g. rotors) and leading to an increase in a receptor populations mortality rate.

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
	seaduck species, and gannet	Collision risk is sensitive to device operating depth and seabed depth, and the amount of time a bird spends at depth. Common guillemot has particularly high vulnerability. Shag, black guillemot and eider, have high vulnerability where seabed depth is <30 m.
	Storm petrel, fulmar, gull, tern and skua species	*Not important* **-** These species are not likely to be at any collision risk (Furness *et al.*, 2012).
Bright lighting .	European storm petrel (fledglings) and seaduck species (especially in winter)	***Potentially important*** **-** Nocturnal petrel species and wintering seaduck species are vulnerable to disorientation due to high intensity work lights on project vessels, leading to increased risk of collision with vessels and surface-piercing infrastructure and increased predation risk, especially during conditions of low visibility Fledgling storm petrels from breeding colonies within 10 km of light sources are at particular risk. There are at least two small colonies within 10 km of tidal test site.
	All other species	*Not important* - These species are unlikely to show a response to bright lights.
Navigation lighting	All species	*Not important* - Navigation lighting is not likely to be of a high enough intensity to have adverse effects on any bird species.
Displacement from fixed structures .	Diver and auk species	***Potentially important*** **-** These species may avoid tidal devices by up to a few hundred metres from the vicinity of surface-piercing marine fixed-structures, leading to displacement and effectively depriving them of marine habitat.
	All other species	*Not important* - These species are unlikely to show more than a negligible displacement response to fixed structures. Gull and tern species may show a weak to moderate attraction response, however this would be anticipated to have only either a negligible or weakly positive impact on receptor populations.
Seabed habitat loss	Diving species that forage at the seabed (European shag, black guillemot, seaduck species, great northern diver)	*Not important* - Direct localised loss of seabed to device foundations and localised potential for habitat change through scour effects and potentially leading to small-scale reductions in benthic/demersal seabird prey species. Although these species commonly forage at the seabed, the footprint of the areas potentially affected are negligible in the context of the area of seabed at the tidal test site and locally. Effects of seabed habitat loss may be offset by positive effects of creation of artificial reef habitat.
	All other species (i.e., surface feeding and shallow/mid-water diving species)	*Not important* - unlikely to be affected by small scale changes to seabed habitat (Furness *et al.*, 2012).

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	NATURAL HERITAGE FEATURE	POTENTIAL IMPORTANCE
Marine pollution	All species	*Not important* - Accidental release of contaminants such as vessel fuel and device gear oil. Potential to harm and kill seabirds through plumage fouling or poisoning. Although all species of seabirds and waterfowl are vulnerable to pollution from contaminants and marine litter in practise the strong embedded mitigation and requirement to comply with MARPOL regulations mean that incidents are likely to be very rare, of a small scale only and would quickly be contained and cleaned up and/or dispersed to harmless concentrations. For these reasons it is considered that the risk to all bird receptors is negligible.

8.4 Appraisal Mechanisms

Table 8-6 Appraisal mechanism for ornithological receptors

FEATURE TYPE	APPRAISAL MECHANISM/RELEVANT LEGISLATION	APPLICABLE	REASONING
Qualifying feature of European sites	The Conservation of Habitats and Species Regulations 2017 The Conservation (Natural Habitats &c.) Regulations 1994 (as amended)	Yes	Connectivity with SPAs with ornithological qualifying features
European Protected Species (EPS)	The Conservation (Natural Habitats &c.) Regulations 1994 (as amended)	No	No bird species are listed as EPS
Notified features of SSSIs	Nature Conservation (Scotland) Act 2004 (as amended)	Yes	SSSIs with ornithological features will potentially be affected (in practice these are all also designated as SPA)
Protected features of MPAs	The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) Marine and Coastal Access Act 2009 (if relevant)	Yes	One MPA with an ornithological feature potentially affected
Ramsar sites	Ramsar Convention on Wetlands	No	No connectivity with Ramsar sites for any bird species potentially affected
PMFs	Marine (Scotland) Act 2010	No	PMFs do not include any bird species
Other sensitive natural heritage	Appraisal of other features under:	Yes	Captures assessment of sensitive ornithological

FEATURE TYPE	APPRAISAL MECHANISM/RELEVANT LEGISLATION	APPLICABLE	REASONING
features	○ The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore); ○ The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; ○ Marine (Scotland) Act 2010; and ○ Wildlife and Countryside Act 1981.		natural heritage features at a population/habitat scale of concern

8.5 Cumulative Impacts

The assessment will examine the potential for impacts from the Fall of Warness site to contribute to a cumulative impact within the region. A provisional list of other projects in the region that are considered relevant is presented in Section 4.2. The projects listed in Section 4.2 include other wet renewable projects (wave and tide), offshore wind and marine cables and marine aquaculture projects around Orkney and the Pentland Firth. They do not include shipping and fisheries activities as these are considered to be part of baseline conditions.

8.6 Summary and ES appraisal

Given the effect pathways assessed in Section 8.3 and the appraisal mechanisms identified in Table 8-6, the ES will appraise the effects of the Project Envelope as shown in Table 8-7. The ES will also identify any monitoring or mitigation required.

Table 8-7 Summary overview of topics scoped into ES

ACTIVITIES TO BE CONSIDERED	SPECIES GROUPS TO BE CONSIDERED
INSTALLATION AND DECOMMISSIONING	
Disturbance	Auk, diver, cormorant and seaduck species
Bright lighting	European storm petrel (fledglings) and seaduck species
OPERATION AND MAINTENANCE	
Disturbance	Auk, diver, cormorant and seaduck species
Bright lighting	European storm petrel (fledglings) and seaduck species
Collision with tidal devices	Diving species that forage at >10m depth: auk, diver, cormorant and seaduck species, and gannet
Displacement from fixed structures	Auk and diver species

The ES will focus on the ornithological interests of the Fall of Warness site and how the Project Envelope may impact these. It will characterise the ornithological features of the site and their value informed by the information sources summarised in Table 8-6.

The assessment of impacts on bird receptors will follow the guidance set out by IEEM (IEEM, 2010) and NatureScot. More specifically we would adopt the now well-established approach that has been used for other wet-renewable projects, including the appraisal of the EMEC Fall of Warness site (EMEC, 2014a) and the EMEC Billia Croo wave test site (EMEC, 2019).

Where data quality allows, a quantitative approach to appraising the potential impacts will be used as so an approach generally leads to more robust and defendable conclusions than a qualitative approach. For most species, assessment is anticipated to focus on receptors defined at the regional level, corresponding to Nature Scot Natural Heritage Zone 2 – North Caithness and Orkney. Habitat Regulations Appraisal will examine the potential for effects on the population of a qualifying species at individual SPAs. The intended approach to assessing specific impacts is outlined below.

Displacement and disturbance

The assessment of displacement and disturbance will consider the number of birds potentially affected as a proportion of the receptor population size. Where data allow, the number of birds potentially affected will be estimated from mean and peak seasonal densities recorded at the Fall of Warness site, and appropriate sized buffers around proposed infrastructure for the species and effect under consideration.

Collision risk

The assessment of collision risk will be informed by predictive risk modelling in accordance with NatureScot (SNH, 2016) guidance and information on the diving ecology and on-site density of the species potentially at risk. In the absence of full details of device specifications, location and operating depths, it is proposed that modelling will examine a number of scenarios that are indicative of the range of potential project design envelopes. The aim will be to identify which diving bird receptors populations could be subject to a sufficient collision risk magnitude that could adversely affect their receptor population. To do this requires baseline information on receptor population's size and mortality rate and estimates of the predicted increase in mortality (informed by model outputs).

It is proposed that modelling will examine a number of scenarios with respect to device surface clearance and operating depth, the number of devices (or number of turbines for multi-turbine device designs) and the diameter of rotors. The scenarios examined will be illustrative of the worst-realistic case scenarios, bearing in mind that the worst-case scenario may vary between species due to differences in the way they use the marine environment (in particular time at different depths). NatureScot will be consulted with regard to the choice of scenarios examined. Existing survey information will be used as the source of seasonal densities of diving bird species. If baseline data are not adequate, collision risk will be examined for a range of density values. Model outputs will be interpreted for a range of collision avoidances rates, as recommended by Nature Scot.

Bright lighting

The assessment of bright lighting will consider the seasonality and duration of bright lighting (if any) that may occur in connection to the installation, operation and decommissioning of the tidal test site. It will also consider where and when bird receptors that are considered to have potential sensitivity to bright lighting (wintering sea duck and breeding storm petrel) are likely to be present.

9 Basking Sharks

9.1 Introduction

This section describes the likely occurrence of the basking shark (*Cetorhinus maximus*) in and around the Fall of Warness site 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 including underwater noise generation, the zone of effect could potentially extend up to a few kilometres from the tidal testing site. However, as basking sharks are highly mobile, widespread and patchily distributed, available data have been used from the wider Pentland Firth and Orkney waters area and further afield.

9.2 Baseline Overview

9.2.1 Key Data Sources

Table 9-1 shows the key data sources used to inform assessment of basking sharks.

Table 9-1 Data sources relevant to the scoping and EIA process

TOPIC	DATA TYPE	MAIN DATA SOURCES
Conservation areas and protected sites	○ Special Areas of Conservation (SACs) including those with proposed, candidate or draft status; ○ NCMPAs, including those with possible status; ○ Sites of Special Scientific Interest (SSSIs); and ○ Marine Consultation Areas.	○ JNCC; ○ NatureScot; ○ Marine Scotland; and ○ OIC.
Basking sharks	○ Basking shark abundance and distribution; ○ Basking shark sightings.	○ EMEC wildlife sightings data 2009-2015; ○ Shark Trust sightings for elasmobranchs[7]; ○ Marine Conservation Society (MCS) basking shark sightings; ○ Review of basking shark abundance and distribution in the Pentland Firth and Orkney waters based on data from 1980-2010 (Evans *et al*, 2011); ○ Statistical approaches to aid the identification of Marine Protected Areas for minke whale, Risso's dolphin, white-beaked dolphin and basking shark (Paxton *et al,* 2014); ○ The Marine Conservation Society Basking Shark Watch Project (Bloomfield and Solandt, 2008); ○ Long-term satellite tracking of basking sharks in the northeast Atlantic (Doherty *et al,* 2008); ○ Orkney Biodiversity Records Centre; ○ NBN Gateway; ○ Seawatch Foundation; and ○ NatureScot.

[7] https://recording.sharktrust.org/basking_shark_results_landing

9.2.2 Natural Heritage Context

Basking sharks are a wide-ranging species occurring from temperate waters of the European continental shelf as far north as the Arctic (Sims, 2008). They are most sighted along the western seaboard of British and Irish waters. The warming of European seas has resulted in basking sharks occurring further north in recent decades, including around the coasts of Orkney (Sims, 2008). Presently, no robust estimates exist for the global or regional population size of basking sharks. The global population status of basking sharks is assessed as 'Vulnerable' (A1a, d, A2d) in the 2000 IUCN Red List. Two subpopulations, the North Pacific and the North-East Atlantic are assessed as Endangered.

Basking shark records from Orkney are widely scattered with no particular concentration in any one area. They have been recorded around Orkney in most months of the year, most frequently between spring and late summer. The peak period for records is between July and September, with sightings between November and April being rare (Evans *et al.*, 2003).

Land-based wildlife observations carried out by EMEC at the Fall of Warness site between 2005 and 2009 show basking sharks recorded between June and October, with peak sightings in July and August. The number of observations has been variable, with more than 40 in 2005 but fewer than five in 2009 (Robbins, 2011). Basking shark sightings in the wider Fall of Warness area reflect the general pattern of records from around Orkney.

Having been hunted until the mid-1990s, basking shark are now protected by a suite of national and international legislation. This species is listed in Appendix II of the Berne Convention, Appendix I/II of the Convention on Migratory Species (Bonn Convention) and Annex V of the OSPAR Convention. In the UK, protection of basking sharks has progressed through amendments to the Wildlife and Countryside Act 1981 (WCA) by the Nature Conservation (Scotland) Act 2004 and under the Wildlife and Natural Environment (Scotland) Act 2011 (WANE Act), with licensing requirements similar to those for EPS. Basking sharks are also listed in several conservation policy documents for their importance as a UK species, including their designation as a UK Biodiversity Action Plan (UK BAP) Priority species, a Scottish Priority Marine Feature (PMF) (Tyler-Walters *et al.*, 2016) and their inclusion in the Scottish Biodiversity List.

9.2.3 Protected Sites

The only site designated for the protection of basking sharks in Scotland is the Sea of the Hebrides NCMPA located over 250 km southwest of Orkney. This site covers the seas between the eastern coastline of the Outer Hebrides and the west coast of the Inner Hebrides, including Skye, Mull and the Ardnamurchan Peninsula. This region forms key habitat for basking sharks in the UK and therefore requires protection to conserve and support this pelagic species. The tidal front feature at the site, which appears during the spring and summer southwest of Tiree, facilitates favourable feeding conditions.

As basking shark are a wide-ranging species, it is possible that animals visiting Orkney during north-south migrations west of the UK may also pass through the Sea of the Hebrides NCMPA. However, the Project Envelope will not have any effects on the front systems or feeding grounds in the Sea of the Hebrides MPA, is very remote from it and, given the small scale of the test site, there will be no important negative effects on basking shark using the MPA that could impact its integrity or conservation objectives.

9.3 Effect Pathways

For basking shark, the defined potential effect categories are applied to activities/effect pathways relevant to tidal energy developments comprising design-types involving the rotation of turbines

within natural hydrodynamic conditions. First, potential effects are considered in broad principles. Deployment/installation effects (Table 9-2) are addressed separately from those during the operational and maintenance phases (Table 9-3).

The potential effect-pathways assessed on the baseline environment include:

- Installation vessel(s) transits and manoeuvring leading to disturbance;
- Underwater noise from foundation/mooring installation methods and vessels leading to auditory injury, death or disturbance;
- Increased suspended sediment/turbidity (including release of drill cuttings);
- Entanglement in lines or cabling leading to injury or death;
- Maintenance vessel transits and manoeuvring leading to disturbance;
- Other maintenance activities (i.e. non vessel-based) leading to disturbance;
- Underwater noise from turbine operation leading to disturbance;
- Entanglement in lines or cabling leading to injury or death;
- Changes to hydrodynamic and sediment regime;
- Collision with turbine blades leading to injury or death;
- Electromagnetic field (EMF) effects; and
- Presence of tidal device(s) and associated infrastructure leading to barrier effects.

Table 9-2 Potential effects on basking sharks during the deployment phase, identifying activities/effect pathways for further assessment

POTENTIAL EFFECTS FROM DEVICE DEPLOYMENT (AND DECOMMISSIONING[8])		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
Installation vessel(s) transits and manoeuvring leading to disturbance.	Basking shark	***Potentially important*** **–** basking sharks may be sensitive to vessel presence and associated activities (e.g. Kelly *et al.* 2004; Speedie *et al.* 2009). Importance will depend upon the duration and intensity of vessel activity, the likelihood and fidelity of basking sharks in the area, the opportunity for sharks to avoid areas of disturbance and the motivation for the basking sharks to be in that area (e.g. quality of feeding opportunity). The need for a licence to disturb basking shark should be considered.
Underwater noise from foundation/mooring installation methods and vessels leading to auditory injury, death or disturbance.	Basking shark	***Potentially important*** **–** the hearing physiology of basking sharks is poorly understood, but they may be sensitive to noise and vibration from foundation installation activities, such as drilling, which are intuitively more likely to occur at audible frequencies. Importance will depend upon the range and frequency of noise sources (including background noise), duration and intensity of activity, the likelihood and fidelity of basking sharks in the area, the opportunity for sharks to avoid areas of disturbance and the motivation for the basking sharks to be in that area (e.g. quality of feeding opportunity). The need for a licence to disturb basking shark should be considered.
Increased suspended sediment/turbidity (including release of drill cuttings).	Basking shark	*Not important* – although basking sharks, as filter feeders, could be negatively affected by increased suspended sediment concentrations, in tidally active sites suspended material will disperse quickly and widely and so basking sharks are unlikely to be exposed to the effect once construction activity is

[8] To save unnecessary repetition, decommissioning impacts will be considered alongside installation impacts, highlighting where necessary impacts specific to decommissioning only.

POTENTIAL EFFECTS FROM DEVICE DEPLOYMENT (AND DECOMMISSIONING[8])		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
		complete.
Entanglement in lines or cabling leading to injury or death.	Basking shark	*Not important* – it is unlikely that basking sharks will be exposed to this potential interaction during installation procedures as any construction activities with associated cables or lines not under tension would be likely to be of very short duration.

Table 9-3 Potential effects on basking sharks during the operations and maintenance phase, identifying activities/effect pathways for further assessment

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
Maintenance vessel transits and manoeuvring leading to disturbance.	Basking shark	***Potentially important*** **-** basking sharks may be sensitive to vessel presence and activity (e.g. Kelly *et al.*, 2004; Speedie *et al.*, 2009). Importance will depend upon the duration and intensity of vessel activity, the likelihood and fidelity of basking sharks in the area and the opportunity for sharks to avoid areas of disturbance. The need for a licence to disturb basking shark should be considered.
Other maintenance activities (i.e. non vessel-based) leading to disturbance.	Basking shark	*Not important* – maintenance activities include inspection (e.g. divers/ROV), repairs or temporary retrieval and replacement of nacelles by winch. In all cases it is the presence of the accompanying vessel that presents the primary disturbance risk and is appraised separately.
Underwater noise from turbine operation leading to disturbance	Basking shark	***Potentially important*** – the hearing physiology of basking sharks is poorly understood. However, some other elasmobranchs are attuned to low-frequency sounds for prey detection (Helfman *et al.* 1997), thus turbine operation noise is potentially audible. Although precautionary at this stage, potential for impact remains. Importance will depend upon noise signatures in the context of background and anthropogenic noise, the layout of devices, the likelihood and fidelity of basking sharks in the area, the opportunity for sharks to avoid areas of disturbance and the motivation for the basking sharks to be in that area (e.g. quality of feeding opportunity). The need for a licence to disturb basking shark should be considered.
Entanglement in lines or cabling leading to injury or death.	Basking shark	*Not important* **–** relatively few tidal turbines involve rotating blades that are suspended mid-water or floating structures that are anchored/moored. Although they could in theory present some form of entanglement risk, evidence from other receptor groups suggest this is very limited.
Changes to hydrodynamic regime.	Basking shark	***Potentially important*** – the relationship between hydrodynamic conditions and the importance of an area for basking sharks is poorly understood, but there is some evidence to suggest that tidal front systems have some disproportionate value for this species (Speedie *et al.* 2009). Consequently, a precautionary view is taken at present that

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
		extraction of tidal energy on a sufficient scale could have biological implications for basking sharks.
Collision with turbine blades leading to injury or death.	Basking shark	***Potentially important*** **–** 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.
Electromagnetic Field (EMF) effects.	Basking shark	*Not important* – 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. The potential for EMF effects on benthic fish species is discussed in Section 7 of this document.
Presence of tidal device(s) and associated infrastructure leading to barrier effects.	Basking shark	*Not important* **–** basking sharks may utilise or move though sounds and channels that may also present opportunity for tidal development. 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 Fall of Warness site, at the edge of a channel rather than in the middle, and given the small spatial scale of the development, there is not expected to be any barrier effect. Any effect would be limited to a short diversion around the site, if it was perceived as a block.

9.4 Appraisal Mechanisms

Table 9-4 presents the relevant legislation and any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features.

Table 9-4 Appraisal mechanism for basking sharks

FEATURE TYPE	APPRAISAL MECHANISM/RELEVANT LEGISLATION	APPLICABLE	REASONING
Qualifying feature of European sites	The Conservation of Habitats and Species Regulations 2017 The Conservation (Natural Habitats &c.) Regulations 1994 (as amended)	No	There are no SACs with basking shark as a qualifying feature
European Protected Species (EPS)	The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) The Wildlife and Countryside Act 1981 (as amended) Wildlife and Natural Environment (Scotland) Act 2011 (WANE Act)	Yes	Not an EPS, but a licence to disturb basking shark under the WANE Act is likely to be required by developers prior to commencing installation activities at the test site.

FEATURE TYPE	APPRAISAL MECHANISM/RELEVANT LEGISLATION	APPLICABLE	REASONING
Notified features of SSSIs	Nature Conservation (Scotland) Act 2004 (as amended)	No	There are no SSSIs with basking shark as a feature
Protected features of MPAs	Marine (Scotland) Act 2010	No	Basking shark using the Sea of Hebrides MPA will not be significantly affected.
PMFs	Marine (Scotland) Act 2010	Yes	Basking shark are a PMF in Scottish territorial and offshore waters and are occasionally present in the Fall of Warness site.
Other sensitive natural heritage features	Appraisal of other features under: ○ The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore); ○ The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; ○ Marine (Scotland) Act 2010; and ○ Wildlife and Countryside Act 1981.	Yes	Captures assessment of all other sensitive natural heritage features at a population/habitat scale of concern

9.5 Cumulative Impacts

Given the wide-ranging distribution of the northeast Atlantic sub-population of the basking shark and its IUCN Endangered status, it can be expected that it is subject to a diverse range of pressures over a very large sea area. The cumulative impact assessment will consider the potential for the Project at the Fall of Warness site to act cumulatively with other long-term projects and activities in Orkney in this part of the basking shark's range. Table 4-2 of this document provides an indicative list of the developments to be considered in the cumulative impact assessment; developments will be included that could also potentially impact basking sharks through any potentially important effect pathway.

9.6 Summary and ES appraisal

Given the natural heritage features and effect pathways assessed in Section 9.3 and the appraisal mechanisms identified above, the ES will appraise the effects of the Project Envelope on basking sharks, as shown in Table 9-5. The ES will also identify any monitoring or mitigation required.

Table 9-5 Summary overview of topics scoped into ES

STAGE	EFFECT PATHWAYS
Installation and decommissioning	Installation vessel(s) transits and manoeuvring leading to disturbance
	Underwater noise from foundation/mooring installation method and vessels leaving to auditory injury, death or disturbance
Operation and maintenance	Maintenance vessel transits and manoeuvring leading to disturbance.
	Underwater noise from turbine operation leading to disturbance
	Changes to hydrodynamic regime.

STAGE	EFFECT PATHWAYS
	Collision with turbine blades leading to injury or death.

The focus will be on the site-specific basking shark characteristics of the Fall of Warness site and how the Project Envelope may impact these. Consideration of the following features will be applicable:

- Baseline data – although site-specific data for basking sharks is more than 10 years old, the patterns around Fall of Warness seem to reflect those of Orkney in general, and we propose that the assessment will draw upon Orkney and wider north Scotland datasets to inform the baseline;
- EPS - Basking sharks are not EPS; however, under The Wildlife and Natural Environment (Scotland) Act 2011, licence requirements for basking sharks are similar and a licence may need to be applied for given the occasional occurrence of basking sharks in the wider Fall of Warness area;
- PMF – The assessment will take full account of basking shark status as a Scottish PMF; and
- Other basking shark sensitivities – Captures assessments not covered under other legislation and licencing which may impact at population/habitat level including indirect impacts as a result of changes in hydrodynamics.

The assessment will be informed by an assessment of noisy activities as per those included in the Project Envelope. This will be a desk-based exercise (i.e. no project-specific underwater noise modelling undertaken) utilising published data on basking shark sound detection, available and/or provided data on sound associated with vessels, installation activities and device operation.

The consideration of impact on basking sharks will also be informed by a quantitative assessment of collision risk. Despite the low number of basking sharks observed to date, behaviour tending towards use of water column close to the sea surface, and the lack of connectivity with protected sites, it is recognised that uncertainty around reference population size and lack of observed behaviour around tidal devices means collision risk modelling can be a useful addition to the assessment.

It is proposed that modelling will examine a number of scenarios with respect to device surface clearance and operating depth, the number of devices (or number of turbines for multi-turbine device designs) and the diameter of rotors (i.e. the assessment will consider a range of devices that may be installed, and consider a mix of those different devices, rather than a single design across the entirety of the site). NatureScot will be consulted with regard to the choice of scenarios examined, and it is anticipated that the scenarios proposed for basking sharks will align with those proposed for ornithology, Atlantic salmon and marine mammal features.

10 Cetaceans

10.1 Introduction

This section describes the likely occurrence of cetacean species in and around the Fall of Warness site 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 including underwater noise generation, the zone of effect could potentially extend up to a few kilometres from the tidal testing site. However, as cetaceans are highly mobile, widespread and patchily distributed, available data have been used from the wider Pentland Firth and Orkney waters area and further afield.

10.2 Baseline Overview

10.2.1 Key Data Sources

The key data sources that will be used to inform the assessment of cetaceans will include, but not be limited to, those listed in Table 10-1.

Table 10-1 Data sources relevant to the scoping and EIA process

TOPIC	DATA TYPE	MAIN DATA SOURCES
Conservation areas and protected sites	○ Special Areas of Conservation (SACs) including those with proposed, candidate or draft status; ○ NCMPAs, including those with possible status; and ○ Marine Consultation Areas.	○ JNCC; ○ NatureScot; ○ Marine Scotland; and ○ OIC.
Cetaceans	○ Offshore foraging or breeding areas or migration routes for cetaceans; ○ Cetacean distribution and abundance.	○ Site-specific data from the Fall of Warness; ○ Abundance and behaviour of cetaceans and basking sharks in the Pentland Firth and Orkney Waters (Evans *et al,* 2011); ○ Atlas of cetacean distribution in north-west European waters (Reid *et al.*, 2003); ○ Data from the Sea Mammal Research Unit SCANS, SCANS-II and SCANS-III (Small Cetacean Abundance in the European Atlantic and North Sea) surveys; ○ Cetacean distribution maps (Waggit *et al.*, 2020); ○ Abundance estimates for cetacean management units in UK waters (IAMMWG, 2021); ○ Joint Cetacean Protocol (JCP) cetacean distribution data; ○ Orkney Biodiversity Records Centre; ○ Orkney Wildlife Information and Record Centre; ○ National Biodiversity Network (NBN) Gateway; ○ Seawatch Foundation; ○ NatureScot and Marine Scotland.

10.2.2 Natural Heritage Context

Preliminary site-specific assessments of the use of the Fall of Warness site by cetaceans were carried out in 2005 to inform the original EIA for the tidal device testing site (Aurora, 2005; EMEC, 2009). Following publication of the 2005 ES (Aurora, 2005), a land-based visual surface wildlife observation programme was initiated by EMEC in July 2005 based on regulatory recommendations. Initial analysis of the first three years' of data was undertaken by SMRU (2006, 2007, 2009). The collection of wildlife observation data at the Fall of Warness site was funded by the Scottish Government until 31 October 2015 and extensive analysis of the dataset obtained has been undertaken. EMEC has also used both active and passive acoustic monitoring techniques to help assess the behaviour of marine mammals in close vicinity of an operating tidal turbine. There is therefore extensive site-specific data to inform the EIA, which will be used together with information on the relevant species from further afield as outlined in Section 10.2.1.

The harbour porpoise (*Phocoena phocoena*) is the most frequently sighted cetacean at the Fall of Warness test site. Other cetacean species recorded during the EMEC land-based wildlife observations include minke whale (*Balaenoptera acutorostrata*), killer whale (*Orcinus orca*), white beaked dolphin (*Lagenorhynchus albirostris*) and Risso's dolphin (*Grampus griseus*) (Robbins, 2011). During the April 2013 to March 2014 reporting period, the majority of cetacean sightings were of white-beaked dolphin (EMEC, 2014c). Although other cetacean species could occur at the site, the above five species may, due to their relatively higher occurrence compared to other species, be regarded as appropriate species to consider in relation to the potential risks to other cetacean species as well. Consequently, these five species were considered as part of environmental assessments for the Fall of Warness site conducted in 2014 (EMEC, 2014a, b). All five of these species are PMF in Scottish territorial and offshore waters.

The most frequently occurring cetacean species observed in Orkney waters (Evans *et al.*, 2011) generally were reported as being the above five species and the bottlenose dolphin (*Tursiops truncatus*), with more 'casual visitors' being Atlantic white-sided dolphin (*Lagenorhynchus acutus*), short-beaked common dolphin (*Delphinus delphis*), sperm whale (*Physeter macrocephalus*) and long-finned pilot whale (*Globicephala melas*).

All species of cetaceans are listed in Annex II of CITES, Annex II of the Bern Convention Annex, and in Annex IV of the EC Habitats Directive as species in need of strict protection, i.e. European Protected Species (EPS), and are afforded strict protection under UK law. The harbour porpoise is also covered by the terms of ASCOBANS (Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas).

10.2.3 Protected Sites

10.2.3.1 Special Areas of Conservation (SAC)

The Fall of Warness site is not located within or near any SACs designated for cetacean species. The nearest SACs with a cetacean qualifying feature are:

- The Moray Firth SAC, over 120 km south, is designated to protect the inshore bottlenose dolphin population in that area (this population belongs to a distinct ecotype of bottlenose dolphin which remain within or near a particular area); and
- The Inner Hebrides and the Minches SAC approximately 180 km away and the Skerries and Causeway SAC in Northern Ireland, nearly 500 km away, both designated for the protection of harbour porpoise.

The Inter-Agency Marine Mammal Working Group (IAMMWG, 2015) defined Management Units

(MUs) for the seven most common cetacean species found in UK waters, with updated abundance information provided by IAMMWG (IAMMWG, 2021). The MUs are geographical areas in which animals of a particular species are found and management of human activities is applied. Information from these reports is used below to assess the likelihood of connectivity between the above protected sites and the Fall of Warness test site.

Bottlenose dolphin

The Moray Firth SAC lies within the Coastal East Scotland MU for bottlenose dolphin. The Fall of Warness site lies within the Greater North Sea MU and it is unlikely that any bottlenose dolphin encountered there would be of the wide-ranging offshore ecotype. Consequently, there is not expected to be any connectivity between the Fall of Warness site and the Moray Firth SAC with respect to bottlenose dolphin.

Harbour porpoise

Both the Inner Hebrides and Minches SAC and Skerries and Causeway SAC lie within the West Scotland MU for harbour porpoise whereas the Fall of Warness site lies within the North Sea MU. Although IAMMWG (IAMMWG, 2021) acknowledges that the boundary between these two MUs to the north of the UK is somewhat arbitrary and there will be an interchange of animals between the two areas, given the distance of the Fall of Warness site from these two sites and the very small scale of the test site, there is not expected to be connectivity with these sites. The limited number of animals that could occur within the small test site, coupled with the detectability of the devices, means there is a very low risk of any impact on populations of harbour porpoise.

10.2.3.2 NCMPAs

NCMPAs in Scottish waters with cetacean features are:

- The Southern Trench MPA and the Sea of Hebrides MPA, situated approximately 130 km south and 290 km south west respectively from the Fall of Warness site, both designated for the protection of minke whales; and
- The North-east Lewis MPA (approximately 200 km south west), designated for the protection of Risso's dolphins.

Minke whale

IAMMWG (IAMMWG, 2021) has defined a single very large MU (Celtic and Greater North Sea) for minke whale which occupies the whole of UK waters and adjacent North Sea and Irish waters. Given the distance of well over 100 km of the Fall of Warness site from both the Southern Trench MPA and the Sea of Hebrides MPA and the very small scale of the test site, there is not expected to be connectivity with these MPAs. The limited number of animals that could occur within the small test site, coupled with the detectability of the devices, means the risk of any significant impact on populations of minke whale is extremely low and is scoped out.

Risso's dolphin

IAMMWG (IAMMWG, 2021) has defined a single very large MU (Celtic and Greater North Sea) for Risso's dolphin which occupies the whole of UK waters and adjacent North Sea and Irish waters. Given the distance of approximately 250 km of the Fall of Warness site from the North-east Lewis MPA and the very small scale of the test site, there is not expected to be connectivity with this site. The very limited number of animals that could occur within the small test site, coupled with the

detectability of the devices, means the risk of any significant effects on populations of Risso's dolphin is extremely low and is scoped out.

10.3 Effect Pathways

For cetacean receptors, which are at this stage grouped into broad categories, the defined potential effect categories are applied to activities/effect pathways relevant to tidal energy developments comprising design-types involving the rotation of turbines within natural hydrodynamic conditions. First, potential effects are considered in broad principles. Deployment/installation effects (

Table 10-2) are addressed separately from those during the operational and maintenance phases (Table 10-3).

The potential effect-pathways assessed on the baseline environment include:

- Installation vessel(s) transits and manoeuvring leading to disturbance;
- Underwater noise from foundation/mooring installation methods and vessels leading to auditory injury, death or disturbance;
- Increased suspended sediment/turbidity (including release of drill cuttings);
- Entanglement in lines or cabling leading to injury or death;
- Maintenance vessel transits and manoeuvring leading to disturbance;
- Other maintenance activities (i.e. non vessel-based) leading to disturbance;
- Underwater noise from turbine operation leading to disturbance;
- Entanglement in lines or cabling leading to injury or death;
- Changes to hydrodynamic and sediment regime;
- Collision with turbine blades leading to injury or death; and
- Presence of tidal device(s) and associated infrastructure leading to barrier effects.

Table 10-2 Potential effects on cetaceans during the deployment phase, identifying activities/effect pathways and receptors for further assessment

POTENTIAL EFFECTS FROM DEVICE DEPLOYMENT (AND DECOMMISSIONING[9])		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
Installation vessel(s) transits and manoeuvring leading to disturbance.	Cetaceans	***Potentially important*** – cetaceans can be sensitive to vessel presence and associated activities. Importance will depend upon the duration and intensity of vessel activity, the likelihood and fidelity of cetaceans in the area and the opportunity for animals to avoid areas of disturbance. The need for a licence to disturb EPS should be considered.
Underwater noise from foundation/mooring installation methods and vessels leading to auditory injury, death or disturbance.	Cetaceans	***Potentially important –*** cetaceans can be sensitive to noise and vibration from foundation installation activities, such as drilling. Importance will depend upon the range and frequency of noise sources (including background noise), duration and intensity of activity, the likelihood and fidelity of cetaceans in the area and the opportunity for animals to avoid areas of disturbance. Even where presence is occasional a licence to

[9] To save unnecessary repetition, decommissioning impacts will be considered alongside installation impacts, highlighting where necessary impacts specific to decommissioning only.

POTENTIAL EFFECTS FROM DEVICE DEPLOYMENT (AND DECOMMISSIONING[9])		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
		disturb EPS may be required.
Increased suspended sediment/turbidity (including release of drill cuttings).	Cetaceans	*Not important* **–** although cetaceans, particularly baleen whales, could be negatively affected by increased suspended sediment concentrations, they are unlikely to be exposed to it at tidal development sites as suspended material will disperse quickly and widely.
Entanglement in lines or cabling leading to injury or death.	Cetaceans	*Not important* **–** it is unlikely that cetaceans will be exposed to this potential interaction during installation procedures as any cables or lines not under tension would be likely to be of present for only very short durations.

Table 10-3 Potential effects on cetaceans during the operations and maintenance phase, identifying activities/effect pathways and receptors for further assessment

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
Maintenance vessel transits and manoeuvring leading to disturbance.	Cetaceans	***Potentially important*** – cetaceans can be sensitive to vessel presence and associated activities. Importance will depend upon the duration and intensity of vessel activity, the likelihood and fidelity of cetaceans in the area and the opportunity for animals to avoid areas of disturbance. The need for a licence to disturb EPS should be considered.
Other maintenance activities (i.e. non vessel-based) leading to disturbance.	Cetaceans	*Not important* – maintenance activities include inspection (e.g. divers/ROV), repairs or temporary retrieval and replacement of nacelles by winch. In all cases it is the presence of the accompanying vessel that presents the primary disturbance risk, and is appraised separately.
Underwater noise from turbine operation leading to disturbance	Cetaceans	***Potentially important*** – Potential for impact is poorly understood, but importance may depend upon turbine design number and spacing, the characteristics of background noise (natural and anthropogenic), species sensitivity, the likelihood and fidelity of cetaceans occurring and the opportunity for animals to avoid areas of disturbance. The need for a licence to disturb EPS should be considered.
Entanglement in lines or cabling leading to injury or death.	Cetaceans	*Not important* – thus far, relatively few tidal turbines involving rotating blades are suspended mid-water or have floating structures that are anchored/moored. However, it is expected that those that do will be secured with taut moorings presenting little potential risk for cetaceans to become entangled. In addition, no large baleen whales have been recorded at the site. Benjamin *et al.* (2014) found that biological risk factors for entanglement included an animal's body size and flexibility and ability to detect moorings, as well as physical risk factors associated with moorings such as their tension. Given that the cetacean species expected to frequent the site are small and agile species, the risk of entanglement is not regarded as important.
Changes to hydrodynamic	Cetaceans	***Potentially important*** – the relationship between

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	NATURAL HERITAGE FEATURE	POTENTIAL IMPORTANCE
and sediment regime.		hydrodynamics conditions and the importance of area for cetaceans is at present poorly understood, but it is possible that tidal front systems present disproportionately valuable foraging opportunities for some species. Consequently, a precautionary view is taken at present that extraction of tidal energy on a sufficient scale could have biological implications for cetaceans.
Collision with turbine blades leading to: injury or death.	Cetaceans	***Potentially important*** **–** the potential for impact is poorly understood, but importance may depend upon turbine location & spacing (including water depth), the physical and rotational characteristics of turbines, and the likelihood and fidelity of cetaceans occurring. For animals with sufficient records from survey data, encounter rate modelling should be conducted. Even where presence is occasional a licence to disturb EPS may be required.
Presence of tidal device(s) and associated infrastructure leading to barrier effects.	Cetaceans	*Not important* – cetaceans may utilise or move though sounds and channels that may also present opportunity for tidal development. 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 cetaceans and the likelihood of disturbance from operational noise of turbines. Given the limited number and location of devices in the Project Envelope, there will be plenty of space available for animals to move through and no barrier effects.

10.4 Appraisal Mechanisms

Table 10-4 presents the relevant legislation and any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features.

Table 10-4 Appraisal mechanism for cetaceans

FEATURE TYPE	APPRAISAL MECHANISM/RELEVANT LEGISLATION	APPLICABLE	REASONING
Qualifying feature of European sites	The Conservation of Habitats and Species Regulations 2017 The Conservation (Natural Habitats &c.) Regulations 1994 (as amended)	No	No/limited connectivity with Moray Firth SAC designated for bottlenose dolphin or Inner Hebrides and the Minches SAC and Skerries and Causeway SAC for harbour porpoise
European Protected Species (EPS)	The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) The Wildlife and Countryside Act 1981 (as amended) Wildlife and Natural Environment (Scotland) Act 2011 (WANE Act)	Yes	All cetaceans are EPS
Notified features of SSSIs	Nature Conservation (Scotland) Act 2004 (as amended)	No	There are no SSSIs with cetaceans as a feature
Protected features of MPAs	Marine (Scotland) Act 2010	No	No/limited potential for affecting Southern Trench MPA and Sea of Hebrides MPA designated for

FEATURE TYPE	APPRAISAL MECHANISM/RELEVANT LEGISLATION	APPLICABLE	REASONING
			protection of minke whale or North-east Lewis NCMPA for Risso's dolphin
PMFs	Marine (Scotland) Act 2010	Yes	Cetacean PMFs occur at the Fall of Warness site
Other sensitive natural heritage features	Appraisal of other features under: ○ The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore); ○ The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; ○ Marine (Scotland) Act 2010; and ○ Wildlife and Countryside Act 1981.	Yes	Captures aspects of assessment not addressed under EPS legislation at a population/habitat scale of concern

10.5 Cumulative Impacts

Any direct impacts to cetaceans from the activities at the Fall of Warness site are expected to be limited to within a few kilometres of the site and therefore there is limited potential for overlap of impact mechanisms. However, as the cetacean species frequenting the Fall of Warness site are also known to occur more widely in Orkney and Pentland Firth waters and beyond, there is the potential for cumulative impacts on the cetacean populations with other projects, plans and activities in the area. Table 4-2 of this document provides an indicative list of the developments to be considered in the cumulative impact assessment. The approach will be to identify the other threats to the cetacean populations, considering the relevant management units, to enable the cumulative impacts to be assessed. Key resources for the assessment will be those publications on the abundance, behaviour and distribution of cetacean species within relevant management units as identified in Section 10.2.1, the State of the Environment Assessment for the Orkney Islands Marine Region (OIC, 2020) and the Pilot Pentland Firth & Orkney Waters Marine Spatial Plan (Scottish Government, 2016).

10.6 Summary and ES appraisal

Given the natural heritage features and effect pathways assessed in Section 10.3 and the appraisal mechanisms identified above, the ES will appraise the potentially important effects of the Project Envelope on cetaceans as shown in Table 10-5, focussing on the five species most often sighted in the wider Fall of Warness area (harbour porpoise, minke whale, killer whale, white beaked dolphin and Risso's dolphin). The ES will also identify any monitoring or mitigation required.

Table 10-5 Summary overview of topics scoped into ES

STAGE	EFFECT PATHWAYS
Installation and decommissioning	Installation vessel(s) transits and manoeuvring leading to disturbance.
	Underwater noise from foundation/mooring installation methods and vessels leading to auditory injury, death or disturbance.

STAGE	EFFECT PATHWAYS
Operation and maintenance	Maintenance vessel transits and manoeuvring leading to disturbance.
	Underwater noise from turbine operation leading to disturbance
	Changes to hydrodynamic and sediment regime.
	Collision with turbine blades leading to injury or death.

The focus of the ES will be on the site-specific use of the Fall of Warness site by cetaceans and how the Project Envelope may impact these species. Consideration of the following features will be applicable:

- SAC and MPAs – Based on assessments to date as outlined in this document, there are no likely significant effects on the cetacean protected features of SACs and MPAs;
- EPS – All cetacean species are EPS, therefore there may be licence implications if there is the potential for disturbance as a result of activities;
- PMFs – Several cetacean PMFs are known to use the Fall of Warness site; and
- Other cetacean sensitivities – Captures assessments not covered under other legislation and licencing which may impact at population/habitat level including indirect impacts as a result of changes in hydrodynamics.

The assessment will be informed by the following studies:

- Assessment of noisy activities will be included, as per those included in the Project Envelope. This will be a desk-based exercise (i.e. no project-specific underwater noise modelling undertaken) utilising published data on cetacean sound detection, available and/or provided data on sound associated with vessels, installation activities and device operation. The species which will form the focus of the assessment as listed above include those with high-frequency hearing (harbour porpoise), mid-frequency hearing (killer whale, white beaked dolphin and Risso's dolphin) and low-frequency hearing (minke whale) and therefore inform any potential impacts on other cetacean species; and
- The assessment of collision risk will be informed by predictive risk modelling in accordance with NatureScot guidance (SNH, 2016) and information on the diving behaviour and on-site density of the cetacean species potentially at risk. In the absence of full details of device specifications, location and operating depths, it is proposed that modelling will examine a number of scenarios that are indicative of the range of potential designs within the Project Envelope. Selection of scenarios will consider device surface clearance and operation depth, the number of devices (or number of turbines for multi-turbine device designs) and the diameter of rotors. The scenarios examined will be illustrative of the realistic worst-case scenarios, bearing in mind that the worst-case scenario may vary between species. NatureScot will be consulted with regard to the choice of scenarios examined, and to the input baseline data used. The aim will be to identify which cetacean receptor species could be subject to sufficient collision risk magnitude to adversely affect their populations. This requires baseline information on the receptor populations' size and mortality rate and estimates of the predicted increase in mortality (informed by model outputs). Existing site monitoring and regional survey data will be used as the source of seasonal densities of cetacean species. If baseline data are found not to provide the robust basis required for any species, collision risk for that species will

be examined for a range of density values. Model scenarios and environmental inputs will be informed by further discussion with NatureScot.

11 Seals

11.1 Introduction

This section describes the populations of seals, i.e. grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*), that occur in and around the Fall of Warness site. Consideration is given to their status and seasonal sensitivities and the presence of sites designated for their protection, and to the potential impacts from the deployment and operation of tidal devices and testing infrastructure. Based on the Project Envelope and the possible effect pathways including underwater noise generation, the zone of effect could potentially extend up to a few kilometres from the tidal testing site. However, the potentially affected seal populations are considered in the context of Orkney as a whole, as well as the wider distribution of these species.

11.2 Baseline Overview

11.2.1 Key Data Sources

The key data sources that will be used to inform the assessment of seals will include, but not be limited to, those shown in Table 11-1.

Table 11-1 Data sources relevant to the scoping and EIA process

TOPIC	DATA TYPE	MAIN DATA SOURCES
Conservation areas and protected sites	○ Special Areas of Conservation (SACs) including those with proposed, candidate or draft status; ○ NCMPAs, including those with possible status; ○ Sites of Special Scientific Interest (SSSIs); ○ National Nature Reserves (NNRs); ○ Marine Consultation Areas; and ○ Local Nature Conservation Sites.	○ JNCC; ○ NatureScot; ○ Marine Scotland; and ○ OIC.
Seals	○ Local and regional seal abundance and distribution data; ○ Seal haul-out sites; and ○ Seal foraging areas.	○ Site-specific data from the Fall of Warness as outlined in Section 11.2.2; ○ Orkney Biodiversity Records Centre; ○ National Biodiversity Network (NBN) Gateway; ○ Seawatch Foundation; ○ NatureScot; ○ Special Committee on Seals, annual reports; ○ Marine Scotland Updated Seal Usage Maps: The estimated at-sea distribution of grey and harbour seals; and ○ Seal distribution publications including Carter *et al.*, 2020; Hague *et al*, 2020.

11.2.2 Natural Heritage Context

Preliminary site-specific assessments of the use of the Fall of Warness site by seals were carried out in 2005 to inform the original EIA for the tidal device testing site (Aurora, 2005; EMEC, 2009). One of the main sensitivities identified at the test site were harbour seals, which haul out and pup on rocks to the north of the site. Following publication of the 2005 ES (Aurora, 2005), a land-based visual surface wildlife observation programme was initiated by EMEC in July 2005 based on

regulatory recommendations. Initial analysis of the first three years' of data was undertaken by SMRU (SMRU, 2006, 2007, 2009). The collection of wildlife observation data at the Fall of Warness site was funded by the Scottish Government until 31 October 2015 and extensive analysis of the dataset obtained has been undertaken.

EMEC has also undertaken an integrated environmental monitoring project which included monitoring of marine mammals in the close vicinity of an operating tidal turbine in order to assess the close-range behaviour and the potential risk of harm to marine species due to potential collision with devices. In addition to the monitoring undertaken by EMEC at the site, developers have undertaken their own monitoring using a range of methods, which includes underwater video and drop-camera as well as using strain gauges to identify potential collision events. There is therefore extensive site-specific data to inform the EIA, which will be used together with information on the relevant species from further afield as outlined in Section 11.2.1.

Both harbour seals and grey seals are regularly sighted at the Fall of Warness site. Grey seals are observed more frequently than harbour seals, with the highest proportion of all grey seal observations coinciding with their pupping season during the autumn months.

Scotland holds around 79% of the UK's population of harbour seals and the UK holds around 30% of Europe's harbour seals. They are widespread around the west coast of Scotland and throughout the Hebrides and Northern Isles, with a more limited distribution restricted to concentrations in the major estuaries on the east coast such as Firth of Tay, Moray Firth, The Wash and the Thames. Major declines have been documented around Scotland since 2000. The distribution of harbour seals across the site is significantly varied, concentrating around Sealskerry Bay on Eday.

Around 38% of the world's grey seal population breed in the UK, of which 88% breed in colonies in Scotland, with the majority in the Hebrides and Orkney. While numbers of grey seal pups have increased steadily since the 1960s, there is evidence that this growth is levelling off particularly in Orkney and possibly some of the colonies in the North Sea (SCOS, 2011). Grey seals also vary significantly in their distribution across the test site, with numbers concentrated around Muckle Green Holm to the west of the site (Robbins, 2011).

11.2.3 Protected Sites

Although the Fall of Warness site does not sit within or directly adjacent to any existing designated SAC site, there are two SACs within the local area: Sanday SAC with harbour seal as a qualifying feature and Faray and Holm of Faray SAC with grey seal as a qualifying feature. The test site is adjacent to the Muckle and Little Green Holm Site of Special Scientific Interest (SSSI). The locations of these sites are shown in Figure 1-1, with details of each site summarised below.

There are also a number of designated haul-out sites within the immediate vicinity of the tidal test site. These include Seal Skerry for harbour seals, Muckle Green Holm and Little Green Holm for grey seal breeding colonies, the eastern coastline of Egilsay, Rusk Holm and off the point at War Ness for both species of seal.

11.2.3.1 Sanday SAC

Sanday SAC is located approximately 15 km from the Fall of Warness site and has the largest colony of breeding harbour seals in Orkney. The EMEC test site is well within the foraging range of harbour seals from haul-outs, so it is likely that some of the seals from this SAC use the Fall of Warness site for foraging and/or transit. However, this distance, plus the presence of other (albeit smaller) harbour seal haul-outs in the vicinity of the Fall of Warness site and wider Orkney area, make it highly likely that a large proportion of the harbour seals present are not associated with the

Sanday SAC. Also, there is a good availability of quality foraging habitat near Sanday that makes it unlikely that the Fall of Warness site is important in this regard.

Harbour seals currently have an 'unfavourable declining' status; however, it is notable that this declining trend precedes any activity at the Fall of Warness site and reflects trends throughout the north and east of Scotland.

11.2.3.2 Faray and Holm of Faray SAC

Faray and Holm of Faray SAC is located approximately 4 km to the north of the Fall of Warness site and is one of the most important breeding and haul out sites for grey seals in Orkney. The site supports the third largest breeding colony of grey seals in the UK (and the fourth in the world).

The EMEC test site is well within the foraging range of grey seals from haul-outs, so it is likely that many of the seals from this SAC use the Fall of Warness site for foraging and/or transit. However, there are several other grey seal haul outs in the vicinity and in Orkney generally, including some with even greater proximity to the Fall of Warness site (e.g. Muckle Green Holm and Little Green Holm, and Seal Skerry). Consequently, it is highly likely that a large proportion of the grey seals present in the Fall of Warness site are not associated with the Faray and Holm of Faray SAC. The grey seal population at this SAC is currently in 'favourable maintained' status.

11.2.3.3 Muckle and Little Green Holm SSSI

SSSIs are designated under the Nature Conservation (Scotland) Act 2004 (as amended) and it is an offence for any person to intentionally or recklessly damage the protected natural features of an SSSI. Muckle and Little Green Holm SSSI is immediately adjacent to southern part of the Fall of Warness site. Comprising two neighbouring uninhabited islands (Muckle Green Holm and Little Green Holm), this SSSI regularly supports around 2% of the grey seal pups born in the UK and is one of the largest sites for breeding grey seals in Orkney. This SSSI is in 'favourable maintained' condition.

11.3 Effect Pathways

The defined potential effect categories are applied for seals to activities/effect pathways relevant to tidal energy developments comprising design-types involving the rotation of turbines within natural hydrodynamic conditions. Deployment/installation effects (

Table 10-2) are addressed separately from those during the operational and maintenance phases (Table 11-3).

The potential effect-pathways assessed on the baseline environment include:

- Installation vessel(s) transits and manoeuvring leading to disturbance;
- Underwater noise from foundation/mooring installation methods and vessels leading to auditory injury (permanent or temporary), death or disturbance;
- Entanglement in lines or cabling leading to injury or death;
- Maintenance vessel (s) transits and manoeuvring leading to disturbance;
- Underwater noise from operating turbines leading to auditory injury (permanent or temporary), death or disturbance;
- Other maintenance activities (non-vessel based) leading to disturbance;
- Collision with operating turbine blades leading to injury or death;
- Presence of tidal device(s) and associated infrastructure leading to barrier effects; and

- Entanglement in lines or cabling leading to injury or death.

Table 11-2 Potential effects on grey seal and harbour seal during the deployment phase, identifying activities/effect pathways and receptors for further assessment

POTENTIAL EFFECTS FROM DEVICE DEPLOYMENT (AND DECOMMISSIONING[10])		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURES**	**POTENTIAL IMPORTANCE**
Installation vessel(s) transits and manoeuvring leading to disturbance.	Grey seal and harbour seal	***Potentially important* –** Activity of vessels in close proximity to designated haul-out sites could lead to disturbance (haul-out sites are protected under the Protection of Seals (Designation of Haul-out Sites) (Scotland) Order 2014).
Underwater noise from foundation/mooring installation methods and vessels leading to auditory injury (permanent or temporary), death or disturbance.	Grey seal and harbour seal	***Potentially important*** – Importance will depend upon the range and frequency of noise sources (including background noise), duration and intensity of activity and the likelihood of seals in the area.
Entanglement in lines or cabling leading to injury or death.	Grey seal and harbour seal	*No effect* – No evidence to date to suggest that seal species are at risk from this impact pathway. No further assessment therefore required at this point.

Table 11-3 Potential effects on grey seal and harbour seal during the operations and maintenance phase, identifying activities/effect pathways and receptors for further assessment

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURES**	**POTENTIAL IMPORTANCE**
Maintenance vessel (s) transits and manoeuvring leading to disturbance.	Grey seal and harbour seal	***Potentially important* –** Activity of vessels in close proximity to designated haul-out sites could lead to disturbance (haul-out sites are protected under the Protection of Seals (Designation of Haul-out Sites) (Scotland) Order 2014)
Underwater noise from operating turbines leading to auditory injury (permanent or temporary), death or disturbance.	Grey seal and harbour seal	***Potentially important*** – Importance will depend upon the range and frequency of noise sources (including background noise), duration and intensity of activity and the likelihood of seals in the area.
Other maintenance activities (non-vessel based) leading to disturbance.	Grey seal and harbour seal	*Not important* – maintenance activities include inspection (e.g. divers/ROV), repairs or temporary retrieval or replacement of nacelles by winch. In all cases it is the presence of the accompanying vessel that presents the primary disturbance risk, which is appraised separately.
Collision with operating turbine blades leading to injury or death.	Grey seal and harbour seal	***Potentially important*** – Potential for impact is poorly understood, but importance may depend upon turbine location & spacing, (including water depth), the physical and rotational characteristics of turbines, and the likelihood of seals passing through the risk window.
Presence of tidal device(s) and associated	Grey seal and harbour seal	*Not important* – Seals may utilise or move through Sounds that may also present opportunity for tidal development. Importance will depend

[10] To save unnecessary repetition, decommissioning impacts will be considered alongside installation impacts, highlighting where necessary impacts specific to decommissioning only.

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	NATURAL HERITAGE FEATURES	POTENTIAL IMPORTANCE
infrastructure leading to barrier effects.		upon the spatial occupancy of the channel by tidal devices (in three dimensions), the physical and rotational characteristics of the devices and the importance of the vicinity for passage of seals. Considering the location of the Fall of Warness site, at the edge of a channel rather than in the middle, and given the small spatial scale of the development, there is not expected to be any barrier effect. Any effect would be limited to a short diversion around the site, if it was perceived as a block.
Entanglement in lines or cabling leading to injury or death.	Grey seal and harbour seal	*No effect* – Although direct evidence is not available, seals are intuitively of a size and mobility that greatly limits the potential for this interaction. Future review of this matter may be required, but no further assessment therefore required.

11.4 Appraisal Mechanisms

Table 11-4 presents the relevant legislation and any applicable reasons for undertaking an appraisal based on features present in the Fall of Warness site or nearby qualifying features.

Table 11-4 Appraisal mechanism for seals

FEATURE TYPE	APPRAISAL MECHANISM/RELEVANT LEGISLATION	APPLICABLE	REASONING
Qualifying feature of European sites	The Conservation of Habitats and Species Regulations 2017 The Conservation (Natural Habitats &c.) Regulations 1994 (as amended)	Yes	Captures assessment of harbour and grey seals as qualifying species of SAC.
European Protected Species (EPS)	The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) The Wildlife and Countryside Act 1981 (as amended) Wildlife and Natural Environment (Scotland) Act 2011 (WANE Act)	No	Neither seal species are EPS
Notified features of SSSIs	Nature Conservation (Scotland) Act 2004 (as amended)	Yes	Captures assessment of SSSIs with seal notified features.
Protected features of MPAs	Marine (Scotland) Act 2010	No	Neither seal species is a protected feature of MPAs under the Marine (Scotland) Act 2010.
PMFs	Marine (Scotland) Act 2010	Yes	Both seal species are PMFs and present at the Fall of Warness site.
Other sensitive natural heritage features	Appraisal of other features under: ○ The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore); ○ The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; ○ Marine (Scotland) Act 2010; ○ The Protection of Seals (Designation of Haul-out Sites) (Scotland) Order 2014; and	Yes	Captures assessment required under EIA, and in relation to Seal Management Units and designated haul outs.

FEATURE TYPE	APPRAISAL MECHANISM/RELEVANT LEGISLATION	APPLICABLE	REASONING
	○ Wildlife and Countryside Act 1981.		

11.5 Cumulative Impacts

The zones of effect to seals from the activities at the Fall of Warness site are expected to be limited to within a few kilometres of the site and therefore there is limited potential for direct overlap of impact mechanisms. However, populations of both seal species are subject to a variety of pressures in Orkney and Pentland Firth waters and beyond and there is particular concern over the declining numbers of harbour seal and the 'unfavourable declining' status within the Sanday SAC. Consideration of the potential for cumulative impacts on the seal populations with other projects, plans and activities in the area will be an important element of the EIA.

Table 4-2 of this document provides an indicative list of the developments to be considered in the cumulative impact assessment. The approach will be to identify the other threats to the seal populations, considering the relevant management units and the conservation objectives of all protected sites with connectivity to the Fall of Warness site, to enable the cumulative impacts to be assessed. Key resources for the assessment will be publications on the abundance, seasonal behaviour and distribution of the seal species as identified in Section 11.2.1, the State of the Environment Assessment for the Orkney Islands Marine Region (OIC, 2020) and the Pilot Pentland Firth & Orkney Waters Marine Spatial Plan (Scottish Government, 2016).

11.6 Summary and ES appraisal

Given the natural heritage features and effect pathways assessed in Section 11.3 and the appraisal mechanisms identified in Table 11-4, the ES will appraise the effects of the Project Envelope on grey seal and harbour seal as shown in Table 11-5. The ES will also identify any monitoring or mitigation required.

Table 11-5 Summary overview of topics scoped into the ES (potentially important) and appraised as sensitive natural heritage features

STAGE	EFFECT PATHWAYS
Installation and decommissioning	Installation vessel(s) transits and manoeuvring leading to disturbance.
	Underwater noise from foundation/mooring installation methods and vessels leading to auditory injury (permanent or temporary), death or disturbance.
Operation and maintenance	Maintenance vessel(s) transits and manoeuvring leading to disturbance.
	Underwater noise from operating turbines leading to auditory injury (permanent or temporary), death or disturbance.
	Collision with operating turbine blades leading to injury or death.

The focus will be on the site-specific use of the Fall of Warness site by the two seal species and how the Project Envelope may impact these species. Consideration of the following features will be applicable:

- SACs and SSSIs – The potential for effects on the qualifying seal features of SACs and SSSIs will be assessed in detail;
- PMFs – Both grey and harbour seal are PMFs and are known to use the Fall of Warness site; and

- Other seal sensitivities – Captures assessments in relation to Seal Management Units, designated seal haul-outs and population-level impacts.

The assessment will be informed by the following studies:

- Assessment of noisy activities will be included, as per those included in the Project Envelope. This will be a desk-based exercise (i.e. no project-specific underwater noise modelling undertaken) utilising published data on seal sound detection, available and/or provided data on sound associated with vessels, installation activities and device operation; and
- The assessment of collision risk will be informed by predictive risk modelling in accordance with NatureScot guidance (SNH, 2016) and information on the diving behaviour and on-site density of grey seal and harbour seal. In the absence of full details of device specifications, location and operating depths, it is proposed that modelling will examine a number of scenarios that are indicative of the range of potential designs within the Project Envelope. Selection of scenarios will consider device surface clearance and operation depth, the number of devices (or number of turbines for multi-turbine device designs) and the diameter of rotors. The scenarios examined will be illustrative of the realistic worst-case scenarios, bearing in mind that the worst-case scenario may vary between the two species. NatureScot will be consulted with regard to the choice of scenarios examined. The aim will be to identify whether grey or harbour seal could be subject to sufficient collision risk magnitude to adversely affect their populations. This requires baseline information on the receptor populations' size and mortality rate and estimates of the predicted increase in mortality (informed by model outputs). Existing monitoring survey data and recent data on seal distribution as outlined in Section 11.2.1 will be used as the source of seasonal densities. If baseline data are found not to be adequate for either species, collision risk will be examined for a range of density values. Model outputs will be interpreted for a range of collision avoidance rates to be agreed with NatureScot.
- It is proposed that the potential biological removal (PBR) appraisal method be used as the basis against which potential population level effects from the proposed Project will be assessed. This method has been successfully used in the most recent assessments of tidal projects, including for both the MeyGen and Brims Tidal arrays. It continues to be the basis on which subsequent phases of the MeyGen project are assessed. Further, specific consultation is proposed with both Marine Scotland and NatureScot to understand what available headroom within the PBR may exist, considering other consented projects and other potential licensed seal takes.
- It is also proposed, subject to further consultation with Marine Scotland and NatureScot, to use PBR as the method to assess impact on the two relevant SACs. Given the short distances to these sites, and the distances which grey and harbour seals are known to travel, assuming that all grey and harbour seals found at Fall of Warness use at some point these protected sites, represents a reasonably cautious position. These sites also represent the only protected sites for each species within the relevant management unit. Making this assumption at the management unit levels means that the PBR values calculated for Marine Scotland become relevant, since those PBR numbers assess the management unit population.

12 Otters

12.1 Introduction

This section of the Scoping Report identifies otters' relevance to the Project and considers the potential impacts from the construction, operation and maintenance of the Project. Key issues of concern for otters include damage to or loss of protected habitat (holts) and/or disturbance to or loss of protected species or populations.

12.2 Baseline Overview

12.2.1 Key Data Sources

Table 12-1 shows the key data sources used to inform assessment of otters.

Table 12-1 Data sources relevant to the scoping and EIA process

TOPIC	DATA TYPE	MAIN DATA SOURCES
Conservation areas and protected sites	○ Special Protection Areas (SPAs) and Special Areas of Conservation (SACs) including those with proposed, candidate or draft status; ○ NCMPAs, including those with possible status; ○ Sites of Special Scientific Interest (SSSIs); ○ National Nature Reserves (NNRs); and ○ Local Nature Conservation Sites.	○ JNCC; ○ NatureScot; ○ Marine Scotland; and ○ OIC.
Marine mammals and otters	○ Otter sightings data.	○ Orkney Biodiversity Records Centre; ○ National Biodiversity Network (NBN) Gateway; ○ Seawatch Foundation; ○ NatureScot; ○ Annual report of the wildlife observation programme underway at the European Marine Energy Centre (EMEC) in Orkney - Fall of Warness (EMEC, 2014c).

12.2.2 Natural Heritage Context

European otters (*Lutra lutra*) are a European Protected Species (EPS), legally protected under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) and under the Wildlife and Countryside Act 1981 (as amended). European otters are additionally protected within the UK through their inclusion as a priority species in the Biodiversity Action Plan (BAP) 1995 and as Scottish Priority Marine Features (PMFs) (Tyler-Walters *et al.*, 2016). Historically European otter populations were almost obsolete within the UK primarily due to the use of pesticides and their pollution to waterways, however, populations are now recovering strongly with an estimated population of around 8,000 individuals in Scotland alone (NatureScot, 2022). Threats to otters include, but are not limited to: pesticide use; hunting; pollution; static gear fishing; drainage management, modification of hydrographic function, inland water courses, and water levels; and infilling of freshwater sources, such as ponds, pools, marshes or potential freshwater sources,

such as pits, dykes, and ditches (JNCC, 2007). However, the biggest source of mortality (excluding natural cause) in Scotland is road accidents (NatureScot, 2022).

As semi-aquatic mammals, otters use both marine and freshwater habitats for foraging purposes, but terrestrial habitats for all other biological functions (DECC, 2016). Habitat use by otters predominantly takes place on land, where they socialise, rest and shelter. European otters are thought to spend nearly two-thirds of the day at rest-sites (Beja, 1996) indicating the importance of their terrestrial shelters (i.e. holts) to their biological functions (Nolet and Kruuk, 1989). Coastal otters are seen to have much smaller home ranges (i.e. up to approximately 5 km of coastline) than those of riverine otters (32 km for male and 20 km for female), this is due to the abundance of prey sources available in coastal waters (Carrs, 1995; NatureScot, 2022). As well as this, unlike the riverine otters, coastal otters are active during the day. Coastlines which have ample peat-cover, rich seaweed communities and a freshwater supply constitute optimal coastal marine habitat for otters (DECC, 2016).

The Orkney Islands constitute important habitat to UK otters, though the distribution of this species varies across the islands (DECC, 2016). EMEC wildlife observations collected at the Fall of Warness site over the period of April 2013 to March 2014 recorded a total of 16 otter sightings (EMEC wildlife sightings 2013 - 2014).

12.2.3 Protected Sites

There are several sites with otter features located in Orkney, including: Northwall SSSI (22.2 km northeast), the Loch of Isbister SAC (straight-line distance: 29.2 km north-northeast), and Switha SSSI (43.7 km southeast). Otters form a qualifying, but not primary feature of the Loch of Isbister SAC, which offers freshwater habitat for this species. The Switha and Northwall SSSIs protect coastal otters in Orkney, which occur with less regularity than in Shetland (Kruuk *et al.*, 1989). However, unlike the Loch of Isbister SAC, these sites are located on separate islands from Eday, with vast marine waterways to traverse. Given relevant knowledge of habitat use by coastal otters being particularly spatially constrained (NatureScot, 2022; Carrs, 1995), it is unlikely that the otter features at either the Switha or Northwall SSSI would travel to the wider Fall of Warness area, and as such the otter features protected at these sites are considered beyond the range of connectivity with the Fall of Warness site.

12.3 Effect Pathways

For otter receptors, the defined potential effect categories are applied to activities/effect pathways relevant to tidal energy developments comprising design-types involving the rotation of turbines within natural hydrodynamic conditions. First, potential effects are considered in broad principles. Deployment/installation effects (Table 12-2) are addressed separately from those during the operational and maintenance phases.

The potential effect-pathways assessed on the baseline environment include:

- Habitat loss/damage;
- Vessel presence; and
- Underwater noise disturbance.

Given the restricted use by otters of the offshore parts of the site, operation and maintenance activities, which will occur largely in that area, are not assessed further here.

Table 12-2 Potential effects on otters during the deployment phase, identifying activities/effect pathways and receptors for further assessment

POTENTIAL EFFECTS FROM DEVICE DEPLOYMENT (AND DECOMMISSIONING[11])		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**NATURAL HERITAGE FEATURE**	**POTENTIAL IMPORTANCE**
Habitat loss/damage	Otters	*Not Important* – 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 terrestrial species. Installation activities may take place outwith the range of marine habitat use for European otters, which predominantly forage for short periods adjacent coastlines (Nolet and Kruuk, 1989). Moreover, vessels employed for installation activities within the Project Envelope are unlikely to utilise the shallow water habitat targeted by this species, due to limitations from the draft of the vessel. As such, no loss or damage to marine habitats are anticipated from activities taking place at the Fall of Warness site. There may be potential for highly spatially and temporally limited exclusion from onshore habitats in the events landfalls are required for any new cable routes.
Vessel presence	Otters	*Not important* – otters may be sensitive to vessel presence and associated activities taking place in the nearshore environment. Importance will depend upon the duration and intensity of vessel activity, the location in which it takes place (including distance from shore), habitat use by otters in the area, and the opportunity for those animals to avoid areas of disturbance. The area surrounding the Fall of Warness site is not used to a great extent by otters and therefore are unlikely to be disturbed by vessel presence
Underwater noise	Otters	*Not important* – hearing sensitivity in this species is greatly reduced compared to marine mammals (e.g. dolphins, whales and seals). Non-percussive foundation drilling or non-percussive pile-driving operations have the potential to produce low-frequency continuous underwater sounds which range between 0.01 Hz – 100 Hz (Kvaerner Cementation Foundations, Ltd., 2002; Rice, 1983). 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 foundation and mooring installation will emit sound at low frequencies which are likely be inaudible to European otters, and which will take place beyond the range of marine habitat use for this species, it is unlikely that installation activities will cause a disturbance to otters.

12.4 Appraisal Mechanisms

Table 12-3 presents the relevant legislation and any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features

[11] To save unnecessary repetition, decommissioning impacts will be considered alongside installation impacts, highlighting where necessary impacts specific to decommissioning only.

Table 12-3 Appraisal mechanism for otters

FEATURE TYPE	APPRAISAL MECHANISM/RELEVANT LEGISLATION	APPLICABLE	REASONING
Qualifying feature of European sites	The Conservation of Habitats and Species Regulations 2017 The Conservation (Natural Habitats &c.) Regulations 1994 (as amended)	No	No connectivity with SACs with European otter qualifying features
European Protected Species (EPS)	The Conservation (Natural Habitats &c.) Regulations 1994 (as amended)	Yes	European otters are listed as EPS
Notified features of SSSIs	Nature Conservation (Scotland) Act 2004 (as amended)	No	No SSSIs with European otter features will be impacted
Protected features of MPAs	The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) Marine and Coastal Access Act 2009 (if relevant)	No	Not capable of affecting protected otter features of any MPAs.
PMFs	Marine (Scotland) Act 2010	No	European otters are PMFs
Other sensitive natural heritage features	Appraisal of other features under: ○ The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore); ○ The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; ○ Marine (Scotland) Act 2010; and ○ Wildlife and Countryside Act 1981.	No	There are no other identified sensitive natural heritage features at a population/habitat scale of concern.

12.5 Cumulative Impacts

Due to the short distance that coastal otters travel / forage it is unlikely that any of the activities identified in Section 3 will contribute to any cumulative impacts on otters found within the Fall of Warness site.

12.6 Summary and ES appraisal

Given the effect pathways assessed in Section 12.3 and the appraisal mechanisms identified in Section 12.4, it is considered that there will not be an impact requiring further assessment as part of the EIA process, and otters will therefore not be considered further. Following discussion with NatureScot, any interaction with otters from an onshore or EPS regulation perspective will be considered as part of any onshore applications.

13 Commercial Fisheries

13.1 Introduction

This section describes the commercial fisheries impacts of relevance to the Fall of Warness site 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, located within ICES rectangle 47E7, is defined as the seabed within and immediately adjacent to the site.

Note that any issues related to safety are covered by the Navigational Risk Assessment (NRA), and are not discussed herein.

13.2 Baseline Overview

13.2.1 Key Data Sources

Table 13-1 shows the key data sources used to inform assessment of commercial fisheries.

Table 13-1 Data sources relevant to the scoping and EIA process

TOPIC	DATA TYPE	MAIN DATA SOURCES
Commercial fisheries	○ Fishing activities and effort.	○ Landings data from relevant ICES rectangles (MMO and Marine Scotland); ○ Vessel Monitoring System (VMS) data (MMO and Marine Scotland); ○ VMS Amalgamated Fishing Intensity Layers (Marine Scotland); ○ ScotMap (Scottish Government); ○ Automatic Information System (AIS) data of fishing tracks (MMO); ○ Consultation data collected for the ES (2014) and current scoping report (consultation with OFA (02/03/2022)); ○ Spatial data on fisheries, including fishery restrictions (NMPi and Kingfisher Information Service); ○ Pilot Pentland Firth and Orkney Waters Marine Spatial Plan (Scottish Government); ○ State of the Environment Assessment: A Baseline Assessment of the Orkney Island Marine Region (OIC); ○ Sectoral Marine Plan: Regional Local Guidance (Scottish Government); and ○ Marine Scotland Salmon and Sea Trout Fishery Statistics and other associated Reports (Marine Scotland).
Aquaculture	○ Active aquaculture sites in Scotland.	○ Aquaculture Scotland (Marine Scotland).

13.2.2 Baseline Description

13.2.2.1 Commercial Fisheries

The State of the Environment Baseline Description (2020) concluded that the Orkney commercial fishing fleet consisted of 128 active fishing vessels in 2018, predominately undertaken by inshore creel boats under 10 m in length.

The Fall of Warness ES from 2014 (EMEC, 2014a) concluded that around 12 creel fishing boats from Mainland Orkney and two from Westray regularly fish on the south west coast of Eday within the wider Fall of Warness area. Their local catch amounting up to 30%, and in some cases up to 50% for individual vessels. Scallop diving was also noted in the area, but is limited by safety constraints due to the high tidal flow. Input from local fishermen was sought for the 2014 ES through Orkney Fisheries Association (OFA) and Orkney Fishermen's Society (OFS) and the boundary with the west coast of Eday was amended to follow the 30-metre water depth contour line[12], so fishing could continue in the shallower waters out-with this boundary.

Consultation undertaken with OFA in March 2022, to inform this Scoping Report, concluded that it is highly unlikely that any vessel would fish within the Fall of Warness site itself, although the wider area may be used to transit through.

13.2.2.2 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 7 and 10 km from 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 Fall of Warness site.

13.3 Effect Pathways

For commercial fisheries receptors, the defined potential effect categories are applied to activities/effect pathways relevant to tidal energy developments comprising design-types involving the rotation of turbines within natural hydrodynamic conditions. First, potential effects are considered in broad principles. Deployment/installation effects (Table 13-2) are addressed separately from those during the operational and maintenance phases (

Table 13-3).

The potential effect-pathways assessed on the baseline environment include:

- Temporary loss or restricted access to fishing grounds;
- Displacement of fishing effort;
- Interference with fishing activity as a result of increased vessel traffic;
- Increased steaming times; and
- Safety issues for fishing vessels.

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.

[12] *The site boundary will remain unchanged and will thus still follow the 30-metre contour line.*

Table 13-2 Potential effects on commercial fisheries during the deployment phase, identifying activities/effect pathways and receptors for further assessment

POTENTIAL EFFECTS FROM DEVICE DEPLOYMENT (AND DECOMMISSIONING[13])		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**HUMAN FEATURE**	**POTENTIAL IMPORTANCE**
Temporary loss or restricted access to fishing grounds	Static gear vessels	*No effect* – there has been no fishing activity identified within the Project boundaries.
	Mobile gear vessels	
Displacement of fishing effort	Static gear vessels	*No effect* – there has been no fishing activity identified within the Project boundaries.
	Mobile gear vessels	
Interference with fishing activity as a result of increased vessel traffic	Static gear vessels	*Not important* – increased vessel traffic associated with construction and decommissioning works may lead to interference with fishing activity in the grounds adjacent to the Project (e.g. fouling of static gear markers), however, as there is no static gear identified within the Project boundaries and the adjacent areas have very limited fishing, the effect will be negligible.
	Mobile gear vessels	*No effect* – there has been no fishing activity identified within the Project boundaries.
Increased steaming times	Static gear vessels	*Not important* – temporary loss or restricted access to fishing grounds, displacement of fishing effort 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 these steaming times will be minimal.
	Mobile gear vessels	
	Mobile gear vessels	

Table 13-3 Potential effects on commercial fisheries during the operations and maintenance phase, identifying activities/effect pathways and receptors for further assessment

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**HUMAN FEATURE**	**POTENTIAL IMPORTANCE**
Temporary loss or restricted access to fishing grounds	Static gear vessels	*No effect* – there has been no fishing activity identified within the Project boundaries.
	Mobile gear vessels	
Displacement of fishing effort	Static gear vessels	*No effect* – there has been no fishing activity identified within the Project boundaries.
	Mobile gear vessels	
Interference with fishing activity as a result of increased vessel traffic	Static gear vessels	*Not important* – increased vessel traffic associated with construction and decommissioning works may lead to interference with fishing activity in the grounds adjacent to the Project (e.g. fouling of static gear markers), however, as there is no static gear identified within the Project boundaries and the adjacent areas have very limited fishing, the effect will be negligible.
	Mobile gear vessels	*No effect* – there has been no fishing activity identified within the Project boundaries.

[13] To save unnecessary repetition, decommissioning impacts will be considered alongside installation impacts, highlighting where necessary impacts specific to decommissioning only.

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	HUMAN FEATURE	POTENTIAL IMPORTANCE
Increased steaming times	Static gear vessels Mobile gear vessels	*Not important* – temporary loss or restricted access to fishing grounds, displacement of fishing effort 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 these steaming times will be minimal.

13.4 Appraisal Mechanisms

Table 13-4 presents any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features

Table 13-4 Appraisal mechanism for commercial fisheries

FEATURE TYPE	APPRAISAL MECHANISM/RELEVANT LEGISLATION	APPLICABLE	REASONING
Qualifying feature of European sites	The Conservation of Habitats and Species Regulations 2017 The Conservation (Natural Habitats &c.) Regulations 1994 (as amended)	No	No connectivity with SACs with commercial fisheries restrictions
European Protected Species (EPS)	The Conservation (Natural Habitats &c.) Regulations 1994 (as amended)	No	No commercially fished species present in the site are listed as EPS
Notified features of SSSIs	Nature Conservation (Scotland) Act 2004 (as amended)	No	No connection with SSSIs with commercial fisheries restrictions
Protected features of MPAs	The Conservation (Natural Habitats &c.) Regulations 1994 (as amended) Marine and Coastal Access Act 2009 (if relevant)	No	No connection with MPAs with commercial fisheries restrictions
PMFs	Marine (Scotland) Act 2010	No	No connection with PMFs with commercial fisheries restrictions
Other sensitive natural heritage features	Appraisal of other features under: ○ The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore) ○ The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 ○ Marine (Scotland) Act 2010 ○ Wildlife and Countryside Act 1981	No	No connection with commercial fisheries restrictions

13.5 Cumulative Impacts

There is the potential for the potential impacts from the Project to interact with impacts from other projects, plans and activities, resulting in a cumulative effect on commercial fisheries receptors. The majority of potential cumulative impacts on commercial fisheries are likely to be considered localised and will be most likely only occur where other projects / plans are located in areas used

by the same fisheries as the Project. This is unlikely as no fishing activity was identified within the Fall of Warness site, and the adjacent areas only being used by smaller, local static gear vessels. Static gear vessels are not affected by the Wyre and Rousay Sounds protected area, as those restrictions are only for dredges, trawls and seine nets.

13.6 Summary and ES appraisal

Given the effect pathways assessed in Section 13.3 and the appraisal mechanisms identified in Table 13-4, it is considered that there will not be an impact requiring further assessment as part of the EIA process, and the commercial fishing industry will therefore not be considered further. The fishing industry will be kept updated throughout the process with Notice to Mariners (NtM), circulated in a timely manner.

14 Seascape, Coastal Character and Visual Amenity

14.1 Introduction

This chapter identifies the seascape, landscape and visual interests of relevance to the Fall of Warness site and considers the potential for effects to arise from the Project. 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).

14.2 Baseline Overview

The study area for the SLVIA will be defined as a maximum 5 km radius around the outer edge of the test site area, as shown in Figure 14-1. A distance of 5 km from the test site is considered sufficient to capture all landscape and visual receptors that could potentially experience significant effects as a result of the Project. As shown on Figure 14-1, the 5 km area includes the southern part of the island of Eday, and the waters to the south and west extending to Egilsay in the west and the northern tip of Shapinsay in the south.

An initial desk-based review of literature, guidance and available data sources has been undertaken to support this Scoping Report. The findings of this research are presented below to provide an understanding of the Fall of Warness site environment and context, and to inform the Scoping process.

14.2.1 Key Guidance and Data Sources

Table 14-1 presents guidance and key data sources that are of relevance to SLVIA in the Orkney area:

Table 14-1 Key guidance and data sources relevant to SLVIA

DATA TYPE	MAIN DATA SOURCES
Guidance	○ Landscape Institute and the Institute of Environmental Management and Assessment (2013), Guidelines for Landscape and Visual Impact Assessment. Third Edition. (GLVIA3); ○ Landscape Institute (2019). Visual Representation of Development Proposals. Technical Guidance Note 06/19; ○ Scottish Natural Heritage (2018). A Handbook on Environmental Impact Assessment, Appendix 2: Landscape and Visual Impact Assessment, Version 5; and ○ Scottish Natural Heritage (2012). Offshore Renewables: Guidance on assessing the impact on coastal landscape and seascape.
Data	○ LUC (2016) Orkney and North Caithness Coastal Character Assessment. Scottish Natural Heritage; ○ NatureScot (2019) National Landscape Character Assessment; ○ LUC (1999) Orkney Landscape Character Assessment. Scottish Natural Heritage Review No. 100; ○ Orkney Islands Council (n.d.) Local Landscape Area Statements; ○ Orkney Islands Council (2017) Orkney Local Development Plan; ○ Ordnance Survey mapping; and ○ Aerial and street-level photography available online.

Figure 14-1 SLVIA study area and viewpoints

14.2.2 Seascape and Landscape Character

14.2.2.1 Seascape and Coastal Character

There is no characterisation of offshore seascape character in Scotland. As such there is no classification of the character of the areas of open sea within the study area. The coastal character of the study area 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 study area fall mainly within RCCA 5: Eday. The coast of Egilsay is part of RCCA 12: Egilsay and Wyre, while the coast of Shapinsay is divided into RCCA 14 Shapinsay West and RCCA 15 Shapinsay East. At a local scale the Eday RCCA is divided into several LCCAs, of which there are four within 5 km of the Fall of Warness site:

- LCCA 5d: Fersness Bay;
- LCCA 5e: Fersness to Warness;
- LCCA 5f: Warness to Veness; and
- LCCA 5g: Eday Sound.

14.2.2.2 Landscape Character

The onshore landscape character within the study area is described in the National Landscape Character Assessment of Scotland, published online by NatureScot (SNH, 2019). The landscape character types (LCTs) within the onshore parts of the study area tend to reflect the agricultural and coastal nature of the islands, and include:

- LCT 295: Holms;
- LCT 296: Whaleback Islands
- LCT 297: Ridgeline Islands;
- LCT 298: Low Island Pastures;
- LCT 302: Inclined Coastal Pasture;
- LCT 307: Cliffs – Orkney;
- LCT 308: Coast with Sand – Orkney; and
- LCT 314: Moorland Hills – Orkney.

14.2.3 Protected Landscapes

There are no nationally protected landscapes (e.g. National Scenic Areas or Wild Land Areas) within the study area. The Orkney Local Development Plan 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.[14] However, these LLAs are not mapped and their status is unclear.

14.2.4 Visual Receptors

- Visual receptors are the people who will experience views of the Project from their homes and communities, their places of work, or the places they visit for recreation. The types and general locations of key receptors within the study area include:
- People visiting beaches and engaged in water activities along the west coast of Eday;
- People travelling along the unclassified road on the western coast of Eday;
- People walking along the Core Paths ED7 Leeniesdale Hill and ED8 Ward Hill;
- Residents and people working within the west and southern parts of Eday, including the properties of Newbigging, Sandybank and Swenstay; and
- People travelling on ferries and recreational boats along the channel between the Westray Firth and Stronsay Firth, to the west of Eday, including the Westray ferry.

A list of potential viewpoints that represent these visual receptors is set out in Table 14-2 below, and viewpoints are identified in Figure 14-1.

[14] https://www.orkney.gov.uk/Files/Planning/Development-and-Marine-Planning/North%20Isles%20LLA.pdf

Table 14-2 Proposed SLVIA viewpoints

NO.	VIEWPOINT	GRID REFERENCE	DISTANCE FROM TEST SITE	REASON FOR SELECTION
1	Unclassified road near Sandybank	354046, 1031485	<0.1 km	Represents views from the residential properties on the western coast of Eday and similar views experienced from the unclassified road.
2	Ward Hill (Core Path ED8 Ward Hill)	355288, 1030049	1.1 km	Represents elevated views from high point Eday that overlooks the test site. Ward Hill is on a Core Path and likely to be more frequently visited by hill walkers, being the most elevated point on the island.
3	Sanday Ferry	355311, 1026585	0.6 km	Represents open views from the Kirkwall to Sanday ferry to the south of the test site.
4	St Magnus Church, Egilsay	346823, 1030297	4.8 km	Represents views from St Magnus Church and residential properties on Egilsay to the west of the test site.

14.3 Effect Pathways

Effects on landscape and coastal character may arise from the visible presence of tidal energy devices and other infrastructure, including lighting, within the test site. Views of tidal energy devices and other infrastructure, including lighting, may affect the visual amenity of people in the surrounding area. As such, only surface-piercing elements of tidal energy devices, other floating infrastructure, and vessel movements, are of relevance to SLVIA. Devices that are fully submerged will not give rise to any seascape, landscape or visual effects. Table 14-3 below presents the potential landscape and visual effects that may arise as a result of the Project, focusing on the operational phase.

Table 14-3 Potential effects on landscape and visual receptors from operation

POTENTIAL EFFECTS FROM DEVICE OPERATION		
ACTIVITY/POTENTIAL EFFECT PATHWAY	HUMAN FEATURE	POTENTIAL IMPORTANCE
Regular installation and maintenance activity throughout the lifetime of the test site	Seascape, coastal and landscape character and visual receptors	*Not Important* – effects during installation and maintenance will be temporary and occur over short durations of time.
Effect of tidal energy devices and other infrastructure on the characteristics and qualities of coastal and landscape receptors	Seascape, coastal and landscape character	***Potentially important*** – potential for significant effects on the seascape and coastal and landscape character as a result of the potential increased presence of infrastructure and artificial lighting, and the increased period of time over which coastal and landscape character would be altered.
Effect of views of tidal energy devices and other infrastructure on visual amenity	Visual receptors	***Potentially important*** – potential for significant effects on visual amenity as experienced by people across the study area as a result of the potential increase in surface-piercing infrastructure visible within the test site, and the increased period of time over which it may be seen in seaward views.
Effect of views of lighting on visual amenity experienced at night	Visual receptors	***Potentially important*** – potential for significant effects on visual amenity as experienced by people across the study area as a result of an increase in artificial lighting visible within seaward views.

14.4 Appraisal Mechanisms

Table 14-4 presents the relevant legislation for SLVIA.

Table 14-4 Appraisal mechanism for seascape, landscape and visual

FEATURE TYPE	APPRAISAL MECHANISM/RELEVANT LEGISLATION	APPLICABLE	REASONING
Landscape and visual receptors	Appraisal of effects under: ○ The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore); ○ The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017.	Yes	Captures assessment of all sensitive landscape and visual features

14.5 Cumulative Impacts

There are currently no other known marine projects within the 5 km study area. The future baseline, in terms of marine projects that are consented or planned but unbuilt, will be addressed through a cumulative impact assessment if required. Initial research has not identified any projects that would need to be addressed as part of a cumulative SLVIA, though this will be kept under review.

14.6 Summary and ES appraisal

Given the baseline features identified in Section 14.2, the effect pathways assessed in Section 14.3 and the appraisal mechanisms identified in Table 14-4, the ES will appraise the effects of the Project Envelope on seascape, landscape and visual receptors, as shown in Table 14-5. The ES will also identify any monitoring or mitigation required.

Table 14-5 Summary overview of topics scoped into ES

EFFECTS PATHWAY DURING OPERATION	SEASCAPE, COASTAL AND LANDSCAPE CHARACTER	VISUAL RECEPTORS
Effect of tidal energy devices and other infrastructure on the characteristics and qualities of coastal and landscape receptors	Potentially important	N/A
Effect of views of tidal energy devices and other infrastructure on visual amenity	N/A	Potentially important
Effect of views of lighting on visual amenity experienced at night	N/A	Potentially important

14.6.1 Assessment Methodology

Due to the potential variations in the type, size and extent of infrastructure and equipment that will be deployed within the test site, SLVIA would be undertaken based on a realistic worst-case scenario within the Project Envelope. This would be based on the likely maximum number and size

of surface-piercing devices, including artificial lighting. The realistic worst-case scenario is yet to be defined, but the Project Envelope described in Section 3 includes the following key parameters:

- Maximum of 35 surface-piercing devices will be deployed at any one time;
- Maximum surface area of 780 m^2 for any surface-piercing device;
- Maximum height above water of 18 m for any surface-piercing device; and
- All infrastructure will be fitted with lighting.

The approach to impact assessment will be based on the principles set out in the guidance listed in Section 14.2.1 primarily GLVIA3. Preparation of the SLVIA will involve the following key steps:

- The 'realistic worst case' development parameters will be identified, and a study area will be determined and agreed through consultation – proposed to be a 5 km radius from the test site boundary;
- A zone of theoretical visibility (ZTV) of the realistic worst case development parameters will be generated across this area, based primarily on the maximum device height above sea surface (currently 18 m);
- The coastal landscapes of the study area will be analysed to identify landscape receptors, drawing on published landscape and coastal character assessments as set out in Section 14.2;
- The visual baseline will be recorded in terms of the different groups of people who may experience views of the test site, the places where they will be affected and the nature of their views and visual amenity;
- A series of assessment viewpoints will be selected in consultation with Nature Scot and Orkney Islands Council, based on viewpoints listed in Figure 14-1 and taking note of scoping comments;
- Indicative visualisations will be generated based on 3D modelling of the realistic worst case development parameters – visualisations will be produced to standards agreed with Nature Scot and Orkney Islands Council;
- Potentially significant effects on coastal and landscape character will be identified;
- Potentially significant effects on visual amenity will be identified;
- Measures that could potentially be taken to mitigate significant effects will be identified; and
- The level and significance of residual landscape and visual effects will be judged with reference to the sensitivity of the resource / receptor (its susceptibility and value) and magnitude of change (a combination of the scale of change, geographical extent and duration / reversibility).

In relation to coastal character, the SLVIA will consider effects at a LCCA level, focusing on the Eday coast, given the modest extent of the study area. The Orkney and North Caithness Coastal Character Assessment (LUC, 2016) will be used to inform the assessment of effects on relevant LCCAs.

ZTV mapping will be used to identify whether LCCAs and onshore LCTs could be affected by the Project. Visual receptors at locations within the ZTV will be considered, focusing on locations within the study area. The list of landscape receptors (LCCAs and LCTs) and visual receptors to be assessed would be agreed with consultees at a later stage, informed by the ZTV for the finalised Project Envelope design.

14.6.2 Site-Specific Surveys

Site visits will be carried out to obtain photography and to undertake survey work, which will include visits to the assessment viewpoints and travel around the study area to consider potential impacts on coastal character and on experiences of views seen from specific viewpoints, settlements and routes.

14.6.3 Consultation

Following initial consultation with NatureScot, it has been agreed that further engagement will take place to ensure that the scope of the SLVIA assessment is proportionate to the specifics of the proposed activities. As such, the best practice assessment approach outlined above may, in consultation with NatureScot, be amended to some degree as the EIA progresses.

14.6.4 Summary

The general approach of the SLVIA will be to define the study area and identify key coastal, landscape and visual receptors. Consultation will be required to agree viewpoints and the overall approach to the assessment. The magnitude of change will be judged and the level of significance of residual effect will be evaluated on each coastal and landscape character area and each viewpoint. Views will be illustrated with indicative visualisations, and measures that could potentially be taken to mitigate significant effects will be identified.

15 Marine Archaeology and Cultural Heritage

15.1 Introduction

This section describes the potential for any features of marine archaeological or cultural heritage interest of relevance to the Fall of Warness site 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.

15.2 Baseline Overview

15.2.1 Key Data Sources

Table 15-1 shows the key data sources used to inform assessment of the archaeological and cultural heritage environment.

Table 15-1 Data sources relevant to the scoping process

TOPIC	DATA TYPE	MAIN DATA SOURCES
Marine archaeology and cultural heritage	○ Site-specific surveys; ○ Records of wrecks and features of archaeological interest.	○ Site-specific seabed surveys at the Fall of Warness; ○ The National Record of the Historic Environment (NRHE) of Scotland (Canmore, 2022); ○ UKHO wreck register and nautical charts (UKHO, 2022).

15.2.2 Baseline Description

A baseline archaeological study commissioned in 2005 before construction of the Fall of Warness facilities comprised a desk-based assessment, a walkover survey of relevant onshore and coastal areas and a subtidal survey of the offshore area within the limits of the test site, including the cable routes and cable end positions. The subtidal seabed survey used an ROV to obtain still photographs and video footage, with further photography, observations and sampling conducted by divers, and covered water depths from the shoreline to the deepest berth at 51 m. The findings were reported in the first ES (Aurora, 2005; Section 9.6) and by EMEC (EMEC, 2009). This study identified several onshore sites of archaeological interest, none of which would be impacted by the development and operation of the test centre. There have also been a series of developer-specific benthic ROV surveys, typically focussing on more discrete areas of seabed around berth locations.

15.2.1.1 Shipwrecks, aircraft, obstructions and unexploded ordnance (UXO)

Although seven ships have been recorded as wrecked in the general vicinity of the Fall of Warness site, no actual wreck sites are known, and it is not expected that any wreckage would still be present due to the strong tidal streams in the area. A Spitfire plane was abandoned ‘off Eday’ in 1942, but no wreckage has ever been found. The baseline desk-studies and seabed surveys and subsequent operation of the site since 2005 have not identified any evidence of wreckage or obstructions in the vicinity of the test site area or along cable routes.

With the strong seas in the area, there is a high probability for unknown, unrecorded vessels to have sunk in Orkney 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 Fall of Warness site (scoured and tide-swept bedrock and boulders with mobile sand waves; see Section 6.2.2), it is considered extremely unlikely that any unknown archaeological remains will be located at the site.

The modern period of World War 1 and World War 2 has the greatest potential for the preservation of wrecks and aircraft sites, due to their size, relative age and their metal construction. Any aircraft remains found are automatically protected under the Protection of Military Remains Act 1986 if lost on active service. Once designated as a protected place by the Secretary of State for Defence, it is an offence to tamper with, damage, move, remove, unearth or enter such remains. However, the likelihood of survival in this highly dynamic environment at the Fall of Warness site means that the risk of impacting such remains is extremely low. Good-practice monitoring and mitigation in place at the Fall of Warness site, including ROV or diver inspection of the seabed prior to installation, will remove the risk.

During both World Wars a large amount of ordnance, both offensive and defensive, was used in the seas around the Orkney Islands and the Pentland Firth. Some of these munitions still exist and are regularly found by divers or fishermen. These finds are taken very seriously by the MoD who immediately deploy a bomb disposal team to assess and deal with the items located. They are usually detonated where they are found as it is considered too dangerous to move them. However, there are no known reports of mines being laid in the wider Fall of Warness area or of bombs being dropped, and therefore the potential for UXO to be present in the Fall of Warness site is considered to be very low.

15.2.1.2 Submerged landscapes and prehistoric sites

Intertidal area

No features of archaeological interest were noted in the intertidal zone during the baseline studies. Two bronze age archaeological sites located on the point of Warness were already badly affected by erosion in 2005 and, following a coastal processes review, were not considered to be at any additional risk due to the tidal device test site (HR Wallingford, 2005; Aurora, 2005).

Subtidal area

Submerged landscapes are 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.

Inferences can be made on the potential for the survival of prehistoric deposits in the area of Fall of Warness site from seabed surveys in and close to the Project Envelope and observations made during deployment of individual devices. As described above and in Section 6.2.2, the seabed consists of scoured and tide-swept bedrock and boulders with mobile sands. The potential for survival of prehistoric deposits is therefore considered to be very low or negligible.

15.3 Protected sites

No marine cultural heritage statutory designations have been identified in the Project Envelope area. There are no UK Hydrographic Office (UKHO) reports showing the existence of any wrecks within the area and none shown on the relevant UKHO charts.

15.4 Effect Pathways

For marine archaeological receptors, the potential loss of or damage to marine historic environment assets is considered for tidal energy developments comprising design-types involving the rotation of turbines within natural hydrodynamic conditions. Deployment/installation effects (

Table 15-2) are addressed separately from those during the operational and maintenance phases (Table 15-3).

Table 15-2 Potential effects on marine archaeological receptors during the deployment phase, identifying activities/effect pathways and receptors for further assessment

POTENTIAL EFFECTS FROM DEVICE DEPLOYMENT (AND DECOMMISSIONING[15])		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**HUMAN FEATURE**	**POTENTIAL IMPORTANCE**
Loss of or damage to marine historic environment assets	Known assets	*No effect* – Based on the baseline assessments and operation of the site to date, there are no known marine historic assets at the Fall of Warness site.
	Unknown assets	*No effect* – Installation and removal of tidal-power devices and other infrastructure that impact on the seabed have the potential to result in the damage/loss of unknown archaeological features, which may lie undiscovered on or below the surface of the seabed, if any are present. Similar effects may be expected from vessel anchoring systems that impact the seabed. Based on the history and hydrographic conditions of the site, it is very unlikely that any unknown historic environment assets are present within the site. In the unlikely event that any such assets are discovered, EMEC has management and mitigation processes in place to ensure that they would not be damaged or lost, as described in Section 15.7.
	Submerged prehistoric landscapes	*No effect* - Based on the baseline assessments and operation of the site to date, there are no known marine historic assets at the Fall of Warness site.

[15] To save unnecessary repetition, decommissioning impacts will be considered alongside installation impacts, highlighting where necessary impacts specific to decommissioning only.

Table 15-3 **Potential effects on marine archaeological receptors during the operations and maintenance phase, identifying activities/effect pathways and receptors for further assessment**

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**HUMAN FEATURE**	**POTENTIAL IMPORTANCE**
Loss of or damage to marine historic environment assets	Known assets	*No effect* – Based on the baseline assessments and operation of the site to date, there are no known marine historic assets at the Fall of Warness site.
	Unknown assets	*No effect* – Arrays of devices could theoretically alter dynamic processes to a degree that would influence scouring and sediment processes, especially in the vicinity of devices or infrastructure. Any localised scouring has the potential to result in the damage/loss of unknown archaeological features, which may lie undiscovered on or below the surface of the seabed, if any are present. Maintenance vessel anchoring systems that impact the seabed, or the repeated removal and replacement of devices and other infrastructure in ways that disturb the seabed, also have the potential to result in the damage/loss of any such features. Based on the history and hydrographic conditions of the site, it is very unlikely that any unknown historic environment assets are present within the site. In the unlikely event that any such assets are discovered, EMEC has management and mitigation processes in place to ensure that they would not be damaged or lost, as described in Section 15.7.
	Submerged prehistoric landscapes	*No effect* - Based on the baseline assessments and operation of the site to date, there are no known marine historic assets at the Fall of Warness site.

15.5 Appraisal Mechanisms

Table 15-4 presents any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features.

Table 15-4 **Appraisal mechanism for marine archaeology and cultural heritage**

FEATURE TYPE	APPRAISAL MECHANISM	APPLICABLE	REASONING
Scheduled Ancient Monuments	The Ancient Monuments and Archaeological Areas Act 1979	No	None present
Ships and aircraft lost on military service	The Protection of Military Remains Act 1986	No	Very unlikely for unlocated military aircraft to be present. Mitigation measures in place for unknown assets.
Protected features of historic MPAs	Marine (Scotland) Act 2010	No	No Historic MPAs in the Project Envelope Area
Other sensitive archaeological/cultural heritage features	Appraisal of other features under: ○ The Marine Works (Environmental Impact	No	No other potentially sensitive historic environment features present in the Project Envelope area

FEATURE TYPE	APPRAISAL MECHANISM	APPLICABLE	REASONING
	Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore); ○ The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; ○ Marine (Scotland) Act 2010.		

15.6 Cumulative Impacts

No important effects on marine archaeology and cultural heritage are anticipated as a result of the Project Envelope. The effect pathways identified and considered in Section 15.3 could only result in localised effects and therefore there is no potential for any effects to impact cumulatively with other projects, plans and activities and therefore cumulative impacts on marine archaeology and cultural heritage are scoped out of the EIA.

15.7 Summary and ES Appraisal

Given the effect pathways assessed in Section 15.4 and the appraisal mechanisms reviewed in Table 15-4, it is considered that there will not be an impact requiring further assessment as part of the EIA process, and marine archaeology and cultural heritage will therefore not be considered further.

Although the likelihood of any loss or damage to unknown assets has been concluded as not requiring further assessment, it should be noted that the following monitoring and management measures are, and will continue to be, implemented at the Fall of Warness site to remove any residual risk to heritage features:

- Should any 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); and
- Pre-installation ROV or diver survey will be undertaken prior to or during work on the seabed to identify if any aircraft wreckage is present, to inform any micro-siting to avoid any potential impact (impact upon planes lost on military service automatically contravenes the Protection of Military Remains Act 1986, even if they were unknown prior to the impact).

16 Socio-economic, Other Sea Users and Tourism

16.1 Introduction

This section of the Scoping Report identifies the socio-economic receptors relevance to the Project and considers the potential impacts from the construction, operation and maintenance of the Project.

16.2 Baseline Overview

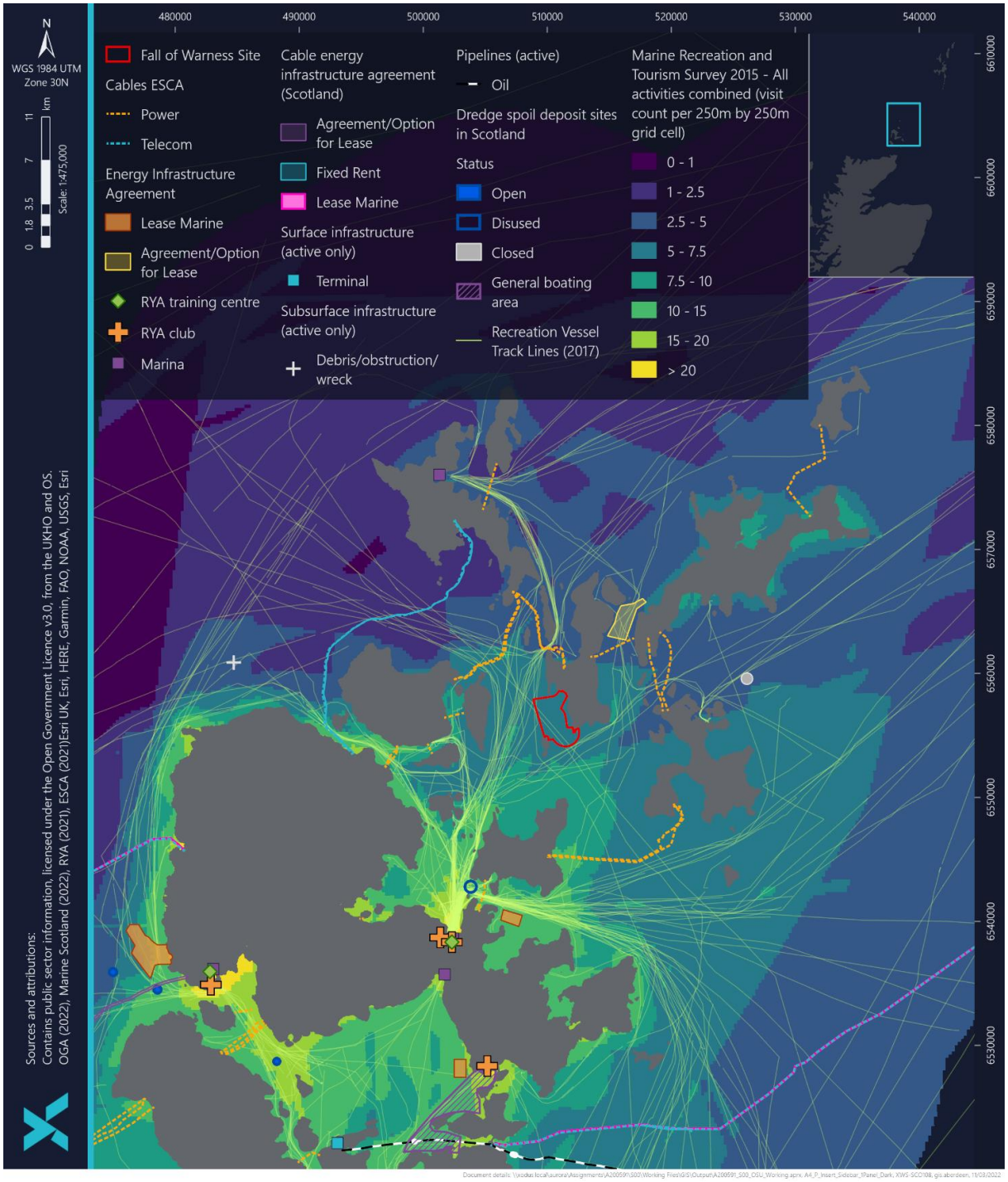
16.2.1 Key Data Sources

Table 16-1 Socio-economic, other sea users, recreation, and tourism key data sources

TOPIC	DATA TYPE	MAIN DATA SOURCES
Other Sea Users	○ Surface Infrastructure; ○ Subsurface Infrastructure; ○ Pipelines; ○ Cables; ○ Wells; ○ Dredge Spoil Deposit Sites; ○ Renewable Energy Infrastructure Agreements; and ○ Cable Energy infrastructure agreements.	○ North Sea Transition Authority (NSTA); ○ Offshore Oil and Gas Activity data portal; ○ NSTA Renewables Lease Agreements Energy App; ○ Crown Estate Scotland; ○ ESCA; and ○ Marine Scotland National Marine Plan Interactive.
Recreation and Tourism	○ General Boating Areas; ○ Marinas; ○ RYA Club; ○ Anchorages ○ RYA Training Centres; ○ Marine Recreation and Tourism Survey 2015; and ○ Anonymised AIS Derived Track Lines.	○ RYA Coastal Atlas of Recreational Boating; ○ Marine Scotland National Marine Plan Interactive; and ○ MMO.

16.2.2 Baseline Description

Figure 16-1 Activity in the vicinity of the Fall of Warness site



16.2.2.1 Other Sea Users

Oil and gas economic activities are in a declining trend in Orkney 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 area surrounding the Fall of Warness site with the Flotta Marine Oil Terminal and connected PL11 P/C Tee to Flotta oil pipeline being the closest infrastructure at over 3.2 km away.

There are a significant amount of offshore wind, wave and tidal energy resources within the Orkney marine region with a lot of scope for future commercial scale renewable energy projects. The closest proposed renewable energy infrastructure is the Lashy Sound tidal stream; an in-development site with an agreement to lease secured. The scoping report was submitted in July 2014 by Scotrenewables Tidal Power Limited (SRTP).

Orkney 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. No cables intersect the existing Fall of Warness site nor the immediate vicinity (Figure 16-1).

16.2.2.2 Recreation and Tourism

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 (Orkney Islands Marine Region: State of the Environment Assessment, 2020).

The Marine Recreation and Tourism Survey 2015 has come out since the EMEC Fall of Warness Test Site: Environmental Appraisal in August 2014. Figure 16-1 depicts 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 Fall of Warness site, moderately low in comparison to the Orkney Islands Marine Region with maximum values of 31 combined activity reports. It is inferred that as the Fall of Warness site was in operation at the time of the Marine Recreation and Tourism Survey in 2015, a large degree of recreation and tourism activities already actively avoid this area.

Orkney is an attractive destination for visiting recreational vessels, with 653 visiting in 2018 (Orkney Islands Marine Region: State of the Environment Assessment, 2020). Recreational vessel activity is greatest around the three marinas in Orkney; Stromness, Kirkwall and Westray. However, vessel activity is minimal in the vicinity of the Fall of Warness site (Figure 16-1).

16.3 Effect Pathways

Several potential impacts on socio-economics receptors have been identified which may occur during the construction, operation and maintenance, and decommissioning phases of the Project. The impacts that have been scoped into the Project assessment are set out in Table 16-2 and Table 16-3.

Table 16-2 Effect pathways during the deployment phase, identifying activities/effect pathways and receptors for further assessment

POTENTIAL EFFECTS FROM DEVICE DEPLOYMENT (AND DECOMMISSIONING[16])		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**HUMAN FEATURE**	**POTENTIAL IMPORTANCE**
Temporary obstruction of recreational activities	Recreation and Tourism	*No effect* - the installation of infrastructure and implementation of safety distances around construction vessels is not predicted to obstruct recreation vessels or activities. There are minimal levels of tourism or recreational vessels within or in close proximity to the Fall of Warness site.
Temporary impacts on the economic value of tourism and recreation activities	Recreation and Tourism	*No effect* – Effects could be negative if Project activities deter visitors, but could on the other hand lead to demand for bedspaces locally to accommodate the proportion of the workforce that is non-locally based.
Temporary obstruction to oil and gas activities within Scapa Flow	Other Sea Users	*No effect* – 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.
Temporary obstruction to subsea cables (telecommunication and power cables)	Other Sea Users	*No effect* – 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 Fall of Warness site.
Temporary obstruction to spoil disposal	Other Sea Users	*No effect* – 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 Fall of Warness site.
Temporary obstruction to renewable energy lease sites	Other Sea Users	*No effect* – an enlarged 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.

Table 16-3 Effect pathways during the operations and maintenance phase, identifying activities/effect pathways and receptors for further assessment

POTENTIAL EFFECTS FROM DEVICE OPERATION AND MAINTENANCE		
ACTIVITY/POTENTIAL EFFECT PATHWAY	**HUMAN FEATURE**	**POTENTIAL IMPORTANCE**
Long-term obstruction of recreational activities	Recreation and Tourism	*No effect* – an enlarged site is not predicted to cause any impact on recreation and tourism features.
Long-term impacts on the economic value of tourism and recreation activities	Recreation and Tourism	*No effect* – the installation and/or decommissioning of the Project is not predicted to disrupt the pre-existing minimal local tourism activity.
Long-term obstruction to renewable energy lease sites	Other Sea Users	*No effect* - an enlarged site will not intersect any active or planned renewable energy sites and is not predicted to obstruct any long-term accessibility to other sites in the Orkney Islands marine region.

[16] To save unnecessary repetition, decommissioning impacts will be considered alongside installation impacts, highlighting where necessary impacts specific to decommissioning only.

16.4 Appraisal Mechanisms

Table 16-4 Appraisal mechanism for other sea users, recreation and tourism

FEATURE TYPE	APPRAISAL MECHANISM/RELEVANT LEGISLATION	APPLICABLE	REASONING
Other sensitive natural heritage features	Appraisal of other features under: ○ The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore); ○ The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017; and ○ Marine (Scotland) Act 2010.	Yes	Captures assessment of all other sensitive natural heritage features at a population/habitat scale of concern

16.5 Cumulative Impacts

It is conceivable that there is potential for the predicted impacts from the Project to interact with impacts from other projects, plans and activities occurring within the regional study area during either the construction phase and/or the operational phase of the Project, thereby resulting in the potential for cumulative effects on socio-economic receptors.

Projects and activities located within the regional study area which will be considered in terms of potential cumulative effects will include (but not necessarily be limited to):

- Other offshore renewable energy projects and associated infrastructure, such as the Lashy Sound Tidal Array, Shapinsay Sound Tidal Test Site, Billia Croo Wave Test Site, and Scapa Flow Wave Test Site;
- The Cluaran Ear-Thuath and The West of Orkney windfarms awarded from the Sectoral Marine Plan Option areas NE2 and N1 respectively; and
- Subsea cables operators.

16.6 Summary and ES Appraisal

Given the effect pathways assessed in Section 16.3 and the appraisal mechanisms identified in Table 16-4, it is considered that there will not be an impact requiring further assessment as part of the EIA process, and other sea users will therefore not be considered further.

17 Additional EIA Matters

17.1 Introduction

This section sets out the proposed approach to the assessment of other matters, including Natural Disasters, Air Quality, Noise and Vibration, Human Health and Climate.

17.2 Natural Disasters

The Fall of Warness site is not located in an area with a history of natural disasters such as extreme weather events. The installation, operation and decommissioning of the proposed scheme will be managed within the requirements of a number of health and safety related regulations. Activities defined within the Project Envelope are designed to operate within the marine environment, and relevant realistic worst-case scenarios of extreme weather events such as high winds or rainfall events are taken into account. Management measures such as weather warnings are already standard practice and provide forewarning of risks that enable impacts to be mitigated. As such, the risk of natural disasters occurring, and then resulting in significant environmental or human health effects, is considered negligible and has not been assessed in further detail.

The scope of the development activities and environmental conditions of the site do not demonstrate conditions which would likely result or give rise to major accidents and natural disasters. As such there is no source-pathway-receptor linkage of a potential hazard that could trigger a major accident and/or disaster or potential for the scheme to lead to a significant environmental effect.

Table 17-1 Potential impacts from natural disasters during the Project

HIGH LEVEL IMPACT SUMMARY AND JUSTIFICATION	SCOPED IN/OUT
POTENTIAL IMPACTS DURING INSTALLATION (AND DECOMMISSIONING)	
Major accidents and disasters are very unlikely to occur due to the scope of the construction activities and environmental conditions of the site. As such there is no source-pathway-receptor linkage of a potential hazard that could trigger a major accident and/ or disaster or potential for the scheme to lead to a significant environmental effect.	Scoped out
POTENTIAL IMPACTS DURING OPERATIONS	
Major accidents and disasters are very unlikely to occur due to the scope of operational activities and environmental conditions of the site. As such there is no source-pathway-receptor linkage of a potential hazard that could trigger a major accident and/ or disaster or potential for the scheme to lead to a significant environmental effect.	Scoped out

17.3 Human Health

17.3.1 Air Quality

Under the current Local Air Quality Management (LAQM) system, which was introduced by the Environment Act 1995, local councils must declare Air Quality Management Areas (AQMAs) where national objectives for certain air pollutants are not likely to be achieved, to make sure that national air quality air standards are met and the potential risk of health effects from air pollutants is as low

as possible. There are no AQMAs declared by Orkney Islands Council for Orkney, so overall Orkney has no significant air quality issues.

The main offshore source of atmospheric emissions in proximity to the test site is anticipated to be from exhaust emissions from existing vessel traffic, since there is very little other offshore industrial activity (e.g. oil and gas installations) off the coast of Orkney, where the test site is located. Analysis of freely available AIS tracks from 2017, provided by the MMO suggests that there is some limited vessel activity within the Project boundary (see Section 16).

The primary pollutants from vessel emissions are sulphur dioxide (SO_2), nitrogen oxides (NO_x) and carbon dioxide (CO_2). During offshore vessel activities, emissions will be generated, however in the highly dispersive offshore environment any effects on local air quality will be minimal, temporary, highly localised and occur over a short period of time. The surrounding Orkney coastline is largely rural with limited coastal development, traffic, and industry. Only rural settlements are present on Eday, as categorised by the Orkney Local Development Plan 2017. The nearest coastline to any of the berths is around 750 m - 1 km.

Due to the largely offshore nature of the activity, there will be no potential for dust-generating activities. Any activities or infrastructure above the MWHS do not form part of this assessment and would be dealt with under the Town and Country Planning (Scotland) Act 1997.

It is considered that there is not the potential for significant air quality impacts upon human receptors due to the intervening distance between the site and onshore human receptors, as well as how sparsely populated the islands surrounding the test site are. More broadly, the commitment to investing effort into renewable energies will ultimately improve large-scale, long-term air quality metrics and support national and international policies designed to combat decreasing trends in air quality.

Table 17-2 Potential air quality impacts during the Project

HIGH LEVEL IMPACT SUMMARY AND JUSTIFICATION	SCOPED IN/OUT
POTENTIAL IMPACTS DURING INSTALLATION (AND DECOMMISSIONING)	
Due to the offshore nature of the activity, there will be no potential for dust-generating activities. During offshore vessel activities, vessels will generate emissions, however in the highly dispersive offshore environment any effects on local air quality will be minimal, temporary, highly localised and occur over a short period of time. As such there is no source-pathway-receptor for the scheme to lead to a significant effect on air quality.	Scoped out
POTENTIAL IMPACTS DURING OPERATIONS	
Due to the offshore nature of the activity, there will be no potential for dust-generating activities. During offshore vessel activities, vessels will generate emissions, however in the highly dispersive offshore environment any effects on local air quality will be minimal, temporary, highly localised and occur over a short period of time. As such there is no source-pathway-receptor for the scheme to lead to a significant effect on air quality.	Scoped out

17.3.2 Noise and Vibration

There are a variety of noise sources which occur within UK territorial waters, both natural and anthropogenic. Natural noise sources include wind and wave action, precipitation, fish and marine mammal species vocalisations and geological events such as earthquakes. Anthropogenic sources range from offshore energy infrastructure, vessel noise, at sea seismic surveys, or the use of

fishing and navy sonar. The nature of the seabed topography and sediment will affect how quickly and easily any noise generated in the area will travel.

The airborne noise generated from installation and operation activities will be minimised due to the fabrication of components onshore. Due to the general lack of offshore industrial development in the seas off the north coast of Scotland, the key anthropogenic noise source is likely to be vessel traffic. The surrounding Orkney coastline is largely rural with limited coastal development, traffic, and industry. Only rural settlements are present on Eday, as categorised by the Orkney Local Development Plan 2017. The nearest coastline to any of the berths is 750 m – 1 km.

There is an IMO routeing measure around the Orkney Islands listing the area as an 'area to be avoided', meaning that vessel activity is likely to be relatively low. There will therefore be limited exposure to human receptors on passing vessels such as fishing boats, recreational vessels and merchant vessels and as such, the potential for impacts is highly limited.

It is considered that there is no potential for significant impacts upon human receptors as a result of airborne noise and vibration due to the intervening distance between the site and sparse onshore human receptors.

Table 17-3 Potential noise and vibration impacts during the Project

HIGH LEVEL IMPACT SUMMARY AND JUSTIFICATION	SCOPED IN/OUT
POTENTIAL IMPACTS DURING INSTALLATION (AND DECOMMISSIONING)	
Due to the offshore nature of the activity, there is not the potential for significant impacts upon human receptors as a result of airborne noise and vibration due to the intervening distance between the site and onshore human receptors. Additionally, there will only be limited exposure to human receptors on passing vessels such as fishing boats, recreational vessels and merchant vessels and therefore potential impacts will not be significant.	Scoped out
POTENTIAL IMPACTS DURING OPERATIONS	
Due to the offshore nature of the activity, there is not the potential for significant impacts upon human receptors as a result of airborne noise and vibration due to the intervening distance between the site and onshore human receptors. Additionally, there will only be limited exposure to human receptors on passing vessels such as fishing boats, recreational vessels and merchant vessels and therefore potential impacts will not be significant.	Scoped out

17.3.3 Conclusion

Human health is impacted by air quality and noise and vibration. As has been identified above, due to the largely offshore nature of the activity, project impacts on air quality, noise and vibration (as it relates to human health) will not be significant and therefore project impacts on human health are scoped out of further assessment.

There are potential, although indirect, human health benefits that derive from expansion of the tidal test site. These human health benefits are associated with tidal and other renewable energies having an increased share in the energy mix and a concomitant reduction in fossil fuel driven energy provision. These link back, in particular, to issues such as air quality and changes in climate both locally and further afield. This will support Scotland in moving towards its 2045 goal of net zero emissions of all greenhouse gases set by the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019.

17.4 Climate

Similar to the consideration of human health, the EIA regulations also require that any direct or indirect significant effects relating to the climate (e.g. greenhouse gas emissions) are identified, described and assessed in an appropriate manner. Further to this, the EIA regulations specify that the EIA report must consider any significant effects on the environment relating to the impact of the Project on climate, as well as the vulnerability of the Project to climate change.

The Scottish Government's carbon reduction targets were set out in the Climate Change (Scotland) Act of 2008 (as amended), and renewables developments such as this project will help meet these targets. Furthermore, as mentioned in Section 17.2, the Project has been designed to operate within the marine and terrestrial environment to reduce any potential vulnerability to climate change. This includes consideration of how weather and other conditions may change over the life of the Project. As a matter of routine, developers bringing devices onto site will consider how climate change may impact upon successful device operation and embed any relevant mitigation into their deployment activities.

Given the small scale of the Project, its function as an enabler for larger-scale tidal projects that will contribute to Scotland's move to Net Zero, and the consideration on a routine basis of how a changing climate may impact successful device operation, further climate change assessment within the EIA is not considered necessary.

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APPENDIX A SUGGESTED STRUCTURE OF THE ES

Non-technical summary

1 - Introduction

2 - Legislation and policy

3 - Site selection and alternatives

4- Project description

5 - EIA methodology

6 - Stakeholder consultation

7 - Hydrodynamic and physical processes

Impact assessments will be structured as follows:

Baseline description

Effect pathways

Appraisal/assessment mechanism

Assessment of potentially significant impacts

8 - Benthic

9 - Offshore ornithology

10 - Cetaceans and basking sharks

11 - Seals

11 - Fish and shellfish ecology

12 - Seascape, coastal character and visual amenity

13 - Conclusions

14 - References

Appendices as relevant (e.g. detail of collision risk modelling)

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