BRIMS TIDAL ARRAY

openhydro a DCNS company

SSE Renewables

Environmental Scoping Report

August 2013

CONTENTS

SSE RENEWABLES AND OPENHYDRO – REQUEST FOR SCOPING OPINION – Brims Tidal Array

Brims Tidal Array Ltd (Previously named Cantick Head Tidal Development Ltd), a joint venture between OpenHydro Site Development Ltd (OpenHydro) and SSE Renewables (Holdings) UK Ltd (SSER) is seeking a Scoping Opinion for the proposed Brims Tidal Array from the Scottish Ministers under Section 7 of the Electricity Works (Environmental Impact Assessment)(Scotland) Regulations 2000. Comment is also sought and welcomed from other stakeholders with an i nterest in the proposed development. At the end of each section the project team have posed specific questions that we are requesting a formal response on. These questions are also summarised in Section 13.

This Scoping Report has been produced by Royal HaskoningDHV and Aquatera in line with relevant guidance and recent consultation with Marine Scotland, Orkney Islands Council (OIC), advisory bodies and other key stakeholders. A description of the proposed development along with Brims Tidal Array Limited's proposed approach to the EIA and NRA is provided.

Further queries relating to the Project should be directed to:

Jennifer Geraghty
Brims Tidal Array Project Manager
Inveralmond House,
200 Dunkeld Road,
Perth, PH1 3AQ, UK

Jennifer.geraghty@sserenewables.com

Glossary of terms

Agreement for Lease	The Agreement for Lease is granted by The Crown Estate for a limited time period and grants a developer exclusive rights to investigate the possibility of a development (with respect to wave and tidal energy projects) within a defined area.
Area of Search	Area covered within the Scoping Report
Array	A number of tidal energy converter devices that are positioned within close proximity of each other as part of the same project
Benthic Communities	Multiple species and habitats on the seabed
Cable Landfall Area of Search	Area in which cables that span the marine and terrestrial environment may be installed.
Cumulative effects	The overall effects of a number of different proposals of the same type of development.
Environmental Impact Assessment	Process to facilitate the identification and assessment of the potential environmental impacts associated with the project.
Environmental Statement	A statutory document (containing the findings of the environmental impact assessment) which is required as part of the consent and licence application processes.
Export Cable	A cable that exports electricity generated by the tidal array(s) to shore.
In-Combination effects	The effects of an activity or development in combination with other, different projects and activities
Inter-array cables	Cables that connect different devices within the tidal array(s) to one another.
Landfall site	Location at which subsea cables come ashore.
Natura 2000 Site	Natura is the term given to Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) which are internationally important sites designated under two pieces of European legislation (see SAC and SPA)

Onshore Cable Area of Search	Areas identified as being of most likely potential within which onshore grid connection routes will be identified.
Onshore substation	Not part of this application, but will be constructed by SHE-T and location will determine onshore cable corridor
Project Briefing Document	A document produced by the Project Team and sent to stakeholders prior to scoping to provide an introduction to the proposed development.
Special Area of Conservation (SAC)	Sites designated under the EC Habitats Directive
Scottish Renewable Energy Zone	A zone between 12 and 200nm from the Scottish coast within which the Scottish Government has exclusively devolved powers for marine planning matters
Scottish Territorial Waters	Waters extending 12 nautical miles from the baseline within which the Scottish Government has responsibility for marine planning.
Special Protection Area (SPA)	Sites classified in accordance with Article 4 of the EC Birds Directive
Subsea Cable Corridor and Offshore Substation Area of Search	Area identified as being of most likely potential for the selection of subsea cable routes and possible offshore substation locations.

Acronyms

AA	Appropriate Assessment
ABDA	Archaeological desk-based assessment
ADCP	Acoustic Doppler Current Profiler
AfL	Agreement for Lease
AIS	Automatic Identification System
ASCOBANS	Agreement on Conservation of Small Cetaceans of the Baltic and North Seas
BATNEEC	Best Available Technology Not Entailing Excessive Costs
B.P.	Before Present
BTAL	Brims Tidal Array Limited
BTO	British Trust for Ornithology
CD	Chart Datum
CITES	Convention on I nternational Trade in Endangered Species
COWRIE	Collaborative Offshore Wind Research Into The Environment
CPA	Coastal Protection Act
CWMTA	Cape Wrath Military Training Area
DECC	Department of Energy and Climate Change
DfT	Department for Transport
DP (vessel)	Dynamic Positioning (vessel)
DTI	Department of Trade and Industry
EEZ	Exclusive Economic Zone
EGA	Expert Geomorphological Assessment
EIA	Environmental Impact Assessment
EMEC	European Marine Energy Centre
EMF	Electro-Magnetic Field
EMMP	Environmental Mitigation Monitoring Plan
EPS	European Protected Species
ES	Environmental Statement
FEPA	Food and Environment Protection Act
FRS	Fisheries Research Services

FSA	Formal Safety Assessment
GCR	Geological Conservation Review
GIS	Geographical Information systems
GW	Gigawatt (power)
GWDTE	Ground Water Dependant Terrestrial Ecosystem
HAT	Horizontal Axis Turbine
HDD	Horizontal Directional Drilling
HIE	Highlands and Islands Enterprise
HRA	Habitat Regulation Appraisal
ICES	International Council for Exploration of the Sea
ICIT	International Centre for Island Technologies
IEEM	Institute of Ecology and Environmental Management
IMO	International Maritime Organisation
IROPI	Imperative Reasons of Overriding Public Interest
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
LAT	Lowest Astronomical Tide
LNCS	Local Nature Conservation Site
LSE	Likely Significant Effect
MCA	Maritime and Coastguard Agency
MCAA	Marine and Coastal Access Act
MDA	Military Danger Area
MESH	Mapping European Seabed Habitats
MGN	Marine Guidance Notice
MLWS	Mean Low Water Spring
MNCR	Marine Nature Conservation Review
MoD	Ministry of Defence
MPAs	Marine Protected Areas
MS	Marine Scotland
MSL	Mean Sea Level
MS-LOT	Marine Scotland Licensing Operations Team
MW	Megawatt (power)
NBN	National Biodiversity Network
NGET	National Grid Electricity Transmission

NLB	Northern Lighthouse Board
NMR	National Monuments Records
NPF	National Planning Framework
NPPG	National Planning Policy Guidance
NRA	Navigational Risk Assessment
NSP	Noise Sensitive Property
OCT	Open-Centre Turbine
OFA	Orkney Fisheries Association
OIC	Orkney Island Council
OFS	Orkney Fishermen's Association
OSF	Orkney Sustainable Fisheries
OREI	Offshore Renewable Energy Installations
OS	Ordnance Survey
PBD	Project Briefing Document
PFOW	Pentland Firth and Orkney Waters
PHA	Preliminary Hazard Analysis
RAF	Royal Air Force
RCAHMS	Royal Commission on the Ancient and Historical Monuments of Scotland
RNLI	Royal National Lifeboat Institution
ROV	Remotely Operated Vehicle
RSPB	Royal Society for the Protection of Birds
RYA	Royal Yachting Association
SAC	Special Area of Conservation
SAMS	Scottish Association of Marine Science
SAR	Search and Rescue
SCADA	Supervisory Control And Data Acquisition
SEA	Strategic Environmental Assessment
SEPA	Scottish Environment Protection Agency
SFF	Scottish Fishermen's Federation
SHEPD	Scottish Hydro Electric Power Distribution
SHE-T	Scottish Hydro Electric Transmission PLC
SLVIA	Seascape and Landscape Visual Impact Assessment
SMRU	Sea Mammal Research Unit

SNH	Scottish Natural Heritage
SPA	Special Protected Area
SPP	Scottish Planning Policy
SSER	SSE Renewables
SSSI	Site of Special Scientific Interest
STW	Scottish Territorial waters
TCE	The Crown Estate
TMP	Traffic Management Plan
TS	Transport Scotland
UK BAP	United Kingdom Biodiversity Action Plan
UKHO	United Kingdom Hydrographic Office
VMS	Vessel Monitoring System
VP	Vantage point
VTS	Vessel Traffic Services
WeBs	Wetland Bird Survey

1 NON-TECHNICAL SUMMARY OF THE PROJECT

1.1 The Project

In November 2008, The Crown Estate opened up the Pentland Firth and Orkney Waters Leasing Round (PFOW) to marine energy developers by inviting bids for exclusive site development rights. On the 16th March 2010, The Crown Estate awarded an Agreement for Lease (AfL) for a tidal energy array up to 200MW in capacity, located off the south coast of South Walls, to Cantick Head Tidal Development Ltd (CHTDL), a joint venture between OpenHydro Site Development Ltd (OpenHydro) and SSE Renewables (Holdings) UK Ltd (SSER).

In 2013 a revision was made to the boundary of the AfL area, whereby 80% of the original AfL area was relocated to the west, with the remaining 20% overlapping with the original site. As a result of this boundary change and in order to ensure a name relevant to the Project location, the site name has been revised from Cantick Head Tidal Development to Brims Tidal Array, with the joint venture partnership now called Brims Tidal Array Limited (BTAL).

1.2 Components

The Project consists of the following:

- Offshore tidal generators;
- Inter-array cables;
- Potential for offshore hub(s) or substation;
- Export cable to shore (Hoy or South Walls); and
- Onshore cabling up to onshore substation.

Full details of these elements are described within this Scoping Report. The consent application will not include the onshore substation or connection to the grid, which is the responsibility of SHE-T and will be subject to its own application. Therefore, there is no request for scoping opinion on the onshore substation as part of this report.

1.3 Project Phases

This Scoping Report is designed to support the application for both phases of the 200MW Project with the applications submitted in two phases. Phase I consists of up to 60MW with construction expected to begin in 2019. Phase II will be subject to a separate application process, with planned delivery of the fully commissioned 200MW Project in 2023. This phasing will allow BTAL to gain experience of deploying devices in an array of reasonable scale and then evaluating its performance, both technically and environmentally before completing the full build-out.

2 INTRODUCTION

2.1 The Developers

Brims Tidal Array Ltd (BTAL) is a joint venture between OpenHydro and SSER, collectively referred to within this document as the "Developers".

SSE Renewables (Holdings) UK Limited (SSER)

SSER is a wholly owned subsidiary of the SSE Group and is responsible for the development of renewable energy projects on behalf of the generation part of the company, which is likely to be the owner and operator of the Project described in this document were it to gain consent and be built.

The overall SSE generation portfolio presently has an installed generation capacity of over 13 GW, including almost 3.2 GW of renewables, and supplies energy to some 10 million customers across the UK and Republic of Ireland. SSE defines its core purpose as providing the energy people need, in a reliable and sustainable way. SSER is one of the UK's leading offshore renewable energy developers, responsible for 6.6 GW of development projects including an interest in 800 MW of wave and tidal energy projects in the PFOW.

OpenHydro Site Development Ltd

OpenHydro, a DCNS company, is a technology business that designs, manufactures and installs tidal energy systems. It has global experience in developing tidal projects, with the intention of providing a cost-effective source of renewable energy that is in harmony with the environment. OpenHydro has over a decade of experience in developing and testing the Open-Centre Turbine in marine conditions, including at the European Marine Energy Centre (EMEC), Orkney's marine energy test site.

2.2 Agreement for Lease

In November 2008, The Crown Estate opened up the Pentland Firth and Orkney Waters Leasing Round (PFOW) to marine energy developers by inviting bids for exclusive site development rights. On the 16th March 2010, The Crown Estate awarded an

Agreement for Lease (AfL) for a tidal energy array up to 200MW in capacity, located off the south coast of South Walls, to CHTDL.

In 2013, following feedback from site surveys and stakeholder consultation, a revision was made to the boundary of the AfL area, whereby 80% of the original AfL area was relocated to the west, with the remaining 20% overlapping with the original site. As a result of this boundary change, and in order to ensure a name relevant to the Project location, the site name has been revised from Cantick Head Tidal Development to Brims Tidal Array.

Based on present knowledge of the site, it is proposed that a tidal array of up to 200 megawatts (MW) capacity could be installed, which equates to between 100 – 200 devices. The AfL area covers water depths ranging from 60 – 100m and lies to the south of the island of Hoy, off the Brims Ness headland.

The AfL provides BTAL with an initial exclusive site investigation period of five years, in respect of other renewable energy developers. It is not a licence or consent to install tidal power devices on the site. The securing of such regulatory permissions is a condition imposed by the Crown Estate before any construction and operation lease is entered into.

2.3 Project Overview

The original Area of Search identified for this Project was 11km^2 off the south coast of South Walls in Orkney, as illustrated in Figure 2.1.

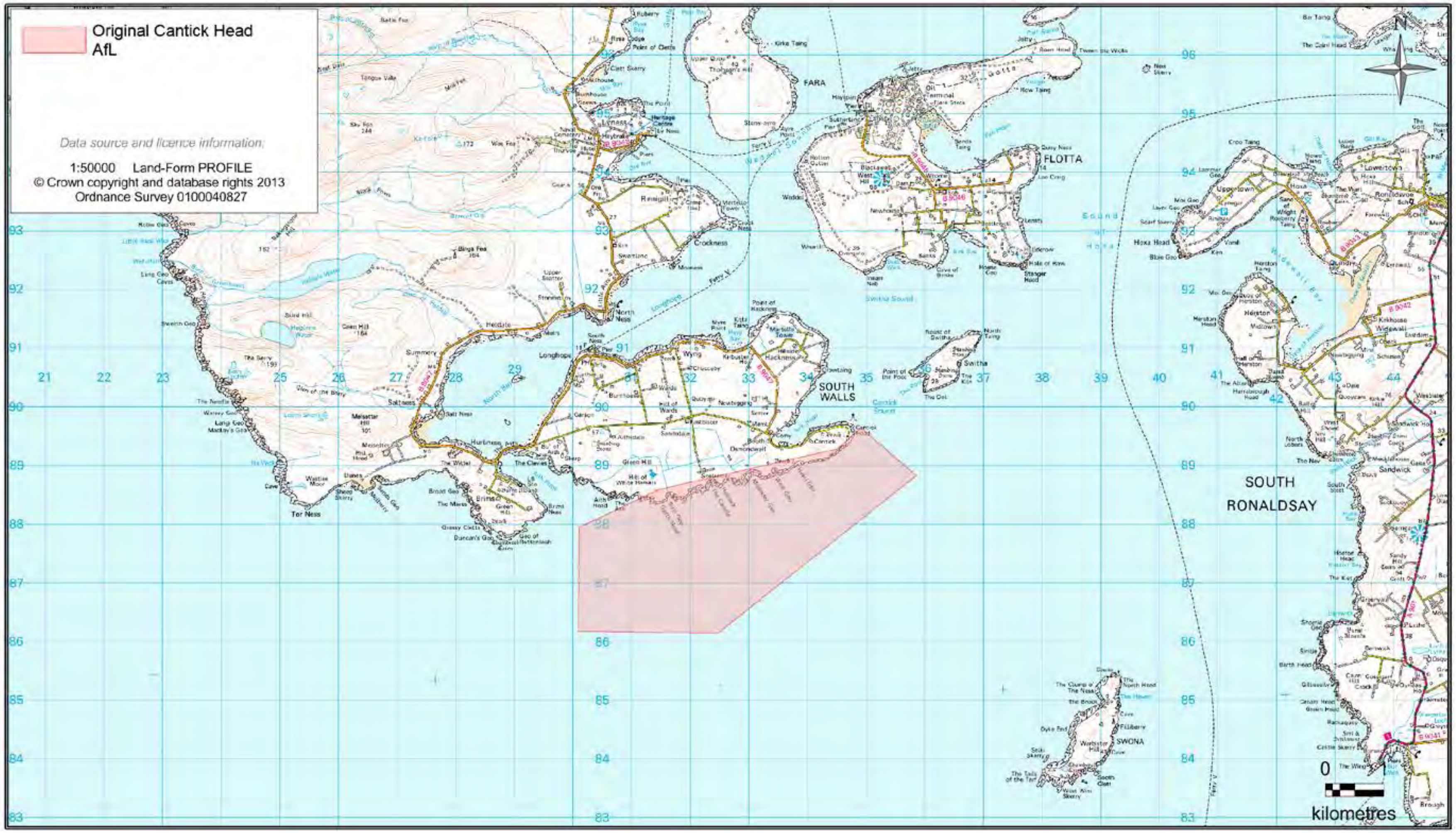


Figure 2.1 Original Cantick Head Agreement for Lease Area

Following the signing of the AfL, the project team engaged in detailed tidal resource assessment surveys in order to characterise the resource in more detail. Complicated flows and eddies were found to be impacting the amount of energy that could be feasibly extracted from the resource at the site, raising concern over the nature of the tidal regime within the AfL and its potential for development.

The surveys suggested that the commercially developable resource lies primarily west of the AfL site, in 60m-100m of water, off South Hoy. This has led to a revised AfL located to the west of the original site and the site is now referred to as Brims Tidal Array, as outlined above.

Figure 2.2 above illustrates the revised AfL area, or Area of Search, within which Phase I and Phase II development zones will be identified. This chart also illustrates the potential cable corridors for the export cable to come ashore as well as broad areas of search for the onshore cable corridor. It should be noted that the onshore areas of search for the substation are indicative only and are outside the scope of this project. The onshore infrastructure (new substation and beyond) will be developed by SHE-T but is shown here to indicate the region in which this is likely to be located.

.

Figure 2.2 Revised Brims Agreement for Lease Area

BTAL is currently undertaking site investigation and project development planning activities, while in parallel commencing the Environmental Impact Assessment (EIA) incorporating a Navigational Risk Assessment (NRA) processes. These are required as part of the consenting process relevant to a project of this type and scale.

The EIA and NRA processes for the Project will consider the likely impacts of the Project which are anticipated to arise through the installation, operation, maintenance and decommissioning phases of the project. As outlined in this Scoping Report, the OpenHydro Open-Centre Turbine (OCT) is the preferred technology for this Project but alternative technology concepts are being considered. At the end of each section the project team have posed specific questions for which we are requesting a formal response. These questions are summarised in Section 13.

2.4 Components

The Project consists of the following:

- Offshore tidal generators;
- Inter-array cables;
- Potential for offshore hub(s) or substation;
- Export cable to shore; and
- Onshore cabling to onshore substation.

Full details of these elements are described within this Scoping Report. The consent application will not include onshore substation or connection to the Grid, which is the responsibility of SHE-T and will be subject to its own application. Therefore, there is no request for scoping opinion on the onshore substation as part of this report.

2.5 Development Process

2.5.1 Approach to Project Phasing and Timescales

Following receipt of a Scoping Opinion for the full 200MW Project, it is proposed that an application for consent to build the first phase of up to 60MW will be submitted by Q4 2014 with construction commencing in 2019 (subject to consent being granted). Following this, depending on the consenting route followed and again, subject to consent being granted, it is anticipated that the full build out of Phase II will be complete by 2023. This will allow BTAL to gain experience of deploying technology firstly in a pre-commercial array before moving to the full build out. This will also enable better understanding of array performance from both a technical and environmental perspective. This Scoping Report relates to the application for both Phase I and Phase II.

2.5.2 Defining the Project

The new AfL area is an 'Area of Search' within which BTAL aim to identify a location suitable for a commercial scale tidal array, which will be built in two distinct phases. At this stage it is not envisaged that the proposed Project would occupy the entire Area of Search, but will instead fall within a development zone or several development zones within the Area of Search, the nature of which will be largely informed by:

- Stakeholder consultation;
- Navigational safety;
- Tidal energy resource distribution across the AfL;
- Environmental factors;
- Economic analysis; and
- Grid connection.

The location, footprint and layout of devices and infrastructure will therefore be determined through detailed planning and be informed by the EIA and stakeholder consultation processes.

In order to identify preferred development areas for each technical component, it is necessary to evaluate a number of key issues relating to technical, environmental, stakeholder and socio-economic aspects. Ultimately this is the purpose of the EIA process but based on work carried out to date it is possible to present some initial findings. These are presented below in relation to two of the key parameters that bring together technical and oceanographic influences.

- **Resource** – Without sufficiently strong tidal streams no site will be economically viable. In addition the direction of flow, turbulence and ebb / flood ratio of tidal flows needs to be within acceptable limits as these factors affect both overall potential energy production and the design (and therefore cost) of the infrastructure. BTAL have completed a programme of Acoustic Doppler Current Profile (ADCP) deployments across the Area of Search, the data from which will be used to inform mathematical models of the flow characteristics in and around the AfL area. Outputs from this process are then used in conjunction with device power curves to estimate the generation capacity of specific array layouts.

- **Bathymetry** – Water depths in the AfL range from 60m – 100m but it is likely that technology to be deployed within the site will be within waters of 60 - 80m depth. Devices deployed on the seabed, a category which includes the preferred OpenHydro Open-Centre Turbine, will extend approximately 27m – 30m above the seabed, which leaves a clearance in the region of 30m – 50m to LAT. Surface piercing structures may also be deployed within the AfL area. Geophysical survey results will be required to understand both the sub-bottom conditions as well as seabed topology, which will in turn inform array design and associated cable route corridors.

There are of course a number of stakeholder and wider EIA issues that will influence the selection and design of the final proposed development zone(s). Further technical considerations will also be of significant importance, not least those aspects relating to array layout design and technology type.

2.5.3 Tidal Site Development

The flowchart in Figure 2.3 illustrates the key processes and dates relevant to the phased development of the Project.

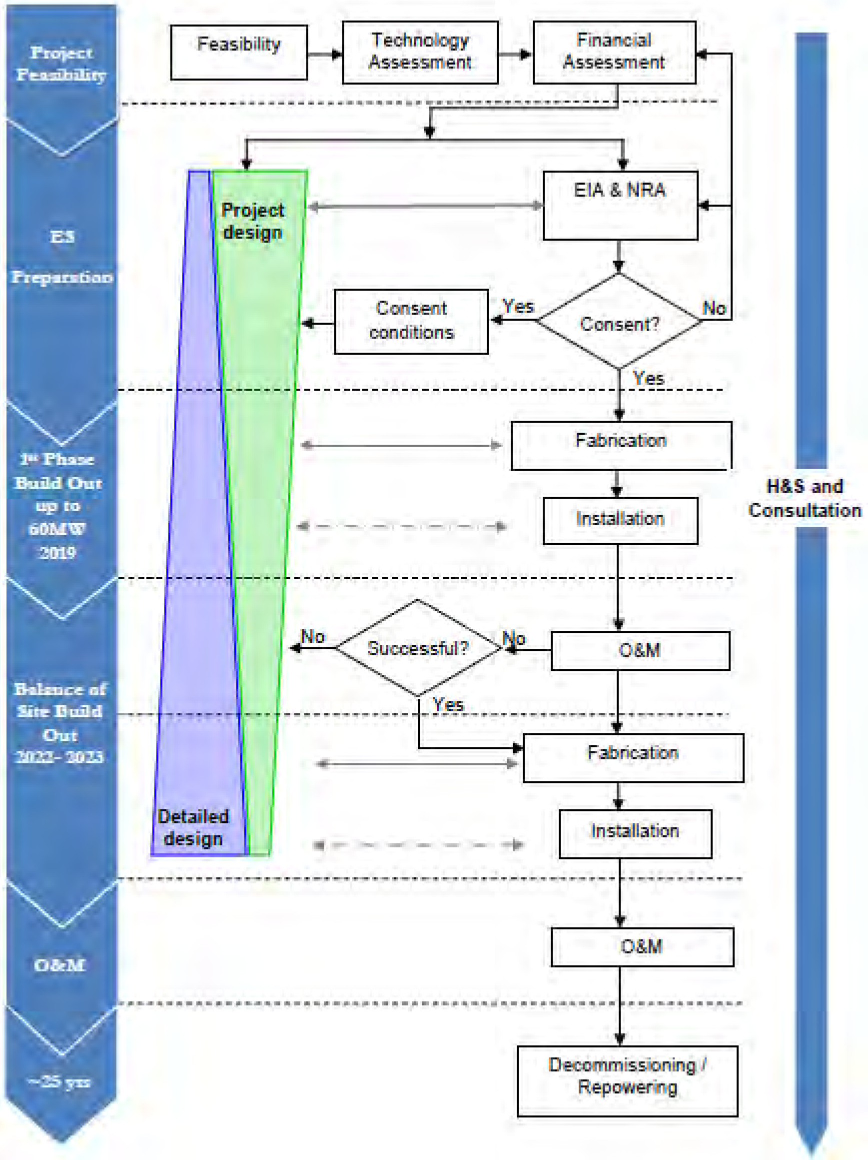


Figure 2.3 Brims Tidal Array Project programme

2.5.4 Grid Connection Development

BTAL have applied to National Grid Electricity Transmission (NGET) for a grid connection and hav e accepted the offer put forward. This grid offer is based on connecting the Project back to the infrastructure being developed at the Bay of Skaill on Mainland Orkney to support other marine renewable projects. This route is largely overland but does include some buried and subsea cabling. SHE-T will also be responsible for developing local onshore infrastructure e.g. substation to support the Project.

The required infrastructure and its routing will be determined ultimately by SHE-T and will be informed by factors relating to:

- Project installed capacity;
- Environmental appraisal;
- Consultation with local and national stakeholders;
- Potential links with other projects and the wider Orkney grid;
- Economics;
- Proximity to site (influenced by connection voltage from site to substation); and
- Access (by sea and road).

Options for the onshore grid connection infrastructure include:

- New overhead lines/ inter-island cables on new routes;
- New overhead lines/ inter-island cables adjacent to existing routes;
- Part new/ part rebuild of existing routes;
- Undergrounding; and
- Combinations of all of the above.

It should be no ted that BTAL has no responsibility for rebuilding or upgrading grid infrastructure. SHEPD is the owner and operator of the existing Orkney grid which is classified as a di stribution network; whilst both SHEPD and S SER have the same parent company (SSE plc), they are separate entities. In particular, SHEPD is a regulated business which means its investment in new infrastructure and the return earned on its activities is closely controlled by the regulator OFGEM. The new proposed grid connection links from the Scottish mainland to Orkney will be classed as transmission network assets and these are being developed by SHE-T which is the part of SSE, which develops and owns the transmission network, of which there is presently none in Orkney. As with SHEPD, SHE-T is regulated by OFGEM.

2.6 Pre-scoping Consultation

A Project Briefing Document (PBD) was circulated for the Project to a wide range of stakeholders to initiate the EIA and NRA process. A list of stakeholders who responded to the PBD can be found in Appendix A of this document. The aim of the pre-scoping consultation was to provide an introduction to the proposed Project, provide the earliest opportunity for stakeholders' views to influence subsequent parts of the EIA processes and to allow the regulator, stakeholders and the local community to engage with the project development team at an early opportunity. This document indicated the requirement to revise the boundary for the Project also.

During the pre-consultation period, BTAL held meetings with a number of key stakeholders including Marine Scotland, Scottish Natural Heritage, OIC Planning, OIC Marine Services, Hoy and Graemsay Community Council, Orkney Fisherman's Association (OFS), local fishermen and local landowners. Since the issue of the PBD in April 2012, further consultation has been undertaken with stakeholders in respect of the boundary change, name change and the consideration of alternative technologies.

2.7 Layout of this Document

The following sections of this document are laid out as follows:

Section 3: Project Boundaries, approach to EIA and Consenting Process, detailing geographical boundaries for each section of the Project, the project and non-project components and the Approach to EIA and consenting;

Section 4: Project Description, detailing the status of technology development, an overview of preferred and alternative technologies and a description of onshore infrastructure;

Section 5: Key Policy and Legislation Objectives, detailing key marine and terrestrial legislations, policies, consents and licences;

Section 6: Possible impacts of the human environment, detailing possible human receptors, potential impact and significance on each receptor and a methodology for addressing information gaps;

Section 7: Possible impacts of the ecological environment, detailing possible human receptors, potential impact and significance on each receptor and a methodology for addressing information gaps;

Section 8: Possible impacts of the physical environment, detailing possible human receptors, potential impact and significance on each receptor and a methodology for addressing information gaps;

Section 9: cumulative and in-combination effects, identifying key projects and receptors to be included and anticipated key issues;

Section 10: Preliminary Hazard Analysis – Summary, summarising the Appendix C

Section 11: Proposed EIA methodology, detailing the process and layout of the Environmental Statement (ES);

Section 12: Conclusions, summarising the potential impacts to each receptor and what will be carried through to the ES;

Section 13: Scoping Questions, summarising the questions asked of stakeholders throughout this document; and

Section 14: References.

This report is supported by:

Appendix A	Stakeholders;
Appendix B	Identification of Natura 2000 interests which may be affected by the proposals; and
Appendix C	Preliminary Hazard Analysis Brims Tidal Array

3 PROJECT BOUNDARIES, APPROACH TO EIA AND CONSENTING PROCESS

This chapter defines the geographical and technical boundaries of the EIA along with the approach that BTAL plans to take with regards to site development and t he implications for the EIA process. Please note that the boundaries regarding the NRA process are outlined in the Preliminary Hazard Analysis (PHA) provided in Appendix C.

3.1 Geographical Boundaries of Project Components

There are a number of technical components to the proposed Project. Figure 3.1 illustrates the areas of search proposed for the following onshore and offshore components of the Project:

- Offshore tidal generators, inter-array cables offshore hub and offshore substation shown by the Area of Search for offshore infrastructure;
- Export cable to shore (Hoy or South Walls) shown by the Subsea Cable Corridor;
- Cable Landfall Area of Search; and
- Onshore Cable Corridor Area of Search.

The consent application will not include the onshore substation or connection to the grid, which is the responsibility of SHE-T and will be subject to its own application. However, it is likely to be located within the footprint of the Onshore Cable Area of Search.

Figure 3.1 EIA Geographical Boundaries and Project Components.
Note the SHE-T substation is likely to be located within the Onshore Cable Area of Search footprint.

3.2 Non-Project Components

As discussed in Section 2.4, there are a number of supporting infrastructure components that will be considered within the EIA. There are also a number of technical components that would support the proposed Project which will not be developed by BTAL and which, therefore, will not be considered within the EIA. These may include:

- SHE-T onshore substation;
- Any port/harbour upgrade/development or associated works which may be required to facilitate construction or operation and maintenance activities;
- Any upgrade to or addition to the existing electricity transmission or distribution infrastructure (both onshore and offshore) or associated works; and
- Onshore lay down and maintenance facilities.

Questions to be put forward to reader
Q1. Are the Project geographic and technical boundaries outlined both clear and sufficient for what will / will not be included in the EIA?

3.3 Approach to EIA – Rochdale Design Envelope

The 'Rochdale Design Envelope' is based on planning case law and has been adopted in connection with other offshore renewable consent applications where a level of flexibility is required in the Project Description. It provides a set of maximum and minimum parameters enabling a developer to seek consent for a project on the basis that the final development design is within the parameters and the significance of environmental impact is no greater than predicted. The tidal energy sector is an emerging industry with the world's first full scale tidal energy converters only now going through initial testing programmes. Operating vessels, installation equipment and undertaking most works and procedures in high energy tidal areas has traditionally been avoided by mariners and as such, methodologies and procedures are developing alongside the design and installation of technologies. However, the industry is moving at a fast pace and as technology testing progresses, information and data regarding efficiency, performance and the interactions with the receiving environment is being generated and analysed.

BTAL proposes taking a 'Rochdale Design Envelope' approach during the EIA to retain scope for adaptation within the Project Description.

BTAL's preferred option is the installation of non-surface piercing tidal turbines at the site. Our preferred technology for the site is the non-surface piercing OpenHydro Open-Centre Turbine, with an appropriately developed Rochdale Design Envelope to allow consideration of alternative turbine technologies within the Project Description. However, there may be a requirement for some surface piercing elements, in particular for offshore hubs/substations. In addition, BTAL wishes to seek consent for a design envelope sufficiently broad to potentially include surface piercing turbine systems, as an alternative option.

The Open-Centre Turbine technology is undergoing demonstration trials at EMEC in Orkney and information from these trials and from turbines currently deployed in Canada, France and future deployments in the USA and Northern Ireland will inform the final design of the commercial device. However, the approach to consent is to consider a series of maximum and minimum parameters for key aspects of the proposed Project, for which the significance of environmental effects will be assessed during the EIA. Using this approach it is anticipated that detailed design of the Project or scheme could vary within specific parameters described whilst remaining within the assessment of the EIA. In this context, alternative technology concepts are also being considered for the purpose of the formal scoping exercise for the Project.

Our approach involves the definition of a set of Project parameters using maximum extents for a number of technical components, for example, support structure footprint, offshore substation height, number of inter array cables etc. The potential significance of effects on the receiving environment resulting from the installation, operation, maintenance and decommissioning of these components will then be assessed based on these maximum extents.

In taking this approach to the EIA, we are seeking to provide a 'design envelope' for the Project whilst maintaining the integrity and outputs of the EIA process.

Questions to be put forward to the Regulators

Q2. Are MS-LOT / OIC comfortable in the application of the Rochdale Envelope principle to the assessment of impacts of the proposed Project and would any further information be required?

3.4 Consenting Strategy

Although this Scoping Report is intended to cover both Phase I and Phase II of the Project, BTAL plan to submit separate applications for Phase I and II. The timing between these applications has yet to be determined but will be informed by ongoing consultation and dialogue, experience in the wider tidal technology market and the findings from the Brims EIA process in the coming 12 months. It is intended to identify an Area of Search for Phase I that is significantly less in total extent than the AfL area. Identification of this area will be undertaken based on technical, economic and environmental constraints, and in conjunction with wider stakeholder consultation. Phase I of the Project must be independently economically viable.

3.4.1 Section 36

Section 36 consent under the Electricity Act will be required for each phase of the offshore generators, inter-array cables and subsea cables to landfall area. The actual landfall area could be by Section 36 or Town and Country Planning Act.

3.4.2 Marine Licence

It is assumed that a Marine Licence will be required for the marine Project components up to Mean High Water Spring (MHWS), as per the Section 36.

3.4.3 Terrestrial Planning

A terrestrial planning application will be required through Terrestrial Planning (Town and Country Planning (Scotland) Act) for the onshore cable corridor to the new SHE-T substation and possibly the landfall area. It is expected that SHE-T would submit a separate terrestrial planning application for the new substation.

The planning application will cover project components in the terrestrial and intertidal, down to mean Low Water Springs (MLWS), with associated overlap with the Section 36 and Marine Licence discussed above. It is assumed one of either Marine Scotland or

Orkney Island Council (OIC) will take responsibility for the intertidal region of the application.

In terrestrial planning Pre Application Consultation (PAC) is normally required for major projects. It is assumed PAC is not required for the onshore cable route.

3.4.4 Other Licences

Other licences may be required for example: Licence to disturb basking shark, Licence to disturb European Protected Species (EPS), Controlled Activities Regulations (CAR) Licence.

Public consultation will continue to be undertaken with regards to the whole Project, based on a phased development approach.

The necessary licence applications for Phase I will be submitted based on the approach to EIA and design envelope outlined above. This is a common approach to large infrastructure development projects as there is an almost continual interaction between the design functions of a project and the overall consenting and development process. Consent conditions are also intrinsically linked to the detailed design phase of a project which occurs post-consent.

Questions to be put forward to the Regulators
Q3. Does MS-LOT / OIC have any questions relating to the proposed consenting strategy?
Q4. Please could MS-LOT / OIC confirm the party who will take the lead consenting role for the intertidal area?
Q5. Please could OIC confirm Pre Application Consultation is not required for the onshore cable corridor

4 PROJECT DESCRIPTION

This chapter provides an overview of the anticipated technical components of the proposed Project along with an overview of the associated operations and activities. The Project Description aims to be as informative as possible and is based on current information; however the project is in the early stages of design and, as the Project progresses, some aspects may be subject to change.

4.1 Technology Envelope

BTAL has reviewed a wide range tidal technology concepts, including horizontal axis turbines, oscillating hydrofoils and venturi devices (based on devices which extract energy from a flow induced pressure drop), which are in various stages of development (including those still at the R&D stage or in laboratory testing). Following this review it was determined that only horizontal axis turbines will be included for the purpose of requesting a Scoping Opinion. BTAL has considered three broad categories of technology development as follows:

- Tested at full scale (or derivative of full scale prototype, including the OpenHydro Open-Centre Turbine, the preferred technology for this development);
- Tested at scale, moving to full scale prototype; and
- Research and development stage or laboratory testing.

BTAL is seeking an opinion only on devices which fall within the first two categories above and these are outlined in the sections below. For clarity, these are all horizontal axis turbines. For the avoidance of doubt, technologies not considered here in the request for a Scoping Opinion include vertical axis turbines, oscillating hydrofoils, venturi devices and anything the last category above.

The following sections describe the OpenHydro preferred technology and then the alternative technology options under consideration. Lastly, elements of the Project which are independent to the chosen technology are then described.

4.2 Overview of Preferred Tidal Technology

4.2.1 OpenHydro Technology Description

The preferred technology for this development is the OpenHydro Open-Centre Turbine (OCT). Alternative technologies are also considered and are outlined in the next section.

The OpenHydro Open-Centre Turbine (OCT) is a bi-directional (bi-directionality ensures that the turbine can extract energy in both the ebb and flood flow directions) shrouded horizontal axis turbine (HAT), which is illustrated in Figure 4.1 below. It is a simple device comprised of four key components: a direct-drive permanent magnet generator, a hydrodynamic duct, a horizontal axis rotor, and a subsea gravity base type support structure.

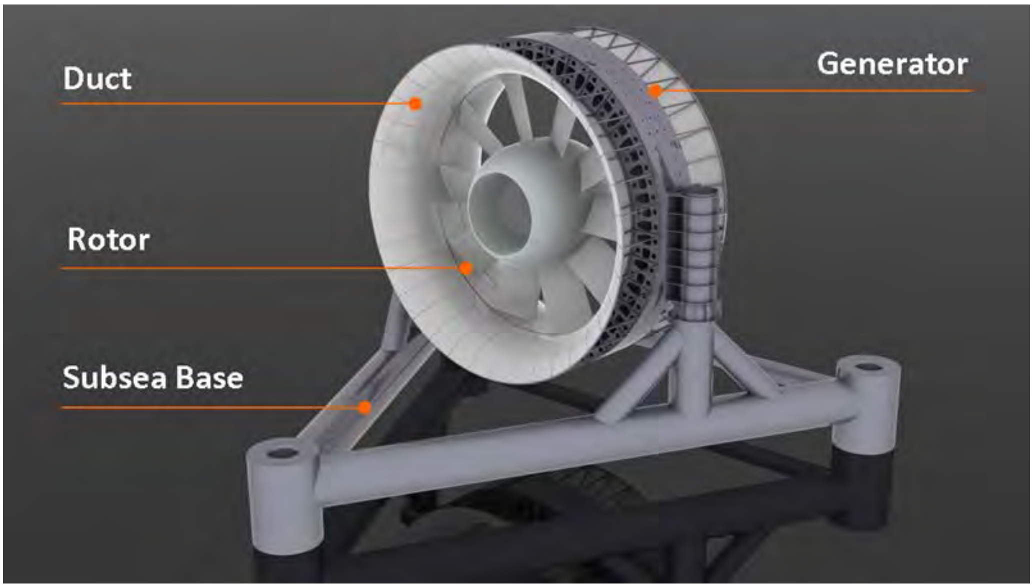


Figure 4.1- OpenHydro Open-Centre Turbine

The turbines designed for this site would have an outer diameter of up to 20m, resulting in a turbine height of up to 27m above the seabed. The size of the subsea base will depend on the site design characteristics but is likely to have a length between each foot in the order of 30m - 50m. Only the feet will be in contact with the seabed and the area of the feet on the seabed will be minimal. Each device will be capable of generating at least 1 MW but actual output will be determined through detailed design and will depend on actual individual site conditions. The location, spread and layout of devices and infrastructure will be determined through detailed planning, informed by the EIA, NRA and stakeholder consultation.

The OCT design has no need for a gearbox or other complicated components and is based on a philosophy of zero maintenance between overhauls. The turbine is also seawater-cooled and lubricated by seawater, which means there is no requirement for oils or lubricants.

From an environmental perspective a number of key design features minimise the risk to marine life:

- No requirement for oils or lubricants, thereby removing pollution risk;
- Rotor blades retained within the outer housing;
- Low levels of underwater sound production and low rotational speeds;
- High degree of solidity and closed geometry, reducing likelihood of impacts; and
- Open centre which provides a passage for marine life.

4.2.2 OpenHydro Support Structure

The support structure for the OpenHydro OCT is an unpinned gravity base structure, which is installed along with the turbine as one assembly. A general concept view of the OpenHydro subsea base arrangement is provided in Figure 4.2 below. It is likely to have three to four ‘legs’ terminating in cones to provide resistance to sliding forces imparted on the turbine by the currents. The likely length of each side of the subsea base is 30 – 50m and final dimensions would be determined during a detailed design process.

This type of support structure allows for rapid installation and facilitates the ease of potential relocation and removal / decommissioning of the turbines (which is effectively the reverse of the installation technique).

Figure 4.2 Subsea Base

4.2.3 OpenHydro Installation Method

OpenHydro has developed a specialist methodology for installing and retrieving its OCTs, allowing all preparatory works to be performed in the safe and controlled working environment of a harbour. A specialist custom-design heavy lift barge is loaded with one OCT and its supporting subsea base, following towing to the tidal array site the whole system is lowered onto the seabed in one tidal cycle. OpenHydro have designed and built two such barges, the OpenHydro Installer for 6m and 10m turbines, and the OpenHydro Triskell for 16m turbines. Figure 4.3 shows a 16m turbine being loaded on the OpenHydro Triskell barge for deployment and Figure 4.4 shows the turbine being towed out to site in France.

A new barge will be constructed to support the installation and maintenance of the turbines for the Project. Mobilisation ideally takes place from a harbour facility located within 24 hours of the site. Lyness in Orkney and Scrabster in Caithness are examples of the types of location which will be considered for siting a mobilisation base.

Figure 4.3 - 16m OCT being loaded onto custom-built barge

Figure 4.4 16m OCT being towed out to site in France

At the site each OCT unit is lowered to the seabed following the method outlined in Figure 4.5. It should be noted that, in addition to the installation barge, other vessel types will be required for operations including tugs and support boats etc. This method currently allows a single installation to be completed in less than 1 hour as successfully demonstrated in Scotland, Canada and France.

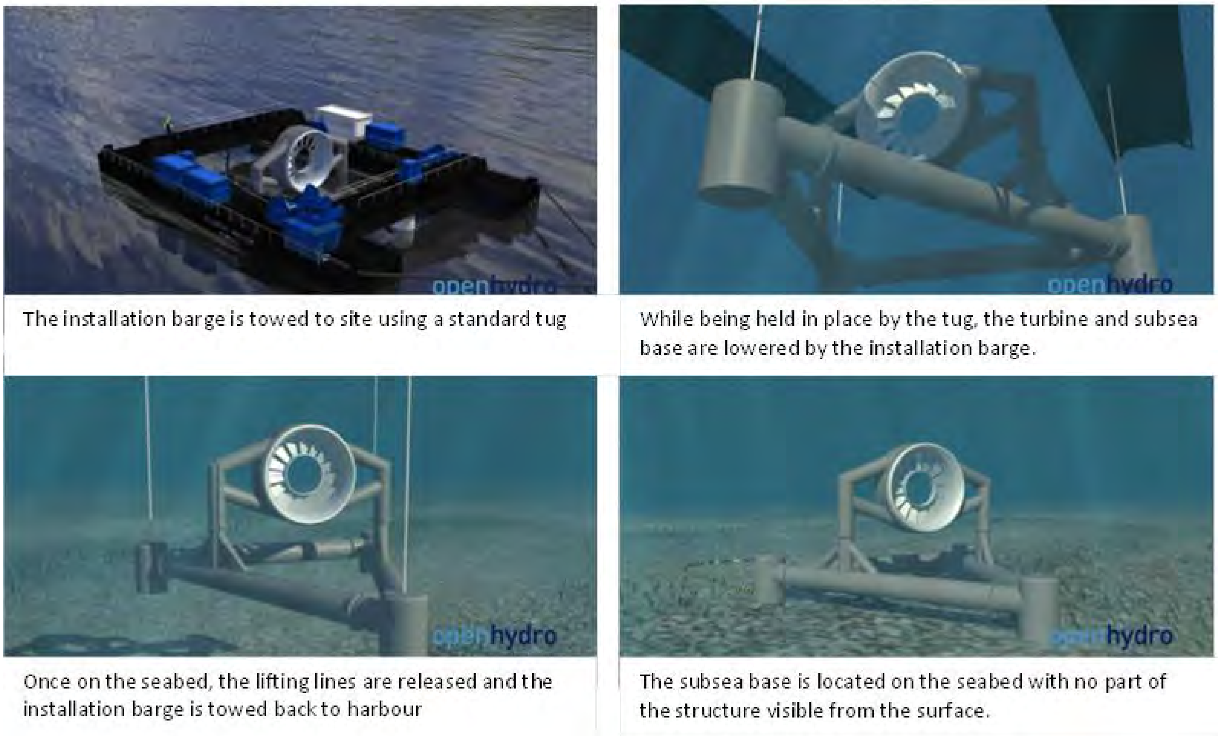


Figure 4.5 OpenHydro Deployment Methodology

This deployment methodology allows for a high degree of accuracy (to ±5m) in placement of the turbine, with no pilling or drilling required.

4.2.4 Ongoing Research of OpenHydro Technology

Testing of the turbine technology is ongoing at the OpenHydro research platform at the European Marine Energy Centre (EMEC). Experience in Orkney waters from OpenHydro's 2009 deployment in the Bay of Fundy (Canada) and the 2011 deployment at Paimpol–Bréhat in France will provide essential information regarding the technical performance of the turbine, its interactions with the receiving environment, and the operational implications associated with development of a site of this scale.

4.2.5 OpenHydro Decommissioning

At the end of the project's operational life, forecast at 20 – 25 years, two alternatives will be considered:

- Repower the site using commercially available technology of the time. This will be subject to securing all necessary permits and consents; or
- Decommission the site in accordance with the relevant legislation.

If the decision is made to decommission the site a final decommissioning report will be prepared and submitted to the appropriate regulatory authorities for approval. Removal of offshore infrastructure is likely to be carried out as follows:

- OpenHydro's installation barge can be used by reversing the deployment operation to remove both the turbine and subsea base from the seabed in a single lift. This operation has been successfully demonstrated three times; recovery of a 10m (360t) Bay of Fundy turbine in December 2010; and with recoveries of a 16m (1,080t) EDF turbine in Paimpol-Bréhat in January 2012, and in Brest Harbour in March 2013.
- Hardware removed from the site will be dis-assembled, and where possible all materials will be recycled.

4.3 Overview of Alternative Tidal Technologies

The tidal energy industry is in a state of continuous development. Turbine technology is evolving and adapting with continuous improvement. BTAL may wish to use the most appropriate technology on site, allowing for potential technology advances. An overview of potential alternative technology solutions is provided here to illustrate various alternative turbine types and support structures which may be deployed at the site. It is possible that device parameters described in the section above may change and specific questions are posed throughout this Scoping Report on the following technologies.

4.3.1 Alternative Technology Description

Horizontal Axis Turbines can be either shrouded or un-shrouded in nature. Devices typically have three or more blades which rotate around a nacelle and may be of fixed or variable pitch. Power take-off and generation configurations vary, from utilising direct-drive solutions with no gearbox, through to marinised wind turbine nacelles. Commercial scale devices in development have rotor diameters of up to around 20m. Some illustrative examples of un-shrouded device types to be included for the purposes of a Scoping Opinion are outlined in Figures 4.6 to 4.10 below, but note this is not a definitive list. As can be seen, some of these devices have a single turbine per foundation/structure and some have multiple turbines per foundation/structure.

Examples of Alternative Technologies

Figure 4.6 - TGL Alstom

Figure 4.7 Andritz Hydro Hammerfest

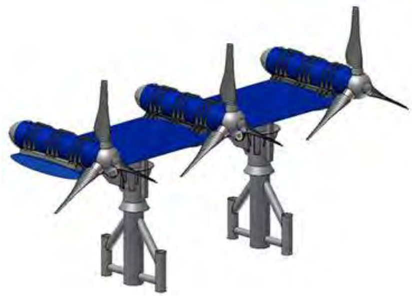


Figure 4.8 - Siemens MCT Seagen U

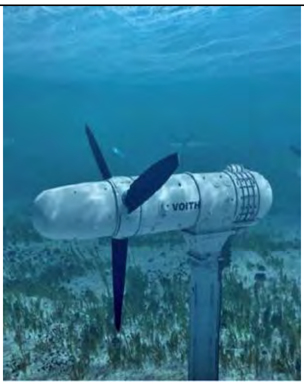


Figure 4.9 – Voith Hydro HyTide

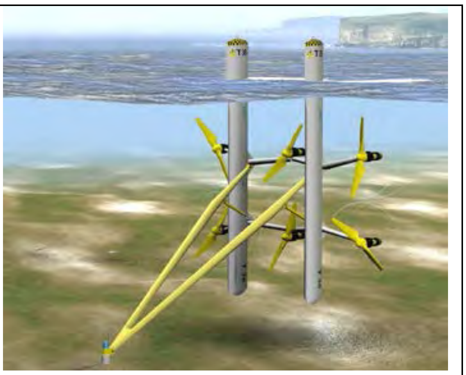


Figure 4.10 – TidalStream

4.3.2 Support Structures for Alternative Technologies

As indicated by the images above, there are a range of potential support structures/foundation types which may be associated with HAT's:

- Monopile foundation (drilled socket in seabed);

- Multi-leg/braced structure (with pinned piles); or
- Gravity base (pinned or unpinned).

If an alternative technology is selected for build out on the site, the final choice of support structure would be made post-consent, at a more advanced stage of the detailed design process. This approach is analogous to established practice for other offshore renewable energy developments.

4.3.3 Installation of Alternative Technologies

Table 4.1 below summarises the main techniques that have been used, or are thought to be technically feasible, to deploy both shrouded and un-shrouded devices.

Table 4.1 Possible Deployment Methods for Tidal Devices

Technique	Comment	Example Technology
Device and support structure deployed as a single entity from a barge	Tugs may be used to float barge out to site.	OpenHydro (utilising purpose built barge)
Foundation installed, and device floated out and lowered separately	Device deployed onto support structure by ballasting with water and run down guide wires	TidalStream,
Heavy lift (possibly with guide wires/ winches)	Device lifted into position utilising a heavy lift vessel.	Voith Hydro

4.3.4 Installation Methods for Alternative Technologies

There are a wide range of installation and removal methodologies currently being trialled in the testing of tidal energy converters and support structures ranging from the use of moored and tugged barges, anchored crane barges, through to dynamically positioned (DP) heavy lift construction vessels. All options may be considered and both the EIA process and NRA processes will describe the potential significant effects associated with the range of support structures which may be utilised at the site, based on a worst case scenario for the predicted likely effects.

4.3.4.1 Monopiles

Monopiles would be installed by being placed into a drilled socket and grouted in place. This would most likely be conducted from a DP vessel (Figure 4.11).

Figure 4.11 DP Vessel 'North Sea Giant'

4.3.4.2 Multi leg / Braced structure

Braced structures are typically held into place with drilled pin pile anchors which are usually fixed into pre-drilled sockets. Installation options and m ethodologies are essentially similar to those for monopile installation using a DP vessel.

4.3.4.3 Gravity Base Structure

Gravity base structures rely on their own inherent weight and des ign which may incorporate self-penetrating legs and/or ballast (with rocks, water, concrete etc.).

Gravity base structures can either be installed with the turbine unit attached or in a separate operation with attachment of the turbine unit completed after installation of the gravity base. To date, gravity base structures have been installed using DP or purpose built deployment vessels.

Pinned gravity based structures have to date been tripod based and the feet pinned to the seabed with grouted piles (in drilled sockets). The turbine would then be mounted on a central column.

4.3.5 Operation and Maintenance for Alternative Technology

Taking a conservative approach, the overall principle that should be assumed for operation and maintenance activities is that at some stage in the lifetime of the Project it may be necessary to repeat the activities carried out during construction.

The following sections provide a conservative overview of the potential operational and maintenance activities which may be required for both the preferred and alternative technologies.

For major maintenance or modification, the turbine would be removed from the support structure using a reverse of the installation procedure described earlier. Where the turbines and the gravity base structures are incorporated into one unit the whole unit would be removed.

A DP-equipped vessel with a heave compensated crane or a purpose built deployment vessel would most likely be used for these tasks.

4.3.6 Decommissioning of Alternative Technology

At the end of the project's operational life, forecast at 20 – 25 years, two alternatives will be considered:

- Repower the site using commercially available technology of the time. This will be subject to securing all necessary permits and consents;
- Decommission the site in accordance with the relevant legislation.

If the decision is made to decommission the site a final decommissioning report will be prepared and submitted to the appropriate regulatory authorities for approval. Removal of offshore infrastructure is likely to be carried out as follows:

The decommissioning process for most tidal energy converters will essentially be a reversal of the installation process and will follow the agreed decommissioning plan.

4.4 Overview of Technology Independent Infrastructure

4.4.1 Layout of Array

The array layout is in development and will be informed by ongoing investigations at the site, including resource modelling and bathymetry assessment, as well as cable and vessel handling experience gained from other development sites.

4.4.2 Electrical Infrastructure

This section discusses the likely electrical equipment required for connecting the individual turbines and bringing the power to shore. Electrical infrastructure will include the following components/equipment:

4.4.2.1 Subsea Cables (Inter-Array)

Tidal turbines will be inter-connected in arrays subsea. A number of factors, including turbine parameters and available technical solutions will influence the number, length, spacing and configuration of inter-array cables. It is anticipated that the majority of the cables would be laid in line with the prevailing tidal flow directions, although clearly there will be a need to interconnect within the arrays, and some cables may run across the prevailing flow directions.

4.4.2.2 Installation

A specialised cable lay vessel would be used to install all subsea cables (similar to that shown in Figure 4.12). More than one vessel may be employed in cable laying activity at any one time. A DP vessel is most likely to be used for Phase I.

Figure 4.12 Cable ship Galathea (left) and ductile iron cable protection (right)

Where the seabed has a suitable covering of sediment it may be possible to use a cable plough or a jetting system to install the cable between 1-1.5m below the seabed but this is unlikely at the Brims site, except perhaps in the shallower, inshore cable route location. In other areas the cables may be laid directly onto the seabed. Where the cables are laid directly on the seabed (as shown in Figure 4.12) they will most likely be armoured using materials such as ductile iron sheathing or a synthetic polymer such as 'Uraduct'. The use of pre-cast concrete mattresses or overlaying of rock may need to be considered to secure and protect some areas of the cable.

4.4.3 Subsea Cables (Export from Array to Shore)

Connection of the offshore arrays to the grid will be through one or more export cables to shore. As part of the site design process, export cable routes from the tidal array to landfall and any grid connection options will be identified based on technical and environmental criteria, as well as through discussions with the electricity network operator, regulatory authorities and stakeholders. The type and routing of the cables will be subject to further detailed electrical design for the Project.

All cables would be armoured to protect against abrasion, and where there is a lack of sediment they would be laid directly onto the seabed. In some areas pre-cast concrete mattresses or a similar form of protection may also be required on top of the cable. In inshore waters and towards landfall points, where there is sufficient sediment, cables may be buried.

For Phase I of the Project it is envisaged that there will be a requirement for between 1 to 3 export cables, with one cable leading from each sub-sea hub or offshore (surface piercing) substation back along the seabed towards the most suitable landfall location. It is assumed that mechanical excavation will be required to dig a trench into which piping will be laid or cable directly placed. Another option may be directional drilling at the landfall site. There are a number of landfalls currently being considered including either side of Aith Hope, the coastline south of the Melsetter Estate and the coastline around Brims Ness. The final selected landfall will be closely linked to the decision of where to site the onshore substation. Broad indicative Onshore Cable Corridor Search Areas are indicated in Figure 3.1 above but this will be confirmed by SHE-T who will be responsible for the development of the onshore substation.

4.4.4 Installation of Subsea Cables

In deeper water, installation methods would be similar for those utilised for laying inter-array cables. On approach to the landfall the cable(s) is typically pulled ashore from the cable laying vessel whilst being supported with buoys.

Where multiple cables to shore are proposed, the distance between cables at the landfall site may be substantial depending on the installation method utilised and the phasing of the installation. It is anticipated that cables laid in the same installation phase could be placed as close as 3m apart. However, subsequent installation phases require a spacing of up to 10m apart from the previous phase's cables.

4.4.5 Offshore Hub or Substation

The design of the offshore electrical infrastructure continues to be developed and as such there may be a requirement to have one or several offshore electrical hubs either mounted on the seabed or on a surface piercing structure. The current technical maturity of such infrastructure is not sufficient to allow a definite description to be made at this point.

A surface piercing structure may be part of a turbine installation or a separate structure altogether. Typically, such a platform might be supported by a jacket structure, braced monopile or alternatively it could be a moored surface piercing structure. A surface piercing offshore substation would normally be unmanned with access by helicopter or vessel. In the event such a structure becomes a requirement, these may be considered for use as navigational aids, for example, to provide site marking, if appropriate.

Alternatively, it may be possible to group a number of turbines together using subsea hubs, using technology currently in development. This is because, at present, the technology limits the voltages at which devices can be connected subsea, which in turn limits the MW rating of cable which can be installed. An offshore platform would bring multiple lower voltage cables together, with the power then being exported to shore on fewer, high voltage cables. The final proposal will be based on both technical and environmental assessment.

4.4.5.1 Installation of Cables and Substation

Installation could involve the use of heavy lift vessels or DP vessels. Cables from shore and from the devices/device arrays would be conveyed onto the offshore substation via J-tubes, assuming the substation is a surface piercing platform. If the substation is on a surface piercing structure then this could be towed into place without the need for heavy lift vessels.

4.5 Onshore Infrastructure

4.5.1 Cable Landfall

There are two main options for constructing a landfall:

- Directionally drilled from a near-shore location to beyond the surf zone and the offshore cable pulled through the drilled duct to shore; or
- Cable burial up an existing beach in an open trench.

In the scenario where horizontal directional drilling (HDD) is required, ideally, the location of the drilling site would be as close to the onshore substation as possible in order to minimise the distance of any onshore electrical cabling. The exact location for cable landfall has not yet been determined but Figure 3.1 above illustrates the Area of Search.

4.5.2 Construction

The method(s) employed for construction will depend on whether HDD or trenching is required and will be informed by environmental and engineering constraints, planning guidance and consultation.

4.5.3 Transition Pit

Depending on the distance between the landfall site and the onshore substation, transition pits may be required for each export cable. Transition pits provide the means of linking a subsea cable to an onshore cable, the latter being a more efficient and less costly cable. Each transition pit would be roughly 3m x 5m and located directly behind the associated cable landfall to avoid any kinks in the cable. Each pit would consist of a box that is placed in an excavated hole around 2m below ground. The transition pits will be completely covered after the installation activity and the only visible feature will be a surface mounted metal cover to allow for occasional (roughly every three years) access to the link box for maintenance.

4.5.4 Onshore Export Cables

The most likely method of linking the export cable to the onshore substation would be by burying the cable(s) in a trench no less than 1m below ground, though this is dependent on the distance between the landfall and the onshore substation. If the distance is significant, then an overhead line may be considered.

Underground installation would most probably involve burial at a target depth no less than 1m. In suitable soil types this can be achieved with minimal disruption to the ground by use of a cable burial plough. Alternatively a trenching and back-filling method can be employed in any soil type. In most circumstances normal use of the land can resume post installation.

4.5.5 Onshore Substation

This is currently outside the scope of the Project. It is expected that SHE-T will be responsible for the onshore substation. However, it is an important part of the development and a typical description is therefore provided below for completeness.

It is currently anticipated that the following infrastructure could be included:

- Compound to house a grid transformer and connection terminations;
- A control building compound for housing switchgear, SCADA etc.; and
- An operational/personnel/office compound area.

The exact locations for the onshore infrastructure have not been defined at this stage of the design process and will be determined by SHE-T but the likely search area is shown in Figure 3.1 above. It is currently anticipated that a 33/132kV substation is required.

The likely development area such a substation would require for an installed capacity of 200MW is of the order of 70m x 50m. It is likely that the area requirement for Phase I will be less than this. The actual footprint of the substation will be determined by a number of factors such as:

- Whether air or gas substation design is chosen. Air insulation requires considerably more space and is usually used in outdoor substations. Inert gas is more commonly used where more of the infrastructure is housed indoors; and
- Whether the cables are brought vertically or horizontally into the building. The volume of the substation is likely to remain consistent in order to accommodate control and electrical equipment however the footprint of the building will be greater if the building is constrained to a single story or low rise. The footprint may be reduced if the building is of a greater height allowing more equipment to be stacked.

It is expected that SHE-T carry out the required engineering and environmental assessments on the identified location.

Figure 4.13 below illustrates an example of a substation which is fully enclosed within a building, while Figure 4.14 illustrates an example of a substation whose components are situated outdoor. At this stage it has not been determined whether the substation would be of an enclosed or open design. It should also be noted that there may be some (limited) scope to reduce building height by adjusting other parameters.

Figure 4.13 Example enclosed 132kV substation

Figure 4.14 Example outdoor 33kV substation

Construction of this infrastructure would use general civil, mechanical and electrical construction methods, which would be managed by SHE-T.

4.5.6 Access Roads

These would need to be of sufficient width and strength to accommodate transport of the landfall and onshore cable route construction equipment. As the location of the onshore substation has not been decided yet it is not known what road works will be required to support onshore infrastructure development, however it is likely that there will be a requirement for some upgrades to the current roads from Lyness to South Hoy and South Walls. These upgrades may include road strengthening and/or corner modifications in places to allow access for wide and heavy loads.

It is also likely that temporary access will be needed for construction purposes, but these should be reinstated if not required for the permanent operation of the Project.

This substation will form the connection point for the Project to export power into the national grid.

4.5.7 Operation and Maintenance of Technology Independent Infrastructure

It is unlikely that the support structures will require major maintenance during the lifetime of the Project except for occasional anti-fouling or potential sacrificial anode replacement. Monopile and pinned gravity based structures (i.e. fixed structures) would most likely be cleaned *in situ,* whilst unpinned gravity based structures may be retrieved from the seabed and taken ashore for overhaul using either a DP vessel or a purpose built recovery / deployment vessel.

4.5.7.1 Electrical Infrastructure

Most offshore electrical infrastructure components, apart from electrical connectors required to build a project of this scale are in widespread use although not typically in such a harsh environment. The operation and maintenance requirements are therefore uncertain at this stage.

4.5.7.2 Subsea Cables – Inter-Array and Export to Shore

In general, subsea cables require little maintenance. Enhanced protection through design and at the installation stage in response to identified risks is preferred to relying upon retrospective maintenance due to the difficulties associated with fault-finding and cable retrieval.

4.5.7.3 Offshore Substation

If an offshore substation is required then it will be designed to be operated as an unmanned installation. Routine maintenance would be conducted either by vessel or helicopter transfer of personnel from an existing helipad area. Except in exceptional circumstances (e.g. very large and heavy items) the procedures for replacing any equipment would most likely require use of multi-cat type vessels in conjunction with the onboard cranes of the substation platform. For replacement of very large and/ or heavy items it may be necessary to utilise heavy-lift cranes mounted on large offshore construction type vessels/ barges.

4.5.7.4 Onshore Electrical Infrastructure

The onshore electrical infrastructure options available are all established technologies in widespread use with a proven track record for reliability. Beyond allowing for exceptional events it is anticipated that the operation and maintenance requirements should be minimal compared with the scale of operations required for installation and decommissioning.

4.5.8 Decommissioning Technology Independent Support Structures

Where possible, it is anticipated that all structures will be completely removed from the site. Monopiles or pins would most likely be cut as close as possible to the seabed.

4.5.9 Decommissioning Technology Independent Offshore Electrical Infrastructure

4.5.9.1 Subsea Cables – Inter-Array and Export to Shore

Removal of subsea cable and electrical infrastructure is likely to be a reverse of the laying process for cable that is laid on the seabed. Subsea cables can either be removed, or left in situ. This may have a lower impact on the environment than their removal. With buried cables removal is generally considered to lead to more significant environmental effects. If the cables are to be left in situ they will be marked as 'disused' on charts.

4.5.9.2 Offshore Substation

At the end of its lifespan the platform will be completely decommissioned. Any steel piles would be cut near to seabed level to allow the whole of the substructure to be lifted from the seabed as near as possible and returned to land for recycling or disposal.

4.5.10 Decommissioning Technology Independent Onshore Electrical Infrastructure

4.5.10.1 Landfall

Beach or shore landfall cables would most probably be removed whereas it is likely that directionally drilled cables would be left in place.

4.5.10.2 Overhead Line/Underground Cable

In a scenario where the grid connection infrastructure is no longer required overhead lines are likely to be removed whilst for underground cables the final decision would be taken in consultation with the relevant authorities.

Questions to be put forward to the Regulators
Q6 Please could all readers confirm if enough information has been provided to form a Scoping Opinion for a) the preferred technology and b) the alternative technologies?

5 KEY POLICY AND LEGISLATIVE OBJECTIVES

The aims of this section are:

- To demonstrate the alignment of the proposals with relevant national policies; and
- To identify the Consents and Licences required for the construction/installation, operation and removal of this type of project.

The EIA process will be informed by the draft Marine Renewable Licensing Manual going forward.

5.1 Renewable Energy Policy in Scotland

The UK is a signatory to the EU Renewable Energy Directive, which includes a UK target of 15% of energy from renewable sources by 2020. 30% of this energy is expected to have to come from renewable electricity generation[1]. Scotland's potential to produce marine renewable electricity is vast, with the total wave and tidal resource in Scotland estimated at 14 GW and 7.5 GW respectively (Scottish Government, Undated). In September 2008 The Scottish Government published its future approach to energy policy, this recognises that marine renewable energy has a part to play in future energy supply and as part of its strategy to reduce greenhouse gases and tackle global warming.

In 2011 the Scottish Government raised its renewable energy target from 80% to 100% equivalent of Scottish electricity consumption to come from renewable energy sources by 2020[2].

Therefore with such optimistic electricity targets to be achieved from renewable sources and a wealth of wave and tidal resource, energy developments in Scotland's seas will continue to contribute to meeting the Government's renewable energy policy and targets.

[1] http://www.decc.gov.uk/en/content/cms/meeting_energy/renewable_ener/renewable_ener.aspx
[2] http://www.scotland.gov.uk/News/Releases/2011/05/18093247

5.2 The Climate Change (Scotland) Act 2009

This Act introduced binding targets on the Scottish Government to reduce net Scottish greenhouse gas emissions by 83% by 2050 from 1990 levels; with an interim target of 42% by 2020. The Scottish Governments' Renewables Action Plan, published in July 2009 and most recently updated in March of 2011, reiterates the targets set in 2007. Support for renewables development, including tidal, is contained in National Planning Framework (NPF) 2 and Scottish Planning Policy (SPP).

Therefore, adequate reduction of greenhouse gases is still an important target to be achieved by the Scottish Government, with the initial 2007 target re-iterated in 2011 and identified in their Renewables Action Plan. The development of renewable energy devices will assist in achieving such targets by providing 'green energy', reducing the use of finite fossil fuels as well as ensuring Scotland (and the UK) meet international commitments to reduce greenhouse gases under the Kyoto Protocol.

5.3 Marine Planning Policy

The Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 (MCAA) have introduced a marine planning regime for the UK marine area. The Scottish Government has responsibility for marine planning within both STW (0 -12nm), and within the Scottish Renewable Energy Zone (REZ) (12 – 200nm).

In accordance with the MCAA, a joint Marine Policy Statement has been prepared by the UK Government in conjunction with the Scottish Government and the devolved administrations of Wales and Northern Ireland. In March 2011 the Scottish Government published a draft National Marine Plan which covers both Scottish Territorial Waters (STW) and the Scottish REZ. The draft Plan is currently under development (Scottish Government, 2011b). The draft Plan identifies certain key objectives for management of the marine environment. The draft Plan identifies the role offshore renewables can play in promoting economic growth and tackling climate change. The draft Plan also identifies the need for offshore renewables developments to be constructed and operated to minimise noise and collision risk to Best Available Technology Not Entailing Excessive Costs (BATNEEC) standards.

The Marine (Scotland) Act 2010 requires the Scottish Government to establish marine regions. The number and extent of the marine regions have yet to be established. Following creation of the marine regions, regional marine plans will be put in place with policies applicable at a local level. The Marine (Scotland) Act 2010 and MCAA also provide for the creation of Marine Protection Areas (MPAs). MPAs will be afforded particular protection on account of their nature conservation, historic or research and development value.

The Scottish Government's Strategic Environmental Assessment (SEA) on Marine Renewables in 2007 concluded that the deployment of new technology, particularly marine renewable devices, would carry a degree of uncertainty regarding potential associated environmental impacts. As a result, a risk-based 'Survey, Deploy and Monitor Policy' is being developed to enable efficient, sustainable deployment of wave and tidal energy devices; BTAL awaits the publication of the policy.

Therefore, marine planning policy within UK waters will facilitate the integration of renewable energy developments within the marine environment. Currently, the Plan is still within draft formation but identifies the key role offshore renewable energy will play in increasing economic growth and reducing climate change. Best Available Technologies will ensure that disturbance by noise and collision risk is minimised but there still remains a level of uncertainty regarding associated environmental impacts, which are currently being dealt with in a risk-based approach.

5.4 Marine Spatial Planning

Under the Marine (Scotland) Act 2010, new statutory marine planning systems were brought into place to manage conflicting demands in the Scottish marine environment. A marine spatial plan for the Pentland Firth and Orkney Waters (PFOW)[3] area was undertaken given the potential resource of wave and tidal power, and outlined different uses in the PFOW area, how such activities may cause interaction and recommendations for avoiding conflict. Such planning systems will enable the integration of marine renewable energies into the marine environment, avoiding conflict

[3] http://www.scotland.gov.uk/Resource/Doc/295194/0115355.pdf

where possible, and contributing towards Government targets to achieve 100% of Scottish electricity consumption to come from renewable energy sources.

5.5 Marine Protected Areas

Under the Marine (Scotland) Act 2010 (Discussed in Section 5.7 Below), the Scottish Government, through Marine Scotland and Scottish Natural Heritage, is to designate habitats and species of special marine nature conservation interest as Marine Protected Areas (MPAs) within Scottish territorial waters. At the moment the MPA process is in a public consultation period, having being approved by Scottish Ministers and are referred to as 'possible' MPAs.

There are no possible MPAs within the area immediately surrounding the AfL. The closest are the Wyre and Rousay Sounds possible MPA, East Caithness Cliffs possible MPA and Noss Head possible MPA.

5.6 Terrestrial Planning Policy

The National Planning Framework (NPF) is prepared by the Scottish Government and subject to the approval of the Scottish Parliament. The NPF provides the long term strategy for development in Scotland over a 25 year period. The NPF provides an important context for renewable energy development and supporting electricity infrastructure.

The current NPF, NPF2, was published in June 2009. The National Planning Framework is supported and underpinned by the Scottish Planning Policy (SPP), Planning Advice Notes (PANs), and a number of Circulars. The consolidated SPP supersedes and replaces the SPPs and National Planning Policy Guidance (NPPG) series (including SPP 6 Renewable Energy). The new SPP includes policies on a range of topics, including renewable energy.

Development plans and statements of policy are a material consideration with regard to the authorisation of electricity generation schemes under Section 36 of the Electricity Act 1989. The draft National Marine Plan states that legislation is to be brought forward to ensure Marine Plans are a material consideration for land use planning decisions.

Therefore, the importance of marine renewable energy developments is of key consideration for terrestrial planning policy as well as marine. The Scottish planning policies incorporate renewable energy developments and are a key consideration for gaining electricity generation consents as well as assisting in the development of the onshore aspects of a marine development.

5.7 Marine (Scotland) Act

In March 2010 the Marine (Scotland) Act received Royal Assent; it provides a framework for the sustainable management of Scotland's seas and one of its key aims is to streamline and simplify the licensing and consenting process for offshore renewable projects.

Projects have historically been required to seek licences and planning consent under several pieces of legislation before development can proceed. Prior to the introduction of the Act, developers would submit licence and planning consent applications to a number of authorities under various pieces of legislation. However, with the introduction of the Act, co-ordinated applications for planning consent and associated licences (under the Electricity Act, the Coastal Protection Act, and the Food and Environment Protection Act) can now be made via a single point of access, Marine Scotland Licensing Operations Team (MS-LOT), as part of a unified licensing and consenting process.

5.8 The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000

These Regulations implement the European EIA Directive 1985 (as amended, 2009), and outline the requirement for assessment of the effects of certain public and private projects on the environment. Such projects include the construction, extension and operation of a power station or overhead electricity lines under Sections 36 and 37 of the Electricity Act.

As the Project is over 1 MW and requires Section 36 Consent, it is considered to be a Schedule 2 development under The Electricity Works (EIA) (Scotland) Regulations 2000; defined as:

"*a generating station, the construction of which (or the operation of which) will require a Section 36 consent but which is not Schedule 1 development*".

To ensure full compliance with the regulations, BTAL will undertake an EIA and produce an ES to accompany its Section 36 Consent application.

Under Regulation 7, the developer (i.e. BTAL) is entitled to ask the Scottish Ministers, before submitting an application for a Section 36 consent under the Act, to state in writing their opinion as to the information to be provided in the ES (i.e. to provide a 'Scoping Opinion').

In accordance with Regulation 7, BTAL is requesting a formal scoping opinion and this report provides a summary of relevant information on the proposed Project including:

- A plan which identifies the site which is the subject of the proposed Project;
- A brief description of the nature and purpose of the proposed Project and its possible effects on the environment; and
- Further information or representations the developer may wish to provide.

EIA regulations guidance states that the developer should also submit a draft outline of the ES, giving an indication of what they consider to be the main issues.

Once they have all the information they require, the Scottish Ministers are required to consult and obtain the views of the Consultative Bodies (the Planning Authorities of the area in which the Project is planned, Scottish Natural Heritage (SNH) and the Scottish Environment Protection Agency (SEPA), the developer and other organisations (as they see fit)). When the Scottish Ministers issue a Scoping Opinion, they must state what information should be included in the ES, giving their reasons why.

5.9 Consents & Licensing

In order to permit the construction and operation of all components of the proposed tidal array, it is anticipated that the following consents and agreements may be required:

- Section 36 of the Electricity Act, 1989;
- Section 37 of the Electricity Act 1989 to install overhead electric lines;
- Section 16 of the Marine (Scotland) Act Marine Licence (replacing Section 5 Part II of the Food and Environment Protection Act (FEPA), 1985 and Section 34 of Coast Protection Act, 1949[4]);
- Planning permission (express or deemed) under the Town and Country Planning (Scotland) Act 1997 as amended by Planning etc. (Scotland) Act 2006;
- Lease of the seabed from TCE[5];
- Wayleaves and leases for onshore infrastructure development areas;
- Appropriate Assessment, under The Conservation of Habitats and Species Regulations 2010 (SI 2010 No 490) (as amended by The Conservation of Habitats and Species (Amendment) Regulations 2012 ,S.I. 2010/490, amended by S.I. 2011/603 and 625 and 2012/637) and The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007/1842 (as amended); and
- Approval of a decommissioning programme under Energy Act 2004.

In addition to the above, further consents may also include:

- Approvals from Scottish Environment Protection Agency (SEPA) under Section 20 of the Water Environment & Water Services (Scotland) Act 2003 and Water Environment (Controlled Activities) (Scotland) Regulations 2005 for activities liable to pollute or significantly affect the water environment;

[4] From April 2011, a Single Marine Licence granted under the Marine (Scotland) Act 2010 and UK Marine and Coastal Access Act 2009 will replace the requirement for Coastal Protection Act consent and a FEPA licence.
[5] TCE issue leases for the development of Marine Renewable developments within the 12nm territorial limit.

- Under The Conservation (Natural Habitats, & c.) Regulations 1994 (as amended in Scotland) a European Protected Species licence may also be required; and
- The Wildlife and Natural Environment Act (WANE) (2011) brought in a mechanism for licensing disturbance to other animals besides European Protected Species. Under Section 16 (3) of the Wildlife and Countryside Act 1981 (as amended by the WANE Act, 2011), species listed on schedule 5 of this Act (including the Basking Shark) which are protected under the aforementioned sections, actions that would normally be illegal may be carried out legally under licence.

The applicable legislation to the licences and consents required for the Project are discussed in further detail in the following sections below.

5.10 Electricity Act 1989 ('S36 Consent')

Section 36 of the Electricity Act 1989 is the primary consent required from the Scottish Ministers (administered by Marine Scotland on their behalf) for the construction and operation of a tidal power generating station with a capacity of 1 megawatt (MW) or more. Consent for the construction and operation of both phases of the development will therefore be sought under Section 36.

As part of a Section 36 Consent, the Scottish Ministers can also grant deemed planning permission for associated onshore works under Section 57 of the Town and Country Planning (Scotland) Act 1997. Alternatively, onshore works from Mean Low Water Spring (MLWS) can also be consented by the onshore planning authority under the Town and Country Planning (Scotland) Act 1997.

5.11 Electricity Act 1989 ('S37 Overhead power lines')

Section 37 of the electricity Act 1989 requires consent from Scottish Ministers for the construction of most overhead electric lines. Overhead electric lines may need to be installed between the onshore substation and the electricity network.

5.12 Marine Licence (Section 16)

From April 2011, under the Marine (Scotland) Act 2010 a single Marine Licence has replaced the previously separate FEPA and CPA licences required under Section 5, Part II Food and Environment Protection Act 1985 (FEPA licence) and Section 34 of the Coastal Protection Act 1949 (CPA licence). Developers will be able to submit their application for a Marine Licence alongside their S36 consent application to MS-LOT.

A Marine Licence will be required for the Project due to the installation of the support structures, devices and associated cabling being considered as a deposit by construction activity both in the sea and or under the seabed as described within the legislation.

5.13 Town and Country Planning (Scotland) Act 1997, Section 57)

A request to the Scottish Government for planning permission under Section 57 of the Town & Country Planning (Scotland) Act (i.e. deemed planning permission) can be made as part of the Section 36 application process, therefore removing the need for a separate planning application. A statutory provision in the Growth and Infrastructure Act 2013, which amends s57 of the Town and Country Planning (Scotland) Act 1997, allows Scottish Ministers to direct that planning permission is deemed to be granted for the ancillary onshore components and related onshore infrastructure for a marine based electricity generating station consented under Section 36. Developers can still choose to make a separate planning application for the onshore components if they wish.

5.14 Energy Act 2004

Sections 105 – 114 of the Energy Act 2004 introduce a decommissioning scheme for offshore wind and marine energy installations. Due to the decommissioning responsibilities not being devolved to Scotland all licensing requirements lie with the Department of Energy and Climate Change (DECC), under the terms of the Act, the Secretary of State may require a person who is responsible for one of these installations to submit (and ultimately carry out) a decommissioning programme for the installation. BTAL will produce a decommissioning programme for the Project as per the DECC guidance Note standards 2011.

5.15 Conservation Regulations

5.15.1 Habitat Regulation Appraisal

Under the Conservation (Natural Habitats, etc & C) Regulations 1994 (as amended by the Conservation of Habitats and Species Regulations 2010 as amended by The Conservation of Habitats and Species (Amendment) Regulations 2012 ,S.I. 2010/490, amended by S.I. 2011/603 and 625 and 2012/637),and the Offshore Marine Conservation (Natural Habitats, etc & C.) (Amendment) Regulations 2010), where a development is proposed in or near to a Natura 2000 site, or in an area recognised as an important site for marine species which are a feature of a Natura 2000 site, the competent authority should determine, and inform the developer as early as possible, on the requirement to undertake an Appropriate Assessment (AA) prior to granting the relevant consents and licences for development. In order to do this a Habitats Regulation Appraisal (HRA) will be undertaken. The HRA has been provided as a separate supporting document.

The HRA is undertaken in two steps:

a) The screening stage which questions Likely Significant Effect (LSE), i.e. is the proposal likely to have a significant effect on the qualifying interests of the site either alone or in combination with other plans or projects?, prior to the appropriate assessment stage.
b) The appropriate assessment stage, during which the competent authority considers if it can be ascertained whether the proposal will adversely affect the integrity of the site or not, either alone or in combination with other plans or projects.

5.15.2 European Protected Species (EPS)

For any European Protected Species (EPS)[6], Regulation 39 of the Conservation (Natural Habitats, &c.) Regulations 1994 makes it an offence to deliberately or recklessly capture, kill, injure, harass or disturb any such animal. An EPS Licence is required for any activity that might result in disturbance to EPS. In the case of the Project any requirement for an EPS Licence would be on advice from SNH to Marine Scotland as the licensing authority.

[6] EPS include all cetaceans and otters amongst other species

Questions to be put forward to Regulators
Q7. Please could OIC confirm if Pre Application Consultation (PAC) will be required for the construction of the onshore cable corridor?
Q8. Have all the regulatory requirements for the Project been identified?

6 POSSIBLE IMPACTS ON THE HUMAN ENVIRONMENT

This chapter considers the potential impacts of the proposals on the following receptors:

- Local communities;
- Commercial fisheries;
- Shipping and navigation;
- Ports and harbours;
- Utilities;
- Disposal sites;
- Land use;
- Seascape and landscape;
- Archaeology and cultural heritage;
- Ministry of Defence (MOD) areas;
- Aviation;
- Tourism;
- Other renewables; and
- Onshore traffic and transport.

An overview of the relevant baseline environment is provided for each along with the anticipated impacts, a baseline characterisation strategy, impact assessment strategy and where applicable, possible mitigation and monitoring measures.

6.1 Local Communities and Socio-economics

6.1.1 Baseline

6.1.1.1 Population

The population of Orkney has slowly been increasing. The 2002 estimate was 19,210 rising to an estimated 20,110 in 2010 (OIC, 2011). The population of Hoy as published on Scottish National Census Statistical Bulletin, published on the 15 August 2013, is 419. These figures were collected in 2011 and show the population has increased from 392 in 2001[7]).

6.1.1.2 Employment

Figures for 2006 and 2010 show that 7% more of the working age population of Orkney are economically active as compared to statistics for Scotland and the UK (OIC, 2011) and that unemployment rates remain largely stable at 1.4%. The vast majority of employees work in the services, public administration, education and heal th, and distribution, hotels and restaurants industries. Within Hoy there has been a recent trend of non-economically active migrants entering the Island (Hallaitken, 2009) subsequently unemployment rates are likely to be higher than on mainland Orkney.

6.1.1.3 Income

Data from the Office for National Statistics shows that income levels in Orkney are 15% lower than Scottish mean levels and 5% lower than Scottish median levels (Office for National Statistics, 2011). Note that mean and median figures for Scotland are lower than those for the UK. These figures are representative across Orkney, with little variation across the islands.

6.1.1.4 Education

Academic standards are above the national average and teacher/pupil ratios are among the lowest in Scotland. Orkney also has amongst the highest proportion of school leavers going into higher and further education in Scotland. This statistic is inclusive of the Island of Hoy. The pupils of North Walls Junior High School on Hoy attend from

[7] **National Records of Scotland, 15th Aug 2013, Statistical Bulletin,**
http://www.scotlandscensus.gov.uk/documents/censusresults/release1c/rel1c2sb.pdf

nursery to 2nd year of secondary, at which point they can continue their education by travelling to Kirkwall Grammar School or Stromness Academy.

6.1.1.5 Public Services

Orkney enjoys high levels of public services, many of them provided and managed by OIC. The Island of Hoy is served with two Orkney Islands Ferry services from Houton or Stromness to Lyness or North Hoy respectively. During the summer months, the Stromness to North Hoy service runs 4 times a day. In the winter the service varies daily but averages 3.4 trips per day. The Houton to Lyness ferry runs 5 times a day during the week and 3 times a day over the weekend. These services provide a vital life line for the Island (Scottish Ferries Review, 2010).

6.1.1.6 Fuel Poverty

In Orkney the cool, damp climate, high fuel costs and comparatively low incomes compared to the mainland mean that 46% of households are in fuel poverty compared with the Scottish average figure of 26.5% (Office for National Statistics, 2011).

6.1.2 Potential Impacts

Possible impacts along with the potential significance of effect on local communities are considered in Table 6.1 below:

Table 6.1 Potential Impacts on Local Communities

Potential impact	Phase	Potential significance	Comment
Local employment and business opportunities	All	Beneficial impact	There will be significant opportunities for local residents and businesses to become involved at various stages of the project. Local content in contracts will help to ensure that opportunities are maximised.
Wage inflation	All	Potential significance of impact unknown	The Project may attract a significant number of high wage earners to the Islands resulting in slight wage inflation
Improvements	All	Beneficial	External investment into

Potential impact	Phase	Potential significance	Comment
to infrastructure and facilities		impact	infrastructure i.e. ports, grid, public service facilities to meet increased demand etc.
Population increase	All	Potential significance of impact unknown	Jobs created by the Project may cause an influx of workers into Orkney leading to a population increase.
Change in population distribution	All	Potential significance of impact unknown	Workers associated with the Project may wish to live close to the AfL or main ports which could cause a change in the distribution of population.
House price inflation	All	Potential significance of impact unknown	An increase in population caused by an influx of workers associated with the Project could lead to an increase in demand for property causing house price inflation. This could create a barrier for first time buyers trying to get on the property ladder and/or push up rent for locals.
Pressure on local utility services	All	Potential significance of impact unknown	An increase in population caused by an influx of workers associated with the Project could lead to an increase in demand for utility services beyond present capabilities.
Improvements to local transport services	All	Beneficial impact	An increase in population caused by an influx of workers associated with the Project could lead to an increase in demand for transport services providing stimulus for improvement

6.1.3 Baseline Characterisation Strategy

It is proposed that baseline conditions regarding local communities can be further refined by completing the tasks outlined in Table 6.2 below:

Table 6.2 Baseline Characterisation Strategy

Data gap	Methodology	Example data sources
Population numbers and distribution through settlements	Gather census data and other sources	Scottish economic statistics OIC statistics HIE statistics
Employment by sector and wages	Survey businesses directly, discuss with business organisations, HIE, and OIC	Scottish economic statistics OIC statistics HIE statistics
Supply chain capacity, capability and aspirations	Survey companies directly, discuss with business organisations, HIE, and OIC	Scottish economic statistics OIC statistics HIE statistics Crown Estate commissioned research into the economic impacts of marine energy projects Scottish Enterprise
House availability, pricing and standards	Liaise with Orkney Housing, OIC and local house builders	Orkney Housing OIC Local building companies
Infrastructure and facilities investment	Create a catalogue of investment plans	OIC, HIE and business organisations

6.1.4 Impact Assessment Strategy

It is proposed that the following impact assessment strategy, Table 6.3 below, is applied to address the potentially significant impacts identified and those impacts for which the potential level of significance is unknown.

Table 6.3 Impact Assessment Strategy

Potential impact	Assessment topics	Assessment method	Relevant research
Local employment and business opportunities	Amount and type of employment Pulling employees from other key roles Scale and type of contracts	Strategic level socio-economic impact assessment	Multipliers for economic benefit Multipliers for economic benefit
Wage inflation	Average wages and wages per sector		Previous instances of rapid growth
Improvements to infrastructure and facilities	Identify local community investment targets and assess compatibility		None
Change in population distribution	Impacts on existing residents from increase housing and services demands		None
House price inflation	Change in house prices		None
Pressure on local utility services	Mark out utility networks		None
Improvements to local transport services	Existing service provision		None

6.1.5 Possible Mitigation and Monitoring Measures

The following possible mitigation and monitoring measures, Table 6.4 below, will be considered during on-going EIA and Project development activities:

Table 6.4 Possible Mitigation and Monitoring Measures

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
Local employment and business opportunities	BTAL will investigate measures which can help to facilitate local business involvement.	Track numbers Track local content in contracts	None proposed
Wage inflation	Track wage levels	Scottish and local stats	None proposed
Improvements to infrastructure and facilities	Monitor level and type of investment	Direct catalogue	None proposed
Distribution of population	Track level	Use local monitoring data	None proposed
House price inflation	Track level	Use local monitoring data	None proposed
Pressure on local utility services	Early notification of any needs Monitor any issues	Direct catalogue	None proposed
Improvements to local transport services	Track level of activity	Ferry and air route operators	None proposed

6.2 Commercial Fisheries

This section discusses commercial fisheries. Navigation with regards to fishing vessels is discussed in Section 6.14 and in Appendix C (PHA). Potential impacts on commercial fish and shellfish species are covered in Section 7.3.

6.2.1 Baseline

The number of active fishing vessels based in Orkney was 152 in 2011, which is just under 7% of the Scottish total. The majority (110 out of the 152 vessels) of active vessels based in Orkney are 10m and under in length, with an additional 35 vessels of between 10m and 15m in length. The remaining 7 vessels are between 15m and 50m (Scottish Government, 2011).

The majority of landings into Orkney, some 3,876t, are of shellfish, with a value of £7,487,000 landed in 2011, compared to 59 tonne of demersal fish and 10 tonne of pelagic fish (values of £82,000 and £10,000 respectively (Scottish Government, 2011)).

The proposed Project lies in a region of strong, complex tidal currents and the seabed within the area is predominantly hard ground combining bedrock, boulders, cobbles and pebbles, or sandy sediment overlain with cobbles and boulders (see Section 7.5 Subtidal Seabed Communities and Section 8.1 Physical Processes). Water depths in the area are generally between 60 and 90m, reducing closer to shore along potential cable routes. A general description of the seabed conditions is provided in Section 7.5.

The area of the proposed Project is assessed by SCOTMAP to be fished by between 4-6 boats; of these vessels 2-3 are less than 10 metres. SCOTMAP's research indicates that between 15-27 people are employed on the vessels operating in this area. From a monetary perspective SCOTMAP's assesses that the area is currently worth between £3362- £8107 per vessel fishing in the area, per annum. This figure is predominantly based around the creel fishing industry and in particular lobster creeling (Marine Scotland 2012, 2012)

Fishing in the AfL is limited to creeling and it is unsuitable for any kind of trawling. The area is transited by other types of fishing vessel bound for port or the fishing areas west of Orkney, as well as further offshore.

The area is relatively exposed with complex tidal conditions making it a challenging site to set and maintain creels. However, the area is frequently targeted by a number of active creel fishermen from South Ronaldsay, Longhope and Stromness, targeting lobster and crab. At least one local creel fishermen sets a relatively large number of creels within the AfL and the surrounding area on a regular basis. It is understood that these creels are moved regularly within the wider area, depending on weather conditions, season and market demand.

The vessels operating out of Longhope are a key mainstay of industry for Hoy and South Walls, contributing significantly to the local economy.

The site of Aith Hope is a recognised in the Locational Guidelines for the Authorisation of Marine Fish Farms in Scottish Waters as a category 3 site, meaning that the site is categorised amongst the sites that have the lowest predicted combined nutrient enhancement and benthic impact. The site is 1.8 km in length and occupies an area of 0.6 km² (Scottish Government, 2010). Currently Aith Hope has authorisation for a for a fin fish farm licence (Marine Scotland & The Scottish Government, 2013), however its current status is unknown.

North of the proposed development the closest active aquaculture sites are located ~7.5km north of the proposed development, the first site is an Atlantic salmon marine cage site operated by Northern Isles Salmon Ltd. The second is a long line mussel farm operated by Orkney Mussels Ltd.

6.2.2 Potential Impacts

Possible impacts along with the potential significance on commercial fisheries are considered in Table 6.5 below:

Table 6.5 Potential Impacts on Commercial Fisheries

Potential impact	Phase	Potential significance	Comment
Loss of access to fishing grounds resulting from any restrictions / exclusion zones	Installation, operation and maintenance	Potential significance of impact unknown	It is known that the AfL area and the wider area are actively used by creel fishermen.
Obstruction to regular fishing vessel transit routes	Installation, operation and maintenance	Potential significance of impact unknown	Larger fishing vessels may transit the AfL regularly as they travel to/from fishing grounds. It is also assumed that smaller vessels transit the AfL area and the adjacent coastal area on a regular basis to reach other fishing grounds within and outside Orkney.
Change in abundance of targeted species	Operation	Potential significance of impact unknown	The addition of new structures at the seabed, which may provide some degree of shelter from strongest tidal currents, may provide suitable shelter for some commercial species.

6.2.3 Baseline Characterisation Strategy

It is proposed that baseline conditions regarding commercial fisheries can be further defined to sufficient detail by completing the tasks outlined in Table 6.6 below:

Table 6.6 Baseline Characterisation Strategy

Data gap	Methodology	Example data sources
Establish the types and level of fishing activity within and around the AfL area, any offsite storage/ maintenance areas and along	Through targeted consultation with OFA, local fishermen and Marine Scotland, the types and level of fishing activity undertaken in and around the AfL	Liaison with OFA and Marine Scotland (commenced and on-going) as first point of contact. Consultation with local fishermen (commenced and

Data gap	Methodology	Example data sources
potential cable corridors	area/along the cable corridors will be established. This process will be informed by the Project NRA.	ongoing)
		OFA fisheries mapping exercise
		MS Scotmap
Establish any potential fishing 'hot spots' or other strategically important sites within the AfL area, any offsite storage/ maintenance areas and along potential cable corridors	Through consultation with local fishermen, identify whether any hot spots or other strategically important sites exist within or around the AfL area/along the cable corridors.	Consultation with local fishermen
		Automatic Identification Systems (AIS) and VMS data
		Orkney Sustainable Fisheries vessel tagging research
Establish the 'usage patterns' of any hot spots or other strategically important sites within and around the AfL	Through consultation with local fishermen, establish when, how often, within which weather systems, during which tides etc. each hot spot or other important site is particularly utilised.	Consultation with local fishermen
		AIS and VMS data
		Orkney Sustainable Fisheries vessel tagging research
Establish the number and types of fishing vessels transiting the AfL area to reach other fishing grounds	Using existing data and through consultation with Marine Services, SFF, MS, OFA and local fishermen, the types and numbers of vessels using the South Hoy area as a transit route to/from fishing grounds/ports will be determined.	AIS and VMS data
		Consultation with local fishermen
		Experience of local mariners, especially ferry crews
		NRA vessel traffic survey

6.2.4 Impact Assessment Strategy

It is proposed that the following impact assessment strategy, Table 6.7 below, is applied to address the potentially significant impacts identified and those impacts for which the potential level of significance is unknown:

Table 6.7 Impact Assessment Strategy

Potential Impacts	Assessment topic	Assessment method	Relevant research
Loss of access to fishing grounds resulting from any restrictions / exclusion zones	Relative economic and social value of AfL area and cable corridors in terms of commercial fishing	Determine what use is made of the key areas Discuss with local fishermen the implication of any disruption to fishing activity within the context of wider site access and availability Establish the relevant value of any catch for the relevant areas through consultation with local fishermen and OFA	MS Scotmap OFA Fishing Data OFS vessel tagging project
	Availability of other suitable areas	Discuss with local fishermen the availability of alternative sites during times that the AfL area and peripheral area is normally most utilised for fishing	Application of the redistributed effort models developed by Jon Side at ICIT (Heriot Watt University)
	Potential opportunities	Consider the extent of	On-going

Potential Impacts	Assessment topic	Assessment method	Relevant research
	within the AfL area in conjunction with the proposals	habitat creation associated with the development Establish a notional density of shellfish per amount of habitat Liaise with OFA and local fishermen to identify potential opportunities	experimental habitat enhancement trials at EMEC with the local lobster hatchery
Disruption to regular fishing vessel transit routes	Potential for suitable channel through / around proposed AfL area / proposed development zone within the AfL area	This will be informed by the Project NRA	
	Availability of suitable routes	This will be informed by the NRA and consultation with Marine Services, OFA, local fishermen and navigational experts on potential ways forward	
Change in abundance of targeted species	Potential for habitat and population enhancement	Liaise with lobster hatchery and local experts in shellfish behaviour over possible attributes to artificial habitats Establish the design options available for	On-going experimental habitat enhancement trials at EMEC with the local lobster hatchery

Potential Impacts	Assessment topic	Assessment method	Relevant research
		structures in relation to prompting population stocking	

6.2.5 Possible Mitigation and Monitoring Measures

The following possible mitigation and monitoring measures, Table 6.8 below, will be considered during ongoing EIA and project development activities:

Table 6.8 Possible Mitigation and Monitoring Measures

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
Loss of access to fishing grounds	Liaise with local fishermen prior to establishing the deployment plan for Phase I and II. Collate best available information with regard to fishing activities and possible interactions with the proposed development.	None	Liaise with OFA and local fishermen to quantify the extent of any effects which may be linked to the development.
Obstruction to regular fishing vessel transit routes	Evaluate options to minimise disruption through on-going consultation with SFF, OFA and local fishermen through the NRA process.	None	AIS and VMS records plus direct observations

6.3 Ports and Harbours

6.3.1 Baseline

The nearest ports to the AfL are Lyness on Hoy, Stromness and Scrabster (Figure 6.1).

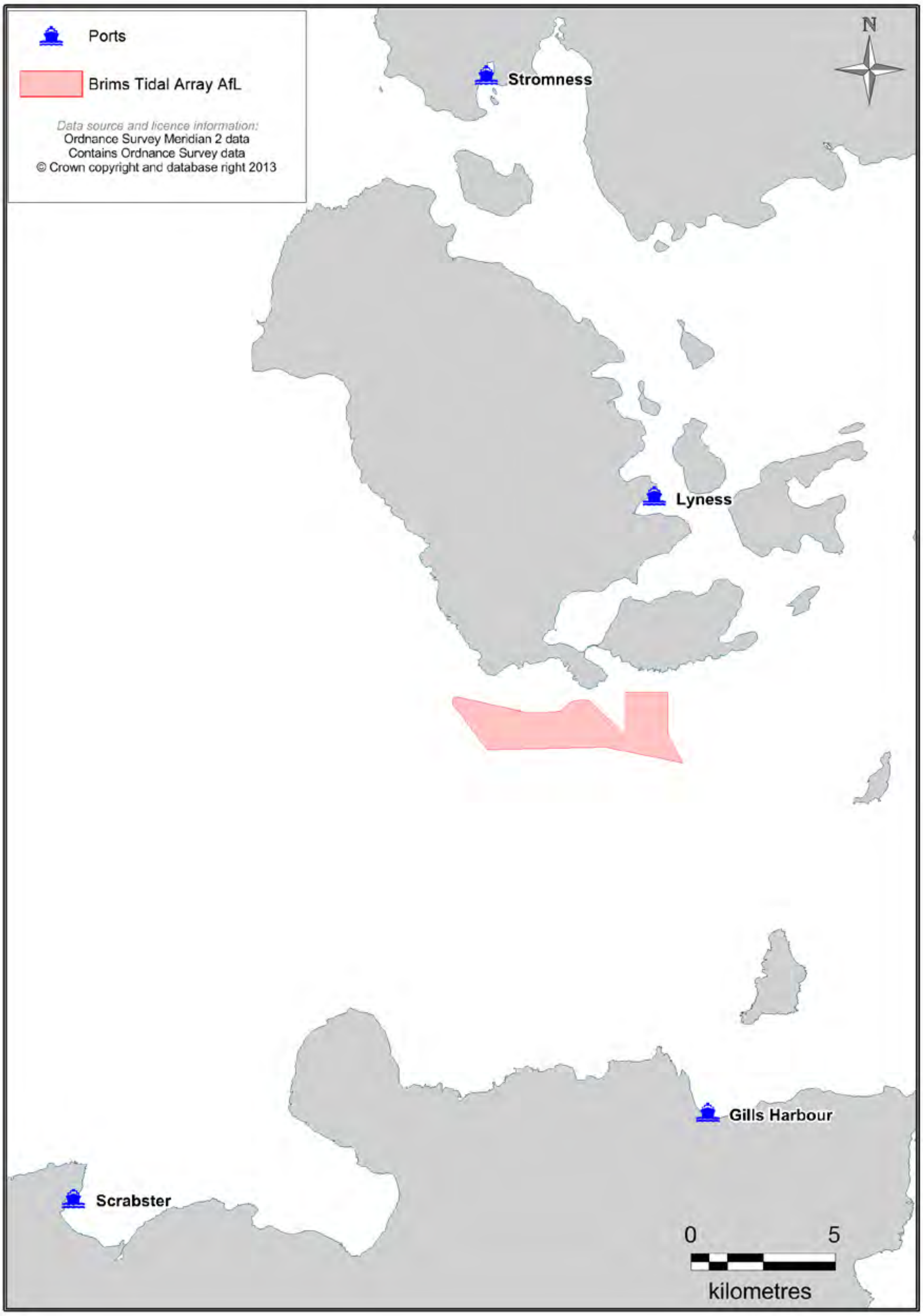


Figure 6.1 Ports within the PFOW

6.3.1.1 Stromness Harbour - Copland's Dock

Copland's Dock (a 100 metre long pier) is currently being constructed within Stromness Harbour (Figure 6.2). This facility will provide additional capacity for the marine renewable energy industry in Orkney and when completed (estimated to be in February 2014) the new pier will provide up to 3,200 square metres of working space and a guaranteed water depth of 5 metres CD (chart datum).

Figure 6.2 Stromness Harbour, Copland's Dock under construction

6.3.1.2 Lyness

Lyness (Figure 6.3) was established as a major base for the British fleet during WW1 but has recently undergone a £2.98 million upgrade of the two existing wharfs. The harbour is now regularly used by wave energy developers testing at the EMEC Billia Croo test site. Lyness offers 265 metres of safe and sheltered mooring, and 4,000m² of hard standing to assist with assembly and servicing of marine renewable devices.

Future plans are to provide steel framed buildings, secure compounds and office and communication facilities as the site and the industry develops. A Ro-Ro (roll on roll off) ferry service between Flotta, Hoy and the Orkney Mainland (Houton) also operates adjacent to the newly improved harbour.

Figure 6.3 Lyness Harbour

6.3.1.3 Scrabster Harbour

Scrabster (Figure 6.4) is situated on the northern coast of Scotland and is one of the top four fish and shellfish landing ports in the UK[8] and is also a regionally important ferry terminal that provides life line services to Orkney. Scrabster is also accommodating an increasing number of cruise ships.

The harbour services both the North Sea oil and gas industry and the growing marine renewable energy sector in the PFOW. The port authority has recently undertaken a £50 million refurbishment of in order to meet the growing demands.

[8] www.**scrabster**.co.uk/files/downloads/download617.pdf

Figure 6.4 Scrabster Harbour

There are other smaller piers and harbours within the area that may be used by smaller vessels throughout the Project i.e. survey and maintenance vessels.

6.3.2 Potential Impacts

Possible impacts along with the potential significance of effect on ports and harbours are considered in Table 6.9 below. Impacts to Navigation are considered in Section 6.14: Shipping and Navigation and in Appendix C: Preliminary Hazard Analysis.

Table 6.9 Potential Impacts on Ports and Harbours

Potential impact	Phase	Potential significance	Comment
Overcapacity of port infrastructure	All	Potential significance of effect unknown	The marine renewable energy sector has already provided the incentive for the significant growth of a number of harbour facilities including, Stromness, Lyness, Hatston (Kirkwall) and Scrabster and it is anticipated that this growth will continue as the sector becomes

Potential impact	Phase	Potential significance	Comment
			increasingly important to Scotland's strategic plans for a low carbon secure energy future (see Section 5: Key Policy and Legislative Objectives). The improvement in harbour infrastructure has provided direct employment and led to an increase in the number of tourists to the islands and promoted the local area as a centre of renewable energy innovation. It is anticipated that the improved ports will reach capacity during the build-out of phase I PFOW projects.

6.3.3 Baseline Characterisation Strategy

No further baseline information is required to inform the EIA process. Ongoing consultation with the relevant harbour authorities and port operators will ensure that any necessary/relevant updates are included in the ES.

6.3.4 Impact Assessment Strategy

It is proposed that the following impact assessment strategy, outlined in Table 6.10 is applied to address the potentially significant impacts identified, and those impacts for which the potential level of significance is unknown:

Table 6.10 Impact Assessment Strategy

Potential impact	Assessment topics	Assessment method	Relevant research
Overcapacity of port infrastructure	How much capacity will be required? Where and when will this be required?	To be determined following detailed project planning and definition of	N/A

		project requirements	

6.3.5 Possible Mitigation and Monitoring Measures

The following possible mitigation and monitoring measures, Table 6.11 below, will be considered during on-going EIA and project development activities:

Table 6.11 Possible Mitigation and Monitoring Measures

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
Overcapacity for ports infrastructure	Proactive forward planning Ongoing consultation with Marine Services	N/A	N/A

6.4 Utilities

6.4.1 Baseline

6.4.1.1 Electrical Grid

Orkney is connected to the national grid via two 33kV AC subsea cables across the Pentland Firth. The majority of the inhabited islands (including Hoy) are connected to the Orkney Mainland via a 33kV loop. This cable network is shown below in Figure 6.5:

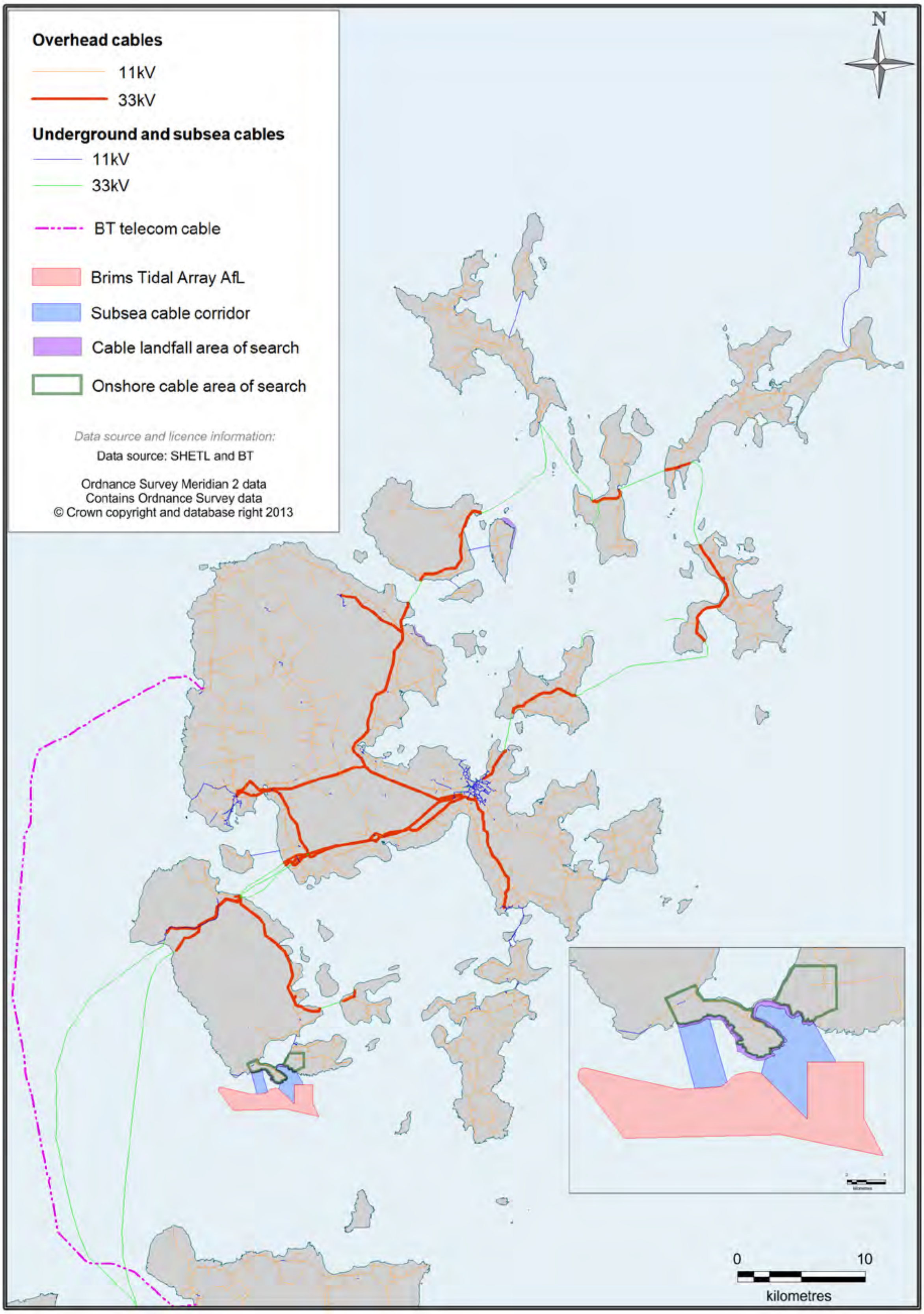


Figure 6.5 Electrical and telecoms cables in Orkney

This project, along with other renewable energy generation projects in the PFOW Leasing Round, will require improvements to the existing onshore and offshore transmission grid network. These improvements are currently being planned by SHE.

These improvements will include the construction of a 4.2 hectare 220 kV substation just north of the Bay of Skaill, a 70 km 220 kV subsea cable link between Caithness and Orkney[9] and the installation of a 275/220 kV transformer and associated equipment at the existing Dounreay substation.

6.4.1.2 Telecoms Network

The subsea telecom link for Orkney makes landfall at the Bay of Skaill. Within Orkney telecoms links are mainly provided by subterranean cables that follow the road network.

6.4.1.3 Water Distribution Network

Water pipes typically follow the local road network. However some more isolated properties are served by off grid water, sewerage and electricity systems.

6.4.2 Potential Impacts

Possible impacts along with the potential significance of effects on utilities are considered in Table 6.12 below:

Table 6.12 Potential Impacts on Utilities

Potential impact	Phase	Potential significance	Comment
Potential upgrade of existing electrical grid infrastructure	Construction	Indirect Potential Beneficial impact	Depending on the approach taken to enveloping the Hoy grid connection there is the possibility that this could strengthen the existing grid network. This may create opportunities for other renewable projects, including community projects, to connect into the planned hub and export

[9] http://www.sse.com/OrkneyCaithness/ProjectInformation/

Potential impact	Phase	Potential significance	Comment
			power to the national grid.
Potential impacts on electrical grid, telecoms and water network during construction and installation	Construction	Effect unlikely to be significant	The routing of onshore cables and location of onshore substations will take into account existing facilities and avoid existing infrastructure
Disruption to utilities provision	Construction	Effect unlikely to be significant	Presence of all utility networks will be fully investigated. Any disruption will be localised and temporary with prior notice and alternative supplies provided where appropriate.

No potentially significant impacts have been identified and utilities are therefore, scoped out of the EIA. It is proposed that the relevant stakeholders are consulted during the project design process to ensure that any potential issues that may arise are identified and the existing utilities infrastructure can be avoided.

6.5 Disposal Sites

6.5.1 Baseline

There are five licenced disposal sites for dredged material in Orkney waters, (Scottish Government and Marine Scotland 2011), one north of Kirkwall, three to the North of Hoy in or around Scapa Flow, and one to the south of Scapa Flow between Hoy and South Ronaldsay (Site F1055) (Figure 6.6). Site F1055 is the largest in terms of average tonnage disposed at the site, with approximately 2,500-10,000 tonnes deposited at that site between 2005 and 2009 (Scottish Government, Marine Atlas, 2011b, compared to a combined tonnage of 2,500 tonnes at all other sites for the same period.

All sites are used for the disposal of silt, sand, gravel or rock whilst two of the sites to the North of Hoy have also historically been used for fish waste (Scottish Government, 2007). Two further disposal sites for silt, sand, gravel or rock on the north coast of the Scottish Mainland are shown on maps contained within the Scottish Marine Renewable SEA, although these sites are not shown in the Marine Atlas and may therefore be historic sites that are no longer used. The SEA data includes sites active within the last 10 years, while the Marine Atlas data does not show historic disposal sites.

The closest dredging disposal site to the proposed Project is disposal site F1055. Recently, this site has predominantly been used for the disposal of material dredged from the Hatston Pier development. This site is the most heavily used dredge disposal site in Orkney Waters and is situated 6.6 Km from the northern edge of the AfL.

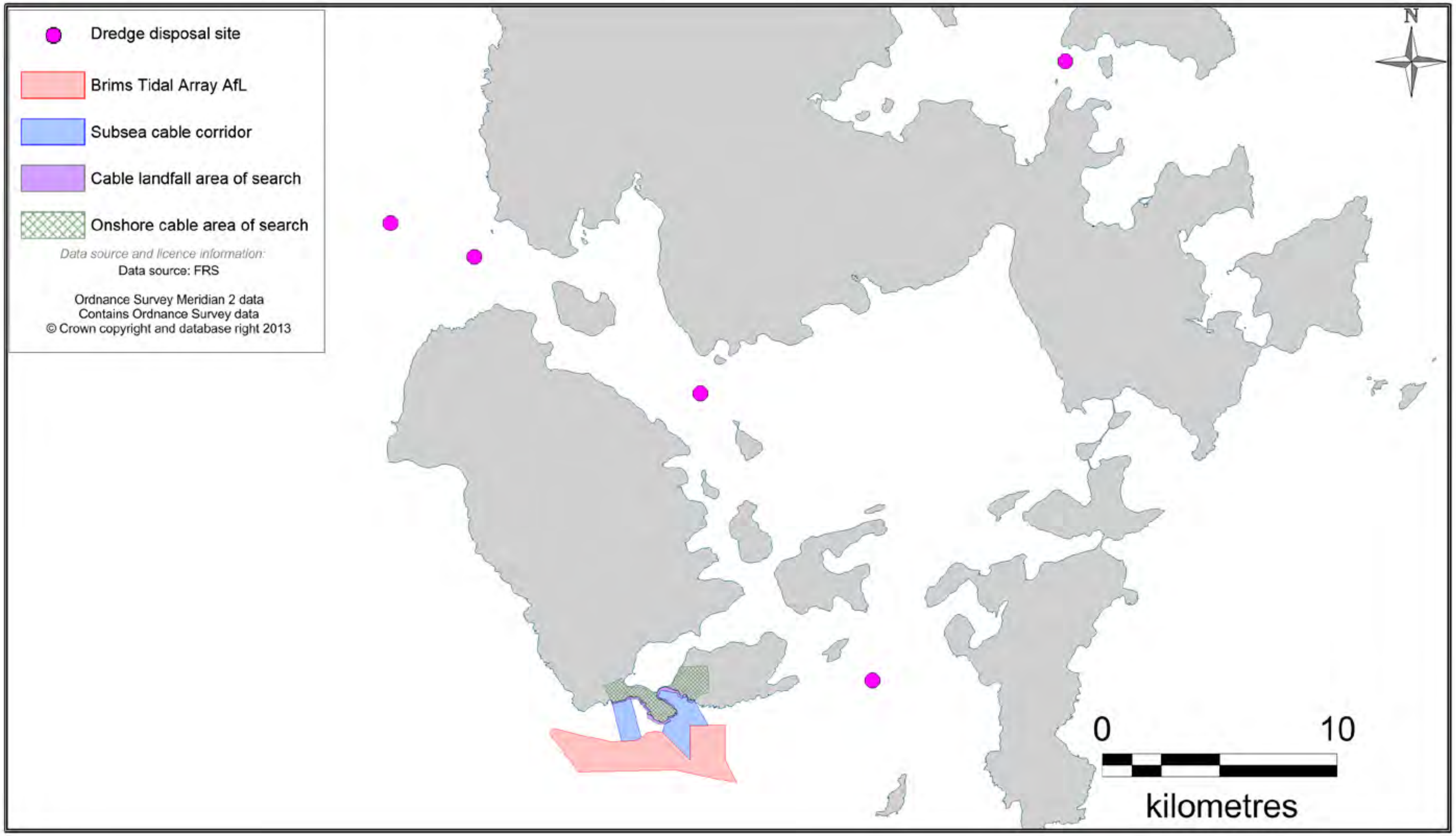


Figure 6.6 Designated disposal sites within Orkney waters

6.5.2 Potential Impacts

Possible impacts along with the potential significance of effect on disposal sites are considered in Table 6.13 below:

Table 6.13 Potential Impacts on Disposal Sites

Potential impact	Phase	Potential significance	Comment
Potential disruption to existing disposal site activity	All	Negligible	Given the distance to the revised AfL, no impact on existing disposal site activity at site F1055 is anticipated.

No potentially significant impacts have been identified and disposal sites are therefore, scoped out of the EIA. It is proposed that SEPA is consulted during the EIA to confirm that no changes in the baseline conditions have occurred; particularly just prior to ES preparation and Licence Application submission.

6.6 Land Use

6.6.1 Baseline

The predominant use of land across Orkney is agriculture (Barne *et al,* 1997). The majority of land on the islands of Hoy and South Walls is used for agricultural grazing with small areas of crofting peat cutting also present.

6.6.2 Land Use Within South Hoy

South Hoy is predominantly typified as a whale back landscape (Land Use Consultants, 1998) that has been enclosed by dry stone walls. The land in the area is sustainably grazed and the anthropogenic landscape is characterised by farm buildings and enclosed grazing land.

In addition to the use of land for agriculture South Hoy is also popular with tourists and ornithologists and subsequently it has a number of nature reserves and walking paths.

A suite of ecological surveys were undertaken in summer 2012 to inform the EIA process, which included a survey of land-use (Figure 6.7 below). The results showed that the predominant land-use within the onshore study area is pastoral, grazed by cattle and sheep. The second most common land use is arable, and land which appears to be left idle. The remaining land uses identified included coastal path, other grazed land (where it could not be identified as cattle or sheep), historically grazed land, left for wildlife (including Local Nature Conservation Sites (LNCS)), quarry, paddock, recreation, storage areas and buildings.

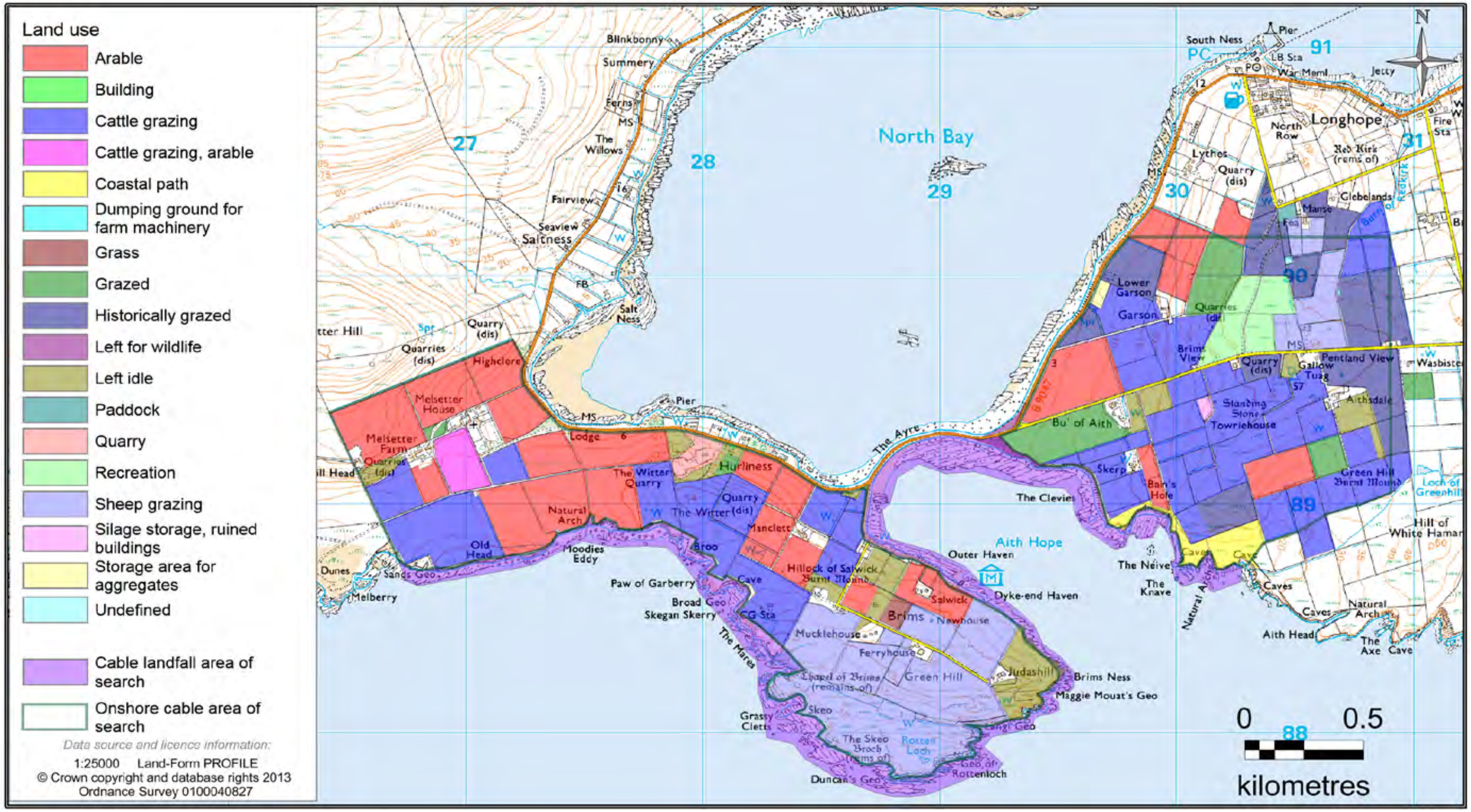


Figure 6.7 **Land use across Orkney**

6.6.3 Potential impacts

Possible impacts along with the potential significance of effect on land use are considered in Table 6.14 below:

Table 6.14 Potential Impacts During Construction and Operation

Potential impact	Phase	Potential significance	Comment
Nuisance or obstructions to land use from construction and presence of overhead or buried cables from coast to onshore substation	Construction and operation	Potential significance of impact unknown	Construction of a new grid connection would place restrictions on future changes to land use along the grid connection routes (restriction on construction of buildings directly above or below electrical wires). Selection of the grid connection route will consider likely future land use so as to minimise any potential impacts. Noise and lighting may impact on local residents, depending on location of cable route and methods used

6.6.4 Baseline Characterisation Strategy

It is proposed that baseline conditions regarding land use can be further defined to sufficient detail by completing the tasks outlined in Table 6.15 below:

Table 6.15 Baseline Characterisation Strategy

Data gap	Methodology	Example data sources
Distribution of land use activities	Map and describe the activities presently undertaken and any important trends (this has been undertaken; see section 1.1.1)	Local plan OS mapping Field survey

Data gap	Methodology	Example data sources
Distribution of services and utilities	Obtain GIS data of pipeline, cable and overhead wire routes	OS mapping BT Scottish water SHEPD
Distribution of roads and dwellings, including Noise Sensitive Properties (NSPs)	Obtain GIS data on roads and dwellings	OS mapping OIC engineering division

6.6.5 Impact Assessment Strategy

It is proposed that the following impact assessment strategy (Table 6.16) is applied to address the potentially significant impacts identified and those impacts for which the potential level of significance is unknown:

Table 6.16 Impact Assessment Strategy

Potential impact	Assessment topics	Assessment method	Relevant research
Nuisance or obstructions to land use from construction and presence of overhead or buried cables	Access, noise, lighting and other activities associated with land use which may be affected	Percentage change consult with key local consultees potential need for noise investigations	None

6.6.6 Possible Mitigation and Monitoring Measures

The following possible mitigation and m onitoring measures (Table 6.17) will be considered during on-going EIA and project development activities:

Table 6.17 Mitigation and Monitoring Measures

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
Nuisance or obstructions to land use from construction and presence of overhead or buried cables	Employment of a land agent who will seek to secure appropriate landowner agreements to permit construction of the grid connection	None	None

6.7 Landscape and Seascape

6.7.1 Introduction

This section discusses the proposed development in terms of landscape and seascape. Cultural heritage also forms an important part of the landscape within the search area in terms of the setting of archaeological features within the wider landscape.

6.7.2 Baseline

Orkney has a predominantly low and gentle relief, the smooth contours of which are emphasised by the general lack of trees and woodland cover. This landscape, though windswept, supports large areas of productive pastures and some arable farming. The onshore grid connection corridor search area is characterised by grassland, moorland, rough grazing, rural development, peatland and dunes, with high ground steeply rising from the sea in the centre of Hoy. The Hoy and West Mainland National Scenic Area is also located directly to the north-west of the AfL.

The islands are interlinked by ferries, with recreational sailing and cruise liners also transiting the AfL area, Subsea Cable Corridor and Offshore Substation Area of Search. These factors, along with the close proximity of islands, mean the AfL area and areas of search (including potential landfall, substations and cable routes) would be visible from both land and sea view points.

The Landscape Character of Orkney has been described by Land Use Consultants (1998), with two different landscape characters identified within the onshore search areas. These different landscape characteristics are listed in Table 6.18 as are the three different Orkney seascapes recognised by SNH in the Scottish Marine Renewables Strategic Environmental Assessment (Faber Maunsell and Metoc PLC, 2007) and found in the proximity of the areas of search. The table also shows the Landscape characters and seascapes found within 10km of possible infrastructure. The landscape character types within the search areas and within 10km of possible infrastructure are shown in Figure 6.8 below.

Table 6.18 Landscape Characteristics

Landscape Character types within onshore search areas	Seascapes types adjacent to search areas	Additional landscape character types within 10km of possible infrastructure	Additional seascapes within 10km of possible infrastructure
Inclined coastal pastures Whaleback island landscapes	High cliffs Inter-island associated with outer island chains Low lying agricultural coastal fringe	Cliff landscapes Coastal island Holms Inland loch Low island pastures Low moorland hills Moorland hills Sweeping moorland Urban and rural development	Rugged coastal shelf & headlands with open views to sea

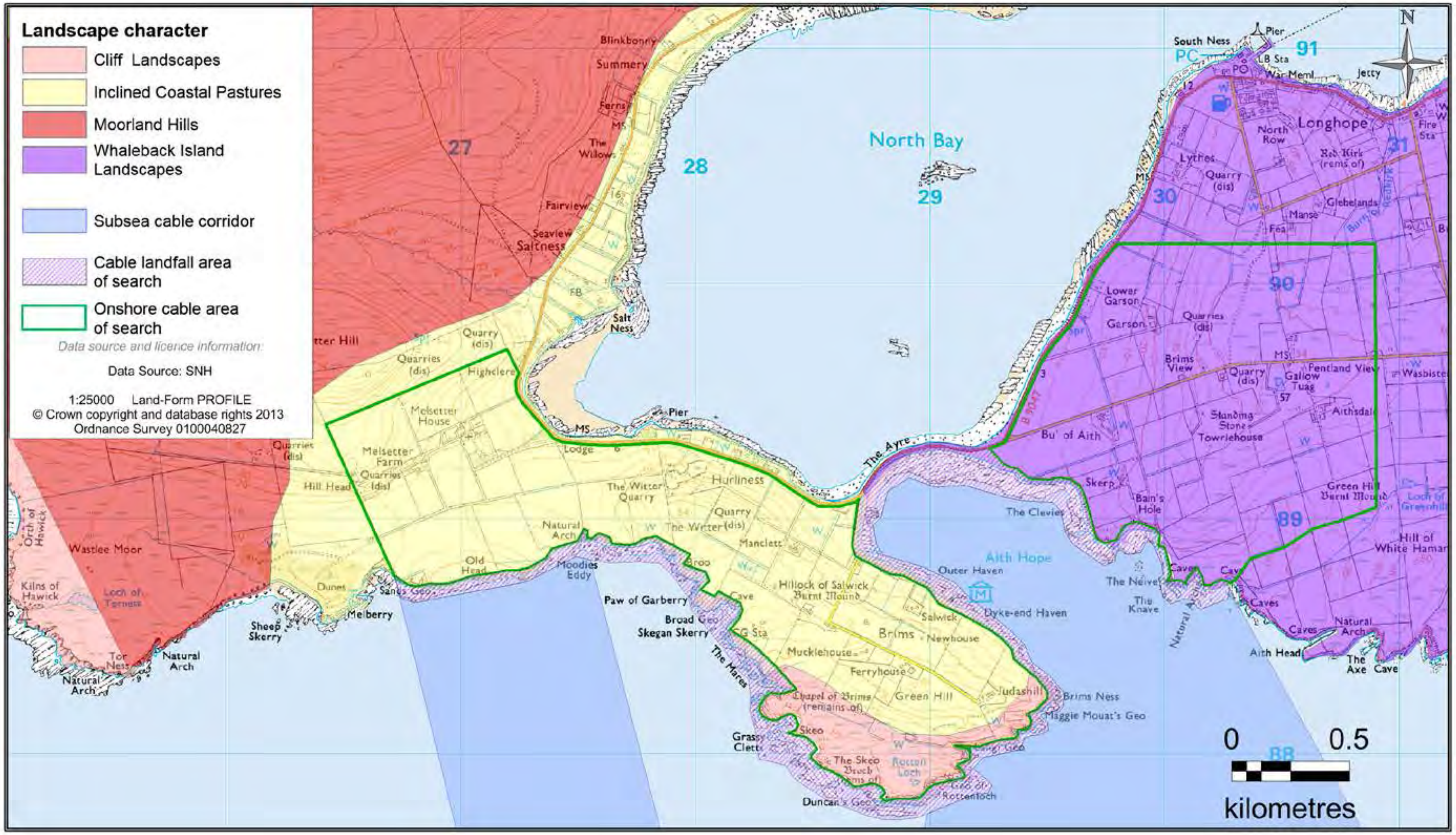


Figure 6.8 Landscape Character Types Within the Search Area

6.7.3 Potential Impacts

Possible impacts along with the potential significance of effect on landscape and seascape are considered in Table 6.19 below:

Table 6.19 Potential Impacts During Construction, Operation and Decommissioning

Potential impact	Phase	Potential significance	Justification
Changes to landscape character	Construction and Operation	Potential significance dependant on sensitivity of landscape and the magnitude of change	The introduction of permanent man-made features, such as the overhead power lines, as well as alterations to landforms as a result of excavation/surface preparation may lead to changes in the existing landscape character. This is especially the case where there is currently limited infrastructure adjacent to the coastline. Increased traffic and the introduction of lighting (structural/security) will also potentially alter landscape character.
Changes to seascape character	Construction, Operation and decommissioning	Potential significance dependant on sensitivity of seascape and the	Any infrastructure above the sea surface, safety and navigational lighting and/or the temporary increase in vessel traffic associated with the

Potential impact	Phase	Potential significance	Justification
		magnitude of change	development has the potential to alter the seascape character locally during construction, operation and maintenance and decommissioning.
Changes to visual amenity	Construction and Operation	Potential significance dependant on susceptibility of visual receptors to change and the value attached to views experienced by receptors as well as the magnitude of change	The development has the potential to change perception of the area from, for example, a wild or remote area to an active, working landscape. Such a change may be balanced by the perception of some receptors of the development as a point of interest in the local landscape.
Cumulative impacts	Construction and Operation	Potential significance dependant on scale and other nearby development	Cumulative effects may occur to the seascape, landscape, or visual resource and are defined as "the additional changes caused by a proposed development in

Potential impact	Phase	Potential significance	Justification
			conjunction with other similar developments or as the combined effect of a set of developments, taken together." (SNH 2012).

6.7.4 Baseline Characterisation Strategy

It is proposed that baseline conditions regarding landscape and seascape can be further defined to sufficient detail by completing the tasks outlined in Table 6.20 below:

Table 6.20 Baseline Characterisation Strategy

Data gap	Methodology	Example data sources
SLVIA (desk-based and field survey)	All methodologies are based primarily on "Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape" (SNH, 2012a), "Guidance for Landscape/Seascape Capacity for Aquaculture" (SNH 2008), "Guidelines for Landscape and Visual Assessment 3rd Edition" (Landscape Institute and Institute of Environmental Management and Assessment 2013 [GLVIA3]). A desk study to establish the existing conditions, including the seascape, landscape and visual	SNH Commissioned report No. 103 (2005). SNH Commissioned Report No.215 (2007) SNH assessment report (Land Use Consultants, 1998) Orkney Local Development Plan (OIC, 2011)

Data gap	Methodology	Example data sources
	resources of the study area, and initial mapping of Zones of Theoretical Visibility (ZTVs) for the Project components. Field survey work, initially at strategic/reconnaissance level and later at detailed level, to verify the important seascape, landscape, and visual characteristics of the area highlighted by the desk study Consultation with Local Authority / stakeholders for identification of key seascape, landscape, and visual receptors.	

6.7.5 Impact Assessment Strategy

It is proposed that the following impact assessment strategy (Table 6.21) is applied to address the potentially significant impacts identified and those impacts for which the potential level of significance is unknown:

Table 6.21 Impact Assessment Strategy

Potential impact	Assessment topics	Assessment method	Relevant research
All	Key features, components and characteristics which determine the existing land and seascape and assessment of impacts during construction and operation.	SLVIA	Landscape Institute and IEMA (2013).

6.7.6 Possible Mitigation and Monitoring Measures

The following possible mitigation and monitoring measures (Table 6.22) will be considered during on-going EIA and project development activities:

Table 6.22 Possible Mitigation and Monitoring Measures

Potential impact	Approach to mitigation measures	Monitoring during installation	Post-deployment monitoring
All	Adherence to best practice (SNH, 2012) with respect to Layout and Design, and siting and Design (sections 5 and 6 respectively). Will include for sensitive design, siting and positioning of infrastructure Close consultation with relevant stakeholders during project design activities	To be determined through consultation and outcomes of SLVIA	To be determined through consultation and outcomes of SLVIA

6.8 Archaeology and Cultural Heritage

6.8.1 Introduction

The archaeological assessment will cover both marine and terrestrial archaeological features. The final assessment will also consider impacts upon the setting of archaeological features.

To date, initial consultation has taken place with Historic Scotland, following circulation of the PBD, which has informed this Scoping Report. Historic Scotland is responsible for nationally important onshore Scheduled Ancient Monuments and for the preservation of the marine archaeological resource within Scottish Territorial Waters (STW).

The installation of the tidal devices, cable routing, substation(s), and other ancillary works has the potential to cause damage to any features of archaeological significance located within the vicinity of the scheme.

6.8.2 Baseline

6.8.2.1 Marine Archaeology

Two wrecks listed in the National Monuments Records for wrecks lay within the AfL area, the *AASE* and the *Challenger* (Figure 6.9). Data provided by the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) identified a couple of National Monument Records for wrecks near Brims Ness and Tor Ness, the former, the *Neptunia*, lying 0.4km north of the AfL area and close to the cable landfall area of search, and the latter, the *Silanion*, 0.8km of the AfL area. Several other wrecks are recorded within the Pentland, Firth and around Swona, Island of Stroma and Dunnet Head.

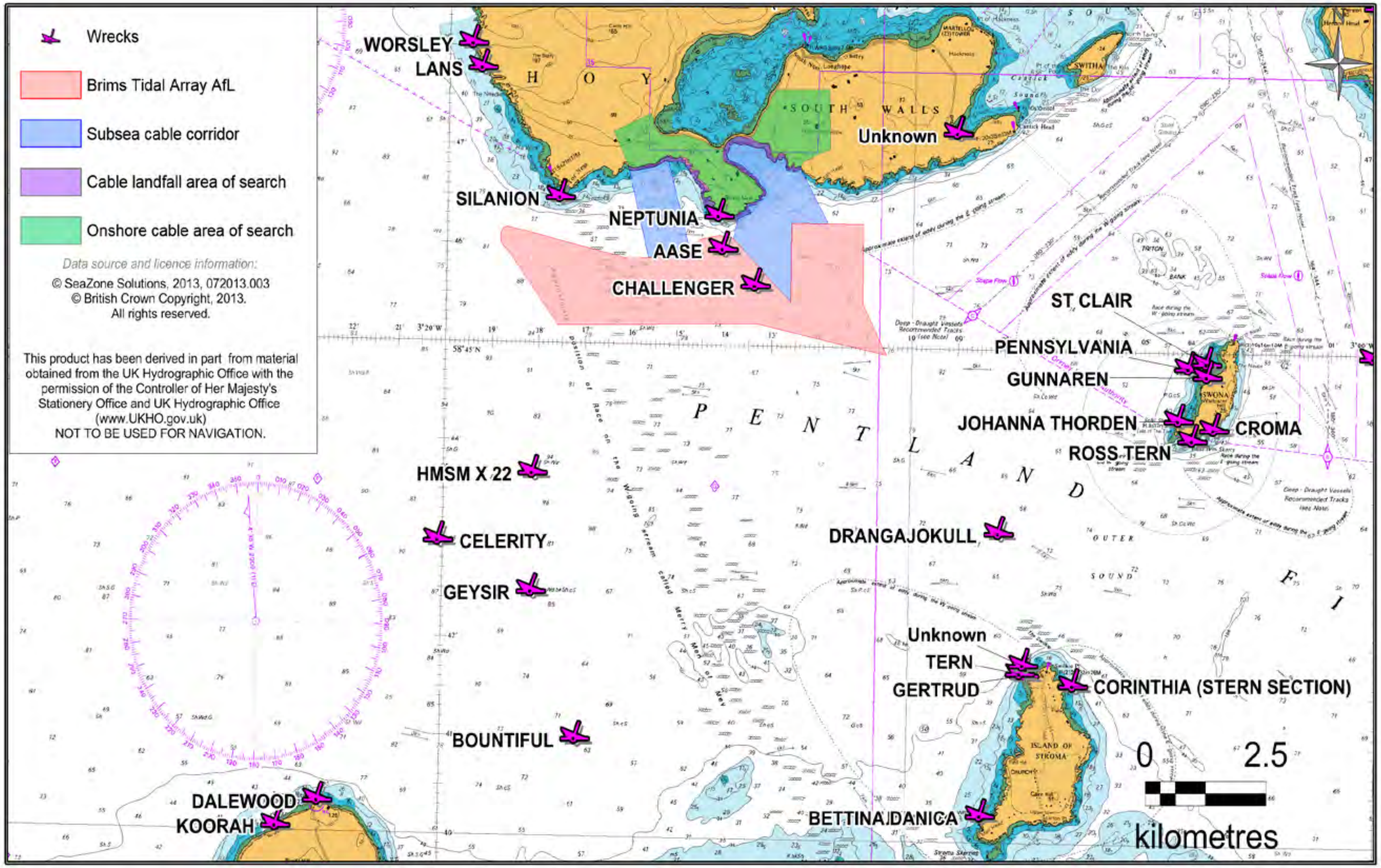


Figure 6.9 Offshore archaeology in the vicinity of the search area

The high energy marine environment found within the Pentland Firth is not conducive to the conservation of wrecks and it is likely that wrecks located across much of the study area would be rapidly broken up and dispersed. However, there is potential for wrecks to persist in more sheltered areas along a potential export cable route. Identification of potential development sites and cable routes will avoid known wreck locations.

In response to initial consultation on another tidal project, the Westray South Tidal Array (a project being undertaken by the developer SSE Renewables Developments (UK) Limited), Orkney Island Council identified the greatest potential for archaeology was in inundated bays, anticipating that coastal areas around all bays will have been inhabited at some point in the Norse period. This information is also applicable to the Project, since it is in the same geographical area.

There is potential for submerged landscapes (archaeological sites on the seabed following sea level rise since the last ice age) to persist within Orkney waters, with the potential greatly reduced in areas that experience high tidal current. Consultation with the County Archaeologist has identified the potential for these features in 5m or less in depth, and the retention of potential depends on the depositional and erosional history of the seabed and will vary from place to place. In deeper waters the sea bed has potential to contain information related to the post-glacial inundation of Orkney.

6.8.2.2 Onshore Archaeology

Data held by the RCAHMS show that over an area incorporating the whole of the island of Hoy and the waters south of it into the Pentland Firth, there are 26 Scheduled Monuments, over 100 Listed Buildings and National Monument Records, 11 Scottish Sites and Monuments Records, and 1 Garden and Designed Landscape Record. Further unknown sites may also be present (Figure 6.10). The Heart of Neolithic Orkney World Heritage Site was designated by UNESCO in 1999, incorporating a group of Neolithic monuments on Orkney. As tourism is a mainstay of the Orkney Islands' economy, the setting of archaeological sites is important and is a consideration under both Scottish Planning Policy (SPP) and Planning Advise note (PAN) 2/2011 in particular.

.

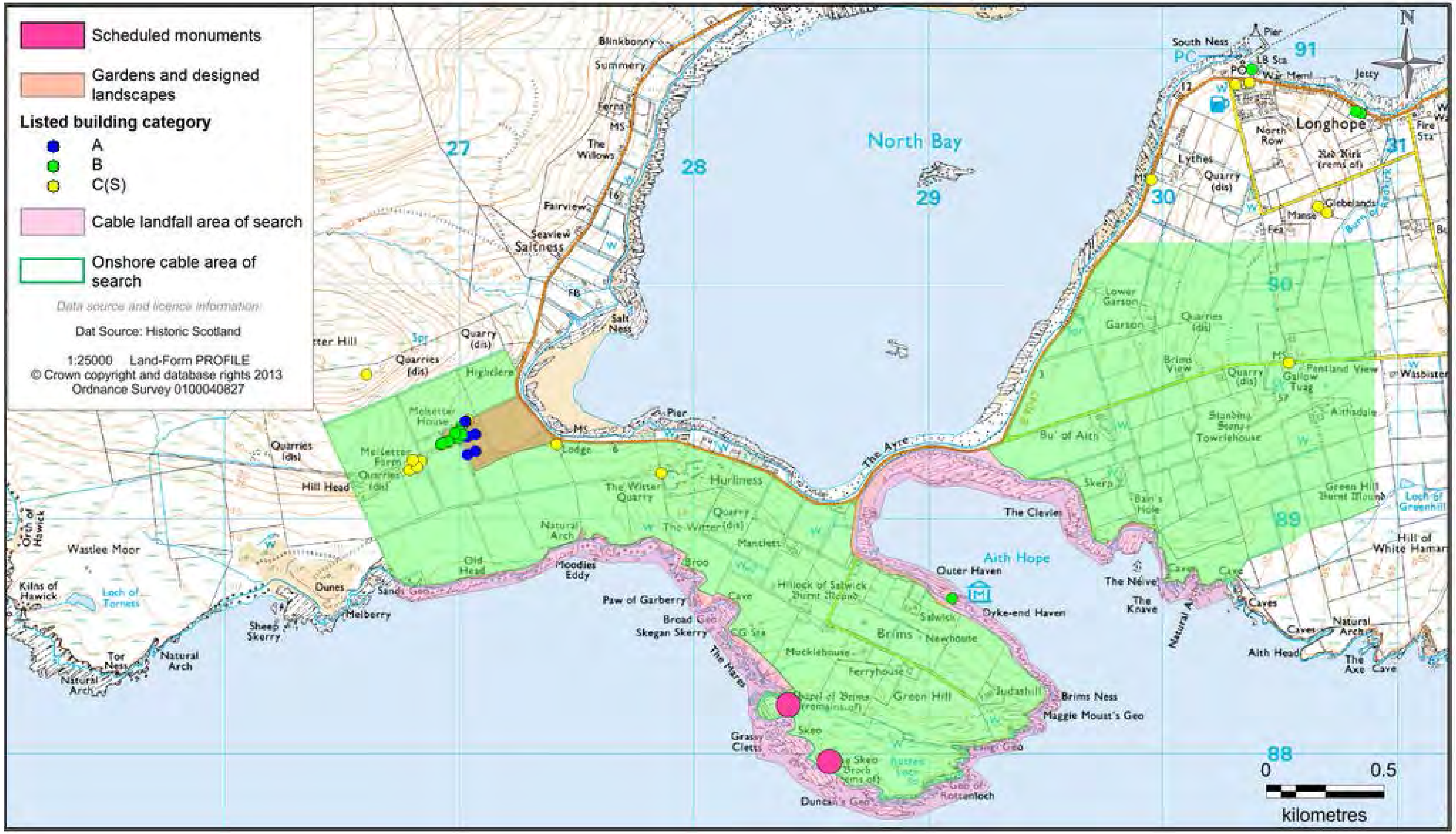


Figure 6.10 Onshore archaeology in the vicinity of the search area

6.8.3 Potential Impacts

Possible impacts along with their potential significance on archaeology and cultural heritage are considered in Table 6.23 below:

Table 6.23 Potential Impacts Identified During Construction, Operation and Decommissioning.

Potential impact	Phase	Anticipated significance	Comment
Physical disturbance of submerged historic and prehistoric land surfaces and archaeological finds (known and unknown)	Construction, decommissioning	Potential significance of impact unknown	Potential known and unknown features within the development footprint may be disturbed during construction and decommissioning activities
Physical disturbance of terrestrial (onshore) sites and finds (known and unknown)	Construction, decommissioning	Potential significance of impact unknown	Potential known and unknown features within the development footprint may be disturbed during construction and decommissioning activities
Direct disturbance to the visual setting of Scheduled Monuments and effects on historic landscape character (both within and	Construction and operation	Potential significance of impact unknown	Construction activities, permanent surface piercing structures and overhead power cables may lead to impact on

Potential impact	Phase	Anticipated significance	Comment
outwith the areas of search)			historic setting. Key viewpoints will need to be identified to enable assessment to be completed
Indirect disturbance of submerged historic and prehistoric land surfaces and archaeological finds as a result of changes to the hydraulic and sedimentary regime	Operation	Potential significance of impact unknown	Depends on location of historic features and predicted change to regime

6.8.4 Baseline Characterisation Strategy

Possible impacts along with the potential significance of effect on archaeology and cultural heritage are considered in Table 6.24 below:

Table 6.24 Baseline Characterisation Strategy.

Data gap	Methodology	Example data sources
Assessment of current records	Archaeological desk-based assessment (ADBA) using relevant guidance e.g. Institute of Archaeologists (2012). This will: Identify the known and potential archaeological resource in both terrestrial and marine	Consultation with Scottish Natural Heritage, Historic Scotland, and the Local Council Archaeological Service Sites and Monuments Record; NMR, UKHO, Receiver of Wreck, BGS boreholes, historic maps,

Data gap	Methodology	Example data sources
	environments; Evaluate the importance of the sites that could be affected by the proposed scheme; Consider the visual impacts of the proposed scheme on the key heritage resource within the Area of Search (including Scheduled Monuments and Historic Landscape Character); Identify, in detail, past impacts on the Area of Search; Undertake a detailed assessment of the potential impacts of the proposed scheme on archaeological features; and Identify the nature of any further work/surveys that may be required to fill any data gaps Site walkovers, including an inspection of historic assets that may be visually impacted by the development (may include sites outside the proposed development) Consultation with relevant stakeholders	additional relevant sources. The results of all archaeological assessments will be archived through the Royal Commission on the Ancient and Historical Monuments of Scotland Joint Nautical Archaeology Policy Committee (JNAPC) Code of Practice for Seabed Development The Crown Estate Protocol for Archaeological Discoveries COWRIE Historic Environment Guidance for the Offshore Renewable Energy Sector COWRIE Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy Offshore Geotechnical investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector
Review of existing bathymetric and geophysical data in the Area of Search.	Desk review for anomalies and other indicators of archaeological interest by marine archaeologist Analysis of magnetometer and sub-bottom profiling data (where available)	Survey of Area of Search, and reference to the guidelines identified in ‘Historic Environment Guidance for the Offshore Renewable Energy Sector’ (Wessex Archaeology Ltd, 2007) and ‘Offshore Geotechnical

Data gap	Methodology	Example data sources
		Investigations and Historic Environment Analysis' (Gribble and Leather, 2011)
Review of local planning policy	Desk review of policies relevant to archaeological features.	OIC Local Development Plan (2012)

6.8.5 Impact Assessment Strategy

It is proposed that the following impact assessment strategy, Table 6.25 below, is applied to address the potentially significant impacts identified and those impacts for which the potential level of significance is unknown:[10]

Table 6.25 Impact Assessment Strategy

Potential impact	Assessment topics	Assessment method	Relevant research
Physical disturbance of submerged historic and prehistoric land surfaces and archaeological finds (known and unknown) Physical disturbance of terrestrial (onshore) sites and finds (known and unknown) Indirect disturbance of submerged historic and prehistoric land surfaces and archaeological finds as a result of changes to the hydraulic and sedimentary regime	As far as possible determine presence of indefinable features within onshore cable corridor, assessing importance of features, assess potential for submerged features within development	Desk reviews, reviews of bathymetric and geophysical data, stakeholder consultation, assessment of features, site walk overs, potential for further surveys such as tidal excavations, depending on outcomes of ADBA and consultation. Outcomes of ADBA to determine level of	Historic Scotland Guidance Note on setting (Scottish Government, 2011) Consultation with: Historic Scotland; Council Archaeology Service; Joint Nautical Archaeology Policy Committee (JNAPC); and Receiver of Wreck. Orkney Local Development Plan (Orkney Island Council 2012)

[10] http://www.historic-scotland.gov.uk/setting-2.pdf

Potential impact	Assessment topics	Assessment method	Relevant research
	footprint, landfall(s) and offshore cable route	further work required e.g. excavations or analysis of marine engineering cores etc. Consideration of anchoring methods for assessment of likely impacts on unknown features	
Direct disturbance to the visual setting of Scheduled Monuments and effects on historic landscape character	Consultation and assessment of features	Liaison with Historic Scotland and the EIA landscape architects in order to identify key views that will need to be assessed in terms of potential disturbance on setting	

6.8.6 Mitigation and Monitoring Strategy

The following possible mitigation and m onitoring measures, Table 6.26 below, will be considered during on-going EIA and project development activities:

Table 6.26 Mitigation and Monitoring Strategy

Potential impact	Approach to Mitigation measures	Monitoring during installation (validating predictions)	Post-deployment monitoring (measuring impacts)
All impacts	Assessment of features, avoidance	To be determined from ADBA, may	To be determined from ADBA

	where possible of significant /sensitive / scheduled features, through consultation and iterative design, including micro-siting of structures.	include archaeological watching briefs during construction	

6.9 Ministry of Defence (MOD) Areas

6.9.1 Baseline

Scotland's coastal areas and seas are used for military training, surveillance and monitoring of potential threats, locating bases as well as testing and evaluation activities.

The map below (Figure 6.11) indicates key military training areas, military danger areas (MDA) in the North of Scotland. The military danger area (MDA) is a military practice zone for high altitude Royal Air Force (RAF) training exercises. The MDA is also utilised by the Royal Navy for navigational and patrolling exercises. In addition the MDA is home to the Cape Wrath Military training area (CWMTA). CWMTA is the only range in Europe where land, sea and air training activities can be conducted simultaneously and where the RAF can train using live 1,000lb bombs.

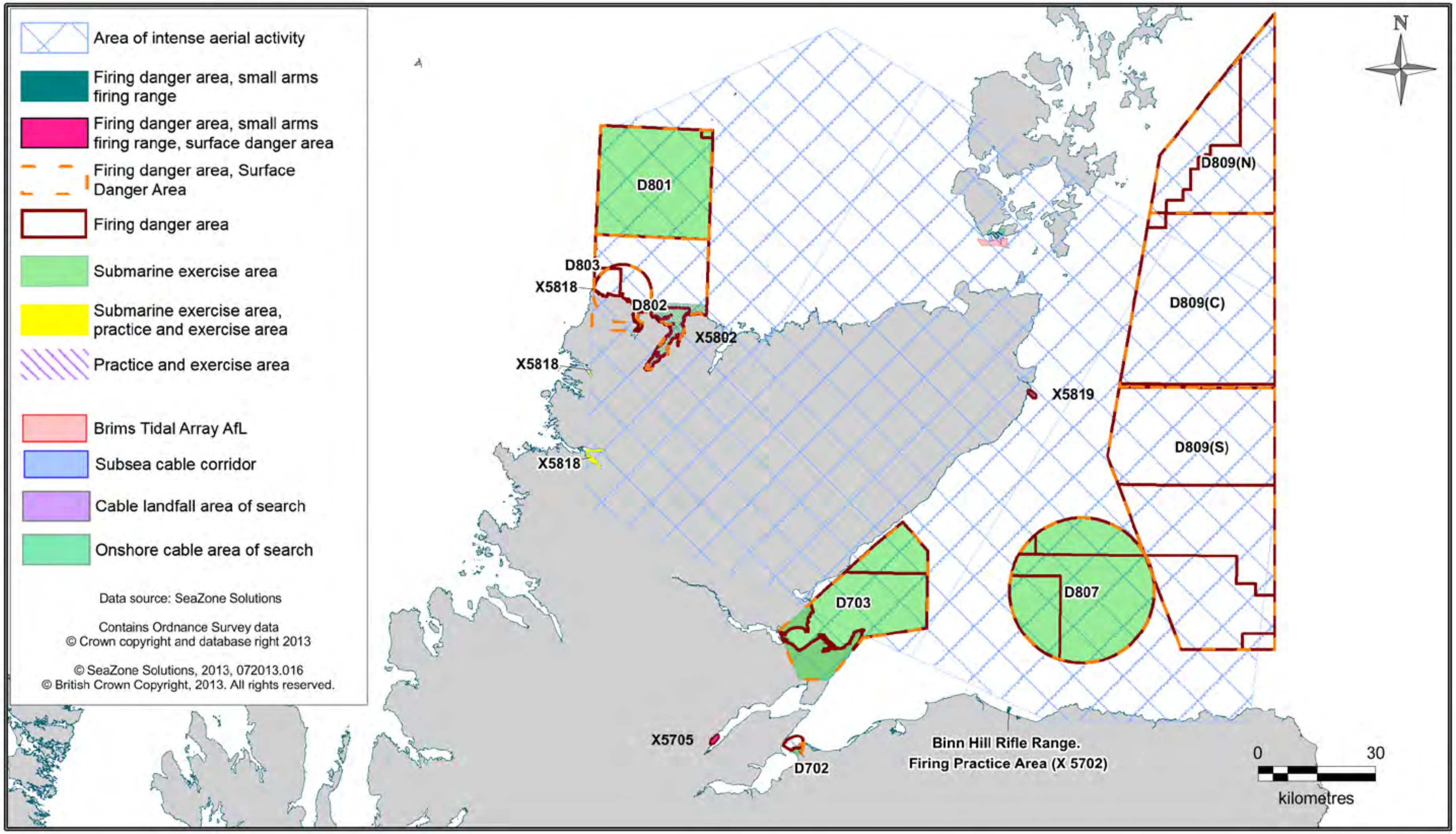


Figure 6.11 Military Danger Areas (MDA)

Interactions with military vessel activity with regards to general rights of navigation will be addressed in the project specific NRA.

6.9.2 Potential impacts

Possible impacts along with the potential significance of effect on MOD areas and activities are considered in Table 6.27 below:

Table 6.27 Potential Impacts on MOD Areas

Potential impact	Phase	Potential significance	Comment
Disruption to surface ships	All	Potential significance unknown	As shown in Figure 6.11 the Area of Search lies within the MDA. Surface piercing structures may affect existing activities.
Disruption to submarine activity	All	Potential significance unknown	As shown in Figure 6.11 the Area of Search lies within the MDA. Structures placed on the seabed, in the water column and at the surface may affect existing activities.
Disruption to airborne activity	All	Potential significance unknown	Fixed winged aircraft flying at high altitude will not be affected by the proposals. Rotary winged aircraft flying at low altitude during military training exercises may be affected by surface piercing structures.
Disruption to land based activity	All	Nil	No activities will be taking place on MOD land

6.9.3 Impact assessment strategy

It is proposed that baseline conditions regarding MOD areas and activities can be further defined to sufficient detail by completing the tasks outlined in Table 6.28 below:

Table 6.28 Baseline Characterisation Strategy

Data gap	Methodology	Example data sources
Disruption to surface ships	Consultation with MOD	TBC – It is anticipated that information regarding vessel movement will be classified and therefore accurate information will be unattainable
Disruption to submarine activity	Consultation with MOD	Information regarding vessel movement will be classified and therefore accurate information will be unattainable
Disruption to airborne activity	Consultation with MOD: RAF Lossiemouth	TBC – It is anticipated that information regarding aircraft movement will be classified and therefore accurate information will be unattainable

6.9.4 Impact Assessment Strategy

It is proposed that the following impact assessment strategy (Table 6.29) is applied to address the potentially significant impacts identified and those impacts for which the potential level of significance is unknown.

Table 6.29 Impact Assessment Strategy

Potential impact	Assessment topics	Assessment method	Relevant Research
Disruption to surface ships	Level of possible disruption to existing MOD activities	Consultation with the MOD to identify use patterns, identify and assess level of potential impact and risk	N/A
Disruption to submarine activity			
Disruption to airborne activity			

6.9.5 Possible Mitigation and Monitoring Measures

The following possible mitigation and monitoring measures (Table 6.30 below) will be considered during on-going EIA and project development activities:

Table 6.30 Possible Mitigation and Monitoring Measures

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
Disruption to surface ships	AfL and devices marked on navigational charts AfL and devices correctly marked as per Northern Light House Board regulations	No monitoring required however continued liaison with the MOD should be maintain pre- and post-installation	
Disruption to submarine activity	AfL and devices marked on navigational charts AfL and devices correctly marked as per Northern Light House Board regulations	No monitoring required however continued liaison with the MOD should be maintain pre- and post-installation	
Disruption to airborne activity	AfL and devices marked on navigational charts AfL and devices correctly marked as per Northern Light House Board regulations	No monitoring required however continued liaison with the MOD should be maintain pre- and post-installation	

6.10 Aviation

6.10.1 Baseline

Commercial air services to all major Scottish city airports, including Sumburgh, Inverness, Glasgow, Edinburgh and Aberdeen, are available from Kirkwall Airport, Orkney. Aircraft of these services may be routed over the AfL area. There are also inter-island flights from Kirkwall to the Northern Isles of Orkney including: Stronsay, Sanday, Eday, North Ronaldsay, Westray and Papa Westray but these flights will not transit the Area of Search.

In addition to commercial services there are also a number of privately owned aircraft that may overfly the area. Rotary winged aviation may also transit the area on route to North Sea Oil Platforms and the Flotta Oil Terminal.

The routing of long distance international air services may on occasion transit the AfL area at high altitude.

Helicopters may be used occasionally to transfer personnel to and from the AfL area but this is unlikely to cause a significant impact on aviation.

6.10.2 Potential Impacts

Possible impacts along with the potential significance of effect on aviation are considered in Table 6.31 below:

Table 6.31 Potential Impacts on Aviation

Potential impact	Phase	Potential significance	Comment
Disruption to aviation	All phases	No impact	Occasional use of helicopters for personnel transfer. There is no mechanism for impact on aviation arising from the proposals. The highest structure will be any offshore substation constructed.
Increased use	Operation and	Effect unlikely	Helicopters may occasionally be used

Potential impact	Phase	Potential significance	Comment
of local airport facilities	maintenance	to be significant	to transfer personnel to and from offshore hubs should they be used. These occurrences are likely to be rare and involve single helicopters. Kirkwall airport currently estimates that it receives 5-6 helicopter flights per month (personal communication, David Berston: Kirkwall Airport Manager, 16th Aug 2013). This number can increase if other airports in Northern Scotland experience inclement weather conditions. It is therefore expected that any nominal increase in activity will result in negligible impact on local services.

No potentially significant impacts have been identified and aviation is therefore, scoped out of the EIA.

6.11 Recreation

The following baseline description of recreation within the AfL and surrounding area is split into onshore and offshore. It is proposed that this format will be reflected in the ES.

6.11.1 Onshore Recreation

The scenery, coastline, history and wildlife of Orkney provide a major focus for much of the outdoor recreation in the county. Angling is a popular activity with a num ber of well-established local clubs fishing lochs and burns, particularly for trout. There is a wide variety of sports clubs with leagues and p ractices continuing through the year. Clubs and associations for wildlife, archaeology and phot ography also exist, although much of the recreation in Orkney, such as walking and sightseeing is undertaken on an informal basis. Art is also an activity undertaken in Orkney.

It can be assumed that most areas are used for at least one type of recreation and that user groups will exist for most sites in Orkney.

The Islands also have an established coastal footpaths network implemented by OIC as part of the Core Paths initiative. Those close to the proposed Area of Search are shown in Figure 6.12.

Figure 6.12 OIC Core Paths in Hoy and South Walls

6.11.2 Offshore Recreation

The waters around Orkney are regularly utilised for various types of recreation; particularly sailing, sea kayaking, surfing, kite boarding, angling, diving, power boating and other boat based activities. Sailing, diving and angling are important contributors to the local economy and draw large numbers of visitors to the islands throughout the year.

There are three marinas in Orkney (Kirkwall, Stromness and Westray) and two on the north coast of Scotland (Scrabster and Wick). All are popular with visiting and local boats (particularly yachts) and it is common for vessels to travel between them. There are two Royal Yachting Association (RYA) light recreational cruising routes between Scrabster and Stromness and one RYA medium recreational cruising route between Wick and Stromness (Baxter *et al*., 2011). One of the light recreational routes between Scrabster and Stromness (via Scapa Flow) passes to the south east of the AfL.

Additionally the AfL is located adjacent to, but not within, an RYA sailing area (Figure 6.13). However it is reasonable to assume that recreation craft deviate from the RYA recreational cruising routes.

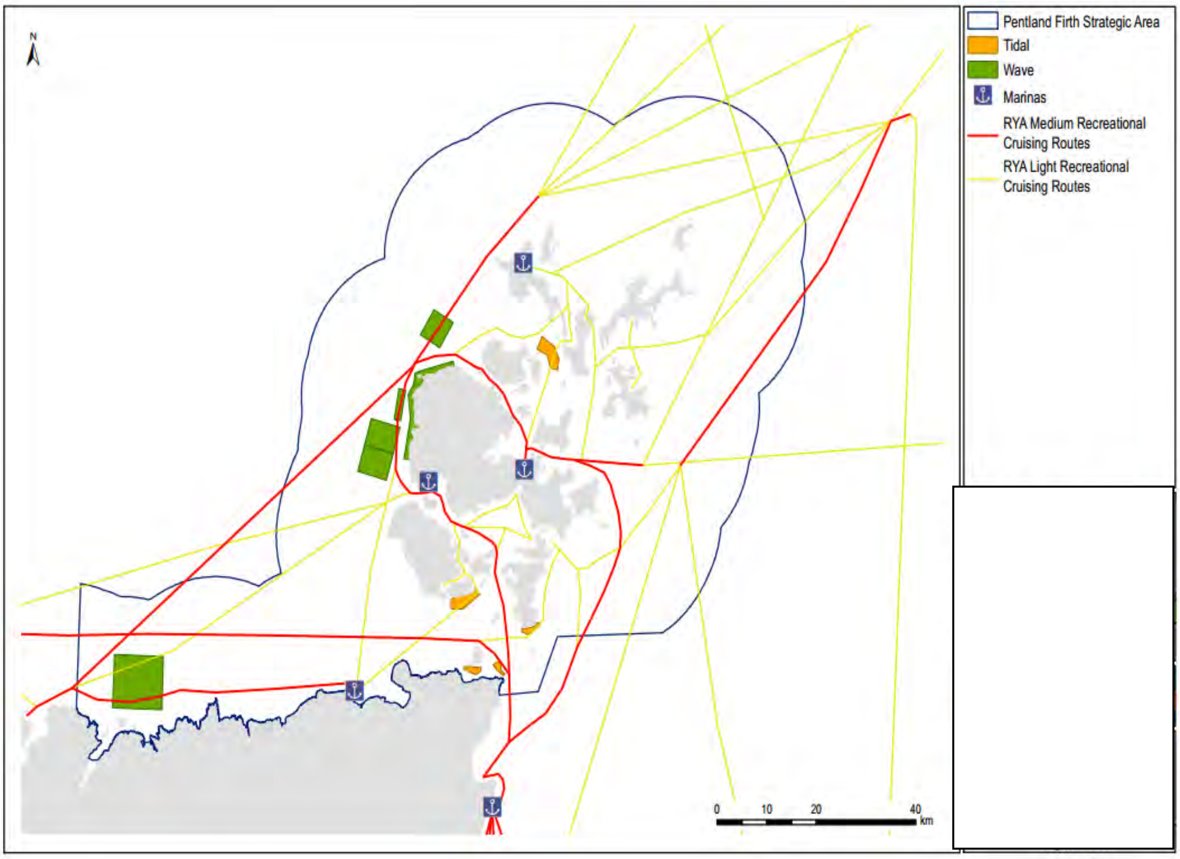
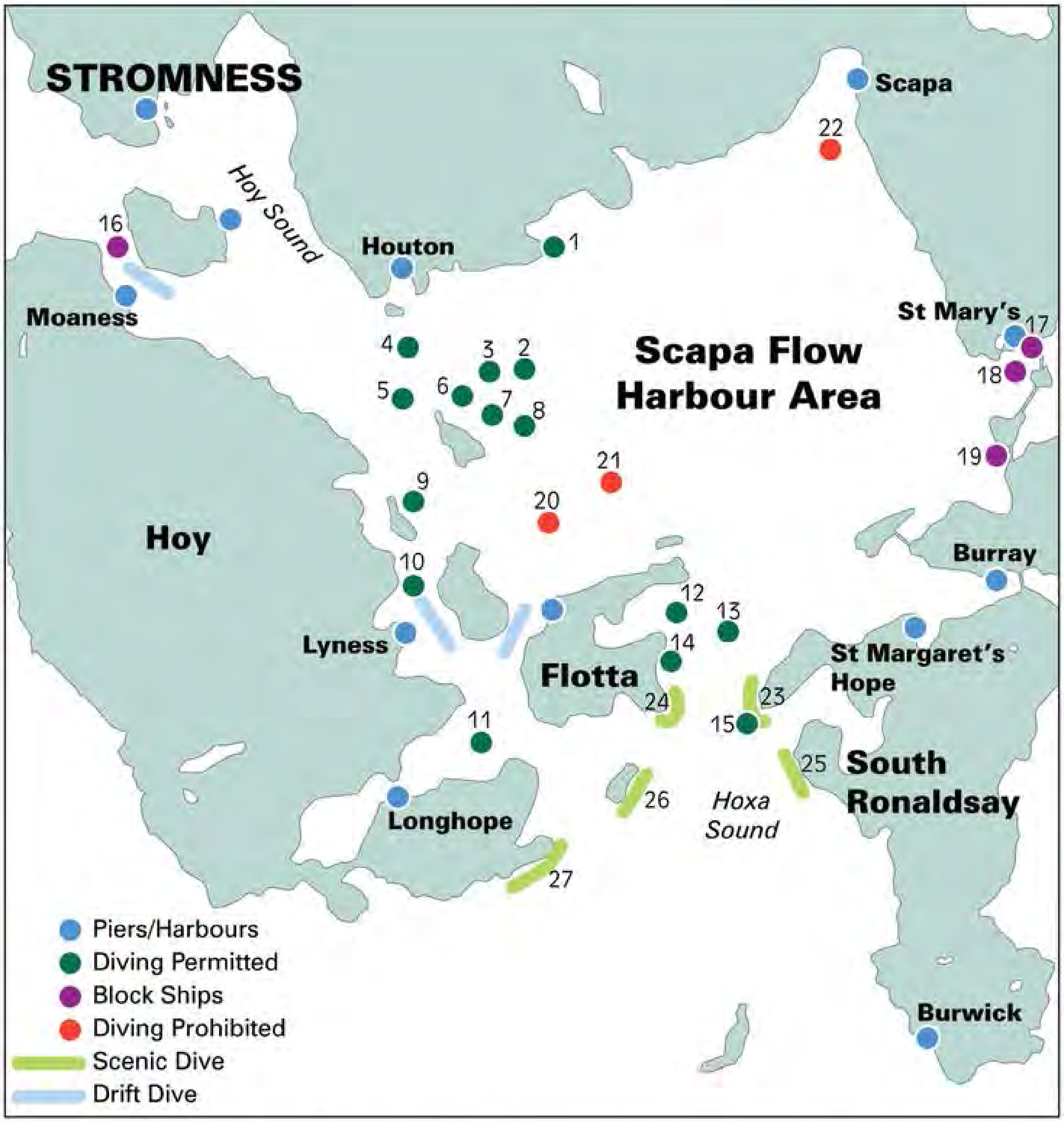


Figure 6.13 RYA Cruising Routes in the Pentland FirthStrategic Area (Image Source ABPmer, 2012)

Most recreational diving in Orkney occurs in Scapa Flow around wreck sites. However, information provided by Orkney Island Council (presented in Figure 6.14), indicates that Cantick Head, to the east of the AfL area, is a scenic dive site. Following liaison with local dive boat operators it can be concluded that neither Switha nor Cantick Head have been regularly dived in recent years and the preferred dive spot in the area is off Stranger Head on Flotta.

It is anticipated that very little in the way of surfing, kite boarding, kayaking or recreational offshore fishing (including sea angling) is conducted in the vicinity of the AfL due to local hydrographic conditions and the risks associated with the marine environment in this highly dynamic area. The level of recreational activity in and around the AfL will be further determined through consultation with the relevant local groups and associations. Dive sites are shown in Figure 6.14.



Diving Permitted
1 Bremse
2 Koln
3 Brummer
4 Bayern gun turret
5 Karlsrhue
6 Kronprinz & Markgraf
7 Konig
8 Dresden
9 V83
10 F2 & YC21
11 Rodean
12 UB116
13 Strathgarry
14 S54
15 James Barrie

Block Ships
16 Gobenador Bories
Inverlane
Tabarka
Doyle
17 Thames
18 Rosewood
19 Gartshore
Empire Seaman
Martis

Diving Prohibited
20 Pridentia
21 Vanguard
22 Royal Oak

Scenic Dives
23 Hoxa Head
24 Stanger Head
25 Herston Head
26 Switha
27 Cantick Head

Figure 6.14 Dive sites (image source: OIC Marine Services, undated)

6.11.3 Potential Impacts

Possible impacts along with the potential significance of effect on recreation are considered in Table 6.32 below:

Table 6.32 Potential Impacts on Recreational Activities

Potential impact	Phase	Potential significance	Comment
Disturbance to offshore recreation activities during construction and maintenance works offshore	All	Potential significance of impact unknown	The level of usage of the AfL by recreational vessels is currently unknown. Any new structures at or above the surface will pose a potential risk to passing vessels.
Disturbance to onshore recreation during onshore construction works and afterwards from presence of overhead power cables or surface piercing structures	All	Potential significance of impact unknown	The Cable Corridor Area of Search has some recreational value; be it as a walking destination, visual amenity or other use. Therefore, the potential significance of the effects of erecting any structures, such as overhead power cables within the proposed areas will be considered within the ES.

6.11.4 Baseline Characterisation Strategy

It is proposed that baseline conditions regarding recreation can be further defined to sufficient detail by completing the tasks outlined in Table 6.33 below:

Table 6.33 Baseline Characterisation Strategy

Data gap	Methodology	Example data sources
Establish uses and levels of activity within and around the AfL	Discussions with local sailors and sea users. Radar data collected during 4	key activity groups and clubs and stakeholders, including sailing, sea angling,

Data gap	Methodology	Example data sources
area.	weeks of survey as part of the NRA	kayaking, diving
Establish uses and levels of activity within and around the Cable Landfall Area of Search, and Cable Corridor Area of Search.	Discussions with local landowners, community groups, activity groups and tourism groups	Landowners Orkney Tourism Association Visit Scotland Community councils Orkney Field Club Orkney Archaeological Trust

6.11.5 Impact Assessment Strategy

It is proposed that the following impact assessment strategy, Table 6.34 below, is applied to address the potentially significant impacts identified and those impacts for which the potential level of significance is unknown:

Table 6.34 Impact Assessment Strategy

Potential impact	Assessment topics	Assessment method	Relevant research
Disturbance to offshore recreation activities during offshore construction and afterwards	Impact on recreational vessels. Interference with wave and tidal conditions. Re-routing through less favourable sea areas. Impact on activities such as diving from any ongoing restrictions.	NRA to examine possible impact scenarios and associated consequences	Influence of devices on wave and tidal conditions
Disturbance to onshore recreation during onshore construction works	Visual disturbance, noise, dust, restricted access	Landscape and visibility assessment, noise assessment, detailed route and site planning	None

and afterwards from presence of overhead power cables or surface piercing structures			

6.11.6 Possible Mitigation and Monitoring Measures

The following possible mitigation and monitoring measures, Table 6.35 below, will be considered during future on-going EIA and project development activities:

Table 6.35 Potential Impacts, Mitigation and Monitoring Measures

Potential impact	Mitigation measures	Monitoring during installation (validating predictions)	Post-deployment monitoring (measuring impacts)
Disturbance to offshore recreation activities during offshore works	Site design and subsea cable route selection will consider offshore recreation use patterns Vessel monitoring system (VMS) during construction periods will be considered and described in the NRA	None	None

Potential impact	Mitigation measures	Monitoring during installation (validating predictions)	Post-deployment monitoring (measuring impacts)
Disturbance to onshore recreation during onshore construction works and afterwards from presence of overhead power cables or surface piercing structures	Site design and onshore cable route selection will consider onshore recreation use patterns	None	None

6.12 Tourism

6.12.1 Baseline

Tourism is a mainstay industry in Orkney employing approximately 6% of the local workforce in 2008 (around 1,000 jobs). Orkney received approximately 141,000 visitors in the period 2008/09 with an estimated spend of £31,822,917 (ABP associates, 2010).

Recreational visitors travel to Orkney for a number of reasons, however, by far the most popular reasons for travel was sightseeing or touring (53%) and to enjoy the coastal scenery and beaches. Approximately 12% of visitors also stated walking as their main reason to visit the Islands. 14% of holiday makers to the Islands cited archaeology and prehistoric sites as their main motivation for travel followed by 8% who said they were visiting the Islands due to the remoteness of the area and the wilderness experience (ABP Associates 2010).

Orkney also receives visits from a large number of cruise liners throughout the year; in 2009 it was estimated that 45,500 cruise line visitors berthed at Hatston Pier. On average Orkney receives 75 cruise ships per year contributing around £1.1 million pounds annually to the local economy (ABP Associates, 2010). In 2011 Kirkwall Orkney was voted best cruise liner destination in the UK by www.cruisecritics.co.uk.

6.12.2 Potential Impacts

Possible impacts along with the potential significance of effects on tourism are considered below in Table 3.36

Table 6.36 Potential Impacts on Tourism

Potential impact	Phase	Potential significance	Comment
Offshore - Industrialisation of the local seascape reducing tourists' visual amenity	All	Potential significance of impact unknown	Increased vessel activity at the offshore site and along cable routes during construction, within the context of existing shipping and marine energy related vessel activity in the area, is unlikely to

Potential impact	Phase	Potential significance	Comment
			have a significant effect. Vessel presence during operation and maintenance and decommissioning is likely to be minimal and of a temporary nature. The impact of any permanent surface piercing structures should be determined.
Onshore - Industrialisation of the local landscape reducing tourists' visual amenity	All	Potential significance of impact unknown	The installation and sustained presence of any substation and overhead grid infrastructure may reduce the visual amenity associated with an area.
Increased pressure on local temporary accommodation	Construction and installation	Potential significance of impact unknown	Increased personnel in Orkney, particularly during the construction phase, may put increased pressure on temporary accommodation, reducing availability for tourists during summer months when construction activities are planned.
Additional topic of interest creating new draw for tourists	All	Beneficial	There is already significant interest in the renewables industry in Orkney and it is reasonable to assume that the industry may be a key area of interest for some visitors to the Islands. A project of this scale may contribute to this.

6.12.3 Baseline Characterisation Strategy

It is proposed that baseline conditions regarding tourism can be further defined to sufficient detail by completing the tasks outlined in Table 6.37 below:

Table 6.37 Baseline Characterisation Strategy

Data Gap	Methodology	Example Data Source
Establish existing levels and types of tourism in the local area	Desk based analysis of available data	OIC Visit Scotland Community Councils SNH
Identify key tourist locations, user levels and patterns	Map areas / resources of key importance to tourism industry	Orkney Island Council Visit Scotland

6.12.4 Impact Assessment Strategy

It is proposed that the following impact assessment strategy, Table 6.38 below, is applied to address the potentially significant impacts identified and those impacts for which the potential level of significance is unknown:

Table 6.38 Impact Assessment Strategy

Potential impact	Assessment topics	Assessment method	Relevant research
Offshore - Industrialisation of the local seascape reducing tourists' visual amenity	Refer to Section 6.7: Seascape and landscape	Refer to Section 6.7: Seascape and landscape	None
Industrialisation of the local landscape reducing tourists'	Refer to Section 6.7: Seascape and landscape	Refer to Section 6.7: Seascape and landscape	None

Potential impact	Assessment topics	Assessment method	Relevant research
visual amenity			
Increased pressure on local temporary accommodation	Establish the requirements of existing and planned developments in the wider area	Capacity assessment for different scenarios based upon phase and pace of development	None

6.12.5 Possible Mitigation and Monitoring Measures

The following possible mitigation and monitoring measures, Table 6.39 below, will be considered during future ongoing EIA and project development activities:

Table 6.39 Possible Mitigation and Monitoring Measures

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
Offshore - Industrialisation of the local seascape reducing tourists' visual amenity	None proposed	None proposed	None proposed
Industrialisation of the local landscape reducing tourists' visual amenity	None proposed	None proposed	None proposed
Increased pressure on local temporary accommodation	BTAL will investigate the potential for suitable temporary accommodation prior to construction to avoid conflict with tourism	None proposed	None proposed

6.13 Onshore Traffic

6.13.1 Introduction

Possible transport infrastructure links are examined as key routes for material and people to the site as well as a potential receptor for impacts to the existing transport network.

6.13.2 Baseline

6.13.2.1 Road Network

There are no trunk roads on Orkney. Several A–roads connect the main towns / villages with B-road branches connecting smaller settlements and houses to the network.

Transportation of material and people to the site will, where possible, use the main roads although for certain parts of the grid connection route the use of B-roads and unclassified roads may also be necessary, depending on the final route chosen.

There are no designated trunk roads on the Orkney mainland however the arterial route that crosses the island East to West (A965) is of a sufficient grade to provide an adequate route for any plant or heavy goods vehicle associated with the Project. The A964 will also provide a key transit route for plant and heavy goods vehicles transiting from ports in Stromness and Kirkwall to the Houton ferry terminal that connects the Orkney mainland to the port of Lyness on Hoy.

The road network on the Island of Hoy and in particular on the Island of South Walls area is limited. The highest grade road on Hoy is the B9047. The B9047 starts in Linksness; a settlement in NE of Hoy and terminates in Longhope, a coastal settlement on South Walls.

6.13.2.2 Onshore Traffic

Traffic information will be gathered during the EIA process from OIC and Transport Scotland and, if required, a field study will be conducted to determine traffic density on key routes in Hoy and South Walls. Studies will include peak traffic flows, annual average traffic flows and information on public transport networks serving the relevant areas.

6.13.3 Potential Impacts

Possible impacts along with the potential significance of effect on onshore transport are considered in Table 6.40 below:

Table 6.40 Potential Impacts on Onshore Traffic

Potential impact	Phase	Potential significance	Comment
Temporary increase in traffic	Construction	Potential significance of impact unknown	Possible sporadic temporary driver delay and community effects during construction, potential for construction traffic.
Road crossings	Construction	Effect unlikely to be significant	The grid connection route will potentially cross some roads. The height of any proposed lines will cause little or no disruption to normal conditions other than temporary disturbance during construction.
Movement of abnormal loads (cable drums, transformers etc)	Construction	Potential significance of impact unknown	Movement of abnormal loads may require Special Order authorisation under Section 44 of the 1988 Road Traffic Act. This will be addressed prior to construction.
Permanent increase in traffic during operation	Operation	Effect unlikely to be significant	TIA (traffic impact assessment) may be necessary but it is anticipated that standard road vehicles will be used in all operations associated with the onshore cable route construction activities.

6.13.4 Baseline Characterisation Strategy

It is proposed that baseline conditions regarding onshore transport can be further defined to sufficient detail by completing the tasks outlined in Table 6.41 below:

Table 6.41 Baseline Characterisation Strategy

Data gap	Methodology	Example data sources
Transport assessment for the cable corridor	Desk based review of data and assessment Peak and average traffic flows	OIC Transport Scotland Public Consultation Ordnance Survey

6.13.5 Impact Assessment Strategy

It is proposed that the following impact assessment strategy, Table 6.42 below, is applied to address the potentially significant impacts identified and those impacts for which the potential level of significance is unknown:

Table 6.42 Impact Assessment Strategy

Potential impact	Assessment topics	Assessment method	Relevant research
Temporary increase in traffic	Driver delay, Community effects	Using guidelines outlined in (Department of Transport et al., 1993; Institution of Highways and Transportation, 1994; and Institute of Environmental Assessment, 1993).	
Movement of abnormal loads	A separate assessment of the capacity of road to take abnormal loads will be undertaken	As above	

6.13.6 Possible Mitigation and Monitoring Measures

The following possible mitigation and m onitoring measures (Table 6.43 below) will be considered during future on-going EIA and project development activities:

Table 6.43 Possible Mitigation and Monitoring Measures

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
All changes to existing traffic regime	A traffic management plan (TMP) will be developed. The plan will be agreed with OIC in advance of construction. Temporary off road parking for contractors' vehicles will be provided at works compounds and at other suitable off-road sites along the route. Local residents will be kept informed of any potentially disruptive activities (such as delivery of abnormal loads, delays or diversions) and the actions being taken to mitigate the impact of these activities.	The contractor will be required as part of the TMP to monitor delays through and in proximity to the works and if any significant delays were identified to take account of this and programme activities to reduce the impacts on local traffic.	As for installation

It is proposed that Transport Scotland and OIC are consulted during the EIA to confirm that no additional actions are required and that there have been no significant changes to baseline conditions.

6.14 Shipping and Navigation

This section identifies the baseline, potential impacts and strategy for shipping and navigation. A Preliminary Hazard Analysis (PHA) has been completed Appendix C and is summarised in Section 10.

Non-navigational impacts for commercial fisheries, recreation and tourism receptors are discussed in Sections 6.2, 6.11 and 6.12 respectively.

6.14.1 Baseline

The Pentland Firth is an important international shipping route between the North Sea and the North Atlantic. It is particularly important for vessels transiting to and from Scapa Flow and the Flotta Oil Terminal, as well as passenger ferries transiting between Orkney and the Scottish Mainland. The surrounding inshore waters are also fished regularly by a number of local creel fishermen.

The Pentland Firth is a dynamic maritime passage with complex tidal currents, as well as often challenging surface conditions in certain weather conditions. The area is regularly utilised by a wide range of vessels from laden oil tankers to small creel boats and personal craft. Inshore areas are regularly fished (creeling), adding to the already challenging navigational profile of the area.

A wide range of vessel types transit the Pentland Firth and adjacent waters, including:

- Merchant vessels;
- Tankers;
- Fishing vessels (all types);
- Passenger vessels;
- Recreational craft;
- Lighthouse supply ships;
- Military craft ;
- Pilot craft ; and
- Lifeboat and coastguard.

Full details of shipping movements through the AfL and adjacent waters are presented in the PHA (Appendix C).

6.14.2 Potential Impacts

Possible impacts along with the potential significance of effect on shipping are considered in Table 6.44 below:

Table 6.44 Potential Impacts on Shipping and Navigation

Potential impact	Phase	Potential significance	Comment
Disruption to navigation created by devices or any required marine exclusion zone	Construction, operation, maintenance, decommissioning	Potential significance of effect unknown	Surface piercing structures may be required within the AfL including device support structures and offshore substations/platforms. Any subsurface structures will result in reduced underkeel clearance.
Disruption to navigation created by support vessels	Construction, operation, maintenance, decommissioning	Potential significance of effect unknown	Support vessels required during installation, maintenance and decommissioning will present additional obstacles to navigation.
Loss of or change to traditional navigation routes	Construction, operation, maintenance	Potential significance of effect unknown	Any potential changes to existing navigational routes will require careful management and consultation.

6.14.3 Baseline Characterisation Strategy

Baseline conditions regarding shipping and navigation will be further defined, to sufficient detail for assessment, by completing the tasks outlined in Table 6.44 below (for additional baseline characterisation measures, please refer to the PHA in Appendix C):

Table 6.44 Baseline Characterisation Strategy

Data gap	Methodology	Example data sources
Vessel traffic survey	A vessel traffic survey will be undertaken in line with the requirements of MGN 371 and DTI's Guidance on the Assessment of the Impact of Offshore Wind Farms (2004) as part of the NRA which will inform the wider EIA.	AIS VMS Feedback from local mariners Orkney Harbours VTS, Northern Lighthouse Board (NLB), MCA, Chamber of Shipping Harbour Master RYA, Royal National Lifeboat Institution (RNLI)
Fishing vessel movements	Discussions with key organisations and local fishermen	Local fishermen Orkney Fisheries Association (OFA) Scottish Fishermen's Federation (SFF) VMS, Orkney Harbours VTS
Recreational boating	Discussions with local recreation vessel operators, sailing clubs and Orkney Marinas	Orkney Marina's committee and members Local sailing clubs (Longhope, Stromness and Orkney Sailing Clubs) Orkney Harbours VTS RYA
Cruise liners	Discussions with promoters of cruise liner services and specific captains	OIC Marine Services Orkney Harbours VTS

6.14.4 Impact Assessment Strategy

The strategy for assessment of the potential impacts on shipping and navigation is outlined in Table 6.45 below. Note that any detailed methodologies are presented in the PHA in Appendix 3.

Table 6.45 Impact Assessment Strategy

Potential impact	Assessment topics	Assessment method	Relevant research
Disruption to navigation created by devices	Undertake a full NRA	Traffic survey Trajectory modelling for drifting ships Collision modelling Consequence assessment Plunge depth assessment	Failure rates in vessels The Crown Estate's Strategic Area Navigation Appraisal
Disruption to navigation created by support vessels	Undertake a full NRA		
Loss of or change to traditional navigation routes	Undertake a full NRA	Consultation with local seafarers	

6.14.5 Mitigation and Monitoring Strategy

Potential mitigation and monitoring measures are outlined in Table 6.46, below. These will be further considered during on-going EIA and project development activities (please refer to the PHA in Appendix C for further details):

Table 6.46 Potential Mitigation and Monitoring Measures

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
Disruption to navigation created by devices	Maximise potential keel clearance during device and support structure design and	Operational reporting	AIS surveillance VTS surveillance

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
	site layout		
	Marking and Lighting, Chart Depiction & Local Information Circulation. The sea room available for vessels will be investigated in the NRA and EIA once the layout has been developed and discussed with maritime stakeholders.	Operational reporting	AIS surveillance VTS surveillance
Disruption to navigation created by installation and support vessels	Consideration of the approach to installation, O&M and decommissioning to include minimisation of navigation disruption, including contingency plans	Operational reporting	AIS surveillance VTS surveillance
Loss or change to traditional safe passage routes	Early discussion and dialogue with local seafarers over plans. Establish any new regime in advance of the devices being installed	None	None

6.15 Questions

Questions for Reader
Q9. Are the studies proposed for assessment of effects on the human environment appropriate and complete for a) the preferred technology and b) the alternative technologies?

7 POSSIBLE IMPACTS ON THE ECOLOGICAL ENVIRONMENT

This chapter considers the potential impacts of the proposals on the following receptors:

- Birds;
- Marine mammals;
- Fish;
- Coastal and terrestrial communities; and
- Seabed communities.

An overview of the relevant baseline environment is provided for each along with the anticipated impacts, a baseline characterisation strategy, impact assessment strategy and where applicable, possible mitigation and monitoring measures.

7.1 Birds

7.1.1 Introduction

This section of the report discusses ornithology for both marine and terrestrial species. This section should be considered alongside Appendix B which identifies the Natura 2000 sites and qualifying features that may be affected based on a range of criteria. The potential effects on birds, including the qualifying species of Natura 2000 sites, the notified features of nationally designated sites and species of local importance are considered within this section.

7.1.2 Baseline Description

7.1.2.1 Natural Heritage Designations

There are several sites designated for their ornithological interests at European, national or local levels that could potentially be affected by the proposed development. The AfL partly overlaps the marine component of the Hoy Special Protection Area (SPA) designated for its internationally important populations of breeding seabirds (Table 7.1 and Figure 7.1). The Onshore Cable Corridor Area of Search is outwith any sites of European or national importance however there are several LNCSs within this area.

7.1.2.2 Internationally Designated Sites – SPAs and Ramsar sites

All SPAs that have qualifying features that could potentially be affected by the proposed development identified by the HRA screening process (see Appendix B) are listed in Table 7.1 and their locations shown in Figure 7.1. There are no Ramsar sites with qualifying features that could potentially be affected by the proposed development.

The HRA screening method follows the procedure recommended by SNH and combines information on theoretical connectivity (based on seabird foraging range meta-data), sensitivity to potential impacts (Furness *et al*. 2012) and occurrence of a species in the anticipated impact footprint (as shown by results from the on-going baseline survey programme) to determine if there is potential for an SPA qualifying feature to be affected. Using the HRA terminology, SPA qualifying features that are screened in are concluded assumed to be subject to a potential LSE from the proposed development. Whilst the screening method recommended by SNH has been followed and HRA terminology adopted, it is worth pointing out that the screening process is highly cautious and that many of the potential LSEs on qualifying features identified are unlikely to be concluded as having significant effects on SPA conservation objectives when considered in greater detail (i.e. when examined through Appropriate Assessment.)

With regard to the AfL area, the screening process identified that there is potential for 29 SPAs to be affected, and that in all cases those SPAs are designated for their breeding seabird interests. Information on the SPAs screened and which qualifying features could potentially be subject to a LSE is summarised in Table 7.1.

For the Onshore Cable Corridor Area of Search, Switha SPA designated for its wintering population of Greenland barnacle goose *Branta leucopsis* has been screened in to the assessment as this species is known to forage in fields in South Walls, within and surrounding the Onshore Cable Corridor Area of Search. The issue of wintering Greenland barnacle geese in South Walls was raised during consultation by SNH as a matter requiring further consideration. A desk-based assessment was carried out to collate historical data on the abundance and distribution of wintering Greenland barnacle geese in South Walls. The findings of this assessment will be used to assess the potential impacts of the proposed development on this species and recommendations will be fed into the project design.

Table 7.1 Summary of Ornithology Internationally Designated Sites with Features with a Likely Significant Effect from the Proposed Project AfL Area. Screening is Based on Theoretical Connectivity, Vulnerability to Tidal Arrays and a Species' Use of the Area of Interest - Full Details of all Screened SPAs are Detailed in Appendix B

Designated site	Distance (km)	Qualifying species	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest
	By sea		Method 1	Method 2		
Hoy SPA	3	Red-throated diver	High	n.a.	Moderate	Rare
		Northern fulmar	High	High	Very low	Very common
		Arctic skua	High	n.a.	Very low	Common
		Great skua	High	n.a.	Very low	Very common
		Black-legged kittiwake	High	High	Very low	Very common
		Common guillemot	High	High	High	Very common
		Atlantic puffin	High	High	Moderate	Very common
Pentland Firth Islands SPA	5	Arctic tern	High	High	Low	Common

Designated site	Distance (km)	Qualifying species	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest
	By sea		Method 1	Method 2		
North Caithness Cliffs SPA	7	Northern fulmar	High	High	Very low	Very common
		Black-legged kittiwake	High	High	Very low	Very common
		Common guillemot	High	High	High	Very common
		Razorbill	High	High	High	Very common
		Atlantic puffin	Moderate	Moderate	Moderate	Very common
Caithness and Sutherland Peatlands SPA	15					
		Arctic skua	Moderate	n.a.	Very low	Common
Copinsay SPA	28	Northern fulmar	High	High	Very low	Very common
		Black-legged kittiwake	Moderate	Moderate	Very low	Very common
		Common guillemot	High	High	High	Very common
Marwick Head SPA	39	Black-legged kittiwake	Moderate	Moderate	Very low	Very common
		Common guillemot	Moderate	Moderate	High	Very common
East Caithness Cliffs SPA	40	Northern fulmar	High	High	Very low	Very common
		Black-legged kittiwake	Moderate	Moderate	Very low	Very common
		Common guillemot	Moderate	Moderate	High	Very common
		Razorbill	Moderate	Low	High	Very common
		Atlantic puffin	Moderate	Moderate	Moderate	Very common
Calf of Eday SPA	62	Northern fulmar	Moderate	Moderate	Very low	Very common
		Black-legged kittiwake	Moderate	Low	Very low	Very common
		Common guillemot	Moderate	Moderate	High	Very common
Rousay SPA	62	Northern fulmar	Moderate	Moderate	Very low	Very common
		Black-legged kittiwake	Moderate	Low	Very low	Very common
		Common guillemot	Moderate	Moderate	High	Very common
West Westray SPA	68	Northern fulmar	Moderate	Moderate	Very low	Very common
		Common guillemot	Moderate	Low	High	Very common

Designated site	Distance (km) By sea	Qualifying species	Theoretical Connectivity Method 1	Theoretical Connectivity Method 2	Vulnerability (Furness *et al* 2012)	Use of Area of Interest
		Razorbill	Low	Low	High	Very common
Sule Skerry and Sule Stack SPA	78	Northern gannet	High	High	Very low	Common
		Common guillemot	Moderate	Low	High	Very common
		Atlantic puffin	Moderate	Low	Moderate	Very common
Cape Wrath SPA	95	Northern fulmar	Moderate	Moderate	Very low	Very common
		Common guillemot	Low	Low	High	Very common
		Razorbill	Low	Low	High	Very common
		Atlantic puffin	Moderate	Low	Moderate	Very common
Fair Isle SPA	125	Northern fulmar	Moderate	Moderate	Very low	Very common
		Common guillemot	Low	Low	High	Very common
		Atlantic puffin	Low	Low	Moderate	Very common
Troup, Pennan and Lion`s Heads SPA	130	Northern fulmar	Moderate	Moderate	Very low	Very common
		Common guillemot	Low	Low	High	Very common
Handa SPA	134	Northern fulmar	Moderate	Moderate	Very low	Very common
		Common guillemot	Low	Low	High	Very common
North Rona and Sula Sgeir SPA	155	Northern fulmar	Moderate	Moderate	Very low	Very common
		Atlantic puffin	Low	Low	Moderate	Very common
Buchan Ness to Collieston Coast SPA	167	Northern fulmar	Moderate	Moderate	Very low	Very common
Sumburgh Head SPA	168	Northern fulmar	Moderate	Moderate	Very low	Very common
Foula SPA						
		Northern fulmar	Moderate	Moderate	Very low	Very common
		Atlantic puffin	Low	Low	Moderate	Very common
Noss SPA	196	Northern fulmar	Moderate	Moderate	Very low	Very common
		Atlantic puffin	Low	Low	Moderate	Very common
The Shiant Isles SPA	216	Northern fulmar	Moderate	Moderate	Very low	Very common

Designated site	Distance (km)	Qualifying species	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest
	By sea		Method 1	Method 2		
Fowlsheugh SPA	231	Northern fulmar	Moderate	Moderate	Very low	Very common
Ronas Hill – North Roe and Tingon Ramsar site	233	Northern fulmar	Moderate	Moderate	Very low	Very common
Fetlar SPA	254	Northern fulmar	Moderate	Moderate	Very low	Very common
Flannan Isles SPA	260	Northern fulmar	Moderate	Moderate	Very low	Very common
Hermaness, Saxa Vord and Valla Field SPA	277	Northern fulmar	Moderate	Moderate	Very low	Very common
Forth Islands SPA	317	Northern fulmar	Moderate	Moderate	Very low	Very common
St Kilda SPA	328	Northern fulmar	Moderate	Moderate	Very low	Very common
Mingulay and Berneray SPA	359	Northern fulmar	Moderate	Moderate	Very low	Very common

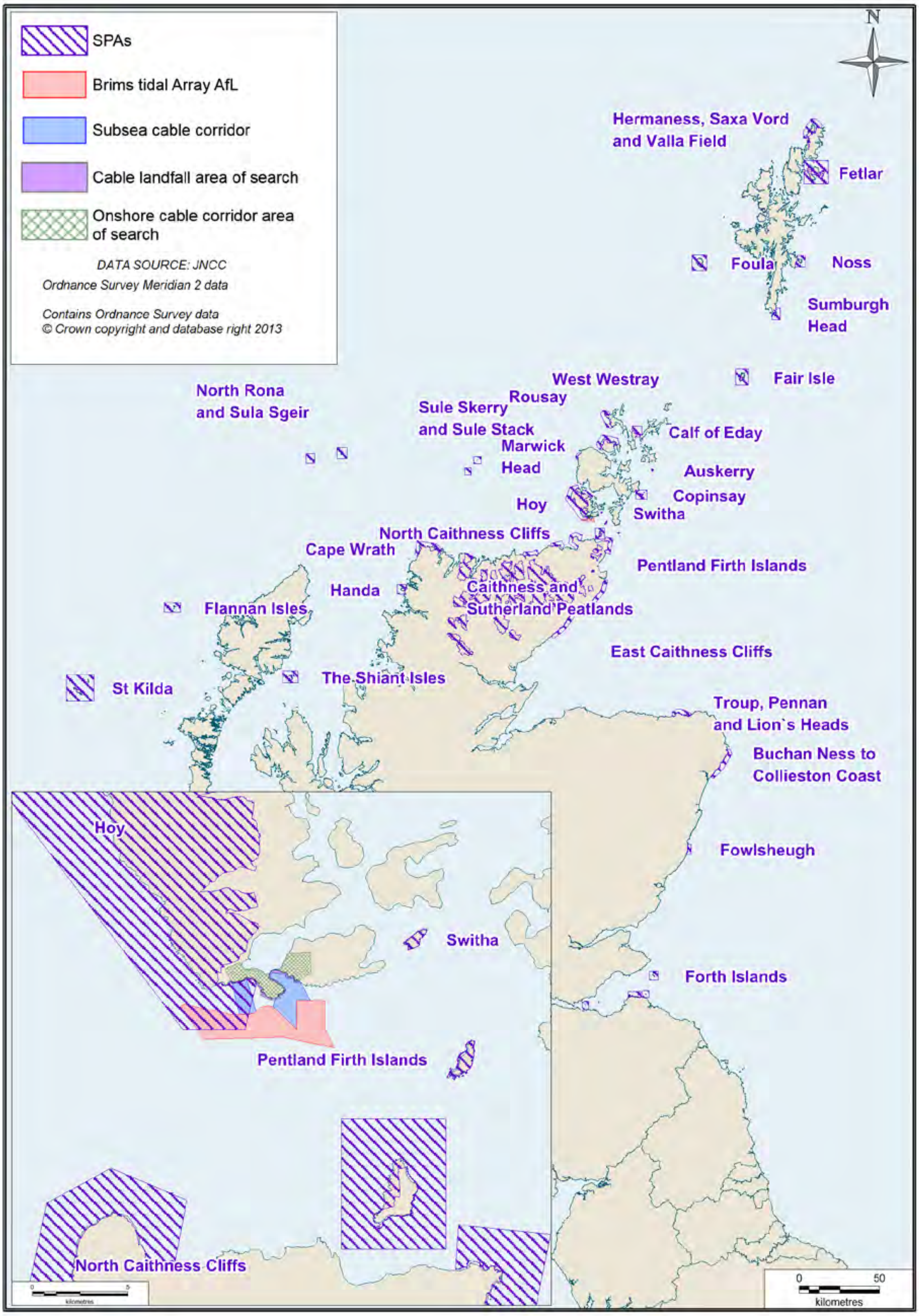


Figure 7.1 SPAs relevant to the proposals

7.1.2.3 Nationally Designated Sites – Sites of Special Scientific Interest (SSSIs)

There are no nationally designated sites within the Onshore Cable Corridor Area of Search. Hoy SSSI is the only SSSI in close proximity to the Onshore Cable Corridor Area of Search that could potentially be affected by the onshore works. All sites that have notified features that may be present in the marine environment, and that could potentially be affected by the proposed development within the AfL have been scoped into the assessment using the same criteria as used for sites with international designations (Table 7.1 above). It should be noted that all SSSIs listed in Table 7.2 are also designated in whole or in part as SPAs however in many instances there are differences between the lists of notified and qualifying features of these sites.

Table 7.2 Sites of National Importance with Notified Features that could Potentially be Affected by the Proposed Development

Site (distance to AfL/Onshore Cable Corridor Area of Search)	Notified feature	Reason for scoping in (marine / onshore / both)
Hoy SSSI (1 km) Same area as terrestrial component of Hoy SPA	Arctic skua, breeding; Northern fulmar, breeding; Great black-backed gull, breeding; Great skua, breeding; Common guillemot, breeding; Red-throated diver, breeding; Breeding seabird assemblage; Moorland breeding bird assemblage; Peregrine, breeding;	Both
Switha SSSI (5 km)	Greenland barnacle goose, non-breeding	Onshore
Pentland Firth Islands SSSI (6 km) Same area as Pentland Firth Islands SPA	Arctic tern, breeding	Marine (within foraging buffer)
Stroma SSSI (7 km) This site forms part of the North Caithness Cliffs SPA	Arctic tern, breeding; Sandwich tern, breeding; Common guillemot, breeding; Breeding seabird assemblage	Marine (within foraging buffers)
Duncansby Head SSSI (14 km) This site forms part of the North Caithness Cliffs SPA	Northern fulmar, breeding; Common guillemot, breeding; Black-legged kittiwake, breeding; Breeding seabird assemblage	Marine (within foraging buffers)

Site (distance to AfL/Onshore Cable Corridor Area of Search)	Notified feature	Reason for scoping in (marine / onshore / both)
Copinsay SSSI (31 km) Same area as terrestrial component of Copinsay SPA	Common guillemot, breeding; Black-legged kittiwake, breeding; Breeding seabird assemblage	Marine (within foraging buffers)
Marwick Head SSSI (37 km) Same area as terrestrial component of Marwick Head SPA	Common guillemot, breeding; Black-legged kittiwake, breeding; Breeding seabird assemblage	Marine (within foraging buffers)
Craig Hammel to Sgaps Geo SSSI (39 km) This site forms part of the East Caithness Cliffs SPA	Common guillemot, breeding; Black-legged kittiwake, breeding; Razorbill, breeding Breeding seabird assemblage	Marine (within foraging buffers)
Berriedale Cliffs SSSI (58 km) This site forms part of the East Caithness Cliffs SPA	Northern fulmar, breeding; European shag, breeding Common guillemot, breeding; Black-legged kittiwake, breeding; Razorbill, breeding Breeding seabird assemblage	Marine (within foraging buffers)
Auskerry SSSI (45 km) Same area as Auskerry SPA	European storm petrel, breeding	Marine (within foraging buffer)
	Arctic tern, breeding;	Scoped out
Rousay SSSI (41 km) Rousay SPA forms part of this site	Arctic skua, breeding; Common guillemot, breeding; Black-legged kittiwake, breeding; Breeding seabird assemblage	Marine (within foraging buffers)
	Arctic tern, breeding; Moorland breeding bird assemblage	Scoped out
West Westray SSSI (57 km) Same area as terrestrial component of West Westray SPA	Common guillemot, breeding; Black-legged kittiwake, breeding; Breeding seabird assemblage	Marine (within foraging buffers)
	Arctic tern, breeding; Razorbill, breeding Arctic skua, breeding;	Scoped out
Sule Skerry SSSI (72 km) The terrestrial component of this site forms part of the Sule Skerry and Sule Stack SPA	European storm petrel, breeding; Breeding seabird assemblage	Marine (within foraging buffers)
	Atlantic puffin, breeding; European shag, breeding	Scoped out, (outwith potential foraging buffers)

Site (distance to AfL/Onshore Cable Corridor Area of Search)	Notified feature	Reason for scoping in (marine / onshore / both)
Sule Stack SSSI (74km) The terrestrial component of this site forms part of the Sule Skerry and Sule Stack SPA	Northern gannet, breeding	Marine (within foraging buffer)
Fair Isle SSSI (120 km) Same area as terrestrial component of Fair Isle SPA	Northern fulmar, breeding;	Marine (within foraging buffer)
	European shag, breeding Common guillemot, breeding; Black-legged kittiwake, breeding; Great skua, breeding; Arctic skua, breeding; Razorbill, breeding; Breeding seabird assemblage	Scoped out (outwith potential foraging buffers)
Gamrie and Pennan Coast SSSI (127 km) This site forms part of the Troup, Pennan and Lion's Head SPA	Northern fulmar, breeding; Gannet, breeding;	Marine (within foraging buffers)
	Common guillemot, breeding; Black-legged kittiwake, breeding; Puffin, breeding; Razorbill, breeding; Breeding seabird assemblage	Scoped out (outwith potential foraging buffers)
North Rona and Sula Sgeir SSSI (148 km) Same area as terrestrial component of North Rona and Sula Sgeir SPA	Northern fulmar, breeding; Gannet, breeding;	Marine (within foraging buffers)
	Common guillemot, breeding; Black-legged kittiwake, breeding; Puffin, breeding; Razorbill, breeding; Storm petrel, breeding; Leach's petrel, breeding; Great black-backed gull, breeding; Breeding seabird assemblage	Scoped out (outwith foraging buffers)
Foula SSSI (162 km)	Northern fulmar, breeding; Breeding seabird assemblage	Marine (within foraging buffers)

Site (distance to AfL/Onshore Cable Corridor Area of Search)	Notified feature	Reason for scoping in (marine / onshore / both)
Same area as terrestrial component of Foula SPA	Common guillemot, breeding; Black-legged kittiwake, breeding; Puffin, breeding; Razorbill, breeding; Storm petrel, breeding; Leach's petrel, breeding; Great skua, breeding; Arctic skua, breeding; European shag, breeding;	Scoped out (outwith foraging buffers)
Noss SSSI (195 km) Same area as terrestrial component of Noss SPA	Gannet, breeding; Breeding seabird assemblage	Marine (within foraging buffers)
	Common guillemot, breeding; Black-legged kittiwake, breeding; Great skua, breeding; Arctic skua, breeding;	Scoped out (outwith foraging buffers)
Shiant Islands SSSI (200 km) Same area as terrestrial component of Shiant Isles SPA	Northern fulmar, breeding; Breeding seabird assemblage	Marine (within foraging buffers)
	European shag, breeding; Common guillemot, breeding; Puffin, breeding; Razorbill, breeding; Greenland barnacle goose, non-breeding	Scoped out (outwith foraging buffers)
Fowlsheugh SSSI (211 km) Same area as terrestrial component of Fowlsheugh SPA	Northern fulmar, breeding; Breeding seabird assemblage	Marine (within foraging buffers)
	Common guillemot, breeding; Black-legged kittiwake, breeding; Puffin, breeding; Razorbill, breeding;	Scoped out (outwith foraging buffers)
Flannan Isles SSSI (252 km) Same area as terrestrial component of Flannan Isles SPA	Northern fulmar, breeding; Breeding seabird assemblage	Marine (within foraging buffers)
	Common guillemot, breeding; Black-legged kittiwake, breeding;	Scoped out (outwith foraging buffers)

Site (distance to AfL/Onshore Cable Corridor Area of Search)	Notified feature	Reason for scoping in (marine / onshore / both)
	Puffin, breeding; Razorbill, breeding; Leach's petrel, breeding;	
Hermaness SSSI (259 km) This site forms part of the Hermaness, Saxa Vord and Valla Field SPA	Northern fulmar, breeding; Gannet, breeding; Breeding seabird assemblage	Marine (within foraging buffers)
	Common guillemot, breeding; Puffin, breeding; Great skua, breeding	Scoped out (outwith foraging buffers)
St Kilda SSSI (318 km) Same area as terrestrial component of St Kilda SPA	Gannet, breeding; Breeding seabird assemblage	Marine (within foraging buffers)
	Common guillemot, breeding; Puffin, breeding; Razorbill, breeding; Storm petrel, breeding; Leach's petrel, breeding;	Scoped out (outwith foraging buffers)
Rum SSSI (259 km) Same area as terrestrial component of Rum SPA	Manx shearwater	Marine (within foraging buffers)

7.1.2.4 Locally Designated Sites - LNCSs

LNCSs are listed in the Orkney Local Development Plan which has been accepted by the Council and is currently awaiting the Scottish Government's examination process. LNCSs that could potentially be affected by the onshore cabling works associated with the proposed development are listed in Table 7.3. These LNCSs will be taken into consideration during development design and in the EIA process. There are no Local Nature Reserves within the vicinity of the Onshore Cable Corridor Area of Search that could be affected by the development.

Table 7.3 LNCSs with Ornithological Interests that could Potentially be Affected by the Proposed Development

Name	Grid reference	Area / ha	Distance and direction from onshore study area/ km	Special features Wildlife
Brims, North Walls LNCS	ND 287880	19	Wholly within	Curlew* Lapwing* Redshank Common gull Skylark*
Aith Head, South Walls LNCS	ND 303988	21	Partially within	Breeding birds of prey*
Fea Heath, South Walls LNCS	ND 303989	19	Wholly within	Curlew* Lapwing* Redshank Arctic tern* Snipe Great skua Skylark*
Loch of Greenhill, South WallsLNCS	ND 311989	8	Contiguous boundary with Onshore Cable Corridor Area of Search	Breeding waders and gulls*

*nationally important species

7.1.3 Baseline Characterisation Surveys – AfL Area

A programme of baseline characterisation surveys has been commissioned to determine the seasonal distribution, abundance and behaviour of birds using the AfL and a surrounding buffer extending up to 4 km (the Survey Area). The results from the baseline surveys will be used to inform the EIA.

Baseline survey work started in March 2012 and is anticipated to continue for two years. The main element of the survey programme is boat-based visual surveys using the European Seabirds at Sea (ESAS) methods (Camphuysen, 2004). The survey design and recording methods are described in 'Cantick Head[11] Tidal Array Project: Proposed Surveys Methods for Birds, Marine Mammals & Basking Shark' (NRP 2012). Briefly, the survey design comprises recording birds in the AfL and a surrounding buffer of up to 4 km at approximately monthly intervals. The survey design comprises 11 parallel transect lines totalling 79.5 km spaced 1.6 km apart across the survey area. A team of two accredited

[11] Cantick Head Tidal Array has been renamed to Brims Tidal Array

ESAS surveyors observe from one side of the vessel and record all birds (and other wildlife) up to 300m from survey vessel. Birds on the water are assigned to one of four distance bands so that the data are suitable for Distance sampling analyses. The survey vessel is shared with the marine mammal surveyors, who operate as an independent team. Seabird survey data is analysed using Distance software and aims to estimate, with confidence limits, the total numbers of each species present at different times of the year and identify any consistent spatial differences in use by a species of the survey area. The ESAS method collects information of species behaviour and this is being used to infer information about why species use the site.

The survey area has high exposure and strong tidal currents, which are significant constraints to undertaking boat-based surveys as ESAS surveys must be undertaken in conditions of sea state 4 or below. For this reason there is inherent flexibility in the timing of surveys within the survey timetable, especially in winter. The emphasis is on collecting high quality data when conditions are suitable and making sure all the main stages of the annual cycle are sampled at least once, rather than dogged adherence to surveying at regular intervals.

In addition to the ESAS boat-based surveys, a small study of shore-based focal watches of auks is being undertaken to better understand the behaviour of auk species using the AfL during the breeding season, in particular to ascertain if birds are diving or loafing.

7.1.3.1 Preliminary Findings - Seabird Species

At the time of writing, the first year of the baseline survey programme has been completed and a provisional analysis undertaken of the results (NRP 2013a, NRP 2013b). On the basis of the distribution and abundance of species recorded in Year 1 baseline surveys and species' predicted sensitivity to tidal energy devices (Furness *et al*. 2012) each species was assigned a provisional priority rating, giving an indication of its likely importance to environmental assessment of the Project.

The survey results for the Year 1 breeding season (NRP 2013a) show that the survey area in 2012 was regularly used by 15 seabird species. At times, several of these species were present in relatively large numbers in the context of their regional population sizes, notably fulmar, shag, great skua, kittiwake, common guillemot, razorbill and puffin.

The survey results for the Year 1 winter (NRP 2013b) show that the survey area in 2012/2013 winter was regularly used by 12 seabird species. For most seabird species the numbers present in the survey area in Year 1 winter were lower, often substantially so than during the preceding breeding season, with several migratory species being absent in the winter. However, the number of shag, great black-backed gull, herring gull and black-guillemot present in the winter period was substantially greater than in the breeding season.

The results of the shore-based focal watches of auks have not been analysed in detail, but they show that the auk species present in the core part of the survey area in the breeding season comprise a mixture of loafing and actively diving birds. The duration of dives suggests that most diving auks seen in the shore-based surveys were actively feeding.

7.1.3.2 Priority Seabird Species

On the basis of the distribution and abundance of species recorded in Year 1 baseline surveys, species' predicted sensitivity to tidal energy devices (Furness *et al*. 2012) conservation status and legislative protection, each bird species using the AfL was assigned a provisional EIA priority rating, giving an indication of its likely importance for the EIA (NRP 2012). The species priority ratings will be reviewed when the two-year programme of baseline surveys is complete.

For the breeding season, two seabird species, common guillemot and razorbill, were provisionally rated as high priority, and two species, kittiwake and puffin, were provisionally rated as medium priority (NRP 2013a). All other species were rated as low priority for the breeding season.

Shag and common guillemot were provisionally rated as high priority and medium priority respectively for the winter period (NRP 2012). All other seabird species were provisionally rated as low priority for the winter period.

7.1.4 Baseline Characterisation Surveys – Onshore Cable Corridor Area of Search

Bird surveys were undertaken in 2012 to establish the ornithological interests of the onshore Area of Search and the adjacent coastal waters. Three types of surveys were undertaken: breeding wader surveys shoreline surveys and coastal waters surveys. The methodology and main findings of each of these surveys are summarised below.

7.1.4.1 Breeding Wader Surveys

Breeding wader surveys were carried out in accordance with the O'Brien & Smith (1992) method fully described in Gilbert *et al.* (1998)[12]. In addition to breeding waders, records were made of any other breeding species observed within the survey area such as gull and tern colonies and breeding passerines.

7.1.4.2 Shoreline Surveys

Shoreline surveys were carried out in accordance with the methods developed for the Non-estuarine Coastal Waterfowl Survey (NEWS) as detailed in Gilbert *et al*. (1998). Shoreline surveys were carried out to establish which species utilise the shoreline habitat and the numbers present. Each section of coastline was walked and all sightings of birds were recorded including the locations of breeding birds and simple count data on the numbers of birds present and any additional information on behaviour and habitat use by foraging, loafing or migrant birds.

7.1.4.3 Coastal Waters Surveys

Surveys of inshore coastal waters were carried out off the south coast of the Onshore Cable Corridor Area of Search to establish which species utilise these areas and the numbers present. Surveys were carried out in accordance with JNCC methodology[13] for shore-based counts which records the number of birds on the water from selected viewpoints around the coastline.

7.1.4.4 Findings

The Onshore Cable Corridor Area of Search is characterised predominantly by agricultural fields, the majority of which are used for pasture, barley and silage and as such hold little of particular ornithological interest. Areas of ungrazed grassland and pockets of wetland held greater species diversity. The main areas of ornithological interest were within the areas listed as LNCSs.

Seven species of breeding wader were recorded within the Onshore Cable Corridor Area of Search. Fifteen other species were recorded breeding including two small colonies of Arctic tern *Sterna paradisaea* and two colonies of common gull *Larus canus*. The cliffs along the South Hoy shoreline held approximately 850 fulmar *Fulmarus glacialis* territories and a

[12] Gilbert, G., Gibbons, D.W. and Evans, J. (1998) Bird Monitoring Methods: A Manual of Techniques for key UK species. RSPB

[13] Shore-based count methodology as detailed in : http://jncc.defra.gov.uk/pdf/jncc414_web.pdf

herring gull *Larus argentatus* colony with fewer fulmars present along the South Walls coastline.

Thirteen species were recorded utilising the inshore coastal waters area. Species recorded in highest numbers were fulmar, common guillemot *Uria aalge*, kittiwake *Rissa tridactyla*, shag *Phalacrocorax aristotelis* and razorbill *Alca torda*, all of which are qualifying species of the Hoy SPA.

The findings and recommendations from the onshore bird surveys will be fed into the project design and EIA process.

7.1.5 Key Issues and Sensitivities

The possible impacts on birds from the onshore and offshore components of the proposed Project, along with the potential significance of effect on birds are considered in Table 7.4.

Onshore works have the potential to result in habitat loss and disturbance to breeding or foraging birds. The potential impacts that birds could potentially experience as a result of the construction and operation of offshore marine energy developments are less well understood. The ranges of impacts seabirds might experience from offshore energy developments have been reviewed in several publications (e.g., Garthe and Hüppop 2009, Grecian *et al* 2010, Jackson and Whitfield 2011, Furness *et al*. 2012). Offshore tidal energy developments are relatively new and as yet there has been little opportunity to monitor the response of seabirds to operational devices and arrays. This means that there is currently uncertainty about how birds will respond and be affected. The uncertainty is particularly great for the matter of the potential collision risk posed to diving birds.

Table 7.4. Summary of Potential Impacts on Birds from the Proposed Tidal Array.

Impact	Phase	Potential significance	Comment
Collision risk from turbine	Operation	Potential significance unknown	There is a general lack of understanding of the behaviour of seabirds in the vicinity of turbines and the potential for collision risks. Until there are studies on how diving birds respond to operational devices the

Impact	Phase	Potential significance	Comment
			risk of collision are theoretical only.
Displacement from vicinity of turbine	Construction and operation	Potential significance unknown	Probably minor. Any displacement from TECs is likely to be partial and highly localised. There is a general lack of understanding of how birds will respond to TECs. It is likely that many seabird species will show no or little response. It is also possible that some species will be attracted to TECs, particularly if there is emergent superstructure that can be used for perching.
Disturbance by vessel activity	Construction, operation and decommissioning	Potential significance unknown	Probably minor. The baseline survey work shows that the seabird species using the AfL show relatively high tolerance to vessels. Any disturbance is likely to be highly localised and short term. The AfL has moderate levels of existing vessel activity. An increase in vessel activity is expected to be greatest during construction and installation works. Impacts can be reduced by mitigation measures.
Lighting of TECs and other	Construction and operation	Potential significance unknown.	Seabirds using the Pentland Firth experience a variety of illuminated

Impact	Phase	Potential significance	Comment
infrastructure			coastal and offshore structures. Details of lighting requirements currently unknown but any lighting is likely to be broadly within range currently experienced by seabirds. Impacts can potentially be reduced by mitigation measures.
Marine seabed habitat loss/change, due to turbine foundations and cable armouring.	Construction and operation	Potential significance unknown	Probably minor. Impacts likely to be small in scale and highly localised.
Onshore habitat loss (breeding or foraging habitat) due to land-take for infrastructure	Construction and operation	Potential significance unknown	Probably minor. Impacts likely to be small in scale and highly localised. Impacts can be reduced by mitigation measures and avoidance of sensitive areas.
Disturbance due to onshore construction works	Construction	Potential significance unknown	

Furness *et al*. (2012) predicted the vulnerability (sensitivity) of seabird species to the potential effects of tidal arrays according to a number of parameters and categorised species as having 'very low', 'low', 'moderate' or 'high' vulnerability (summarised in Table 7.1). All species categorised as having 'moderate' or 'high' vulnerability feed by surface diving, and could be potentially impacted collision strikes with TECs.

7.1.6 Baseline characterisation information

Information on baseline conditions regarding birds sufficient to inform HRA and EIA will be assembled from a combination of existing data sources and the commissioned survey work as outlined in the Table 7.5.

Existing datasets do not address the AfL in sufficient detail to inform HRA and EIA and hence the need to commission baseline surveys. The two-year programme of commissioned baseline surveys has already been described above.

Existing datasets are valuable to providing a wider context to the baseline survey results, enabling the value of the AfL to a species to be quantified. The reviews of at-sea seabird distribution and abundance undertaken by JNCC using a range of ESAS and aerial datasets are particularly valuable (e.g., Kober *et al.,* 2010). The recent aerial surveys of the Pentland Firth and Orkney waters undertaken by APEM also potentially will provide valuable regional context for at-sea seabird densities. These data were collected in 2010, 2011 and 2012 and cover alternate 2x2km blocks of sea around Orkney and the Pentland Firth.

JNCC also manage the national database on population counts of seabird breeding colonies (Seabird Monitoring Programme Database) and this information will also be used to provide additional regional context.

Additional data on coastal birds are held by BTO, e.g. WeBS data. The annual Orkney Bird Reports are also a valuable source of information.

Table 7.5 Information Sources for Baseline Characterisation

Subject	Method	Example data sources
The seasonal distribution and abundance of species using AfL.	Assemble and summarise existing data on: - Seabird breeding colony counts, - Boat-based surveys, - Aerial surveys, - Land-based coastal and terrestrial bird surveys - Records held in national and local bird reports.	JNCC Seabird colony database and reports (e.g. Mitchell *et al.*, 2004) JNCC/ESAS database and reports (e.g. Kober *et al*. 2010) Aerial surveys (e.g. APEM 2010, JNCC surveys). BTO Atlas and WeBs data. Orkney Bird Reports
	Undertake baseline boat-based	Commissioned ESAS surveys.

Subject	Method	Example data sources
	ESAS surveys of AfL and 4 km buffer.	Two-year programme of survey work commenced in March 2012 and is being undertaken by NRP.
Behaviour of species at the development site and their connectivity to breeding sites	Boat-based behavioural observations of birds using the survey area, in particular flight directions of birds carrying fish in breeding season. Shore-based focal watches to look at diving behaviour of auk species during the breeding season (surveys undertaken).	Commissioned ESAS surveys as above. Commissioned shore-based watches undertaken in 2012 and 2012 breeding season

7.1.7 Impact Assessment Strategy

It is proposed that the impact assessment strategy outlined in the Table 7.6 below is applied to identify and estimate the magnitude of potential impacts on birds arising from the Project.

Table 7.6 Impact Assessment Strategy

Potential impact	Assessment topics	Assessment method	Relevant research
Collision risk from tidal turbines	Undertake a high level assessment of species vulnerability based on their behavioural traits	Using baseline information and data from existing studies	Studies on diving behaviour of a species. Furness *et al*. 2012 paper.
	Determine rotational speed envelope of turbine(s)	Data from manufacturer	None
	Conduct a qualitative collision risk assessment	For species at risk compare behaviour manoeuvring ability/ swimming speed with blade velocity and position	Literature on swimming speeds, dive duration and depth and visual acuity.
	Keep abreast with advances in research on effects of tidal devices and arrays on birds		

Potential impact	Assessment topics	Assessment method	Relevant research
Disturbance from vessel activity	Identify which species are vulnerable to disturbance.	Quantify numbers of individuals of vulnerable species predicted to be affected by disturbance and duration and frequency of disturbance events	Extensive disturbance literature and monitoring results from other projects.
Habitat loss due to land-take for onshore infrastructure	Type of land to be used for infrastructure, options available and define associated use by birds for each land type. Onshore bird surveys have already been undertaken.	Comparison of mapped habitat use by key species with predicted loss of habitat buffered to a distance appropriate to each species.	Studies on disturbance sensitivity
Disturbance from onshore works	Consider access routes and needs for services to key infrastructure sites. Define associated use by birds for each land type affected. Onshore bird surveys have already been undertaken.	Map the type and level of disturbance in relation to spatial and temporal use of site by vulnerable key species.	Spatial and temporal data on the distribution, abundance and habitat use by vulnerable key species.

7.1.8 Possible Mitigation and Monitoring Measures

Mitigation aims to avoid or limit any adverse effects on bird populations. This will be achieved by three types of measure, applied in a hierarchical way, that seek to:

- Avoid the adverse effect occurring outright;
- Reduce the magnitude of the adverse effect; and
- Compensate for the adverse effect, e.g. through improving conditions for affected species elsewhere.

Mitigation is desirable for all adverse effects but is considered essential for any effects that are assessed as being of moderate or greater adverse significance under EIA. At minimum mitigation measures will aim to reduce any such effects such that the residual effect is assessed as not significant.

In the first instance measures will be sought that aim to avoid any impacts that are initially judged to be of moderate (or greater) adverse significance under EIA. If mitigation measures cannot be found that avoid a significant impact occurring, then mitigation measures that seek to reduce that impact will be sought next. If this does not result in reducing the magnitude of the impact to an acceptable level (i.e., to minor significance or less) then compensation measures will be proposed.

The results of monitoring will determine the effectiveness of mitigation (if required) and inform any possible changes in operating procedures in response to new information.

Table 7.7 sets out the possible mitigation and monitoring measures that will be considered.

Table 7.7 Possible Mitigation and Monitoring Measures

Potential impact	Possible mitigation measures	Possible monitoring during installation	Possible post-deployment monitoring
Collision risk from tidal turbine	Apply research into birds and tidal streams to inform site development process and reduce future impacts. Avoid areas shown to be consistently of very high value to diving birds.	A suitable monitoring strategy will be developed in consultation with SNH, MS and JNCC Mitigation and monitoring measures will be developed through the engineering design process with the intention of, wherever possible, to minimise potential	A suitable monitoring strategy will be developed in consultation with SNH, MS and JNCC Mitigation and monitoring measures will be developed through the engineering design process with the intention of, wherever possible, to minimise potential for
Disturbance from vessels	Limit vessel speeds to those that minimise disturbance (e.g. <10 knots). Avoid as far a possible vicinity of areas of high importance to vulnerable species. Plan vessel activity careful to minimise number of journeys required and as far as possible sticking to defined routes (as proposed by Schwemmer *et al*.		

Potential impact	**Possible mitigation measures**	**Possible monitoring during installation**	**Possible post-deployment monitoring**
	2010).	for impact.	impact.
Habitat loss due to land-take for onshore infrastructure	Avoid sensitive areas through project design.		
Disturbance from onshore construction works	Time works to avoid sensitive times of year for any vulnerable species present, e.g. avoid nesting season. Avoid as far as possible vicinity of areas used by vulnerable species. Reduce potential for disturbance by sensitive working practices, e.g. speed restrictions on vehicles, use of screening if appropriate.		

7.2 Marine Mammals and Reptiles

7.2.1 Introduction

The marine mammals and reptiles assessment considers cetaceans (whales and dolphins), pinnipeds (seals) and marine reptiles (turtles). It does not consider otters, which are be included in the terrestrial coastline and terrestrial ecology assessment. SNH is responsible for ensuring that the marine mammal populations are maintained within Scottish waters. However, licensing of commercial activities such as installing renewable energy devices in inshore waters, and the determination of imperative reasons of overriding public interest (IROPI) which might affect cetaceans, is the responsibility of Marine Scotland. Both Marine Scotland and SNH have been consulted regarding potential impacts on marine mammals.

7.2.2 Baseline

7.2.2.1 Protection

All marine mammals are protected species and there are a number of legislative requirements that must be met by developers. Grey seals *Halichoerus grypus*, harbour (common) seals *Phoca vitulina*, bottlenose dolphins *Tursiops truncatus* and harbour porpoise *Phocoena phocoena* are protected under European legislation (Annex II of the European Habitats Directive). Annex V (a) of the Habitats Directive provides restrictions on methods for taking or killing seals. All cetaceans are also protected under Annex IV of the Habitats Directive, Appendix II of the Bern Convention, and small cetaceans are protected by the terms of the international agreement ASCOBANS (Agreement on Conservation of Small Cetaceans of the Baltic and North Seas). All cetaceans are further protected under the Wildlife and Countryside Act 1981 (As amended) and it is an offence to intentionally kill, injure or take cetaceans; and to cause damage or destruction to certain areas used by cetaceans for shelter and protection, or to intentionally disturb animals occupying such areas. A number of marine mammals which are regularly sighted in Scottish waters and/or known to have significant populations in Scottish waters are included in Scottish Natural Heritage's list of Priority Marine Features (PMFs)[14].

[14] http://www.snh.org.uk/pdfs/publications/commissioned_reports/388.pdf

The leatherback turtle is protected under UK legislation as well as being of international conservation significance under CITES[15].

7.2.2.2 Cetaceans

A review carried out for SNH (Evans *et al*., 2011) has utilised a number of data sources, including Sea Watch Foundation, European Seabirds at Sea, SCANS, SCANS-II, Cetacean Stranding Investigation Programme and local reports, to identify the behaviour and abundance of cetacean species (and basking shark) found in the Pentland Firth and Orkney waters[16]. It is anticipated that the following cetacean species will also utilise the AfL area:

- Harbour porpoise *Phocoena phocoena*;
- Minke whale *Balaenoptera acutorostrata*;
- Bottlenose dolphin *Tursiops truncatus*;
- Killer whale *Orcinus orca*;
- Risso's dolphin *Grampus griseus*;
- White-beaked dolphin *Lagenorhynchus albirostris*;
- Long-finned pilot whale *Globicephala melas*;
- Atlantic white-sided dolphin *Lagenorhynchus acutus*; and
- Short-beaked common dolphin *Delphinus delphis*.

Of these, harbour porpoise and long-finned pilot whales occur throughout the year whereas the other species have a seasonal occurrence. A number of other species have been observed in Orkney waters since 1980 but are considered to be rare. These include fin whale *Balaenoptera physalus*, humpback whale *Megaptera novaeangliae*, sperm whale *Physeter macrocephalus,* Sowerby's beaked whale *Mesoplodon bidens* (stranding only), Cuvier's beaked whale *Ziphius cavirostris*, northern bottlenose whale *Hyperoodon ampullatus* (stranding only), false killer whale *Pseudorca crassidens*, and Beluga *Delphinapterus leucas*. In addition, three species have been recorded prior to 1980: blue whale *Balaenoptera musculus*, Sei whale *Balaenoptera physalus*, and narwhal *Monodon monoceros*. The level of importance of the Pentland Firth for marine mammals is unknown however it is likely to be used for passage by a number of species.

[15] CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival

[16] http://www.snh.org.uk/pdfs/publications/commissioned_reports/419.pdf

7.2.2.3 Pinnipeds

Both the grey seal and the harbour seal occur in the Pentland Firth (SMRU, 2011). A high proportion of grey seal pups were born in colonies close to or within the Pentland Firth (37% of Orkney population, 2008). Additionally, Stroma, Swona and the Pentland Skerries are heavily used as breeding and haul-out sites[17] for grey seals and Switha Island is an active grey seal haul-out site. Harbour seal numbers in Orkney declined by 63% between 2001 and 2008 (SMRU Ltd, 2011). Haul out sites are discussed in Section 8.2.3 below.

7.2.3 Designated Sites

There are no designated sites for cetaceans in the vicinity of the AfL (Figure 7.2). The closest site where cetaceans are a qualifying feature is Moray Firth SAC where bottlenose dolphins are a qualifying interest. However, despite photo-identification studies (Thompson *et al*., 2011) [18], there is no evidence that the Moray Firth bottlenose dolphins use the Pentland Firth; for this reason the Moray Firth SAC is scoped out of this assessment.

[17] A haul-out site is a location on land where seals haul themselves out to rest
[18] http://www.snh.org.uk/pdfs/publications/commissioned_reports/354.pdf

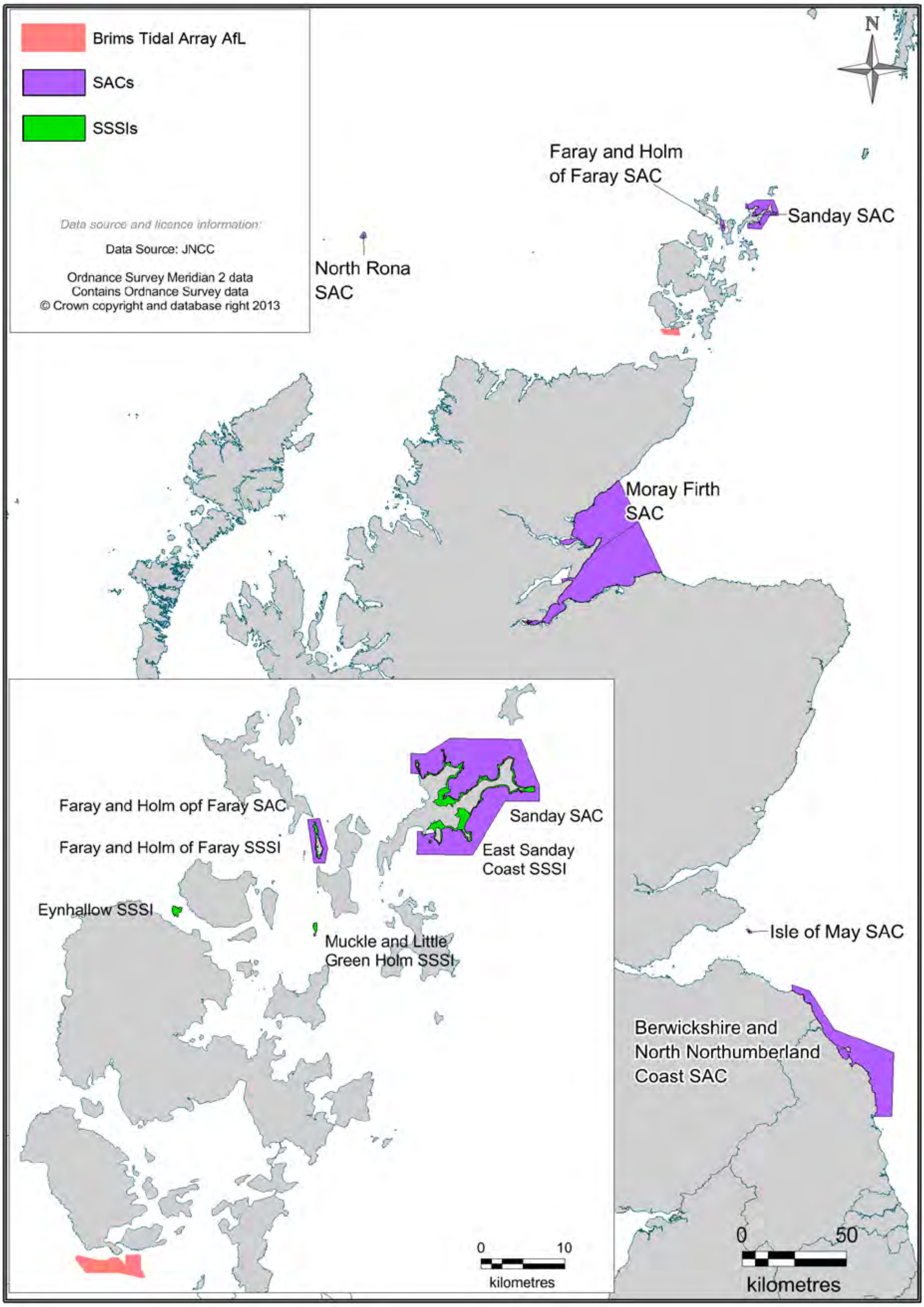


Figure 7.2 Designated sites for marine mammals

The Faray & Holm of Faray SAC (further detail on this designated site can be found in Appendix B) is located approximately 53km to the north of the AfL area. This SAC is primarily designated for its grey seal population and the conservation objectives for this SAC (as specified in the SNH Advice under Regulation 33(2)) are to maintain the population size structure, function and distribution of grey seals and their supporting habitats and to ensure that no significant disturbance is suffered. This SAC is the 2nd largest grey seal breeding site in the UK and accounts for approximately 9% annual UK pup production. Sanday SAC (further details on this designated site can be found in Appendix B) is designated for harbour seal and is located approximately 63km north-east of the AfL area. This site supports the largest group of harbour seal at any discrete site in Scotland and accounts for over 4% of the UK population.

Telemetry studies (SMRU Ltd, 2011) have indicated a level of connectivity[19] between some locations and therefore sites further afield which should be considered include:

- Berwickshire and North Northumberland SAC (grey seals);
- Isle of May SAC (grey seals); and
- North Rona SAC (grey seals).

There are also a number of Sites of Special Scientific Interest which need to be considered in relation to the proposal:

- Eynhallow SSSI is designated for harbour seal and is approximately 41km north from the AfL.;
- East Sanday Coast SSSI (harbour seal);
- Faray and Holm of Faray SSSI (grey seal); and
- Muckle and Little Green Holm SSSI (grey seal).

7.2.3.1 Other Sites

Recent work conducted on behalf of the Scottish Government, in response to the Marine (Scotland) Act 2010 (the Act), has identified important seal haul-out sites across Scotland.

[19] http://www.snh.gov.uk/docs/A600707.pdf

This work did not identify any suitable seal haul out sites within the AfL or Cable Landfall Area of Search (Scottish Government, 2011c). However there are six locations identified for harbour seals within a few miles of the AfL area and three locations for grey seal, Table 7.8, these are:

Table 7.8 Harbour and Grey Seal Haul Out Sites Close to the AfL

Harbour Seal	Grey Seal
Ness of Quoys, West of Duncansby Head	Gills Bay, West of Duncansby Head
Switha, East of Hoy	Stroma North, Stroma, Pentland Firth
Selwick, North Hoy	Mell Head Skerry, South-West Stroma, Pentland Firth
Cava, West Scapa Flow	
Barrel of Butter, West Scapa Flow	
Holm of Houton, South Mainland, Bring Deeps	

As above (section 8.2.3), telemetry studies (SMRU Ltd, 2011) in grey seals have highlighted a level of connectivity between usage areas in the Pentland Firth Area and Abertay Sands, the Monach Islands, Moray Firth, Shetland and the Inner Hebrides[20].

For harbour seals recorded tracks showed more local movements and less distance travelled compared to grey seals. For example harbour seals tagged in the northern isles remained within this local area.

7.2.3.2 Marine Reptiles

Between 1970 and 1997, thirteen leatherback turtles *Dermochelys coriacea* - seven alive and six dead - were recorded either swimming at sea or stranded on the shores of Orkney. Since this time there have been a further 6 live sightings around Orkney in 1999, 2001, 2008 and 2010 (NBN Gateway[21]). The leatherback turtle is now thought to be resident in Scottish waters at certain times of the year (Brongersma 1972; Langton *et al.* 1996); where previously, they were considered to be vagrants (Barne *et. al.*, 1997). Their presence here,

[20] http://www.snh.gov.uk/docs/A600707.pdf
[21] http://data.nbn.org.uk/imt/?mode=SPECIES&species=NBNSYS0000188646

and around the UK in general, is thought to be related to the availability of jellyfish in the summer months which they feed on[22][23].

7.2.4 Marine Mammal Surveys

The first year of survey (March 2012 – March 2013) has been completed and there is an additional year of survey on-going. The methodology consists of boat-based visual and acoustic observations which have been developed in consultation with Marine Scotland and SNH. In addition, land based vantage point surveys are also being trialled from the cliff tops. Surveys were conducted along a series of transects of the study area and a 4km buffer by European Seabirds at Sea (ESAS) observers, dedicated Marine Mammal Observers (MMOs) and towed Passive – Acoustic Monitoring System (PAMS) hydrophone. Surveys were not possible during September, October and November 2012 due to weather constraints, however this data gap is planned to be addressed in Autumn 2013.

For pinnipeds, grey seals use Switha Island and both harbour and grey seals have been seen regularly within the survey region (NRP, 2013a). The peak number of grey seals at Switha was in March 2013 when 438 were counted, in addition 2 grey seal pups and 14 unidentified seals were present. The peak number of harbour seals was in December 2012 when 31 were counted together with one unidentified seal (NRP, 2013b).

Survey results related to cetaceans to date have recorded harbour porpoise, white-beaked dolphin and a minke whale (NRP 2013a, 2013b). Additionally there have been acoustic recordings of harbour porpoise and white-beaked dolphin (Wittich and Gordon 2012) within the survey area. Following consultation with SNH and their request to capture basking shark data within marine mammal surveys, one basking shark was recorded in the survey area in August 2012.

---

[22] http://www.strandings.com/Graphics%20active/TURTLE~3.PDF
[23] http://www.mcsuk.org/what_we_do/Wildlife%20protection/Report%20wildlife%20sightings/Endangered%20Leatherback%20turtles%20arrive%20in%20UK%20waters%20to%20munch%20on%20jellyfish.

7.2.5 Potential Impacts

Possible impacts along with the potential significance of effect on m arine mammals are considered in Table 7.9 below:

Table 7.9 Potential Impacts

Potential impact	Phase	Anticipated significance	Justification
Impact to marine reptiles	Construction, Operation and decommissioning	Effects unlikely to be significant	No records in the AfL but a small number of sightings in the last 5 years were recorded around other Orkney islands. Considered a rare and occasional visitor, therefore the potential encounter risk with a tidal array is very low and no significant impact is likely and therefore marine reptiles are scoped out
Disturbance to marine mammals from underwater noise generated by construction / deployment vessels	Construction, maintenance and decommissioning	Potential significance of impact unknown	Dependant on information on species and behaviour in the vicinity of development , e.g. during breeding seasons of grey and harbour seals– further investigation required
Disturbance to marine mammals and basking shark from underwater noise generated during potential	Construction	Potential significance of impact unknown	Dependant on information on species and behaviour in the vicinity of development e.g. during breeding seasons of grey and harbour seals – further investigation required. Note that the preferred

Potential impact	**Phase**	**Anticipated significance**	**Justification**
drilling activities			technology does not require drilling, however others might.
Marine mammal collision with vessels	Construction, maintenance, decommissioning	Potential significance of impact unknown	Dependant on information on species and behaviour in the vicinity of development – further investigation required. Dependent on use of DP vessels.
Seal collision risk (corkscrew incidents)	Installation, construction, maintenance, decommissioning	Potential significance of impact unknown	Dependent on use of ducted propeller vessels
Disturbance to marine mammals from underwater noise generated by the devices	Operation	Potential significance of impact unknown	Dependant on information on species and behaviour in the vicinity of development and anticipated noise levels from devices – further investigation required
Risk of injury to marine mammals and basking shark from collision with devices	Operation	Potential significance of impact unknown	Dependant on information on species and behaviour in the vicinity of development – further investigation required Some research is available for the preferred technology, OpenHydro, based on orca whale *Orcinus orca* in the Bay of Fundy, however this research is specific to this technology type and further investigation will be required for this technology on smaller marine mammals (such as pinnipeds and harbour

Potential impact	Phase	Anticipated significance	Justification
			porpoise) and for any other device specifications included within the Rochdale Envelope.
Reduction of access to food resource for marine mammals	Operation	Effect unlikely to be significant	Food resource is not predicted to decrease to any level likely to have effect on marine mammals
Accidental contamination to marine mammals and basking shark from vessels or devices	Construction, Operation and decommissioning	Effect unlikely to be significant	Industry best practice will be followed. Risk of contamination is not deemed to be significant

7.2.6 Baseline Characterisation

It is proposed that baseline conditions regarding marine mammals can be further defined in sufficient detail by completing the tasks outlined in Table 7.10 below:

Table 7.10 Baseline Characterisation Strategy

Data gap	Methodology	Example data sources
Determine species present	Review of existing data, marine surveys	Atlas of cetacean distribution in north-west European waters (Reid *et al*., 2003) Data from the Sea Mammal Research Unit (SCANS-II) (Small Cetaceans in the European Atlantic and North Sea). Technical reports on marine mammals from SEA 4, Offshore
Determine the distribution and behaviour of marine mammals within the area	Marine mammal surveys are currently on going. First year of survey completed (March-August 2012) with an additional year to come. Consultation on methodologies to be used was undertaken with SNH and Marine	

Data gap	Methodology	Example data sources
	Scotland and is still on going.	Energy SEA Local biodiversity records EMEC observations Results from commissioned baseline surveys (boat-based surveys) JCP (if available) Crown Estate Aerial Survey data Marine Scotland seal density estimates Special Committee on Seals annual reporting (SCOS 2012) Management Units for marine mammals in UK waters (IAMMWG, 2013) Utilisation of space by grey and harbour seals in the Pentland Firth and Orkney waters (SMRU Ltd, 2011) Abundance and behaviour of cetaceans and basking sharks in the Pentland Firth and Orkney Waters (Evans, *et al.* 2011).
Determine the collision risk	Evaluate likely level of effect based on information relating to operational mode of devices and knowledge of species.	Experience from SeaGen (MCT, 2010), ongoing monitoring at SeaGen (if available). SAMS studies on collision risk modelling Wilson *et. al*., 2007. Experience from EMEC, Puget Sound, Bay of Fundy, French deployments of the preferred technology, OpenHydro, will also be used. Work is ongoing

Data gap	Methodology	Example data sources
		by SMRU on behalf of Marine Scotland to develop collision risk modelling. The best available model (to be agreed through consultation with Marine Scotland and SNH) will be used to determine the collision risk for the Project.
Determine baseline noise conditions	Strategic work to survey baseline noise levels at the site is on-going.	Experienced underwater noise specialists will be commissioned and a survey report produced.

7.2.7 Impact Assessment Strategy

It is proposed that the following impact assessment strategy, Table 7.11 below, is applied to address the potentially significant impacts identified and those impacts for which the potential level of significance is unknown:

Table 7.11 Impact Assessment Strategy

Potential impact	Assessment topics	Assessment method	Relevant research
Disturbance from underwater noise generated by construction vessels	Predicted noise signatures of vessels and drilling activities	Conduct a desk-based assessment investigating the noise signatures of vessels likely to be used in all operations	Available data on likely vessels
Disturbance from underwater noise generated during drilling		Investigate the noise signatures of drilling activity through desk review or noise modelling as appropriate	Subacoustech (2008) Measurement and assessment of background underwater noise and its comparison with noise

Potential impact	Assessment topics	Assessment method	Relevant research
			from pin pile drilling operations during installation of the SeaGen tidal turbine device, Strangford Lough - COWRIE funded research 2008 Noise assessments of drilling activities for Aquamarine projects if available
Collision with construction vessel.	Behavioural traits of marine mammals present within the area	Marine mammal observation of behaviour within the study area, desk based review of collision incidents with vessels	Thompson et al., 2010 research into seal mortalities from ducted propellers
Seal collision risk (corkscrew incidents)	Behavioural traits of marine mammals present within the area	Marine mammal observation of behaviour within the study area, desk based review	Thompson et al., 2010 research into seal mortalities from ducted propellers
Disturbance from underwater noise generated by the device	Noise output of device(s)	Gather noise monitoring results (where available) from technology developers	Research from Environmental Monitoring Programme SeaGen (MCT, 2010).
Risk of injury from collision with devices	Device characteristic of moving parts. Behavioural traits of Marine mammals present within the area	Evaluate likely level of effect based on information relating to operational mode of devices and knowledge of species.	Research from SeaGen (MCT 2010) and by SAMS Wilson *et al*., (2007) and Open Hydro

Potential impact	Assessment topics	Assessment method	Relevant research
		Collision risk modelling is an option that could be used.	

7.2.8 Mitigation and Monitoring Strategy

The following possible mitigation and monitoring measures, Table 7.12 below, will be considered during ongoing EIA and project development activities:

Table 7.12 Mitigation and Monitoring Strategy

Potential impact	Approach to mitigation measures	Monitoring during installation (validating predictions)	Post-deployment monitoring (measuring impacts)
Disturbance from underwater noise generated by construction vessels	Not expected to be required	A suitable Environmental Mitigation Monitoring Plan (EMMP) will be developed in consultation with SNH and JNCC mitigation and monitoring measures will be developed through the engineering design process with the intention to, wherever possible, minimise potential for impact	A suitable EMMP will be developed in consultation with SNH and JNCC mitigation and monitoring measures will be developed through the engineering design process with the intention to, wherever possible, minimise potential for impact
Collision with construction vessel.	Mitigation requirements for potential DP collision (if relevant) will be discussed with SNH, JNCC, MSS and SMRU		
Seal collision risk (corkscrew incidents)	To reduce potential for collision with vessel hulls follow Scottish Marine Wildlife Watching Code [24]		
Disturbance from	Mitigation		

[24] http://www.marinecode.org/scottish-marine-code-g.asp

Potential impact	Approach to mitigation measures	Monitoring during installation (validating predictions)	Post-deployment monitoring (measuring impacts)
underwater noise generated during drilling	requirements will be discussed with SNH and JNCC and if necessary may be based on the JNCC piling protocol		
Disturbance from underwater noise generated by the device	Not expected to be required		
Risk of injury from collision with devices	Not expected to be required		

7.3 Fish and Shellfish Resource

7.3.1 Baseline

The AfL lies within the wider area of ICES rectangle[25] 46E6. Catch data provided by Marine Scotland Analytical Unit (Marine Scotland Science, 2013) provides a good indication of which species are present in commercially exploitable numbers within the study area. Species of which more than ten tonnes were landed from this rectangle in 2011 and 2012 are shown in Table 7.13.

Shellfish, particularly brown crab, are an important resource in terms of both quantity and value. Monks and anglers *Lophius* spp. is a category within the landings data which comprise a number of species, which, together with herring, have been an important resource over the last 5 years. More recently (as shown in the 2011 landings) however, the importance of haddock and scallops to the area appears to have shown relative increase, whereas the importance of herring, monks and anglers has decreased.

Many of the species landed from within the AfL are UK Biodiversity Action Plan (UK BAP) species, priority species identified as being the most threatened and requiring conservation action and Scottish Priority Marine Features (PMFs) identified by SNH as species requiring better protection (Howson *et al*., 2012). Atlantic herring, haddock, spurdog, plaice, erring, cod, European lobster, *Nephrops* and many species of ray are also listed on The World Conservation Union (IUCN) Red List of Threatened Species.

No protected areas have been designated for finfish or shellfish species within the AfL(SNH Site Link[26]).

[25] The International Council for the Exploration of the Sea (ICES) has developed a grid system derived from degrees latitude and longitude that divides the seas into rectangles.
[26] http://gateway.snh.gov.uk/sitelink/index.jsp

Table 7.13 Fish and Shellfish Species Caught Within ICES Rectangle 46E6, Cumulative Catches from 2008-2010, in 2011 and 2012 (Source: Marine Scotland Science 2013) *Indicates UK BAP Species and/or PMF Species.

Demersal / Pelagic (live weight, tonnes)	2008-2010	2011	2012	Shellfish (live weight, tonnes)	2008-2010	2011	2012
Monk / Angler *Lophius piscatorius, L. budegassa* or similar species*	1367	170.75	93.55	Brown / edible crabs *Cancer pagurus*	3466	719.74	626.11
Herring *Clupea harengus**	1090	70	*1079*	Velvet swimming crab *Necora puber*	877	136.98	106.98
Haddock *Melanogrammus aeglefinus*	878	436.59	*263.73*	Scallops *Pecten maximus*	452	198.83	105.99
Cod *Gadus morhua**	358	125.84	*61.42*	European Lobster *Homarus gammarus*	412	85.98	81.66
Megrim *Lepidorhombus whiffiagonis*	125	16.97	*19.19*	Periwinkles *Littorina spp*.	250	39.78	32.3
Whiting *Merlangius merlangus**	105	53.12	*40.74*	Green crab *Carcinus maenas*	248	55.73	54.35
Horse mackerel *Trachurus trachurus** (	100	1.79	*0.86*	Whelk *Buccinum undatum*	185	2.28	26.1
Saithe *Pollachius virens**	75	4.27	*11.49*	Norway lobster/Nephrops *Nephrops norvegicus*	80	18.49	9.6
Spurdog *Squalus acanthias**	43			Squid *Loligo spp*.	35	13.17	1.87

Demersal / Pelagic (live weight, tonnes)	2008-2010	2011	2012	Shellfish (live weight, tonnes)	2008-2010	2011	2012
Ling *Molva molva**	24	4.66	2.36	Razor Clam *Solen* spp.	19	16.93	0.54
Mackerel *Scomber scombrus**	23	8.07	10	Queen scallops *Aequipecten Opercularis*	10	1.27	23.95
Skates and rays *Raja spp.*	16	0.99	1.87				
Plaice *Pleuronectes platessa* *	16	2.89	4.42				
Torsk (Tusk) *Brosme brosme*	13	-	2.36				

The seabed of the AfL is largely composed of a mixture of coarse cobbles and boulders on coarse sand and gravel (Moore, 2009) and this may provide suitable habitat for species which spawn on the seabed, such as herring or sandeel *Ammodytes tobianus*. Low resolution data on spawning and nursery grounds for commercial species are available from Cefas and indicate that the study area is within spawning grounds for sandeel, herring, lemon sole *Microstomus kitt* and sprat *Sprattus sprattus* (Coull *et al*.,1998 and Ellis *et.al*., 2010). Of these, only herring and sandeel spawn on the seabed, while lemon sole and sprat are pelagic spawners. The AfL also lies in wider nursery grounds for herring, blue whiting *Micromesistius poutassou*, angler fish, common skate *Dipterus batis*, European hake *Merluccius merluccius*, ling, mackerel, spotted ray *Raja Montagui*, spurdog, saithe, cod, tope *Galeorhinus galeus*, lemon sole, sandeel and whiting (Coull *et al*.,1998 and Ellis *et al*., 2010).

Sandeel is an important food source for commercial fish species such as cod, haddock and whiting, as well as an essential food source for seabirds and marine mammals. It is thought that a decline in the populations of sandeel has contributed to fluctuations in puffin *Fratercula arctica* numbers within the area (Marine Scotland *et. al.,* 2010).

7.3.1.1 Elasmobranches

The Offshore Energy SEA (DECC, 2009) indicates that the following elasmobranch species may also be present within the AfL: porbeagle shark *Lamna nasus*; several species of dogfish (e.g. lesser-spotted dogfish *Scyliorhinus canicula* and the spiny dogfish *Squalus acanthias*), skates and rays (e.g. common skate, cuckoo ray *Raja naevus* and spotted ray). Barne *et. al.,* (1997) reports that 19 species of elasmobranch can be found in Orkney waters.

The basking shark *Cetorhinus maximus* is known to inhabit the waters around Orkney (NBN Gateway, 2011). This species is listed as a UKBAP and OSPAR species and is protected under the Wildlife and Countryside Act 1981 (as amended in 1985) and CITES[27]. Further information regarding basking sharks is presented in Section 8.2 Marine mammals and reptiles.

[27] CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

7.3.1.2 Migratory Fish

Several species of diadromous (migratory between fresh and marine waters) fish may migrate through the Pentland Firth. A recent study commissioned by Marine Scotland (Malcolm *et. al*., 2010) concluded that although broad scale patterns of migration can be identified for adult Atlantic salmon *Salmo salar* and to some extent European eel *Anguilla anguilla* no specific migratory routes for either of these species or sea trout *Salmo trutta* can be identified with any certainty, due to a lack of data. The mapped distribution of salmonid rivers in Scotland (Gardiner and Egglishaw, 1985) indicates that no salmonid rivers feed into the seas around the AfL. The River Thurso, located over 20km south west of the AfL on the southern coast of the AfL, feeds into the Pentland Firth and is designated as an SAC for salmon. However, fish from this river are likely to head north towards their feeding grounds in the Norwegian Sea thus traveling up the west coast of Orkney and not toward the AfL as migrations patterns are usually in an offshore direction (Malcolm *et. al*., 2010).

There are historical records of the sea lamprey *Petromyzon marinus* in Orkney waters (Barne *et., al* 1997), however, there are no records for this species on the NBN gateway database (NBN gateway 2012).

7.3.2 Potential Impacts

Possible impacts along with the potential significance of effect on fish are considered in Table 7.14 below:

Table 7.14 Potential Impacts During Construction, Operation and Decommissioning

Potential impact	**Phase**	**Anticipated significance**	**Comment**
Disturbance of spawning grounds (herring and sandeel)	Construction , Decommissioning	Potential significance of impact unknown	Further information on the construction methods and project design required.
Disturbance of habitat for demersal species	Construction, Decommissioning	Potential significance of impact unknown	

Potential impact	Phase	Anticipated significance	Comment
Effects of noise and vibration (increased boat traffic and construction, operational and decommissioning activity) on hearing specialists (i.e. herring and sprat)	Construction, Operation, Decommissioning	Potential significance of impact unknown	
Collision of slow moving larger species (e.g. basking sharks) with the devices or strike of migratory fish	Operation	Potential significance of impact unknown	Further information needed on presence of basking shark and potential for collision before assessment can be made
Effects of electro-magnetic fields (EMF) on elasmobranches and salmonids.	Operation	Potential significance of impact unknown	Further research on industry knowledge required
Changes in the existing habitat (due to colonisation of infrastructure)	Operation	Potential significance of impact unknown	Further information on species and habitats present required before assessment can be made

7.3.3 Baseline Characterisation Strategy

It is proposed that baseline conditions regarding fish can be further defined to sufficient detail by completing the tasks outlined in Table 7.15 below:

Table 7.15 Baseline Characterisation Strategy

Data gap	Methodology	Example data sources
Assessment of	Desk-based assessment, including:	- Cefas data and reports

Data gap	Methodology	Example data sources
species utilising the study area	- Fish and shellfish of conservation importance, including protected under the Wildlife and Countryside Act (including seasonal sensitivities). - Designated sites and protected habitats. - Species of fish/shellfish of significant importance to recreational and commercial fisheries. - Species with restricted geographical distribution, which may be locally abundant. - Elasmobranch species of commercial and recreational importance. - Species which use the area for spawning or nursery grounds (including types of spawning and seasons). - Over-wintering areas for crustaceans such as lobster/crab.	(spawning, nursery grounds) - Marine Scotland Science (landings data) and ICES rectangle data and reports - OSPAR, BAP, IUCN lists - Consultation with local and national fishermen's associations, representatives, groups and federations (confirmation of presence, absence and seasonality) - Benthic survey drop down video/ stills photography data - Relevant guidance i.e. (EMEC 2005, EMEC and Xodus, in press) - SEA (DECC, 2009) Basking shark sightings have been incorporated with the bird and marine mammal surveys (Natural Research Projects 2013a, 2013b)

BTAL plan to conclude baseline characterisation investigations by March 2014.

7.3.4 Impact Assessment Strategy

It is proposed that the following impact assessment strategy, outlined in Table 7.16, is applied to address the potentially significant impacts identified, and those impacts for which the potential level of significance is unknown:

Table 7.16 Impact Assessment Strategy

Potential impact	Assessment topics	Assessment method	Relevant research
Disturbance of spawning grounds (herring and sandeel)	Determine the extent of herring and sandeel spawning/nursery area and species abundance	Desk review of available data, including outputs from specialist studies.	Cefas data, fisheries consultation and benthic survey.
Disturbance of habitat for demersal species	Assess the potential level of disturbance and risk to crustacean and demersal fish species	Review technology options and installation methodology	
Effects of noise and vibration (increased boat traffic and construction, operational and decommissioning activity) on hearing specialists (i.e. herring and sprat)	Investigate the predicted noise output of the array and its construction	Desk study. Noise modelling and impact assessment, if necessary.	Existing noise studies of underwater turbine devices and similar equipment, including during installation).
Collision of slow moving larger species such as basking sharks with the devices or strike of migratory fish	Collision risk	Desk based assessment.	Studies into collision incidents at established tidal turbine sites and relevant research from other industries.

Effects of EMF on elasmobranches and salmonids.	EMF effects from subsea cables depending on the type of cable used.	Desk based assessment and literature review.	Desk study based on body of research e.g. COWRIE 2003, 2009).
Changes in the existing habitat (due to colonisation of infrastructure)	Review of colonisation of marine renewables structures and surrounding habitats.	Desk based review.	EMEC, SAMS, site data from marine renewables developers including SeaGen and offshore wind sites.

Potential effects on migratory species e.g. salmonids, eels.	Assessing the potential effects of construction noise and EMF on migratory patterns. Determining the effect of infrastructure within migratory routes in relation to collision risk.	The project team will agree an appropriate approach to assessment of impacts on migratory fish in consultation with SNH and MS.	Review of existing noise studies for tidal devices Studies into collision incidents at established tidal turbine sites and relevant research). Literature review of current research on migratory species, including Pentland Firth and Orkney Waters Enabling Actions Report (Slaski *et al*, 2013)

7.3.5 Possible Mitigation and Monitoring Measures

The following possible mitigation and monitoring measures, outlined in Table 7.17, will be considered during on-going EIA and project development activities:

Table 7.17 Possible Mitigation and Monitoring Measures

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
Loss of spawning or nursery ground for substrate spawning species.	Suitable mitigation will be developed in consultation with SNH and MS. Mitigation will be developed through the engineering design process with the intention of, wherever possible, minimising the potential for impacts, such as size of seabed footprint, noise levels associated with construction methods etc.	A suitable monitoring strategy will be developed in consultation with SNH and MS as part of the agreement of conditions for consent.	A suitable EMMP will be developed in consultation with SNH and MS as part of the agreement of conditions for consent.
Disturbance of habitat for demersal species			
Effects of noise and vibration (increased boat traffic and construction, operational and decommissioning activity) on hearing specialists (i.e. herring and sprat)			
Collision risk for slow moving larger species (e.g. basking sharks) with vessels or devices or strike with migratory fish			
Effects of EMF on elasmobranches and salmonids.			
Changes in the existing habitat (due			

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
to colonisation of infrastructure)			

7.4 Coastal and Terrestrial Ecology

This chapter addresses intertidal and terrestrial ecology. Birds are discussed separately in Section 8.1 Ornithology. Further details on peat are discussed in Section 8.4: Geology, Hydrology and Soils.

7.4.1 Baseline

7.4.1.1 Baseline Data Sources

This baseline description is based on desk studies and field surveys.

Desk studies undertaken to date include:

- A review of designated sites within 5km of the study area, including statutory sites obtained from Scottish Natural Heritage (SNH)'s Sitelink (gateway.snh.gov.uk/sitelink) website;
- Review of information on non-statutory, locally designated sites within 1km of proposed development areas, obtained from the OIC website (www.orkney.gov.uk);
- A biological records search using information from National Biodiversity Network (NBN) (http://www.nbn.org.uk/); and
- A specially commissioned biological records search undertaken by the Orkney Biodiversity Records Centre (OBRC).

Field studies undertaken to date include:

- Extended Phase 1 Habitat Survey;
- Intertidal Survey;
- Otter Survey; and
- Breeding bird Survey.

A separate, dedicated section is provided in relation to birds (see Section 8.1), and birds are only covered briefly in this section.

7.4.1.2 Baseline Description

Two statutory designated sites for terrestrial and c oastal ecological features (non-ornithological) were identified, as were 5 non-statutory sites. The details for the statutory and non-statutory sites are summarised in Tables 7.18 and 7.19 and Figures 7.3 and 7.4 below.

Table 7.18 Statutory Designated Sites within 5km of the Study Area

Name	Grid reference	Area / ha	Distance and direction from study areas/ km	Notified features
Hoy SAC, SPA & SSSI SSSI Same area as terrestrial component of SPA	HY 225010	SSSI: 9499.7	0.16 north-west	SAC: Alkaline fens , alpine and boreal heaths, blanket bogs* , calcareous rocky slopes with chasmophytic vegetation European dry heaths , natural dystrophic lakes and ponds Northern Atlantic wet heaths with Erica tetralix, petrifying springs with tufa formation (*Cratoneurion*)*, vegetated sea cliffs of the Atlantic and Baltic coasts *priority habitat SPA: Atlantic puffin *Fratercula arctica*, arctic skua *Stercorarius parasiticus*, breeding**, black-legged kittiwake *Rissa tridactyla*, fulmar *Fulmarus glacialis*, breeding**, great black-backed gull *Larus marinus*, breeding**, great skua *Stercorarius skua*, breeding**, guillemot *Uria aalge*, breeding**, peregrine *Falco peregrinus*, breeding**, red-throated diver *Gavia stellata*, breeding** **Also a SSSI notified feature SSSI: Bogs: Blanket bog, freshwater habitats: dystrophic loch, uplands: upland assemblage, woodland: upland oak woodland; birds: breeding bird assemblage, seabird colony, breeding. Also notified for geological interest.
Switha SPA and SSSI	ND 363907	57.39	4.70 east	SPA and SSSI: Birds: Greenland barnacle goose *Branta leucopsis*.

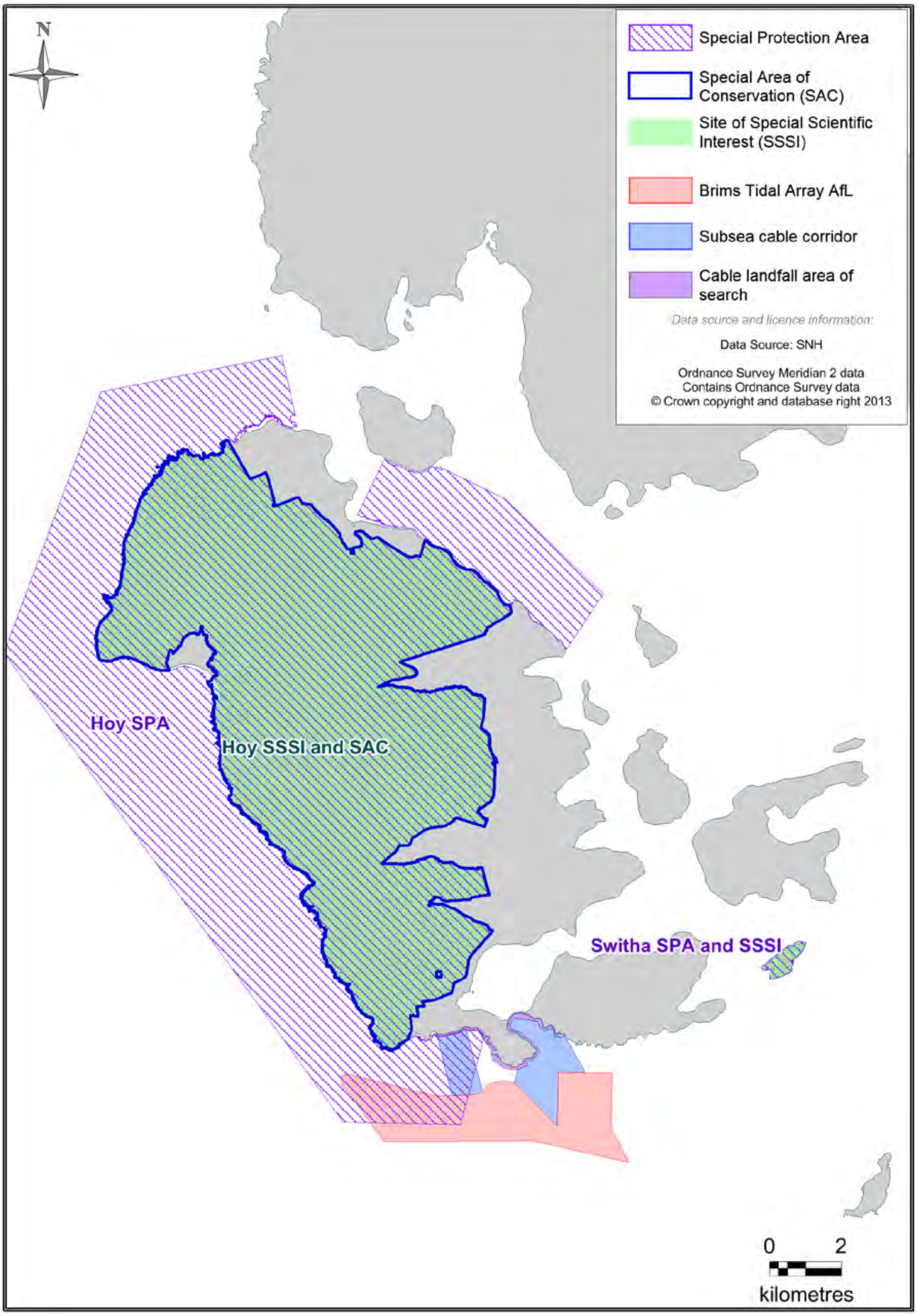


Figure 7.3 Statutory Designated Sites

Table 7.19 Non-Statutory Designated Sites within 1km of the Study Area

Name	Grid reference	Area / ha	Distance and direction from study area/ km	Special features	
				Habitats	**Wildlife**
Brims LNCS	ND 287880	19	Wholly within	Lowland meadow* Maritime heath Lowland fens* Maritime cliff and slope* Maritime grassland	Curlew* Lapwing* Redshank Common gull Skylark*
Aith Head LNCS	ND 303988	21	Partially within	Upland heath* Maritime heath Maritime cliff and slope* Maritime grassland	Breeding birds of prey* *Hieracium maritimum* (a hawkweed)
Fea Heath LNCS	ND 303989	19	Wholly within	Upland heath*	Curlew* Lapwing* Redshank Arctic tern* Snipe Great skua Skylark*
Loch of Greenhill	ND 311989	8	Immediately east	Upland heath* Lowland fen*	Breeding waders and gulls*

Name	Grid reference	Area / ha	Distance and direction from study area/ km	Special features	
				Habitats	Wildlife
LNCS					
Quoy LNCS	ND 323899	23	0.980 east	Upland heath* Lowland meadows* Lowland fens*	Curlew* Lapwing* Snipe

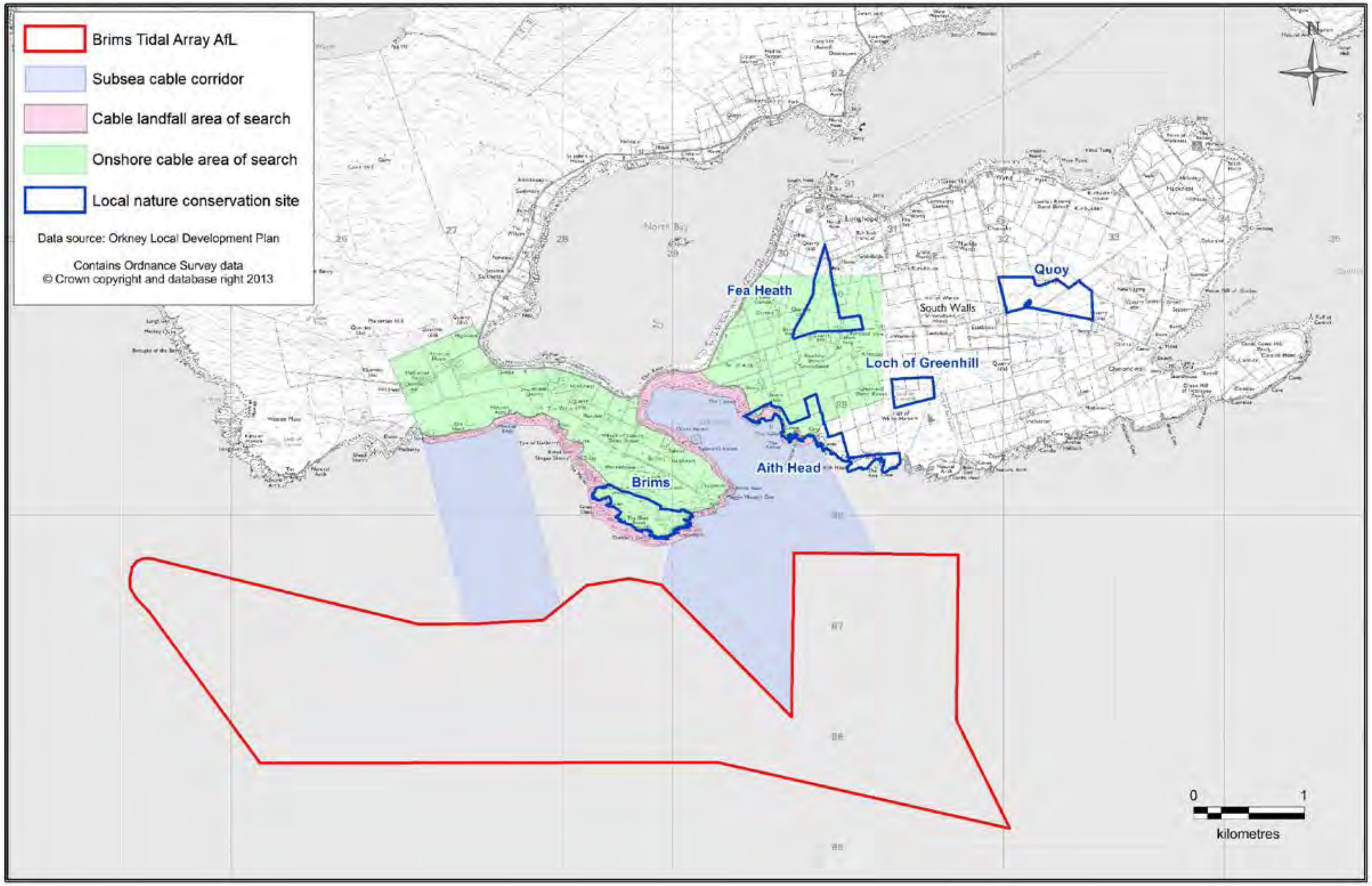


Figure 7.4 Non-Statutory Designated Sites

There are no National Nature Reserves or RSPB reserves within the study area.

LNCSs are out to consultation at the present time and will be taken into consideration during the EIA process.

7.4.2 Habitats

Orkney

The majority of the habitat across Orkney is improved grassland, with some areas of blanket bog and peatlands on higher ground (approximately 25% of the West Mainland is classified as blanket bog and peatland or heather moor). Several freshwater lochs are present within the study area, with associated networks of rivers and burns.

The coastline of Orkney is characterised by rugged sea cliffs, shore platforms, geos and caves, with beaches and dunes within more sheltered areas. The landfall options are characterised by either grassland or duneland.

7.4.3 Study Area

The Project Onshore Cable Corridor Area of Search is predominantly arable and improved grassland, with some areas of heathland, semi-improved grassland and coastal grassland. Coastal features are also present in some onshore substation locations under consideration.

Table 7.20 provides a summary of the terrestrial habitats found within the study area during the Phase 1 Habitat survey (Figure 7.5) along with information concerning their importance with regard to UK Biodiversity Action Plan (UKBAP) plans and their dependence on groundwater.

Table 7.20 Summary of Habitats within the Onshore Cable Area of Search

Phase 1 classification (JNCC, 2010)	EC Habitats Directive UK Interest features (JNCC	UKBAP priority habitat (Brig 2008)	Groundwater Dependant Terrestrial Ecosystem (Sniffer 2009)
Fen	N/A	Lowland fen	yes
Swamp	N/A	N/A	yes
Wet heath acid grassland mosaic	N/A	Lowland heathland	yes

Phase 1 classification (JNCC, 2010)	EC Habitats Directive UK Interest features (JNCC	UKBAP priority habitat (Brig 2008)	Groundwater Dependant Terrestrial Ecosystem (Sniffer 2009)
Dry heath acid grassland mosaic	European dry heath	Lowland heathland	no
Improved grassland	N/A	N/A	no
Marshy grassland	N/A	N/A	yes
Coastal grassland	N/A	N/A	no
Strandline vegetation	N/A	Vegetated shingle	no
Semi improved neutral grassland	N/A	Lowland meadows	no
Tall ruderal	N/A	N/A	no
Arable land	N/A	Arable field margins	no
Running water	N/A	N/A	no
Standing water	N/A	N/A	no
Amenity grassland	N/A	N/A	no
Deciduous plantation	N/A	N/A	no
Scattered coniferous trees	N/A	N/A	no
Ephemeral	N/A	N/A	no
Drystone wall	N/A	N/A	no
Dry ditch	N/A	N/A	no

Figure 7.5a Phase One Habitat Survey of South Hoy Onshore Cable Area of Search

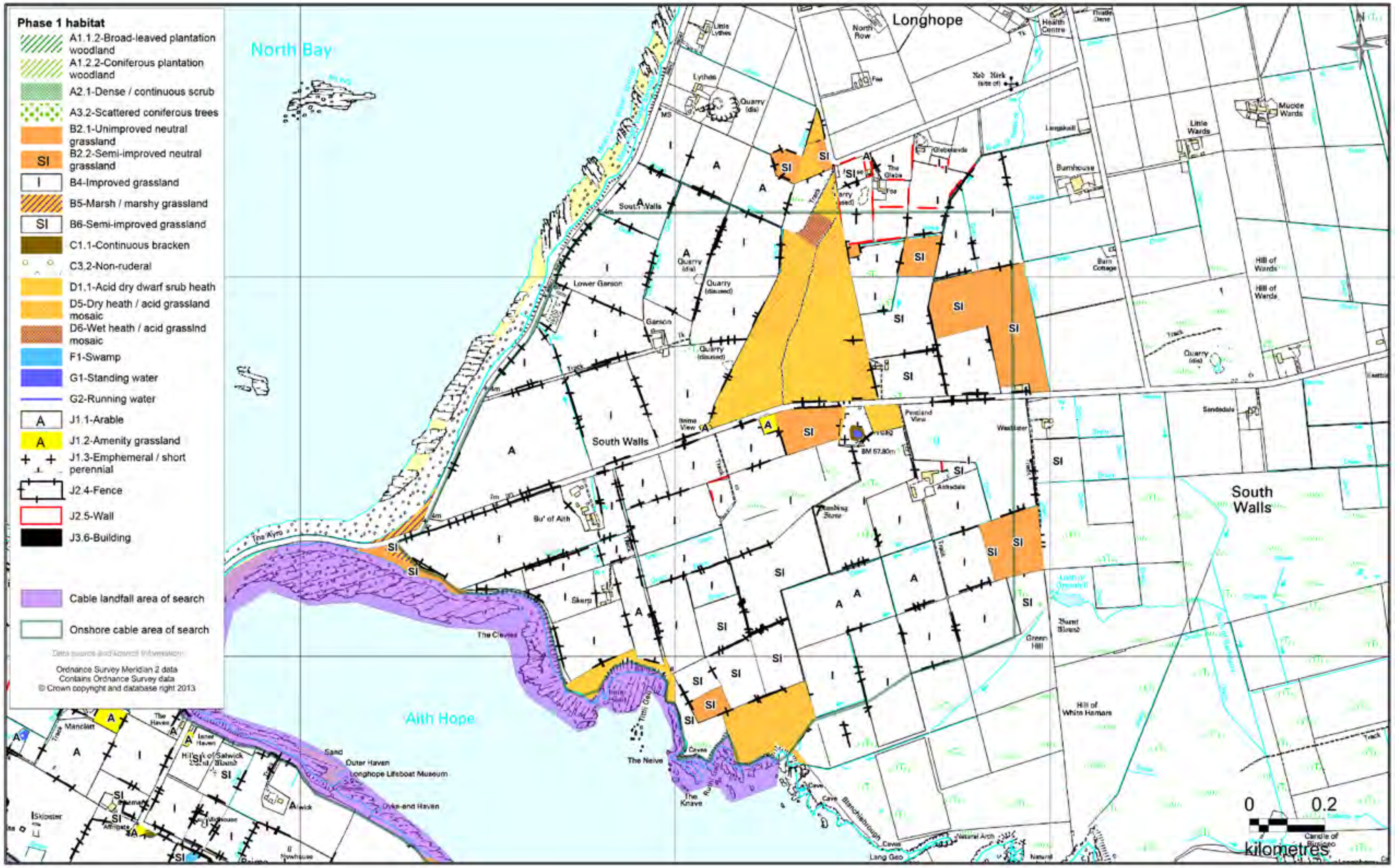


Figure 7.5b Phase 1 habitat survey of South Walls Onshore Cable Area of Search

The intertidal zone within the study area is composed of a number of different substrates, ranging from solid bedrock in the more exposed locations, through to cobbles and sand in the more sheltered environments of Aith Hope. This variety of habitats supports a number of biotopes, some of which support very few species (for example, barren shingle and sand), while others (for example bedrock and boulder biotopes) support a large number of species. Table 7.21 provides a summary of the intertidal habitats found within the study area during the dedicated survey.

Table 7.21 Intertidal Biotopes Recorded within Study Area

Biotope	Description	Target Note locations identified
IR.HIR.KFaR.Ala.Ldig	*Alaria esculenta* and *Laminaria digitata* on exposed sublittoral fringe bedrock	5
IR.HIR.KSed	Sand or gravel-affected or disturbed oarweed and seaweed Communities	2
IR.MIR	Moderate energy infralittoral rock	2
IR.MIR.KR.Ldig.Bo	*Laminaria digitata* and under-boulder fauna on sublittoral fringe boulders	1
IR.MIR.KR.Ldig.Ldig	Laminaria digitata on moderately exposed sublittoral fringe rock	9
LR	Littoral rock	1
LR.FLR.Eph.EntPor	*Porphyra purpurea* and *Enteromorpha spp*. on sand-scoured mid or lower eulittoral rock	2
LR.FLR.Lic	Lichens or small green algae on supralittoral and littoral fringe rock	1
LR.FLR.Lic.Ver	*Verrucaria maura* on very exposed to very sheltered upper littoral fringe rock	5
LR.FLR.Lic.Ver.Ver	*Verrucaria maura* on very exposed to very sheltered upper littoral fringe rock	2
LR.FLR.Rkp	Rockpools	1

Biotope	Description	Target Note locations identified
LR.FLR.Rkp.G*∞	Green seaweeds (*Enteromorpha spp.* and *Cladophora spp.*) in shallow upper shore rockpools	1
LR.HLR	High energy littoral rock	3
LR.HLR.FR.Him∞	*Himanthalia elongata* and red seaweeds on exposed to moderately exposed lower eulittoral rock	1
LR.HLR.MusB.Cht.Cht	*Chthamalus spp.* on exposed upper eulittoral rock	2
LR.HLR.MusB.Sem.FvesR	*Semibalanus balanoides, Fucus vesiculosus* and red seaweeds on exposed to moderately exposed eulittoral rock	4
LR.HLR.MusB.Sem.Sem	*Semibalanus balanoides*, *Patella vulgata* and *Littorina spp.* on exposed to moderately exposed eulittoral rock	9
LR.LLR.F.Asc.FS	*Ascophyllum nodosum* on full salinity mid eulittoral rock	5
LR.LLR.F.Fserr.X	*Fucus serratus* on full salinity lower eulittoral mixed substrata	1
LR.LLR.F.Fspi.X	*Fucus spiralis* on full salinity upper eulittoral mixed substrata	1
LR.LLR.F.Fves.X∞	*Fucus vesiculosus* on mid eulittoral mixed substrata	7
LR.LLR.F.Pel	*Pelvetia canaliculata* on sheltered littoral fringe rock	1
LR.MLR.BF.Fser.Bo*∞	Fucus serratus and under-boulder fauna on exposed to moderately exposed lower eulittoral boulders	4
LR.MLR.BF.FspiB	*Fucus spiralis* on exposed to moderately exposed upper eulittoral rock	1

Biotope	Description	Target Note locations identified
LR.MLR.BF.FvesB	Fucus vesiculosus and barnacle mosaics on moderately exposed mid eulittoral rock	2
LR.MLR.BF.PelB	*Pelvetia canaliculata* and barnacles on moderately exposed littoral fringe rock	1
LR.MLR.MusF	Mussels and fucoids on moderately exposed shores	1
LS	Littoral sediment	1
LS.LCS	Littoral coarse sediment	4
LS.LCS.Sh	Shingle (pebble) and gravel shores	2
LS.LCS.Sh.BarSh	Barren littoral shingle	2
LS.LMx	Littoral mixed sediment	1
LS.LSa.FiSa.Po	Polychaetes in littoral fine sand	1
LS.LSa.MoSa.BarSa∞	Barren littoral coarse sand	1
LS.LSa.St	Strandline	1

7.4.4 Protected Fauna

NBN gateway identifies records of bats on the islands of Sanday and South Ronaldsay, and on Mainland close to Kirkwall and Stromness. There are no records of bats within the study area on NBN Gateway. Booth and Booth (2005) report that in general, bats are considered to be rare in Orkney with only one known colony of common pipistrelles in Hoy. There is also local knowledge of a maternity roost near Melsetter (Marcia Humes pers comm), which may or may not be the colony cited in Booth and Booth (2005). Multiple records located in Melsetter have also been provided by Orkney Biological Records Centre (OBRC) as well as one record in Longhope, South Walls. In most years, there are 1 or 2 sightings from widespread localities (Booth and Booth, 2005). The results of the extended phase 1 survey identified some buildings that may support roosting bats but found that the habitat for bats was not optimal.

The European otter *Lutra lutra* is a semi-aquatic mammal, which is common around the freshwater and coastal areas of Scotland. UK populations are internationally important, especially since their widespread decline across much of their western European range (JNCC, 2004). Populations in coastal areas utilise shallow, inshore marine areas for feeding and require fresh water for bathing and terrestrial areas for resting and breeding holts (JNCC, 2004). Where otters live in coastal areas (particularly in Scotland) they tend to have a largely diurnal habit, live in group territories, and have home ranges below 5km (Kruuk, 1996). Records provided by the NBN indicated the presence of otter is widespread across Orkney. In addition, results from the dedicated otter field survey indicated the presence of otter in the south of Hoy.

The presence of a number of highly protected species of birds (listed on Schedule 1 of the Wildlife and Countryside Act 1981(as amended)) were reported within 1km of the study area according to the records search undertaken, including corncrake *Crex crex*, peregrine, hen harrier *Circus cyaneus*, merlin *Falco columbarius*, great northern diver *Gavia immer*, red-throated diver, long-tailed duck *Clangula hyemalis*, redwing *Turdus iliacus*, whimbrel *Numenius phaeopus*, crossbill *Loxia curvirostra*, golden oriole *Oriolus oriolus*, brambling *Fringilla montifringilla*, Slavonian grebe *Podiceps auritus* and snow bunting *Plectrophenax nivalis*. Finally, a record for white-tailed eagle was provided. This bird has the highest level of protection under the Wildlife and Countryside Act 1981(as amended). For further information regarding birds, see the dedicated section of the Scoping Report (Section 7.1).

7.4.4.1 Local Biodiversity Action Plan

The Orkney Local Biodiversity Action Plan (OLBAP) (OIC, 2007) has prepared plans for several habitats and species[28]. Potential habitats with Action Plans within the study area include: Road Verges, Eutrophic Standing Waters, Mesotrophic Standing Waters, Coastal Sand Dunes, Coastal Vegetated Shingle, Coastal Strandline, Coastal Saltmarsh, and Seagrass beds. The Orkney Local Biodiversity Action Plan lists all species on the local BAP list, and those on the Scottish Biodiversity List or UK Biodiversity Action Plan, including otter *Lutra lutra*, Orkney vole *Microtus arvalis orcadensis*, and mountain hare *Lepus timidu.* Records for BAP species within the study area are presented in Table 7.22 below.

[28] Orkney Local Biodiversity Action Plan, 2007. Available at: http://www.orkney.gov.uk/Files/Planning/Biodiversity/Local_Biodiversity_Action_Plan_2008-2011.pdf

Table 7.22 Records of BAP Species within the Study Area.

Species common name	UKBAP	Scottish Biodiversity List	LBAP	Source
Heather		✓	✓	OBRC
Eyebright			✓	OBRC
Purple ramping-fumitory	✓	✓	✓	OBRC
Procumbent pearlwort		✓		OBRC
Northern marsh orchid	✓			OBRC
Scottish primrose		✓		OBLAP
Hedgehog	✓		✓	NBN
Ghost moth	✓			OBLAP
Dusky brocade	✓			OBLAP
Toninia sedifolia (lichen)	✓			OBLAP

7.4.5 Potential Impacts

Possible impacts along with the potential significance of effect on coastal and terrestrial communities are considered in Table 7.23 below:

Table 7.23 Potential Impacts on Terrestrial Ecology

Potential impact	Phase	Potential significance	Comment
Physical disturbance of intertidal habitats during cable	Construction, decommissioning	Potential significance of impact unknown	The level and type of disturbance will depend on the character of the shoreline where the cable is landed and the methodologies used.

Potential impact	Phase	Potential significance	Comment
landfall installation			The types of coast in the vicinity of the development are not generally sensitive, often comprising low rocky platforms with a surface veneer of mobile sand.
Alteration of intertidal communities from change in physical processes	Operation	Potential significance of impact unknown	Dependent on physical processes impact assessment
Physical disturbance of terrestrial communities during construction of onshore cable route	Construction, maintenance, decommissioning	Potential significance of impact unknown	There are a number of onshore grid connection options at the southern end of Hoy and South Walls. Ecological surveys have been undertaken across potential cable corridor, which shall inform the route selection process with the aim of avoiding sensitive habitats and species or if not minimising potential impacts.
Terrestrial habitat /species loss during and following construction of onshore cable route	Construction	Potential significance of impact unknown	
Disturbance of otters during landfall and onshore	Construction, maintenance, decommissioning	Potential significance of impact unknown	Otters are protected under Annex IV of the EU Habitats Directive as a species of European Community

Potential impact	Phase	Potential significance	Comment
cable route construction			Interest in need of strict protection. Otters are fairly common in Orkney in the vicinity of burns which run down onto beaches and sheltered coasts and along adjacent coastlines. The potential for disturbance along each potential cable corridor will therefore require careful consideration.

7.4.6 Baseline Characterisation Strategy

It is proposed that baseline conditions regarding coastal and terrestrial communities can be further defined to sufficient detail by completing the tasks outlined in Table 7.24 below:

Table 7.24 Baseline Characterisation Strategy

Data gaps	Methodology	Example data sources	Status
Intertidal habitats	Skilled eye walkover survey assisted by Google Earth images and aerial photography Intertidal survey for prospective development areas for landfall	Digital data providers & SNH Commissioned survey	Intertidal Survey completed and report produced.
Terrestrial habitats	Skilled eye walkover survey assisted by Google Earth images	Digital data providers	Completed
	Desk review of habitats and species within area,	Commissioned survey Biodiversity Records	Extended Phase 1 Survey

Data gaps	Methodology	Example data sources	Status
	including rare, protected, BAP species. Extended phase 1 habitat survey for prospective development option areas Potential National Vegetation Classification survey of GWDTE	Centre for rare species Consultation of local wildlife group records/knowledge Consultation of local Vice County Recorder records/knowledge Consultation with SEPA	completed and report produced.
Bat survey	If potential sites are in vicinity of development option areas	Consultation with SNH to determine requirement for survey, Commissioned survey Local knowledge Consultation of local wildlife group records/knowledge Consultation of local Vice County Recorder records/knowledge	Initial studies completed as part of the Extended Phase 1 Survey report.
Freshwater habitat survey	Desk based assessment	Consultation with SEPA to determine any further requirements Consultation of local wildlife group records/knowledge Consultation of local Vice County Recorder records/knowledge	Further consultation to be undertaken
Establish which areas within the boundaries of	Desk-based review of existing information	SNH Consultation of local mammal recorder records/knowledge	Otter Survey completed and report produced.

Data gaps	Methodology	Example data sources	Status
the proposals may be important for otters			
Further information of proposed landfall, cable corridor	Consultation with SNH, OIC and local environmental specialists to determine which potential landfall locations, areas along the possible grid routes and substation locations may require investigation.	Local knowledge	Consultation process in progress
Establish the importance of relevant areas for otters[29]	All landfall options, relevant grid corridor areas and substation locations i.e. those near to water bodies will be surveyed for otter activity following the recommended guidelines[30]	Commissioned survey	Otter survey completed and sensitive areas identified at Aith Hope

7.4.7 Impact Assessment Strategy

It is proposed that the following impact assessment strategy, Table 7.25 below, is applied to address the potentially significant impacts identified and those impacts for which the potential level of significance is unknown:

Table 7.25 Impact Assessment Strategy

Potential impact	Assessment topics	Assessment method	Relevant research
Physical	Excavation for cables and	Area of change and	Recovery of

[29] SNH, 2008. Otters and Development: Scottish Wildlife Series [online] Available at: http://www.snh.org.uk/publications/on-line/wildlife/otters/default.asp [Accessed November 2011].
[30] Chanin P (2003). *Monitoring the Otter* Lutra lutra. Conserving Natura 2000 Rivers Monitoring Series No. 10, English Nature, Peterborough.

Potential impact	Assessment topics	Assessment method	Relevant research
disturbance of intertidal habitats during cable landfall installation	long term protection measures	possible mitigation measures	beaches from construction disturbance
Alteration of intertidal communities from change in physical processes	Sensitivity to disturbance Likelihood of change	Survey and desk study	Intertidal survey has been conducted
Physical disturbance or loss of terrestrial communities during cable corridor construction	Soil excavation foot print Altered drainage issues Spread of dust	Area of change and possible mitigation measures Sensitivity of surrounding and downstream habitats	Local rates of recovery from development activities
Disturbance of otters during landfall, and cable corridor construction	Sensitivity to disturbance Likelihood of interaction	Predict area and duration of effect.	Typical behaviour of otters Standard guidance including SNH (2008) *Otters and Development* Local groups County Mammal Recorder

7.4.8 Possible Mitigation and Monitoring Measures

The following possible mitigation and monitoring measures (Table 7.26 below) will be considered during future ongoing EIA and project development activities:

Table 7.26 Possible Mitigation Measures

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
Physical disturbance of intertidal habitats during cable landfall installation	Minimise footprint, Prioritise selection of low sensitivity site where other constraints allow, minimise number of cables	A suitable monitoring strategy will be developed in consultation with SNH. Mitigation and monitoring measures will be developed through the engineering design process with the intention of , wherever possible, to minimise potential for impact	A suitable monitoring strategy will be developed in consultation with SNH. Mitigation and monitoring measures will be developed through the engineering design process with the intention of , wherever possible, to minimise potential for impact
Alteration of intertidal communities from change in physical processes	Related to physical processes impact assessment		
Physical disturbance of terrestrial communities during onshore cable corridor construction	Minimise footprint, Prioritise selection of low sensitivity site where other constraints allow, select low disturbance methods		
Terrestrial habitat loss during and following onshore cable corridor construction	Minimise footprint, Prioritise selection of low sensitivity site where other constraints allow, identify low disturbance methods		

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
Disturbance of otters during landfall, and onshore cable corridor construction	Site selection and cable corridor identification to be informed by knowledge of sensitive areas for otter, Minimise footprint, Prioritise selection of low sensitivity site where other constraints allow		

7.5 Subtidal Seabed Communities

This section primarily covers benthic ecology. Information regarding marine fish and shellfish species is discussed in Section 7.3, coastal ecology is discussed in Section 7.4.

7.5.1 Baseline

Orkney lies on a bio-geographical boundary between the generally rich marine life of western Britain and the less diverse marine life of the North Sea region (Barne *et al*., 1997). The islands are heavily influenced by the North Atlantic Drift, which carries warm water northwards along the west coast of Britain preventing extreme temperature fluctuations and helping to develop diverse marine communities.

As part of a survey programme requested by Scottish Government, to inform potential marine renewables development in Scotland, underwater video footage was collected around the west coast of Orkney and in the Pentland Firth (Moore, 2010). Although there is no overlap of video footage with the AfL, four existing video monitoring sites are located to the west of Hoy, one at South Ronaldsay, east Stroma and west Stroma.

At Rora Head, west Hoy, footage showed mixed substrate of pebbles, cobbles and boulders with gravelly sand crusts, supporting keel worm *Pomatoceros* spp. and bryozoans supplemented by the strong tidal currents including patches of the hydroid *Tubularia indivisa*, and soft coral *Alcyonium digitatum* with abundant brittlestars *Ophiocomina nigra* and *Ophiothrix fragilis* (**CR.MCR.EcCr.FaAlCr.Bri**). Other sites consisted of medium rippled sand, some gravelly components with little evidence of infauna (**SS.SSa.CFiSa**) (Moore, 2010).

A single video site was located at a depth of 41 - 56 m in the tidal race off the southern tip of South Ronaldsay, where currents reach 8 knots. The seabed here consisted mostly of low relief bedrock and boulders, scoured by coarse sediment and cobbles, with the sediment collecting in pockets and dusting some rock surfaces. The biota varies according to localised differences in current strength and scour but is characterised by large numbers of the anemone *Urticina felina.* In areas of reduced current strength and enhanced scour bryozoan and hydroids increase to form localized turfs (**CR.HCR.FaT.CTub**). Similarly, the east Stroma seabed consists of sand-scoured bedrock outcrops and boulders on shell gravel, with the addition of sparse sponge *Pachymatisma johnstoni* (**CR.HCR.FaT.CTub**) (Moore, 2010).

The west Stroma video run passed through the tidal race which crosses the Pentland Firth south of Hoy, where spring current speeds are around 6 knots. At depths of 33 - 48 m the substrate of shelly medium sand is formed into waves with no evidence of infauna (**SS.SCS.CCS**) (Moore, 2010). This accords with previous data (Moore, 2009) in which video runs in the Pentland Firth, relatively close to the AfL, identified the biotopes as **CR.HCR.FaT.BalTub** (*Balanus crenatus* and *Tubularia indivisa* on extremely tide-swept circalittoral rock) and **CR.HCR.FaT.CTub** (*Tubularia indivisa* on tide-swept circalittoral rock[31])**.**

A detailed study has utilised available data on sediment, bathymetry, topography and other physical conditions combined with biological data to produce predictive habitat and biotope maps in GIS for Orkney (Foster-Smith, 2010). The predicted substrates relevant to the AfL site are rock, boulder/cobbles with species such as brittlestars, faunal turfs and algal crusts depicted (Foster-Smith, 2010).

In general the survey results within the Pentland Firth and Orkney highlight that, as would be expected, in more exposed areas with high currents the communities are less diverse than in slightly more sheltered areas, where species such as *U. felina* begin to establish.

7.5.2 Potential Impacts

Possible impacts along with the potential significance of effects on seabed communities are considered in Table 7.27 below:

Table 7.27 Potential Impacts on Subtidal Seabed Communities

Potential impact	**Phase**	**Anticipated significance**	**Comment**
Substrate / habitat loss / damage from placement of devices and other infrastructure on the	All phases	Potential significance of impact unknown	Significance of impact not known as will depend on species and habitats within the footprint and surrounding area of any infrastructure placed on

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

Potential impact	Phase	Anticipated significance	Comment
seabed, cable laying and eventual removal during decommissioning			the seabed. This will be considered further on completion of seabed surveys for the site.
Scour around devices and other subsea infrastructure (including vessel mooring cables as result of movement with wave and tides)		Potential significance of impact unknown	
Increased suspended sediment and turbidity from installation of subsea infrastructure in inshore waters		Potential significance of impact unknown	
Disturbance of contaminated sediments		Effect unlikely to be significant	Limited source of contaminated sediments in area, not deemed to be significant(See Section 7.3 Marine Water and Sediment Quality)
Decrease in water flow leading to downstream change in benthic habitat		Potential significance of impact unknown	Potential for devices to effect water flow, will be considered further.
Damage to habitat or species due to pollution from routine and accidental discharges		Effect unlikely to be significant	Industry best practice will be followed for all operations therefore effects unlikely to be significant (See Section 7.3 Marine Water and Sediment Quality)

Potential impact	Phase	Anticipated significance	Comment
Introduction of marine non-natives.		Potential significance of impact unknown	Use of devices/infrastructure as stepping stones, and introduction of species through vessel movements. This will be considered further, see Section 9: Cumulative and in combination impacts.
Impact to benthic communities from any thermal load or EMF arising from the cables during operation	Operation	Potential significance of impact unknown	Little is known about the potential effects – this potential impact will be considered further.
Colonisation of subsea infrastructure, scour protection and support structures	Operation	Potential significance of impact unknown	Whilst this could have a beneficial effect, this is dependent on the colonising species which may include non-native species. This will be considered further.

7.5.3 Baseline Characterisation Strategy

It is proposed that baseline conditions regarding subtidal seabed communities can be further defined to sufficient detail by completing the tasks outlined in Table 7.28 below:

Table 7.28 Baseline Characterisation Strategy

Data gap	Methodology	Example data sources
Habitats and species currently existing within the study area and ECR.	Using detailed bathymetric data	Raw data from SeaZone. Geophysical survey data
	Site specific video/stills camera survey; desk based study.	Moore, 2010, 2009; NBN (National Biodiversity Network), MNCR reports. MESH (Mapping European Seabed Habitats).

		EMEC site monitoring data (not publically available) Numerous seabed surveys have been carried out locally using video and stills cameras. Some non-proprietary data held by Aquatera and Roving Eye. Discussions with MS-LOT, MS-Science and SNH will help to inform the scope of appropriate benthic data collection.
	Seabed habitat mapping	Combination of geophysical survey data and visual survey data (above) to determine distribution of key habitats and characterising species.

BTAL plan to conduct baseline characterisation investigations during 2013. It is proposed that this will be based upon video and photo work backed up by more specific sampling if particularly sensitive or unusual communities are discovered.

7.5.4 Impact Assessment Strategy

It is proposed that the following impact assessment strategy (Table 7.29) is applied to address the potentially significant impacts identified and those impacts for which the potential level of significance is unknown:

Table 7.29 Impact Assessment Strategy

Potential impact	Assessment topics	Assessment method	Relevant research
Substrate/habitat loss/damage	Determine the	Site specific	Moore 2009, 2010;

Potential impact	Assessment topics	Assessment method	Relevant research
Scour around devices and other subsea infrastructure (including mooring cables as result of movement with wave and tides) Increased suspended sediment and turbidity from installation of devices and other subsea infrastructure	presence and extent of habitats and species within the study area, including rare, sensitive or protected species	survey and desk based research	Moore and Roberts 2011. NBN (National Biodiversity Network), MNCR reports. MESH (Mapping European Seabed Habitats), UK Biodiversity Action Plan. Relevant guidance includes Guideline for EIA (IEEM 2010) renewables licensing manual (EMEC & Xodus draft[32]), and the benthic volume of SNH/MS guidance document for surveying and monitoring in relation to marine renewables deployments in Scotland (Saunders *et al*., 2011)
Decrease in water flow leading to change in habitat	Changes in water flow	Desk based research.	EMEC

[32] http://www.scotland.gov.uk/Resource/0040/00405806.pdf

Potential impact	Assessment topics	Assessment method	Relevant research
Introduction of marine non-natives.	Identification of relevant species and potential for opportunities	Desk based research	SAMS research, Oil and gas guidance (OGP/ IPIECA, 2010), MacDonald and Davidson, 1997.
Colonisation of subsea infrastructure, scour protection and support structures	Determining the sequence and amount of colonisation that could arise, and monitoring the success of anti-fouling techniques	Placement and periodic monitoring of test structures on site	Oil and gas platform studies. ICIT student/research projects.
Impact to benthic communities from any thermal load or EMF arising from the cables during operation	Zone of effect from cable operation	Refer to literature studies, backed up with evidence from short survey of existing cable across site	Various reviews and published papers, EMEC site monitoring.

7.5.5 Possible Mitigation and Monitoring Measures

The following possible mitigation and m onitoring measures (Table 7.30 below) will be considered during ongoing EIA and project development activities:

Table 7.30 Possible Mitigation and Monitoring Measures

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
Substrate / habitat loss / damage	To be determined following outcomes of desk based research, survey and consultation, will be considered when micro siting of devices.	To be determined following outcomes of desk based research, survey and consultation. Review footage taken during installation to validate predictions (operations will most likely be monitored)	To be determined following outcomes of desk based research, survey and consultation. Post-installation ROV survey along cable route(s) and structures on the seabed
Scour around devices and other subsea infrastructure (including mooring cables as result of movement with wave and tides)			
Increased suspended sediment and turbidity from installation of devices and other subsea infrastructure			
Decrease in water flow leading to change in habitat			
Colonisation of subsea infrastructure, including marine non-natives.	Method statement to minimise risk of non-native introduction Follow relevant IMO regulations		
Colonisation of subsea infrastructure, scour protection and support structures	None	None	Regular inspections as part of engineering works
Impact to benthic	None required	None	Periodic seabed

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
communities from any thermal load or EMF arising from the cables during operation			photos, as part of engineering works

7.6 Questions

Questions for Reader
Q10. Do you consider the studies proposed for assessment of effects on the ecological environment appropriate and complete for a) the preferred technology and b) the alternative technologies?

8 POSSIBLE IMPACTS ON THE PHYSICAL ENVIRONMENT

This chapter considers the potential impacts of the proposals on the following receptors:

- Physical processes;
- Air and climate;
- Geology, soils and hydrology; and
- Water and sediment quality.

An overview of the relevant baseline environment is provided for each along with the anticipated impacts, a baseline characterisation strategy, impact assessment strategy and where applicable, possible mitigation and monitoring measures.

8.1 Physical processes

8.1.1 Baseline Description

This section presents a summary of existing baseline understanding relating to the key physical processes and the seabed and shoreline features that will be considered within the ES. The baseline description will be further developed and enhanced as more data becomes available from ongoing project-specific surveys, particularly the geophysical surveys of the sea bed.

8.1.1.1 Geological Overview of the Sea Bed

Publicly available datasets with additional ROV seabed video footage have been collected and analysed in an earlier desk study. The sea bed within the AfL is likely to consist largely of exposed bedrock (100% Sandstone with subordinate conglomerate, siltstone and mudstone). ROV surveys undertaken indicate a number of large boulder fields in the west and centre of the site. Otherwise, sediment cover is likely to be thin, where present, and variable due to a strong tidal current (> 2 m/s). A very small grab sample of coarse shell fragments collected by BGS supports sparse sediment deposition across the site and this is confirmed on nearby ROV footage taken by FRS.

In summary, the sea bed within and around the AfL is likely to be dominated by:

- Generally exposed bedrock with patchy thin sands and gravels;
- Undulating topography; and
- Localised boulders.

8.1.1.2 Geological Overview of the Shoreline

The Orkney archipelago is formed largely of Middle and Upper Old Red Sandstone rocks of Devonian age (417-354 Million Years Before Present (B.P.)). Locally, older sedimentary rocks, basement igneous and metamorphic rocks, as well as younger lavas, volcanic plugs and numerous dykes (mostly of Carboniferous age) are present.

High-cliff coastlines are a feature of the south-west tip of the island of Hoy, which provide some of the best examples in Europe of Old Red Sandstone cliffs and associated features. The rich variety of cliff and cliff-related forms along this coast include steep and overhung profiles; sea-stacks; arches; caves; and shore platforms, all reflecting the dominant geological control of horizontally bedded, fractured and faulted Devonian sandstone.

In Orkney, sand deposits are a coastal feature within the larger bays. They are often associated with dune systems and a machair type hinterland. Two documented dune and machair systems are noted in close proximity to the study site, namely the bay dune system of The Ayre and the bay dune and machair of Melberry.

8.1.1.3 Tidal Stream and Range

Spring tidal range in the western Orkney Islands is ~3m. The tides around Orkney are the result of the interaction of two independent tidal systems, in the North Atlantic and the North Sea. This produces a net flow of water from west to east and complex interactions among the island sounds and in Scapa Flow.

Tidal currents experienced can be significant and highly variable, particularly within the Pentland Firth where they can run at up to 5m/s on both the flood and ebb tide. Large eddies form in the lee of islands and can be sudden and extremely variable. However, the main tidal flows tend to be pushed offshore by the rocky headlands which occur around much of the southern Hoy coastline.

8.1.1.4 Wave Climate

Along the south-west coast of Hoy, a combination of deep open water and exposure to prevailing winds produces a high-energy wave climate, especially during north and north-west incident storms. Because the sea floor falls steeply away from the west to 60m, the coast is exposed to relatively high wave energies.

Severe wave conditions (>8m) can be incident from any sector, excluding the southeast. Extreme significant wave heights and associated return periods, calculated using data from the Met Office model are presented in Table 8.1. It should be noted, however, that the Met Office model has a coarse grid and therefore the results at this point may not take full account of local bathymetry and local current effects.

Table 8.1 Total Extreme Significant Wave Heights

Return Period (years)	Significant wave height (m)
1	10.65
10	12.79
100	14.82

8.1.1.5 Seabed and Bathymetry

Water depths in the bays and channels around the Isles of Orkney are generally less than 25m and rarely exceed 40m depth in any location. In comparison, the Pentland Firth is significantly deeper, with depths in the main channel reaching between 60m to 80m. Water depths increase to more than 90m in the western part of the Firth, between Hoy and Dunnet Head. An initial single beam bathymetric survey was carried out in 2011 and the data collected is shown in Figure 8.1. Note there is currently a more extensive geophysical survey campaign underway to provide bathymetric data (as well as side scan sonar, sub-bottom profiling and magnetometer data) covering the full AfL.

East of Mainland and to the south of the Orkney Islands, bedrock outcrops occur on the sea bed, which strongly influences the morphology of the sea bed. The sea floor slopes away steeply from the west of Mainland and from the south-west of Hoy and is typically comprised of exposed bedrock.

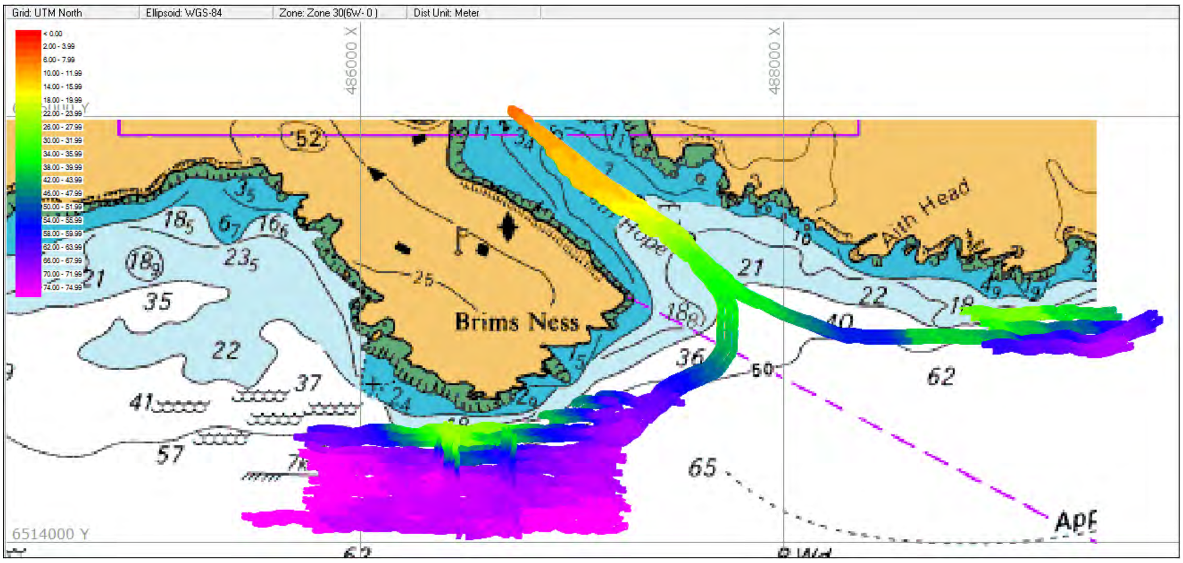


Figure 8.1 Single Beam Bathymetric Survey Extent (Image Source: Partrac 2011)

8.1.1.6 Sediment Transport

Seabed sediments are defined here as the unconsolidated sediments at sea bed laid down since the sea transgressed across the area following the early Holocene rise in sea level.

The existing beach sediments are derived from a combination of eroded glacial till, erosion of sandstone cliffs and from shell material. Sands and gravels notable for their high biogenic carbonate content form the sea-bed sediments around the Orkney Islands. Much of the gravel around the islands, particularly to the north and east, is composed predominantly of shell debris. These carbonate deposits reflect the rich littoral and sublittoral fauna that exists around the Orkney Islands.

There is little documented detail on sediment transport patterns. The coastline is a high energy environment dominated by wave processes. In the south, the isles are rocky and subject to harsh wave conditions.

The extremely high flood and ebb currents that occur in almost all of the straits between islands decrease inshore, and it is unlikely that tidal currents have any direct effect on moving beach material. However, the strength of the currents at peak flows is such that significant movement of material on the sea bed can occur.

Between the main islands the sea bed is swept by strong tidal currents. Within these channels, the sediments are thin and patchy, comprising shell-gravels, coarse sand or rock debris; the mud content of the sediments is extremely low.

8.1.2 Potential Impacts

The potential impacts and the anticipated significance during different development phases are outlined below in Table 8.2.

Table 8.2 Potential Impacts and Anticipated Significance During Construction, Operation and Decommissioning.

Potential impact	Phase	Potential significance	Comment
Release of material due to installation of foundations/substructures and devices and offshore hub(s)	Construction	Potential significance of impact unknown	Further information required regarding foundation/substructure, device and offshore hub installation methods and

Potential impact	Phase	Potential significance	Comment
			locations.
Release of material in water column due to installation of inter-array and export cables	Construction	Potential significance of impact unknown	Further information required regarding inter-array and export cable laying methods and locations.
Effects to physical processes or beach morphology from installation of cable landfall at the shore	Construction	Potential significance of impact unknown	Further information required regarding cable landfall installation methods and locations.
Change to tidal regime due to presence of foundations/substructures and devices and offshore hub(s)	Operation	Potential significance of impact unknown	Further information required regarding foundation/substructure, device and offshore hub type(s) and locations. However, the purpose of the tidal energy converters is to extract energy from the tidal streams and therefore a potentially significant effect is possible.
Effects to bed load sediment transport due to presence of inter-array and export cables	Operation	Potential significance of impact unknown	Further information required regarding inter-array and export cable type(s) and

Potential impact	Phase	Potential significance	Comment
			locations.
Change to physical processes or beach morphology at cable landfall at the shore	Operation	Potential significance of impact unknown	Further information required regarding cable landfall type(s) and locations.
Change to physical processes due to decommissioning of foundations/substructures and devices and offshore hub(s)	Decommissioning	Potential significance of impact unknown	Further information required regarding foundation/substructure, device and offshore hub decommissioning methods and locations.
Change to physical processes due to decommissioning of inter-array and export cables	Decommissioning	Potential significance of impact unknown	Further information required regarding inter-array and export cable decommissioning methods and locations.
Change to physical processes due to decommissioning of cable landfall at the shore	Decommissioning	Potential significance of impact unknown	Further information required regarding cable landfall decommissioning methods and locations.

8.1.3 Baseline Characterisation Strategy

The method for outlining the baseline physical processes environment of the AfL is described in Table 8.3 below.

Table 8.3 Baseline Characterisation Strategy for Physical Processes

Data	Methodology	Example data sources
Sea bed conditions (desk and field studies)	Desk study of available reports and datasets to characterise existing conditions and to focus the type and scope of subsequent field surveys. Initial single-beam bathymetric and drop-down camera survey in April 2011. Subsequent (ongoing) multi-beam hydrographic and geophysical surveys.	Sea bed bathymetry; Shallow subsurface geology; Surface sediment type and thickness.
Baseline physical processes (desk, modelling and field studies)	Desk study of available reports (included in this ES Scoping Report) and an initial vessel-mounted ADCP survey undertaken to inform on locations for further fixed location deployments. Three subsequent phases of bed-mounted ADCP deployments between 2011 and 2012 (Phase 1 within the original AfL and Phases 2 and 3 within the revised AfL). Set-up, calibration and simulations using a MIKE21-Hydrodynamic model of the AfL and surrounding areas to characterise baseline tidal currents.	Water depths; Current velocities; Waves heights, periods and directions; Turbulent kinetic energy; Turbidity (Phase 3 only).

8.1.4 Impact Assessment Strategy

Potential impacts associated with the Project are outlined in Table 8.4 below alongside methodology to assess identified impacts.

Table 8.4 Potential Impacts Associated with Physical Processes and Proposed Methodology and Relevant Research to Assess for Such Impact.

Potential impact	Topic	Methodology	Relevant research
Release of material due to installation of foundations/substructures and devices and offshore hub(s)	Physical processes (further effect on water quality and ecology)	Effects will be assessed in the ES using EGA.	Particular reference will be given to the baseline tidal current modelling and the geophysical survey information on sub-surface and surface sediment types.
Release of material in water column due to installation of inter-array and export cables	Physical processes (further effect on water quality and ecology)	Effects will be assessed in the ES using EGA.	Particular reference will be given to the baseline tidal current modelling and the geophysical survey information on sub-surface and surface sediment types.
Effects to physical processes or beach	Physical processes (further effect on water	Effects will be assessed in the	Particular reference will be

Potential impact	Topic	Methodology	Relevant research
morphology from installation of cable landfall at the shore	quality and ecology)	ES using EGA.	given to the shoreline morphology and beach sediment types.
Change to tidal regime due to presence of foundations/substructures and devices and offshore hub(s)	Physical processes (further effect on ecology)	Effects will be assessed in the ES using numerical modelling (MIKE21-Hydrodynamic Modelling) (effects on tides) and EGA (effects on waves and sediment transport).	Literature review of effects of tidal devices on current, wave and sediment regimes.
Effects to bed load sediment transport due to presence of inter-array and export cables	Physical processes	Effects will be assessed in the ES using EGA.	Literature review of regional sea bed and shoreline sediment transport pathways.
Change to physical processes or beach morphology at cable landfall at the shore	Physical processes	Effects will be assessed in the ES using EGA.	Particular reference will be given to the shoreline morphology and beach sediment types.

Potential impact	Topic	Methodology	Relevant research
Change to physical processes due to decommissioning of foundations/substructures and devices and offshore hub(s)	Physical processes (further effect on water quality and ecology)	Effects will be assessed in the ES using EGA.	Particular reference will be given to the baseline tidal current modelling and the geophysical survey information on sub-surface and surface sediment types.
Change to physical processes due to decommissioning of inter-array and export cables	Physical processes (further effect on water quality and ecology)	Effects will be assessed in the ES using EGA.	Particular reference will be given to the baseline tidal current modelling and the geophysical survey information on sub-surface and surface sediment types.
Change to physical processes due to decommissioning of cable landfall at the shore	Physical processes (further effect on water quality and ecology)	Effects will be assessed in the ES using EGA.	Particular reference will be given to the shoreline morphology and beach sediment types.

8.1.5 Possible Mitigation and Monitoring Measures

Table 8.5 below identifies the potential impacts and possible mitigation measures which will be undertaken as well as possible monitoring during installation and post-deployment.

Table 8.5 Possible Mitigation Measures and Installation and Post-Deployment Monitoring

Potential impact	Possible mitigation measures	Possible monitoring during installation	Possible post-deployment monitoring
Release of material due to installation of foundations/substructures and devices and offshore hub(s)	Optimise locations based on geophysical survey to maximise use of gravity base foundations and minimise use of drilled piles so ensuring minimum impact during construction.	None likely to be required.	None likely to be required.
Release of material in water column due to installation of inter-array and export cables	Optimise locations based on geophysical survey to minimise bed disturbance due to burial during construction and minimise need for installation of cable protection using concrete mattresses or rock	None likely to be required.	None likely to be required.

Potential impact	Possible mitigation measures	Possible monitoring during installation	Possible post-deployment monitoring
	armour.		
Effects to physical processes or beach morphology from installation of cable landfall at the shore	Utilise horizontal directional drilling if practicable and cost-effective. Minimise trench length and width if trenching used.	Pre-installation visual inspection / topographic surveying of beach levels if trenching used across inter-tidal.	Post-installation visual inspection / topographic surveying of reinstatement of beach levels if trenching used across inter-tidal.
Change to tidal regime due to presence of foundations/substructures and devices and offshore hub(s)	Optimise locations of tidal energy converters based on MIKE21-Hydrodynamic numerical modelling results to minimise interaction of wake effects between adjacent devices within the array.	None likely to be required.	ADCP deployments to assess wake effects (if modelling results indicate potential high significance of effects).
Effects to bed load sediment transport due to presence of inter-array and export cables	Optimise locations based on geophysical survey to minimise need for presence of cable protection using concrete	None likely to be required.	Sea bed changes in areas where concrete mattresses or rock armour is used.

Potential impact	Possible mitigation measures	Possible monitoring during installation	Possible post-deployment monitoring
	mattresses or rock armour.		
Change to physical processes or beach morphology at cable landfall at the shore	Ensure cable burial is of sufficient depth to avoid need for cable protection works (rock armour, concrete mattresses) across the inter-tidal.	None likely to be required.	None likely to be required.
Change to physical processes due to decommissioning of foundations/substructures and devices and offshore hub(s)	Optimise locations based on geophysical survey to maximise use of gravity base foundations and minimise use of drilled piles so ensuring minimum impact during decommissioning.	None likely to be required.	None likely to be required.
Change to physical processes due to decommissioning of inter-array and export cables	Optimise locations based on geophysical survey to minimise bed disturbance	None likely to be required.	None likely to be required.

Potential impact	**Possible mitigation measures**	**Possible monitoring during installation**	**Possible post-deployment monitoring**
	due to retrieval of cable and cable protection during decommissioning.		
Change to physical processes due to decommissioning of cable landfall at the shore	Leave decommissioned cable buried beneath beach rather than remove.	None likely to be required.	None likely to be required.

8.2 Air and Climate

8.2.1 Baseline

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

The climate at South Hoy and within the surrounding area is influenced by its position on the edge of the North Atlantic Current which delivers warmer water to the western seaboard of Scotland creating a relatively mild and wet climate with strong prevailing south westerly winds.

Meteorological data collected at Kirkwall (approximately 25km from the study area) between 1970 and 2000 shows yearly average temperatures to range between 5.3 ^{O}C and 10.5 ^{O}C, with an average of 47.5 days of sunshine, 184.4 day of rain (≥ 1mm) and 29 days where air frost is present over the same period. The monthly average wind speeds at the Kirkwall station are between 10.7 knots in August and 16.8 in January, with a yearly average of 13.6. Wind from the west and south-east is one of the most significant features of the Orkney climate, and gales are frequent, occurring on 29 days of an average year (Barne *et al.*, 1997).

8.2.2 Potential Impacts

Possible impacts along with the potential significance of associated effects on air and climate are considered in Table 8.6 below:

Table 8.6 Potential Impacts and Anticipated Significance During Construction, Operation and Decommissioning.

Potential impact	Phase	Anticipated significance	Comment
Vessel emissions, decreasing air quality	Construction, operation, maintenance and decommissioning		Vessels used will emit gasses such as carbon dioxide, sulphur oxides and nitrogen oxides which will have a localised effect on the

Potential impact	Phase	Anticipated significance	Comment
			atmosphere, but there will not be a significant change relevant to current traffic levels. All vessels will operate to IMO standards (refer to MARPOL Annex VI).
Construction of onshore elements for the Project resulting in dust impacts	Construction	Effect unlikely to be significant	Limited potential for dust generation during marine works. While landside construction activities may result in the release of dust during dry periods, this will be limited in scale and duration. Construction activities will follow CIRIA best practise for construction site management including dust suppression measures as required

It is proposed that air and climate since impacts are scoped out as they are likely to be negligible. Therefore, no further baseline conditions, or mitigation or monitoring strategies are required.

8.3 Marine Water and Sediment Quality

8.3.1 Baseline

Onshore water bodies are not considered in this Section, being instead addressed in Section 8.4 Geology, Soils and Hydrology.

The water quality of the seas around Orkney is generally excellent due to their location on the edge of the North Atlantic, which facilitates the dilution and dispersion of any contaminants or pollutants entering coastal waters (Marine Scotland, 2010). The AfL area lies within the Pentland Firth and while a number of landfall options are being considered around the southern coastline of Hoy, there is preference for a single connection point for the whole Project. There are no bathing waters within the AfL but within the wider Pentland Firth area there are two bathing water beaches, Dunnet Bay and Thurso, both of which are classed as having excellent water quality[33]. Section 6.4, Subtidal Seabed Communities, highlights that the sediment around the AfL area consists mainly of gravelly components and areas of rippled sands.

8.3.1.1 Offshore Water Bodies

The AfL falls within the Old Head to Tor Ness coastal water body, which is classified by the Scottish Environment Protection Agency (SEPA) as having a high overall status and state[34]. Furthermore, SEPA state '*The current status of the water body meets the requirements of the Water Framework Directive, thus we must ensure that no deterioration from good status occurs'*.

8.3.1.2 Sediment

Little information exists on sediment quality within the nearshore area. There are five licenced disposal sites for dredged material in Orkney waters, (Baxter *et al*., 2011), one north of Kirkwall, three to the North of Hoy in or around Scapa Flow, and one to the south of Scapa Flow between Hoy and South Ronaldsay (Site F1055). The closest dredging disposal site to the proposed Project is disposal site F1055. Recently, this site has predominantly been used for the disposal of material dredged from the Hatston Pier development. This site is the most heavily used dredge disposal site in Orkney Waters and is situated 6.6 Km from the northern edge of the AfL (Figure 6.6).

---

[33] http://www.sepa.org.uk/water/bathing_waters/bathing_water_profiles.aspx [Accessed June 2013]

[34] 'High status' is defined as the biological, chemical and morphological conditions associated with **no** or **very low** human pressure

8.3.2 Potential Impacts

Possible impacts along with their potential significance on archaeology and cultural heritage are considered in Table 8.7 below:

Table 8.7 Potential Impacts Identified During Construction, Operation and Decommissioning.

Potential impact	Phase	Anticipated significance	Comment
Increase in suspended sediment.	Construction	Effect unlikely to be significant	Increased sedimentation leading to smothering of surrounding habitats or release of contaminated sediments is very unlikely in a tide-swept area or will be rapidly dispersed due to tidal flows. The tidal flows will also reduce any smothering potential due to increased dilution and dispersion rates.
Pollution of the offshore water environment.	Construction and operation	Effect unlikely to be significant	Industry best practice guidelines will be followed at all times e.g. appropriate use of chemicals, spill response, marine pollution contingency plans and pollution prevention guidelines (PPGs), in particular PPG1 (Good Environmental Practices) and PPG5 (Works and Maintenance in or near water) as outlined by SEPA[35]. Risk of pollution not deemed to be significant.

[35] http://www.sepa.org.uk/about_us/publications/guidance/ppgs.aspx

Potential impact	Phase	Anticipated significance	Comment
Contamination of marine sediments.	Construction and operation	Effect unlikely to be significant	Industry best practice guidelines will be followed at all times e.g. appropriate use of chemicals, spill response, marine pollution contingency plans and PPGs, in particular PPG1 and PPG5 as outlined by SEPA. Risk of contamination not deemed to be significant. T

No potentially significant impacts have been identified for marine water and sediment quality and this receptor is therefore scoped out of the EIA. It is proposed that the relevant stakeholders are consulted during the project design process to ensure that any potential issues that may arise are identified.

8.4 Geology, Soils and Hydrology

8.4.1 Baseline

This chapter discusses potential impacts to the onshore components to the Project. Offshore components are discussed in Section 8.1 Physical Processes and Section 8.3 Marine Water and Sediment Quality.

8.4.2 Geology

8.4.2.1 Superficial Geology

The majority of the Area of Search is directly underlain by bedrock, with superficial deposits only present in discrete pockets of the study area. Superficial deposits comprising Devensian Till are present in five locations across the study area: in the Bu of Aith; along the coastal area around Hurliness; the coastal area of Melsetter; and two discrete pockets in the south of the study area. Raised marine beach deposits described as gravel, sand and silt are present in the area of potential landfall identified as The Ayre and blown sand deposits are located at Melsetter. Peat deposits are identified in the south of the Onshore Cable Corridor Area of Search. *Bedrock Geology*
The majority of the Area of Search is underlain by Upper Stromness Flagstone formation of Devonian age. This bedrock is described as siltstone, mudstone and sandstone. There is also an ar ea of Lower Eday Sandstone formation to the east of The Ayre and near to Hurliness. Igneous intrusions known as the Orkney Swarm are present in the coastal areas around the south of the study area. These are older formations dating from Permian and Carboniferous periods.

Near to the Area of Search, high-cliff coastlines are a prominent feature. The rich variety of cliff and cliff-related forms along this coast include steep and overhung profiles; sea-stacks; arches; caves; and shore platforms, all reflecting the dominant geological control of horizontally bedded, fractured and faulted Devonian sandstone.

Orkney contains a nu mber of nationally important examples of glacial and pr e-glacial deposits and r aised beaches. A number of these are designated as geological Sites of Special Scientific Interest (SSSIs) and Geological Conservation Review Sites (GCR). These sites include Hoy SSSI (approximately 400m from the onshore area of investigation) and Muckle Head and Selwick SSSI and GCR over 17km from the onshore area of investigation on Hoy which are both excellent examples of raised beaches, and Invernaver, Red Point and Dunnet Links SSSIs on the Scottish mainland, which are all good examples of coastal geology and geomorphology. There are no SSSI designated for geo-diversity or GCR sites within the study area.

8.4.3 Hydrology and Hydrogeology

8.4.3.1 Rivers

Water features across the study area comprise a number of field drains, as well as a stream draining the peatland area in the south of the Onshore Cable Corridor Area of Search. No rivers, streams or drains have been classified by SEPA under the WFD.

8.4.3.2 Wetlands

There is an area of peatland in the south of the Onshore Cable Corridor Area of Search. The peat deposits in this study area are not protected under specific international, national or local designations, however they may have local ecological importance or may be dependent upon groundwater flow.

8.4.3.3 Groundwater

The majority of the Onshore Cable Corridor Area of Searchis situated on Devonian flagstones, which are classified by SEPA as having a low productivity rating (a typical borehole yield in the order of 0.1 to 1l/s). The groundwater flow is dominated by fracture flow, therefore, the presence of fractures will have a significant effect on the hydraulic conductivity of the aquifer. The Ordnance Survey mapping indicates the presence of 13 wells, therefore groundwater abstraction for private water supplies is likely to be of importance at a local scale.

This study area is situated in the Hoy groundwater body as defined under the River Basin Management Plan produced by SEPA. SEPA has classified the water body as having overall Good status (with high confidence) and no pressures have been identified for this water body.

8.4.4 Land Quality

The Onshore Cable Corridor Area of Search is generally undeveloped agricultural land. There is one active quarry in the study area known as Witter Quarry (ND 279 891) and a number of disused quarries. There is the potential that chemical contaminants and other materials used as part of the quarrying process may have resulted in contamination of the soil and water environment. Furthermore, former quarries may have been backfilled with imported material, which may have the potential to be contaminative.

8.4.5 Potential Impacts

Possible impacts along with the potential significance of effect on geology, soils and hydrology are considered in Table 8.8 below:

Table 8.8 Potential Impacts During Installation and Operation

Potential impact	Phase	Potential significance	Comment
Alteration of existing drainage patterns caused by construction of below ground structures for onshore cabling.	Installation and operation	Potential significance of impact unknown	Assessment will be required to determine likely impact to peatland and design suitable mitigation. Changes of drainage patterns may also have the potential to result in a flooding risk. Assessment will consider whether pathways may be established leading to contamination of the water environment.
Contamination of soils, surface water or groundwater from spills.	Installation and operation	Potential significance of impact unknown	Any spillage of concrete, lubricants, fuels, oils and other fluids used during construction may adversely affect soils and water quality of watercourses and groundwater
Contamination of	Installation	Potential	At the landfall, it may be necessary to

Potential impact	Phase	Potential significance	Comment
groundwater		significance of impact unknown	use directional drilling techniques to connect to the subsea cables. This may lead to contamination of groundwater from additives used in the directional drilling technique or through opening pathways through contaminated land.
Disturbance or loss of features of geological interest	Installation	Potential significance of impact unknown	At the landfall, it may be necessary to use directional drilling techniques to connect to the subsea cables. Any potential impact should be mitigated through design, i.e. avoidance of sites of geological importance.
Direct or indirect impact on watercourses	Installation	Potential significance of impact unknown	Watercourse crossings have the potential to cause erosion leading to increase in sediment entering the watercourse.
Alteration of groundwater flows due to cable trenching	Installation and operation	Potential significance of impact unknown	Creation of a trench and backfilling with excavated material may result in a preferential pathway of higher porosity and permeability. This could lead to an alteration of groundwater and surface water flows. The disturbance of natural water flows could divert the natural course of groundwater and result in draining of waterlogged areas or flooding of currently dry areas.
Increased sediment loads in	Installation	Potential significance of	Construction activities have the potential to create sedimentation in

Potential impact	Phase	Potential significance	Comment
watercourses due to excavation and reinstatement of transitional pits and trenches.		impact unknown	watercourses, particularly during periods of heavy rainfall. For example, rainfall on soil stockpiles could create sediment laden runoff that could reach watercourses
Impacts to private water supplies	Installation and operation	Potential significance of impact unknown	Assessment will be required to determine likely impact to PWS and design appropriate mitigation, which may include providing alternative temporary or permanent water supply.

8.4.6 Summary of Potential Impacts and Study Requirements

It is proposed that the baseline environment can be further defined to sufficient detail by completing the tasks outlined in Table 8.8 below:

Table 8.8 Baseline Characterisation Strategy

Data gap	Methodology	Example data sources
Topographical characterisation	Desk based study and site visit	Ordnance Survey (OS) mapping
Geological and soils characterisation on land	Peat survey, existing geological maps, trial pits dug and boreholes drilled in study area if required.	Published maps (BGS, soil mapping) and project specific survey
Land quality	Review of current and historic land use.	OS mapping.
Hydrological characterisation (including for private water	Water features survey and existing mapping.	Published maps (OS mapping) and project specific survey, SEPA flood risk assessment maps and River

Data gap	Methodology	Example data sources
supplies)		Basin Management Plans

8.4.7 Impact Assessment Strategy

It is proposed that the following impact assessment strategy, Table 8.9 below, is applied to address the potentially significant impacts identified and those impacts for which the potential level of significance is unknown:

Table 8.9 Impact Assessment Strategy

Potential impact	Assessment topics	Assessment method	Relevant research
Alteration of existing drainage patterns caused by construction of below ground structures for onshore cabling.	Duration and extent of impact. Receptor sensitivity. Change in surface water flows. Change to level of flood risk. Change in erosion potential.	Water features survey Likely construction methods Drainage design GWDTE (Groundwater dependent terrestrial ecosystems) assessment	Comply with The Water Environment (Controlled Activities) (Scotland) Regulations 2011. Comply with SEPA Land Use Planning System guidance notes.
Contamination of soils, surface water or groundwater from spills	Sources of spillage Extent of contamination Likelihood of possible spillage events Consequences of possible spillage	Assessment of change to the status of the RBMP groundwater body.	Established best practise regards spill minimisation and management. SEPA groundwater vulnerability map of Scotland (2004)

Potential impact	Assessment topics	Assessment method	Relevant research
	events		
Contamination of groundwater	Materials used to facilitate drilling e.g. drill muds.	Assessment of likely impact to groundwater quality.	In accordance with best practice
Disturbance or loss of features of geological interest	Location and trajectory of drilling.	Assessment of geological features and likely impacts.	In accordance with best practice and in discussion with SNH and JNCC.
Direct or indirect impact on watercourses as a result of crossings.	Duration and extent of impact.	Water features survey Identification of any watercourse crossings Likely construction methods Change in surface water quality status as defined by River Basin Management Plan or Environmental Quality Standards.	Comply with The Water Environment (Controlled Activities) (Scotland) Regulations 2011. In accordance with best practice guidance.
Alteration of groundwater flows due to cable trenching	Duration and extent of impact.	Likely construction methods GWDTE (Groundwater dependent terrestrial ecosystems)	Comply with The Water Environment (Controlled Activities) (Scotland) Regulations 2011. Comply with SEPA Land Use Planning

Potential impact	Assessment topics	Assessment method	Relevant research
		assessment	System guidance notes.
Increased sediment loads in watercourses due to excavation and reinstatement of transitional pits and trenches.	Duration and extent of impact. Sensitivity of receptor	Assessment of the erosion and deposition likelihood. Assessment of the impact of conservation status.	Comply with The Water Environment (Controlled Activities) (Scotland) Regulations 2011. In accordance with best practice guidance.
Impacts to private water supplies (PWS), i.e. deterioration in quantity and / or quality	Receptor sensitivity	PWS identification and characterisation as part of water features survey. Likely to involve visiting nearby properties, which have PWS potentially at risk.	Comply with The Water Environment (Controlled Activities) (Scotland) Regulations 2011.

8.4.8 Possible Mitigation and Monitoring Measures

The following possible mitigation and monitoring measures, Table 8.10 below, will be considered during the EIA and project development activities:

Table 8.10 Possible Mitigation and Monitoring Measures

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
Alteration of existing	Following best practice guidance.	Will be determined through EIA and	Will be determined through EIA and

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
drainage patterns caused by construction of below ground structures.	Appropriate siting of below ground structures or road construction at an appropriate distance from GWDTE.	consultation with SEPA and OIC	consultation with SEPA and OIC.
Contamination of soils, surface water or groundwater from spills	Works carried out in accordance with Construction Environmental Management Plan. Work undertaken in accordance with Pollution Prevention Guidance and CIRIA publications.		
Contamination of groundwater and private water supplies	Will be determined through EIA and consultation.		
Disturbance or loss of features of geological interest	Adoption of best practice techniques. Appropriate siting of landfall to avoid sites of geological interest.		
Direct or indirect impact on watercourses as a result of crossings.	In accordance with Engineering in the Environment Good Practice Guide (March 2009) and other appropriate best practice guidance.		
Alteration of groundwater	Following best practice guidance.		

Potential impact	Mitigation measures	Monitoring during installation	Post-deployment monitoring
flows due to cable trenching	Appropriate siting of below ground structures (e.g. foundations) or road construction at an appropriate distance from GWDTE.		
Increased sediment loads in watercourses due to excavation and reinstatement of transitional pits and trenches.	In accordance with Engineering in the Environment Good Practice Guide (March 2009) and other appropriate best practice guidance.		

8.5 Questions

Questions for Reader
Q11. Are the studies proposed for assessment of effects on the physical environment appropriate and complete for a) the preferred technology and b) the alternative technologies?

9 CUMULATIVE AND IN-COMBINATION EFFECTS

This chapter presents the team's proposed approach to CIA for the Project which is based on a recent guidance document produced by The Crown Estate (AMEC & Aquatera, 2013). It is proposed that once a suitable approach to CIA for The Project is agreed, a more detailed CIA scoping document will be prepared and issued to key stakeholders. This will then be updated as and when appropriate until such a time that the scope can be signed off and the CIA finalised. It is anticipated that the CIA scope can be signed off at least six months in advance of the proposed application submission date.

9.1 Projects to Include in the Brims Tidal Array CIA

It is proposed that the following projects will be included in the CIA:

- Relevant projects that have been consented and are yet to be constructed;
- Relevant projects for which an application has been submitted but which are not yet consented; and
- Wave and tidal energy projects for which a Scoping Report has been submitted (although any assessment made in relation to such projects is likely to be qualitative). It is suggested that projects for which a Scoping Report has been submitted be reviewed with MS-LOT and OIC nearer to the time of submission to determine whether or not they remain 'reasonably foreseeable' and therefore relevant to the Brims Tidal Array CIA.

Note – existing activities, including those not subject to licensing and consent, along with operational projects, will be considered in the main assessment as part of the existing baseline and therefore not in the CIA.

It is proposed that the following types of project may be considered in the CIA, depending on the outcome of this scoping exercise:

- Tidal energy projects;
- Wave energy projects;
- Offshore wind energy projects;
- Offshore infrastructure projects;

- Oil and gas developments;
- Aquaculture (new applications/reviews);
- Dredging;
- Coastal developments;
- Onshore infrastructure projects; and
- Onshore wind energy projects.

It is proposed that the following projects will not be included in the CIA:

- EMEC test sites; and
- Activities not subject to licensing/consent.

It is understood that MS-LOT will develop and maintain a catalogue of projects that can be used to determine which developments to include in a project-specific CIA. It is not yet known if OIC will be taking a similar role with regards to onshore developments or if this will be covered by MS-LOT's database. This database will be used to help determine the specific projects/proposals that should be considered in the Project CIA during the CIA scoping stage.

It is recommended that the scope of the Project CIA be confirmed six months prior to the proposed application submission date.

9.2 Receptors to Include in the Brims Tidal Array CIA

All receptors (human, ecological and physical) considered in the EIA will be initially included in the CIA. During CIA scoping, the following flow chart (Figure 9.1) will be used to determine those that require detailed consideration in the CIA:

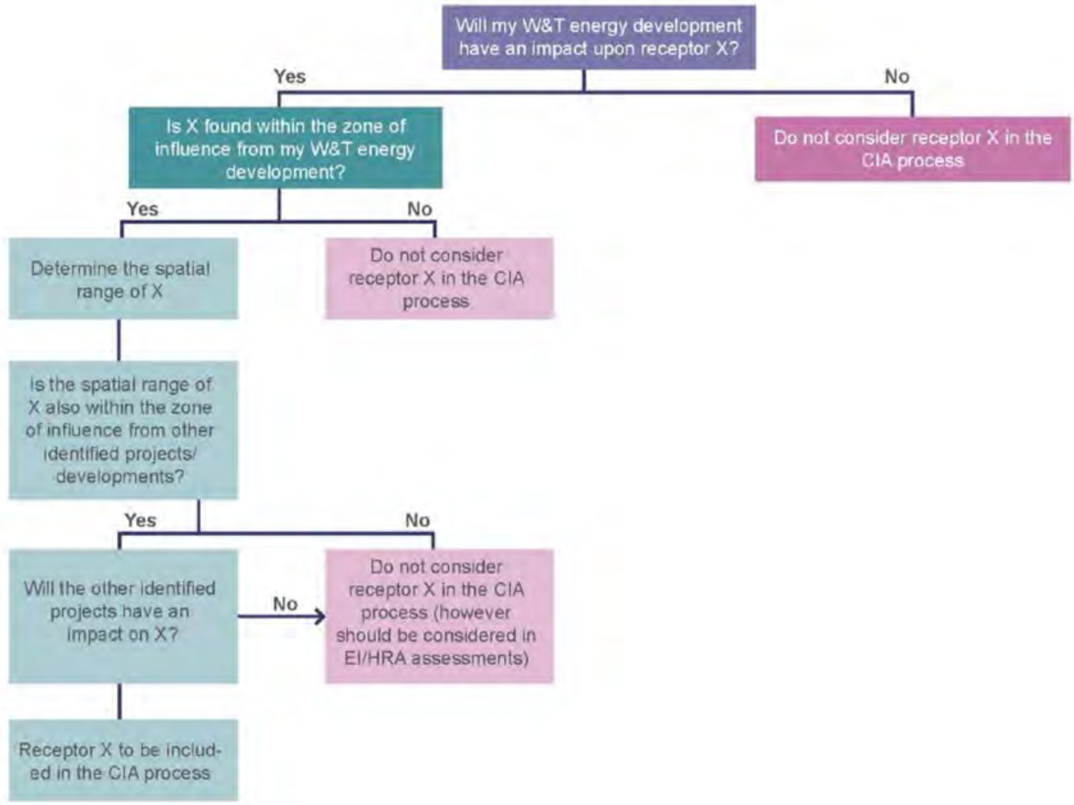


Figure 9.1 Process to Determine Which Receptors to Include in the CIA Process (AMEC and Aquatera 2013)

The EIA process will determine whether or not the proposed development will have an impact on each receptor. This process will also inform decisions with regards to the projects to include and scope out of the CIA.

9.3 Cumulative Impact Assessment

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 Brims Tidal Array) and a receptor, cumulative effects can be ruled out. Possible pathways can be identified using a simple matrix format as shown in Table 9.1 below:

Table 9.1 CIA Pathways to be Identified

Receptor	Source				Screening conclusion
	Brims Tidal Array	Source 1	Source 2	Source 3	
Receptor 1	*Possible pathway*	*No pathway identified*	*No pathway identified*	*No pathway identified*	No CIA required
Receptor 2	*Possible pathway*	*Possible pathway*	*Possible pathway*	*No pathway identified*	CIA required

This screening process will help to refine the relevant projects and receptors and inform the spatial extent of the CIA. This will result in list of key issues for consideration in the Project CIA. An outline plan for assessing these key issues will be presented in the CIA scoping document.

Once the scope of the CIA is agreed with MS-LOT and OIC, a proportionate assessment will be undertaken and the results presented in the ES.

9.4 Anticipated Key Issues

At this stage, it is anticipated that the Project CIA will focus on a number of key issues including:

- Impacts to commercial fisheries, including loss of access to creel grounds; displacement to less profitable areas, increased steaming times, increased running costs and conflict between users of different gear;
- Impacts to shipping and navigation, including constriction of shipping routes; increased navigational risk and disruption, increased travel and running costs;
- Impacts on local residents, including employment opportunities, improvements to local infrastructure, increased industrial activity and increased demand on social services during construction, with benefits to the wider UK economy; and
- Contributions to achieving the Scottish and UK renewable energy targets and promotion of marine renewable energy technology.

Migratory fish, marine mammals and birds may also be considered depending on the outcomes of the impact assessment.

9.5 Next Steps

A detailed CIA scoping document will be produced based on the approach outlined in the previous sections and feedback from stakeholders. The document will be developed in consultation with MS-LOT and OIC and issued to key stakeholders. The document will include:

- Draft list of projects/proposals to be considered in the Project CIA;
- List of projects/proposals scoped out of the Project CIA and justifications as required;
- List of relevant receptors based on the results of the Scoping Report (main document), the Scoping Opinion and other feedback received;
- Initial screening of potential cumulative impacts (using the table format presented previously);
- List of potential key cumulative effects with proportionate outline assessment plans; and
- Update on project timescales and CIA schedule.

Questions for Reader
Q12. Are you aware of any proposed developments within the planning process or activities with which the proposed tidal Project might interact to result in cumulative effects?

10 PRELIMINARY HAZARD ANALYSIS – SUMMARY

Shipping and navigation in the vicinity of the Brims Tidal AfL area has been assessed by Anatec as part of a Preliminary Hazard Analysis (PHA) (Appendix C).

From the baseline data collection and local consultation it was identified a mixture of vessels several vessel types pass through and near the AfL area, most notably the passenger ferry Hamnavoe (when weather routeing via Scapa Flow), the cargo vessel Dettifoss and the fishing vessel Selfoss. Cargo vessels passed through the Outer Sound of the Pentland Firth, to the south of the AfL area.

Vessels operating in the area could be potentially affected by the Brims Tidal Project. The impacts will vary between installation, maintenance, decommissioning and normal operations.

An assessment methodology for the Navigation Risk Assessment has been proposed in the PHA based principally on the following guidance:

- Department for Energy and Climate Change (DECC) Methodology for Assessing the Marine Navigational Safety Risks of Offshore Windfarms (2005); and
- Maritime and Coastguard Agency (MCA) Marine Guidance Notice 371 (MGN 371) Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues.

The DECC methodology, which was produced in association with the DfT / MCA, provides a template for preparing a navigation risk assessment for marine renewable developments. The methodology is centred on risk controls and the feedback from risk controls into risk assessment. It requires a submission that shows that sufficient risk controls are, or will be, in place for the assessed risk to be judged as broadly acceptable or tolerable with further controls or actions.

The MCA guidance MGN 371 highlights issues that need to be taken into consideration when assessing the impact on navigational safety from offshore renewable energy developments in the UK. Specific annexes within the guidance that address particular issues include:

- Annex 1: Site position, structures and safety zones;
- Annex 2: Developments, navigation, collision avoidance and communications;
- Annex 3: MCA's windfarm shipping template for assessing windfarm boundary distances from shipping routes;
- Annex 4: Safety and m itigation measures recommended for OREI during construction, operation and decommissioning; and
- Annex 5: Search and Rescue (SAR) matters.

One of the key requirements of MGN 371 is the collection of maritime traffic survey data of appropriate duration, including seasonal and t idal variations. This is to record all vessel movements in and around the Project site and its vicinity. The method and timetable for data collection will be agreed with the MCA in advance to ensure it meets their requirements.

Local stakeholders representing all the different maritime interests, including ports, ferries, fishing, shipping, recreation and emergency services, will be invited to the Hazard Review Workshop, which are a key part of the NRA and a useful method of identifying additional risk controls.

Other key guidance and reference materials that will be used in the assessment are listed below:

- MCA Marine Guidance Notice 372 (2008). Guidance to Mariners Operating in the Vicinity of UK OREIs;
- IALA Recommendation O-139 On The Marking of Man-Made Offshore Structures, 1st Edition, December 2008;
- DECC Guidance Notes on Applying for Safety Zones around Offshore Renewable Energy Installations; and
- IMO Guidelines for Formal Safety Assessment (FSA).

11 PROPOSED EIA METHODOLOGY

11.1 EIA Process

An EIA will be required to support the consent applications associated with the proposed tidal development. Table 11.1 below identifies the main stages of the EIA process that the Project will follow.

Table 11.1 Stages of the EIA Process

Stage	Task	Aim/objective	Work/output (examples)
Pre-scoping	Project Briefing Document	To initiate consultation with all key stakeholders, providing preliminary information on the scheme to date	Documents tailored to stakeholders groups, consultation
Scoping	Scoping study	To identify the potentially significant direct and indirect impacts of the proposed development and CIA	Targets for specialist studies (e.g. hydrodynamic studies, sediment quality)
EIA	Baseline data collection	To characterise the existing environment	Background data including existing literature and specialist studies
	Specialist studies	To further investigate those environmental parameters which may be subject to potentially significant effects	Specialist reports
	Impact assessment	To evaluate the existing environment, in terms of sensitivity To evaluate and predict the impact (i.e. magnitude) on the existing environment To assess the significance of the predicted impacts To assess the significance of cumulative and in-combination effects	Series of significant adverse and beneficial impacts Identification of those impacts not assessed to be significant
	Mitigation and optimisation measures	To identify appropriate and practicable mitigation measures and enhancement measures	The provision of solutions to minimise adverse impacts and maximise opportunities as far as possible Feedback into the design process, as applicable
	Environmental Statement	Production of the ES in accordance with EIA guidance Including a Non-Technical Summary (NTS).	ES Four main volumes: NTS; Written statement; Appendices; Figures Environmental Monitoring Plan
	Pre-Application Consultation	Advertising of application for licensing must occur at least 12 weeks prior to submission of joint s36 Application	Joint s36/Licence Application (if applicable)
	Post submission	Liaison and consultation to resolve matters or representations/objections	Addendum to ES
EIA Consent Decision			

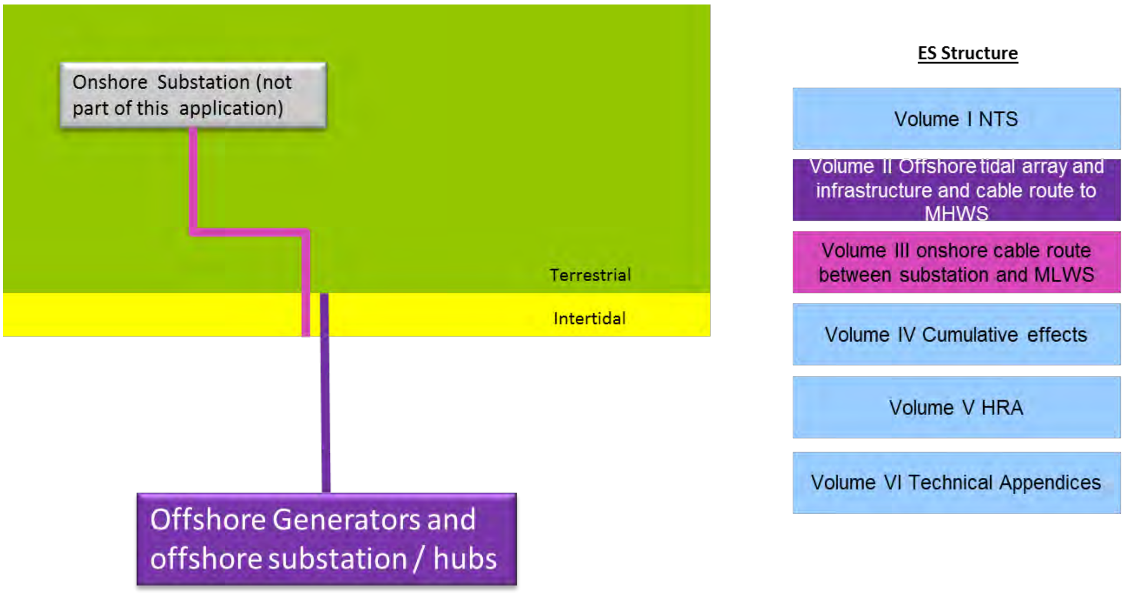
11.2 Environmental Statement

The findings of the EIA are presented in a written ES. It is proposed to submit the ES in a series of volumes, as described below.

The aim of laying out the ES documents as described below is that it allows the information for the full development to be presented together in one document, however, the volumes can also be separated out with sections relevant to each development component and their associated licence applications. This enables regulators and key stakeholders to access easily and succinctly the elements of the ES relevant to each licence application and their specialism/consenting needs.

The ES structure for the Project will contain six volumes (as presented in the schematic below) which will allow flexibility for applications for consent to be made at different times, although the aim will be to submit all applications at the same time. The schematic below (Figure 11.1) illustrates the proposed layout of the Project ES.

Figure 11.1 Schematic layout of the Brims Tidal Array ES



Volume I will include a single overarching NTS which will cover the entire Project. This may need to be updated if applications for onshore and offshore consents are made at different times.

Volume II will include the Phase I offshore array, any offshore substation or hubs and the export cable route up to MHWS. This volume will accompany the application for consent under Section 36 and a Marine Licence.

Volume III will include the onshore cable corridor from MLWS to the onshore substation. The construction of the onshore substation and onward connection to the SHE-T substation is not part of the application. This volume will support the detailed application under Town and Country Planning.

Note: The intertidal area is covered in both volumes II and volume III. This is the approach used in offshore wind ES's where separate ES's have been used to support the applications.

Volume IV will provide an assessment of the cumulative effects of the Project together with other existing, consented and / or proposed development / activity in the Pentland Firth and Orkney waters and beyond.

Volume V will contain information to inform Appropriate Assessment and will be used by the regulator to assess the potential effects of the development of Habitats Regulations Sites and Species.

Volume VI will contain all technical appendices which will be titled using an alpha-numeric code which will allow the reader to easily link each chapter with the appropriate appendices. Volumes II, and III will both contain separate project descriptions and upfront chapters.

It is proposed the text of each assessment volume will be structured as follows.

11.2.1 Introductory Chapters

Overview of Renewable Energy and Project Introduction

- An introduction to renewable energy development and in particular, tidal power will be outlined. It will give a short overview of the tidal resource in Scotland, in particular around Orkney, and will outline the potential benefits of the development in terms of reduced emissions. It will also outline the project drivers, aims and objectives.

Overview of EIA Methodology

- Will include an overview of the impact assessment methodology used for the EIA process including scoping and consultation and the identification of key environmental effects.

Site Selection Process

- A description of the site selection process for the tidal array and grid connection route will be outlined. It will describe the main alternatives studied, and the main reasons for the choice of this site, taking into account the environmental effects. It will describe the way in which mitigation of environmental effects has been c onsidered during project design, layout, cable route to substation and the EIA process.

Project Description

- Details of the site and a des cription of the proposed tidal array will be discussed. This will include details of the possible size, layout and design of the site and associated onshore/offshore infrastructure. This chapter will also outline the construction, installation, operational, maintenance and decommissioning requirements of the Project.

Policy and Legislation

- This section will present an overview of the relevant statutory planning guidance and D evelopment Plan policies which apply to the proposed development.

EIA Results (for Volume II, Volume III or both, as applicable, including CIA with existing activities)

- **Human Parameters**
    - Local communities and socio-economics;
    - Commercial Fisheries;
    - Shipping and Navigation;
    - Ports and Harbours;
    - Utilities;
    - Disposal sites;
    - Land use;
    - Seascape and Landscape;
    - Archaeology and Cultural Heritage;
    - Military Activity;
    - Aviation

- Recreation;
- Tourism;
- Other renewables;
- Onshore Traffic and Transport;

- **Biological Parameters**[36]
  - Birds;
  - Subtidal Seabed Communities;
  - Fish;
  - Marine Mammals;
  - Coastal and Terrestrial communities;

- **Physical Parameters**
  - Physical processes;
  - Geology and Hydrology; and
  - Marine water and sediment quality.

Each topic chapter will describe the approach taken to impact assessment. This will include an outline of relevant consultations undertaken, documentation studied and the means of defining the Area of Search for that topic. Should there be any difficulties (technical deficiencies or lack of know-how) encountered in compiling the required information, this will be noted. The ex isting baseline conditions for the topic will then be described. An assessment will then be made of the nature, magnitude, duration and s ignificance of the likely effects of the construction, installation, operation, maintenance, and decommissioning of the proposed development on the topic.

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

Potential cumulative effects will be discussed within each EIA topic chapter, and summarised in Volume IV Cumulative Effects volume.

[36] Designated sites to be included in the relevant sections

11.2.2 Mitigation

This scoping phase identifies potential direct and indirect impacts associated with the potential development prior to the implementation of appropriate mitigation. Mitigation measures will be identified during the next stages of the EIA process and will be informed through stakeholder consultation and specific surveys and studies, along with best practice industry guidance for renewable and marine and coastal developments. BTAL are committed to considering current best practice to minimise the risk of adverse impact to the physical, biological or social environments on site and in the surrounding area. These include, but are not limited to:

- Timings of works to avoid sensitive times, such as breeding or migratory seasons of important species, unsociable hours for local residents;
- Siting of development to avoid sensitive or protected areas, species or habitats in both marine and terrestrial environments; and
- Use of low toxicity compounds during construction, operation and maintenance.

The proposed development will also draw on key knowledge from the marine renewable industry and the studies (such as underwater noise, onshore noise and wildlife interaction) completed on existing industry knowledge of tidal devices, including those types under consideration for the development, to inform potential effects and possible mitigation.

11.3 Environmental Mitigation and Monitoring Plan

Where elements of uncertainty remain regarding predicted effects (as part of the full EIA exercise) a monitoring programme may be required. Any requirements for monitoring will be discussed with Marine Scotland and the relevant stakeholders and committed to as part of the EIA consultation process. It would be expected that monitoring commitments would become subsequent consent conditions.

A draft Environmental Mitigation Monitoring Plan (EMMP) will be submitted with the application. The plan will include for adaptive management to provide greater confidence for the mitigation of potential impacts where uncertainties remain, and allow for adjustments to be made as the monitoring programme progresses. Comprehensive monitoring, in approval with Marine Scotland and SNH, will also allow for baseline characterisation for construction of Phase II of the Project. A draft Construction Management Plan, Vegetation Management Plan and species protection management plan (as required) will be included.

12 CONCLUSIONS

The ES of the EIA will assess the magnitude of all likely impacts and will identify appropriate mitigation to reduce impacts to an acceptable level. Tables 12.1 and 12.2 outline the need for the potential impacts outlined in this scoping study to be considered further during EIA. In addition to the site specific environmental impacts outlined below there are significant beneficial impacts to the development of renewable energy technologies with regards to reducing carbon emissions and combating climate change.

Table 12.1 Consideration of Effects Shown in Table 12.2

✓ (orange)	Effect significance unknown requiring further data to be collated and assessed
× (yellow)	Effect unlikely to be significant (and therefore has been scoped out of EIA)
×	No effect (and therefore scoped out of EIA)
✓ (green)	Beneficial (and will not be assessed in the EIA)

Table 12.2 Key Potential Effects of the Proposed Tidal Array

Potential Effect	Construction & Installation	Operation	Maintenance	Decommissioning
HUMAN ENVIRONMENT				
Local Communities and Socio-economics				
Local employment and business opportunities	✓	✓	✓	✓
Wage inflation	✓	✓	✓	✓
Improvements to infrastructure and facilities	✓	✓	✓	✓
Population increase	✓	✓	✓	✓
Change in population distribution	✓	✓	✓	✓
House price inflation	✓	✓	✓	✓

Potential Effect	Construction & Installation	Operation	Maintenance	Decommissioning
Pressure on local utility services	✓	✓	✓	✓
Improvements to local transport services	✓	✓	✓	✓
Commercial Fisheries				
Loss of access to fishing grounds resulting from any restrictions / exclusion zones	✓	✓	✓	×
Obstruction to regular fishing vessel transit routes	✓	✓	✓	×
Change in abundance of targeted species	×	✓	×	×
Ports and Harbours				
Overcapacity of port infrastructure	✓	✓	✓	✓
Utilities				
Potential upgrade of existing electrical grid infrastructure	✓	×	×	×
Potential impacts on electrical grid, telecoms and water network during construction and installation	×	×	×	×
Disruption to utilities provision	×	×	×	×
Disposal Sites				
Potential disruption to existing disposal site activity	×	×	×	×
Land Use				
Nuisance or obstructions to land use from construction and presence of overhead or buried cables from coast to onshore substation	✓	✓	×	×
Landscape and Seascape				
Changes to landscape character	✓	✓	×	×
Changes to seascape character	✓	✓	×	✓
Changes to visual amenity	✓	✓	×	×
Cumulative impacts	✓	✓	×	×
Archaeology and Cultural Heritage				

Potential Effect	Construction & Installation	Operation	Maintenance	Decommissioning
Physical disturbance of submerged historic and prehistoric land surfaces and archaeological finds (known and unknown)	✓	×	×	✓
Physical disturbance of terrestrial (onshore) sites and finds (known and unknown)	✓	×	×	✓
Direct disturbance to the visual setting of Scheduled Monuments and effects on historic landscape character (both within and outwith the areas of search)	✓	✓	×	×
Indirect disturbance of submerged historic and prehistoric land surfaces and archaeological finds as a result of changes to the hydraulic and sedimentary regime	×	✓	×	×
MOD				
Disruption to surface ships	✓	✓	✓	✓
Disruption to submarine activity	✓	✓	✓	✓
Disruption to airborne activity	✓	✓	✓	✓
Disruption to land based activity	×	×	×	×
Aviation				
Disruption to aviation	×	×	×	×
Increased use of local airport facilities	×	×	×	×
Recreation				
Disturbance to offshore recreation activities during construction and maintenance works offshore	✓	✓	✓	✓
Disturbance to onshore recreation during onshore construction works and afterwards from presence of structures	✓	✓	✓	✓
Tourism				
Offshore - Industrialisation of the local seascape reducing tourists' visual amenity	✓	✓	✓	✓
Onshore - Industrialisation of the local landscape reducing tourists'	✓	✓	✓	✓

Potential Effect	Construction & Installation	Operation	Maintenance	Decommissioning
visual amenity				
Increased pressure on local temporary accommodation	✓	✓	×	×
Additional topic of interest creating new draw for tourists	✓	✓	✓	✓
Onshore Traffic				
Temporary increase in traffic	✓	×	×	×
Road crossings	×	×	×	×
Movement of abnormal loads (cable drums, transformers etc)	✓	×	×	×
Permanent increase in traffic during operation	×	×	×	×
Shipping and Navigation				
Disruption to navigation created by devices or any required marine exclusion zone	✓	✓	✓	✓
Disruption to navigation created by support vessels	✓	✓	✓	✓
Loss of or change to traditional navigation routes	✓	✓	✓	×
ECOLOGICAL ENVIRONMENT				
Birds				
Collision risk from turbine	×	✓	×	×
Displacement from vicinity of turbine	✓	✓	×	×
Disturbance by vessel activity	✓	✓	×	✓
Lighting of TECs and other infrastructure	✓	✓	×	×
Marine seabed habitat loss/change, due to turbine foundations and cable armouring.	✓	✓	×	×
Onshore habitat loss (breeding or foraging habitat) due to land-take for infrastructure	✓	✓	×	×
Disturbance due to onshore construction works	✓	×	×	×
Marine Mammals and Reptiles				
Impact to marine reptiles	×	×	×	×

Potential Effect	Construction & Installation	Operation	Maintenance	Decommissioning
Disturbance to marine mammals from underwater noise generated by construction / deployment vessels	✓	×	✓	✓
Disturbance to marine mammals and basking shark from underwater noise generated during potential drilling activities	✓	×	×	×
Marine mammal collision with vessels	✓	×	✓	✓
Seal collision risk (corkscrew incidents)	✓	✓	✓	✓
Disturbance to marine mammals from underwater noise generated by the devices	×	✓	×	×
Risk of injury to marine mammals and basking shark from collision with devices	×	✓	×	×
Reduction of access to food resource for marine mammals	×	×	×	×
Accidental contamination to marine mammals and basking shark from vessels or devices	×	×	×	×
Fish and Shellfish				
Disturbance of spawning grounds (herring and sandeel)	✓	×	×	✓
Disturbance of habitat for demersal species	✓	×	×	✓
Effects of noise and vibration (increased boat traffic and construction, operational and decommissioning activity) on hearing specialists (i.e. herring and sprat)	✓	✓	×	✓
Collision of slow moving larger species (e.g. basking sharks) with the devices or strike of migratory fish	×	✓	×	×
Effects of electromagnetic fields (EMF) on elasmobranches and salmonids.	×	✓	×	×
Changes in the existing habitat (due to colonisation of infrastructure)	×	✓	×	×
Coastal and Terrestrial Ecology				
Physical disturbance of intertidal habitats during cable landfall installation	×	✓	×	✓

Potential Effect	Construction & Installation	Operation	Maintenance	Decommissioning
Alteration of intertidal communities from change in physical processes	×	✓	×	×
Physical disturbance of terrestrial communities during construction of onshore grid and substation	✓	×	✓	✓
Terrestrial habitat /species loss during and following grid infrastructure installation	✓	×	×	×
Disturbance of otters during landfall, grid and substation installation	×	✓	✓	✓
Subtidal Seabed Communities				
Substrate / habitat loss / damage from placement of devices and other infrastructure on the seabed, cable laying and eventual removal during decommissioning	✓	✓	✓	✓
Scour around devices and other subsea infrastructure (including vessel mooring cables as result of movement with wave and tides)	✓	✓	✓	✓
Increased suspended sediment and turbidity from installation of subsea infrastructure in inshore waters	✓	✓	✓	✓
Disturbance of contaminated sediments	×	×	×	×
Decrease in water flow leading to downstream change in benthic habitat	✓	✓	✓	✓
Damage to habitat or species due to pollution from routine and accidental discharges	×	×	×	×
Introduction of marine non-natives.	✓	✓	✓	✓
Impact to benthic communities from any thermal load or electro-magnetic fields (EMF) arising from the cables during operation	×	✓	×	×
Colonisation of subsea infrastructure, scour protection and support structures	×	✓	×	×
PHYSICAL ENVIRONMENT				
Physical Processes				
Release of material due to installation of foundations/substructures	✓	×	×	×

Potential Effect	Construction & Installation	Operation	Maintenance	Decommissioning
and devices and offshore hub(s)				
Release of material in water column due to installation of inter-array and export cables	✓	×	×	×
Effects to physical processes or beach morphology from installation of cable landfall at the shore	✓	×	×	×
Change to tidal regime due to presence of foundations/substructures and devices and offshore hub(s)	×	✓	×	×
Effects to bed load sediment transport due to presence of inter-array and export cables	×	✓	×	×
Change to physical processes or beach morphology at cable landfall at the shore	×	✓	×	×
Change to physical processes due to decommissioning of foundations/substructures and devices and offshore hub(s)	×	×	×	✓
Change to physical processes due to decommissioning of inter-array and export cables	×	×	×	✓
Change to physical processes due to decommissioning of cable landfall at the shore	×	×	×	✓
Air and Climate				
Vessel emissions, decreasing air quality	×	×	×	×
Construction of onshore elements for the project resulting in dust impacts	×	×	×	×
Water and Sediment				
Increase in suspended sediment.	×	×	×	×
Pollution of the offshore water environment.	×	×	×	×
Contamination of marine sediments.	×	×	×	×
Geology, Soils and Hydrology				
Alteration of existing drainage patterns caused by construction of below ground structures	✓	✓	×	×

Potential Effect	Construction & Installation	Operation	Maintenance	Decommissioning
Contamination of soils, surface water or groundwater from spills.	✓	✓	×	×
Contamination of groundwater	✓	×	×	×
Disturbance or loss of features of geological interest	✓	×	×	×
Direct or indirect impact on watercourses	✓	×	×	×
Alteration of groundwater flows due to cable trenching and construction of an onshore substation	✓	✓	×	×
Increased sediment loads in watercourses due to excavation and reinstatement of foundations, transitional pits and trenches.	✓	×	×	×
Impacts to private water supplies	✓	✓	×	×

Questions for Reader

Q 13. Have the most likely and significant effects been identified through this analysis for a) the preferred technology and b) the alternative technologies? Are there any others that should be considered for inclusion in the full assessment process and if so why?

13 SCOPING QUESTIONS

A number of questions have been posed to all readers throughout this document, with a number specifically posed to MS-LOT. We would be grateful if you could consider these in your scoping response, making any additional comments as necessary.

MS-LOT	*OIC*	*All Readers*	*Questions to be put forward*
		✓	Q1. Are the Project geographic and technical boundaries outlined both clear and sufficient for what will / will not be included in the EIA?
✓	✓		Q2. Are MS-LOT / OIC comfortable in the application of the Rochdale Envelope principle to the assessment of impacts of the proposed Project and would any further information be required?
✓	✓		Q3. Does MS-LOT / OIC have any questions relating to the proposed consenting strategy?
✓	✓		Q4. Please could MS-LOT / OIC confirm the party who will take the lead consenting role for the intertidal area?
	✓		Q5. Please could OIC confirm Pre Application Consultation is not required for the onshore cable corridor?
✓	✓	✓	Q6. Please could all readers confirm if enough information has been provided to form a Scoping Opinion for a) the preferred technology and b) the alternative technologies?
	✓		Q7. Please could OIC confirm if Pre Application Consultation (PAC) will be required for the construction of the onshore cable corridor?
		✓	Q8. Have all the regulatory requirements for the Project been identified?
		✓	Q9. Are the studies proposed for assessment of effects on the human environment appropriate and complete for a) the preferred technology and b) the alternative technologies?
		✓	Q10. Do you consider the studies proposed for assessment of effects on the ecological environment appropriate and complete for a) the preferred technology and b) the alternative technologies?

		✓	Q11. Are the studies proposed for assessment of effects on the physical environment appropriate and complete for a) the preferred technology and b) the alternative technologies?
		✓	Q12. Are you aware of any proposed developments within the planning process or activities with which the proposed tidal Project might interact to result in cumulative effects?
		✓	Q 13. Have the most likely and significant effects been identified through this analysis for a) the preferred technology and b) the alternative technologies? Are there any others that should be considered for inclusion in the full assessment process and if so why?

14 REFERENCES

AB Associates Ltd (2010) Orkney Visitors survey 2008/2009. Prepared by: HIE, Orkney Islands Council AB Associates Ltd & VisitOrkney

ABPmer (2012). *Pentland Firth and Orkney Waters Enabling Actions Report:A Socio-economic Methodology and Baseline for Pentland Firth and Orkney Waters Wave and Tidal Development.* [online]. The Crown Estate. Available at <http://www.thecrownestate.co.uk/media/391521/socio-economic-methodology-and-baseline-for-pfow-wave-tidal-developments.pdf>

AMEC and Aquatera (2013). CIA Scoping Process.

Aquatera (2012). Breeding Bird Survey Report.

Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody, J.P., Davidson, N.C., & Buck, A.L., eds. (1997). Coasts and seas of the United Kingdom. Regions 15 & 16. North-west Scotland: the Western Isles and w est Highland. Peterborough, Joint Nature Conservation Committee. (Coastal Directories Series.)

Birdlife International. (2011). *Birdlife Seabird Foraging Database.* http://seabird.wikispaces.com

Booth, C. and Booth, J. (2005) Sillocks, skarfies & selkies: The fish, amphibians, reptiles, birds and mammals of Orkney. Orcadian Ltd.

Brongersma, L.D. (1972). European Atlantic turtles. Leiden, Rijksmuseum van Natuurlijke Historie

Camphuysen, C.J., Fox, T., Leopold, M.F. & Petersen, I.K.(2004). Towards standardised seabirds at sea census techniques in connection with environmental impact assessments for offshore wind farms in the UK. A report for COWRIE.

Coull, K.A., Johnstone, R., and R ogers, S.I. (1998). Fi sheries Sensitivity Maps for British Waters. Published and distributed by UK Oil and Gas.

Ellis, J.R., Milligan, S.P., Readdy, L., Taylor, N. and Brown, M.J. (2010). Spawning and nursery grounds of selected fish species in UK waters. Sci. Ser. Tech. Rep., Cefas Lowestoft, 147: 56 pp

Emec and Xodus Aurura (in press) Consenting, EIA and HRA Guidance for marine renewable energy developments in Scotland. Draft available online:
http://www.scotland.gov.uk/Resource/0040/00405806.pdf

Evans, P.G.H., Baines, M.E. & Coppock, J. (2011). Abundance and behaviour of cetaceans and basking sharks in the Pentland Firth and Orkney Waters. Report by Hebog Environmental Ltd & Sea Watch Foundation. Scottish Natural Heritage Commissioned Report No.419

Foster-Smith, B. (2010). The Highland, Hebrides and Orkney Marine Environment: A GIS Resource. Scottish Natural Heritage Commissioned Report No. 387

Furness, R. W., Wade, H. M., Robbins, A. M. C., and Masden, E. A. (2012). Assessing the sensitivity of seabird populations to adverse effects from tidal stream turbines and wave energy devices. - *ICES Journal of Marine Science*, 69: 1466-1479.

Garthe, S. and Hüppop, O (2004). Scaling possible adverse effects of marine windfarms on seabirds: developing and applying a vulnerability index. J. Ap. Ecol. 41: 724-734.

Grecian, W.J., Inger, R., Attrill, M.J., Bearhop, S., Godley, B.J., Witt, M.J. and Votier, S.C. (2010). Potential impacts of wave-powered marine renewable energy installations on marine birds. *Ibis* **152**, 683–697

Gribble, J. and Leather, S. for EMU Ltd. Offshore Geotechnical Investigations and Historic Analysis: Guidance for the Renewable Energy Sector. Commissioned by COWRIE Ltd (project reference GEOARCH-09)

Hallaitken (2009). Orkney Population Change Study, Executive Summary Available at <http://www.orkney.gov.uk/Files/Business-and-Trade/Economic_Review_2010.pdf>

Howson, C. M., Steel. L., Carruthers, M. & Gillham, K. (2012). Identification of Priority Marine Features in Scottish territorial waters. *Scottish Natural Heritage Commissioned Report No. 388*

HR Wallingford, 1986. Kirkwall Pier. A Wave Disturbance Study. HR Wallingford Report EX1509.

Jackson, D., and Whitfield, P. (2011). *Guidance on survey and monitoring in relation to marine renewables deployments in Scotland. Volume 4. Birds*. Unpublished draft report to Scottish Natural Heritage and Marine Scotland.

JNCC (2004). Vertebrate species mammals [online]: Available at http://www.jncc.gov.uk/ProtectedSites/SACselection/species.asp?FeatureIntCode=S1355 [Accessed 26/07/2013]

Katherine Walker, Research Coordinator (2013). Orkney Sustainable Fisheries

Kober, K., Webb, A., Win, I., Lewis, M., O'Brien, S., Wilson, L. and Reid, J.B. 2010. An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs *JNCC Report* No. 431

Kruuk, H., (1996). Wild Otters, Predation and Populations, Oxford University Press, Oxford, England.

Land Use Consultants (1998) Orkney Landscape character assessment Scottish Natural Heritage Review No 100

Landscape Institute and the Institute of Environmental Management & Assessment (IEMA) (2013) Guidelines for Landscape and Visual Impact Assessment (GLVIA) 3rd ed.

Langton, T.E.S., Beckett, C.L., King, G.L., & Gaywood, M.J. (1996). Distribution and status of marine turtles in Scottish waters. Edinburgh, Scottish Natural Heritage Research.

MacDonald, E., and Davidson, R. (1997) Ballast Water Project, Final Report, Spring 1997.

FRS Laboratory, Aberdeen

Macleod, K., Lacey, C., Quick, N., Hastie, G. and Wilson J. (2011). *Guidance on survey and monitoring in relation to marine renewables deployments in Scotland. Volume 2. Cetaceans and Basking Sharks*. Unpublished draft report to Scottish Natural Heritage and Marine Scotland. Available online http://www.snh.gov.uk/docs/A585083.pdf

Marine Scotland (2012). Inshore Fisheries Study Pilot in the Pentland firth and Orkney Waters.

Marine Scotland Science (2013). Marine Scotland Analytical Unit. Catch data, [Online], Available: http://www.scotland.gov.uk/Topics/Statistics/Browse/Agriculture-Fisheries/RectangleData/2012rectangleLandings

Marine Scotland & The Scottish Government. (2013). Pentland Firth and Orkney Waters Marine Spatial Plan Framework & Regional Locational Guidance for Marine Energy. Available online <http://www.scotland.gov.uk/Resource/Doc/295194/0115355.pdf> [Accessed 19/08/2013].

Marine Scotland, The Scottish government, Aecom and Metoc (2010). Pentland Firth and Orkney Waters Marine Spatial Plan Framework. Regional Locational Guidance for Marine Energy.

MCT (2010) SeaGen Environmental Monitoring Programme: Biannual Update. Version 1- SeaGen Biannual

Moore, C. G. and Roberts, J. M. (2011). An assessment of the conservation importance of species and habitats identified during a series of recent research cruises around Scotland. Scottish Natural Heritage Commissioned Report No. 446

Moore, C.G. (2009). Preliminary assessment of the conservation importance of benthic epifaunal species and habitats of the Pentland Firth and Orkney Islands in relation to the development of renewable energy schemes. Scottish Natural Heritage Commissioned Report No. 319.

Moore, C.G. (2010). Preliminary assessment of the conservation importance of benthic species and habitats off the west coast of Orkney and in the Pentland Firth in relation to the development of renewable energy schemes. Scottish Natural Heritage Commissioned Report No. 352.

National Biodiversity Network Gateway, (2012). National Biodiversity Network Gateway [online] Available at: http://data.nbn.org.uk/ [Accessed January 2012]

National Records of Scotland, 15th Aug 2013, Statistical Bulletin, http://www.scotlandscensus.gov.uk/documents/censusresults/release1c/rel1c2sb.pdf

NRP (2012). Cantick Head Tidal Array Project: Proposed Surveys Methods for Birds, Marine Mammals & Basking Shark.

Natural Research Projects. (2013b). Cantick Head Marine Wildlife Surveys September 2012 to March 2013 Interim report

Natural Research Projects (2013a). Cantick Head Marine Wildlife Surveys March to August 2012 Interim report

Office for National Statistics (2010). A nnual Survey of Hours and Earnings (ASHE) 2010 Statistical bulletin, Office for National Statistics, December 2010. (http://www.statistics.gov.uk/statbase/Product.asp?vlnk=1951

Office for National Statistics, (2011). Annual Report on Fuel Poverty Statistics, Office for National Statistics, 2011. (http://www.decc.gov.uk/assets/decc/Statistics/fuelpoverty/2181-annual-report-fuel-poverty-stats-2011.pfd)

OGP/ IPIECA, (2010). Alien invasive species and the oil and g as industry: Guidance for prevention and m anagement. OGP Report 436 [online] Available: <www.ogp.org.uk/pubs/436.pdf> [Accessed June 2013]

Orkney Islands Council (2012). Orkney Local Development Plan (and the modified proposed plan July 2013).

Orkney Islands Council Marine Services, no dat e. *Orkney Ports Handbook, 5th Edition.* [online]. Orkney Islands Council Marine Services

Orkney Islands Council, (2010). Orkney Economic Review 2010. Available online at http://www.orkney.gov.uk/Files/Business-and-Trade/Economic_Review_2010.pdf

Orkney Islands Council (2007). Orkney Local Biodiversity Action Plan. [online] Available at: <http://www.orkney.gov.uk/Files/Planning/Biodiversity/Local_Biodiversity_Action_Plan_2008-2011.pdf [Accessed November 2011]

Orkney Islands Council, 2011, Orkney Economic Review

Partrac (2011). Pentland Firth Metocean. ADCP Data Report – Phase VII – Cantick Head. Report to SSE Renewables, December, 2011.

RCAHMS (2011). Past Maps [online] Available: www.pastmap.org.uk [Accessed November 2011]

Reid. J.B, Evans. P.G.H and Northridge.S.P (2003). Atlas of Cetacean distribution in north-west European waters

Saunders, G., Bedford, G.S., Trendall, J.R., and Sotheran, I. (2011). Guidance on survey and monitoring in relation to marine renewables deployments in Scotland. Volume 5. Benthic Habitats. Unpublished draft report to Scottish Natural Heritage and Marine Scotland. Available online: http://www.snh.gov.uk/docs/A585079.pdf

Schwemmer, P., Mendel, B., Sonntag, N., Dierschke, V. & Garthe, S. (2010). Effects of ship traffic on seabirds in offshore waters: implications for marine conservation and spatial planning. Ecological Applications.

Scottish Ferries Review(2010). Appendix 9, The Historical Context, Central Government Support for ferry services

Scottish Government (2007). Strategic Environmental Assessment (SEA) to examine the environmental effects of developing wave and tidal power, Report to the Scottish Government by Faber Maunsell and Metoc PLC, March 2007

Scottish Government (2010). Locational Guidelines for the Authorisation of Marine Fish Farms in Scottish Waters.

Scottish Government (Natural Scotland) (2011) Scottish Sea Fisheries Statistics 2009. A National Statistics Publication for Scotland.

Scottish Government (2011a). Renewable Energy Targets Available online at http://www.scotland.gov.uk/News/Releases/2011/05/18093247

Scottish Government / Marine Scotland (2011b). Scotland's Marine Atlas: Information for the national marine plan (Hard Copy)

Scottish Government (2011c). Consultation on Seal Haul-out Sites

Scottish Natural Heritage (2008). Scottish Wildlife Series: Otters and Development [online]. Available at: http://www.snh.org.uk/publications/on-line/wildlife/otters/default.asp [Accessed 31/08/2012].

Scottish Natural Heritage (2012). Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape: Guidance for Scoping an Environmental Statement

Scottish Natural Heritage (undated). Detailed Information for Mull Head [online]. Available at: http://www.snh.org.uk/about/lnr/detail.asp?id=8129 [Accessed 18/06/2013].

Scottish Natural Heritage Site Link (Available at http://www.snh.gov.uk/publications-data-and-research/snhi-information-service/sitelink: accessed 17/06/13)

SEPA (2004). Aquifer map of Scotland. British Geological Society (BGS) Commissioned Report CR/04/047N

SEPA (2004). Groundwater vulnerability map of Scotland. SNIFFER Project WFD28.

SEPA (2013a). River Management. Plan.http://www.sepa.org.uk/water/river_basin_planning.aspx

SEPA (2013b). Pollution Prevention Guidelines. Available online at http://www.sepa.org.uk/about_us/publications/guidance/ppgs.aspx

Slaski, R.J,1 Hirst, D2 and G ray, S3 (2013). PFOW wave and t idal stream projects and migratory salmonids

SMRU Ltd (2011). Utilisation of space by grey and har bour seals in the Pentland Firth and Orkney waters. Scottish Natural Heritage Commissioned Report No. 441

Subacoustech (2008) Measurement and assessment of background underwater noise and its comparison with noise from pin pile drilling operations during installation of the SeaGen tidal turbine device, Strangford lough - COWRIE funded research 2008

The Institute of Archaeologists (2012) The standard and guidance for archaeological desk-based assessment

The Scottish Government. (2011) Planning Advice Note (PAN) 2/2011: Planning and Archaeology, [Online], Available: http://www.scotland.gov.uk/Publications/2011/08/04132003/0

Thompson, D., Bexton, S., Brownlow, A., Wood, D., Patterson, T., Pye K., Lonergan, M and Milne, R. (2010). Report on recent seal mortalities in UK waters caused by extensive lacerations. Available online http://www.smru.st-and.ac.uk/documents/366.pdf

Thompson, P.M., Cheney, B., Ingram, S., Stevick, P., Wilson.B and Hammonds, P.S. (Eds) (2011). Distribution, abundance and population structure of bottlenose dolphis in Scottish Waters. Scottish Government and Scottish Natural Heritage funded report. Scottish Natural Heritage Commissioned Report No. 354.

Wessex Archaeology Ltd (2007). Historic Environment Guidance for the Offshore Renewable Energy Sector. Commissioned by COWRIE Ltd (project refrence ARCH-11-05)

Wilson, B. Batty, R. S., Daunt, F. & Carter, C. (2007). Collision risks between marine renewable energy devices and mammals, fish and diving birds. Report to the Scottish Executive. Scottish Association for Marine Science, Oban, Scotland, PA37 1QA

Wittich A. and Gordon, J.(2012). Analysis of towed hydrophone data collected at Costa Head, Westray South and C antick Head sites. Unpublished report to SSER. Marine Ecological Research.

Appendix A: Stakeholders

The following table outlines the stakeholders contacted and records where responses were received to the Project Briefing Document. Note the following colour coding for the type of stakeholder:

	Regulator Group
	Marine Scotland non-statutory stakeholders (to be contacted directly by Marine Scotland)
	Wider non-statutory stakeholder

Record of responses received

Stakeholder	Response (Y / N)
Health and Safety Executive (HSE)	N
Local Fisheries	N
Marine Scotland - Science	Y
Marine Scotland – Compliance	Y
OIC Marine Services	N
Orkney Island Council (OIC)	Y
Scottish Environment Protection Agency (SEPA)	Y
Scottish Natural Heritage (SNH)	Y
UK Department of Energy and Climate Change (DECC)	N
Association of (District) Salmon Fisheries Board	N
BT (Network Radio Protection)	N
Chamber of Shipping	N
Inshore Fisheries Groups	N
Historic Scotland	Y
Marine Coastguard Agency (MCA)	Y
Marine Safety Forum	N
Northern Lighthouse Board (NLB)	Y
Orkney Fisheries Association	Y
Ports & Harbours	N
RSBP	Y
Royal Yachting Association (RYA)	N
Scottish Canoe Association	N
Scottish Fishermen's Federation	N

Scottish Fishermen's Organisation	N
Scottish Government Planning	N
Scottish Surfing Federation	N
Scottish Wildlife Trust	N
Surfers Against Sewage	N
Transport Scotland	N
The Crown Estate (TCE)	N
Whale and Dolphin Conservation Society	Y
Association of Scottish Shellfish Growers	N
British Ports Association	N
British Surf Association	N
British Trout Association	N
Civil Aviation Authority	Y
County Archaeologist	N
Department for Transport (DfT)	N
European Marine Energy Centre (EMEC)	N
Fisherman's Association Ltd	N
Forestry Commission	N
Federation of Scottish aquaculture producers	N
Friends of the Earth	N
Graemsay, Hoy & Walls Community Council	N
Highlands and Islands Airport Ltd	N
Hoy Development Trust	N
International Tanker Owner's Pollution Federation (ITOPF)	N
Joint Nature Conservation Committee (JNCC)	N
Joint Radio Company	N
Longhope Sailing Club	N
Marine Conservation Society	N
MOD	N
National Air Traffic Services (NATS)	N
National Trust for Scotland	N
North District Fisheries Board	N
North of Scotland Industries Group (Energy North)	N
Northlink Ferries	Y

Orkney Archaeological Trust	N
Orkney Dive Boat Operators Association	N
Orkney Fisherman's Society Ltd (OFS)	N
Orkney Island's Sea Angling Association	N
Orkney Renewable Energy Forum (OREF)	N
Orkney Sailing Club	N
Orkney Archaeological Trust/ Orkney Archaeology Society	N
Orkney Tourism Group	N
Orkney Trout Fishing Association	N
Pentland Ferries	N
RNLI	N
Royal Commission on the Ancient and Historical Monuments (RACHMS)	N
Salmon Net Fishing Association	N
Scottish Renewables Forum	N
Scottish Aquaculture Research Forum	N
Scottish Environment Link	N
Scottish Water	N
The Fisheries Committee	N
UK Cable Protection Committee	N
UK Civil Aviation Authority	N
UK Hydrographic Office	N
UK Marine Management Organisation	N
UK Oil and Gas	N
Visit Orkney	N
Visit Scotland	N
World Wildlife Fund	N

Appendix B:
IDENTIFICATION OF NATURA 2000 INTERESTS WHICH MAY BE AFFECTED BY THE PROPOSALS

Brims Tidal Array

Appendix B: Habitats Regulations Appraisal Screening

BTAL

13 August 2013

9W0993

HASKONINGDHV UK LIMITED
INDUSTRY, ENERGY & MINING

10 Bernard Street
Leith
Edinburgh EH6 6PP
United Kingdom

+44 131 555 0506	Telephone
	Fax
info@edinburgh.royalhaskoning.com	E-mail
www.royalhaskoningdhv.com	Internet

Document title	Brims Tidal Array Appendix B: Habitats R egulations Appraisal Screening
Date	13 August 2013
Project number	9W0993
Client	BTAL
Reference	9W0993/R/303719/Edin

Drafted by	Digger Jackson, Jen Trendall, Gemma Keenan
Checked by	Frank Fortune
Date/initials check	…FF………………. ……14/08/13…………….
Approved by	Frank Fortune
Date/initials approval	…FF………………. ……14/08/13…………….

CONTENTS

1 INTRODUCTION

Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora, known as the Habitats Directive, requires Member States to take measures to maintain or restore natural habitats and wild species listed on the Annexes to the Directive at a favourable conservation status and to introduce robust protection for those habitats and species of European importance. There is an obligation to contribute to a coherent European ecological network of protected sites by designating Special Areas of Conservation (SACs) for habitats listed on Annex I and for species listed on Annex II. These measures are also to be applied to Special Protection Areas (SPAs) classified under Article 4 of the Birds Directive. Together SACs and SPAs make up the Natura 2000 network [1] of sites.

The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), known as the Habitats Regulations', place a statutory duty on competent authorities (Orkney Island Council and Marine Scotland for the Brims Tidal Array project), to meet the specific requirements of the Habitats Directive when undertaking their planning, consenting or licensing duties. Where a plan or project could affect a Natura site, the Habitats Regulations require the competent authority to consider the provisions of Regulation 61, under which the Competent Authority must:

1. Determine whether the proposal is directly connected with or necessary to site management for conservation; and, if not,
2. Determine whether the proposal is likely to have a significant effect on the site either individually or in combination with other plans or projects; and, if so, then
3. Undertake an appropriate assessment of the implications (of the proposal) for the site in view of that site's conservation objectives.

This three stage process is now commonly referred to as Habitats Regulations Appraisal (HRA). HRA applies to any plan or project which has the potential to affect the qualifying interest of a Natura site, even when those interests may be at some distance from that site.

The competent authorities, with advice from SNH, will determine whether an appropriate assessment is necessary (stages 1 and 2, above) and if so, undertake that assessment (stage 3). Applicants, in this case Brims Tidal Array Ltd (BTAL), are usually required to provide a package of information to inform the assessment. The appropriate assessment considers only the implications of the project for the Natura site(s) potentially impacted in the context of their conservation objectives.
Under Regulation 49(1) of the Habitats Regulations, a plan or project can generally only be consented if it can be ascertained that it will not adversely affect the integrity of a Natura site unless it is deemed to have Imperative Reasons of Overriding Public Interest. Article 6(4) provides that if, in spite of a negative assessment of the implications for the site, and in the absence of alternative solutions, the plan or project must nevertheless be carried out for imperative reasons of overriding public interest, the Member State shall take all

1 http://jncc.defra.gov.uk/page-1374

compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected.

This document outlines the initial screening of Natura 2000 sites for HRA for the Brims Tidal Array Project. This screening is submitted as an Appendix to the request for Scoping Opinion to seek agreement from the competent authorities as to the information which should be provided to support the HRA.

2 HRA SCREENING AIMS AND METHODS

2.1 Special Protection Areas (SPAs)

The aim of the HRA screening presented here is to determine which seabird qualifying features at SPAs could be subject to a potential Likely Significant Effect (LSE) that would compromise the Conservation Objectives of an SPA. Ramsar sites are also considered during this process. This screening is effectively Step 2 of the HRA process, as described in Section **Error! Reference source not found.** above.

A GIS software tool developed by NRP has been used to assist in the initial steps of the HRA screening. The primary function of the tool is to identify SPA qualifying features (species populations) that have 'theoretical connectivity' with the anticipated impact footprint of a proposed development. The output of this tool is a 'long list' of sites (Annex 1) that could theoretically have connectivity by one or more qualifying features with a proposed development on the basis of the distance travelled by breeding seabirds to feed.

The long-list excludes designated sites more than 400 km away from the Agreement for Lease (AfL) area (Figure 1). Although two species, fulmar and gannet, have foraging ranges that potentially extend further than 400 km, the strength of any connectivity with sites beyond 400 km is likely to be extremely low and both these species are rated as having very low vulnerability to tidal arrays (Furness *et al*. 2012). Furthermore, both these species have several colonies much closer to the AfL area than 400 km, and these are the most likely source of the individuals using the AfL area. For all these reasons it is not plausible that the qualifying gannet and fulmar populations from designated sites more than 400 km away could be subject to a LSE caused by the proposed development.

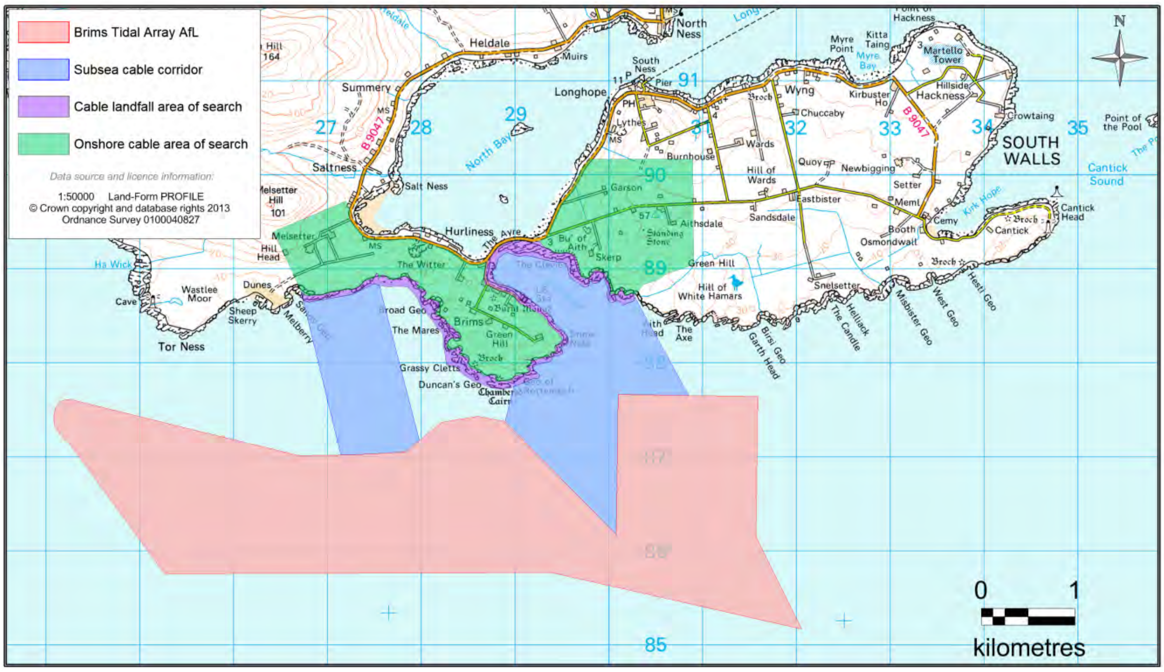


Figure 1 Project Boundaries

The long-list of sites was screened against three criteria to establish, using cautious assumptions, if there is potential for the qualifying features at the sites on the long-list to be adversely affected by the proposed development, i.e. for there to be potential for a LSE. The three criteria are:

- the strength of theoretical connectivity (Tables 1 and 2);
- predicted vulnerability of a species to tidal stream arrays (Table 3); and,
- the indicative use of a species within and in the vicinity of the AfL (Table 4).

Each of these criteria is explained in greater detail under their respective heading below. The potential for LSE on a particular qualifying feature was initially determined according to a combination matrix (Table 5), that classifies the potential for LSE on each qualifying feature as either 'Yes' (conclude there is potential for a LSE) or 'No' (conclude there is no potential for LSE).

In addition to the three screening criteria (theoretical connectivity, vulnerability and a species' indicative use of AfL area), information on a species conservation status and knowledge gaps were also factored in to the determination of the potential for LSE on a case by case basis. These additional considerations potentially increase the likelihood of LSE and could therefore result in a potential LSE being concluded which was not apparent using the three screening criteria alone. In practice, these additional considerations resulted in only two extra potential LSE being identified.

2.1.1 Connectivity

Although connectivity between the AfL area and seabird SPA qualifying species populations is not completely understood it can be inferred approximately and cautiously from analysis of meta-data on the distance a species travels from the breeding colony to forage determined from tagging studies. Analyses of the foraging meta-data can be used to determine approximately how likely it is that the AfL area lies within the area used for foraging by a particular SPA qualifying species population.

The strength of theoretical connectivity was determined according to the criteria in Table 1 and using the summary foraging metrics in Table 2.

The method used to estimate the strength of connectivity does not take into account the presence of conspecifics (individuals of the same species) in the AfL area from other closer colonies, these birds are likely to decrease the strength of actual connectivity between a given site and the AfL area. The estimate strength of connectivity also does not take into account foraging habitat distribution or direction from a colony, it only considers distance. For species with large foraging ranges such as fulmar, gannet and Manx shearwater, this is a significant limitation as it is much more likely that the longer foraging journeys are to areas well offshore (e.g. to feeding grounds along the continental shelf) than to distant coastal waters. Both these limitations, although serious, are likely to mean the estimated strength of connectivity is inherently cautious for HRA screening purposes.

2.1.2 Vulnerability to tidal arrays

The predicted vulnerability (synonymous to sensitivity) of species to tidal stream arrays is taken from Furness *et al*. 2012 and is summarised in Table 3. The Furness *et al.* Vulnerability Categories are predictions and there is currently uncertainty over the actual risks posed by tidal arrays to seabirds. In recognition of this uncertainty, for species categorised as having low or very low vulnerability it is assumed that there is potentially some risk but that they would need to be present in relatively high numbers for this risk to present a potential LSE.

2.1.3 Indicative use of site

Information on the use of the AfL area and its vicinity by seabirds in the breeding season is taken from the interim report presenting results for the first year of baseline studies (NRP 2013a) and is summarised in Annex 1 and Table 4. Four abundance categories were used to give a broad indication of the use of the survey area (an area considerably larger than the AfL area and the anticipated impact footprint) by each seabird species as follows:

- Very common, average of >500 birds present
- Common, average of 25 - 500 birds present
- Uncommon, average of 1 - 25 birds present
- Rare, average of <1 bird present

Each species was categorised according to the results obtained in the first breeding season (2012) of the baseline survey programme (NRP 2013a).

2.2 Special Area of Conservation (SAC)

Whilst there is clear guidance on the criteria that should be used to establish connectivity with SPAs, a similar set is not yet defined for mobile SAC features. Therefore, all SACs identified in recent consultation with SNH as potentially connected, as well as any SACs (with no mobile qualifying interests but with which the proposals have physical overlap or are immediately adjacent to) are considered in Section 3 of this report.

For marine mammals information on foraging ranges and from telemetry studies and photo identification surveys is considered. All SACs with potential for marine mammal connectivity are currently screened in for further consideration.

To screen SACs designated for Atlantic salmon a literature review of migration patterns has been completed. There is a great deal of uncertainty on this subject and therefore a conservative approach is taken and a wide range of SACs are ‘screened in’.

3 SCREENING RESULTS

3.1 SPA

Thirty one breeding seabird SPAs (all breeding seabird SPAs within 400km of the AfL area) were screened. Between them, these SPAs contain 182 qualifying species populations. In addition one breeding seabird Ramsar site that is not a designated SPA was also included in the screening.

The results of the HRA screening are presented in Annex 1 and summarised in Table 6. The screening shows that there is potential for LSE on 63 breeding seabird qualifying features spread across 27 SPAs and 1 Ramsar Site and involving ten seabird species.

It is concluded that these 63 qualifying features are likely to require Appropriate Assessment (Step 3 of the HRA process).

All but one of the LSE were identified by the three screening criteria (theoretical connectivity, vulnerability and a species' indicative use of AfL) alone. The additional considerations of a species conservation status and knowledge gaps identified two further LSE. One of these was breeding Arctic skua qualifying feature at the Caithness and Sutherland Peatlands SPA, in this case the Pentland Firth (where the AfL area is located) is the closest marine feeding ground to the SPA and therefore birds from this population are likely amongst those using the AfL area. In recognition of the uncertainty of the actual level of connectivity between this SPA population and the AfL area and the poor conservation status of this species, it is judged that potential LSE should be concluded. The second is red-throated diver breeding on Hoy SPA. Although no red-throated divers were seen feeding in the AfL area in Year 1 baseline surveys, this species has been seen feeding in the AfL since. On the grounds of small population size and uncertainty regarding the importance of the AfL area for this species it is judged that potential for LSE should be concluded.

Four species account for nearly 86% of the potential LSEs identified, namely fulmar (40%), common guillemot (21%), puffin (14%) and kittiwake (11%). These are all species with large foraging ranges and the AfL area is within potential reach of multiple colonies. Of the species for which LSEs are identified only two, common guillemot and razorbill, are predicted to have a high vulnerability to tidal arrays. For this reason it is suggested that these two species merit the most detailed examination under Appropriate Assessment.

Switha SPA is included for onshore foraging habitat for barnacle goose *Branta leucopsis* in the onshore cable area of search.

Table 1. Criteria used to categorise theoretical connectivity between an SPA qualifying feature and the AfL area.

Theoretical connectivity	Definition
High	Site within Mean Foraging Range
Moderate	Site within Mean Maximum Foraging Range +10%, (Method 1) or Site within 95% of Cumulative Foraging Distance (Method 2)

Low	Site within Maximum Foraging Range
None	Site further than the Maximum Foraging Range

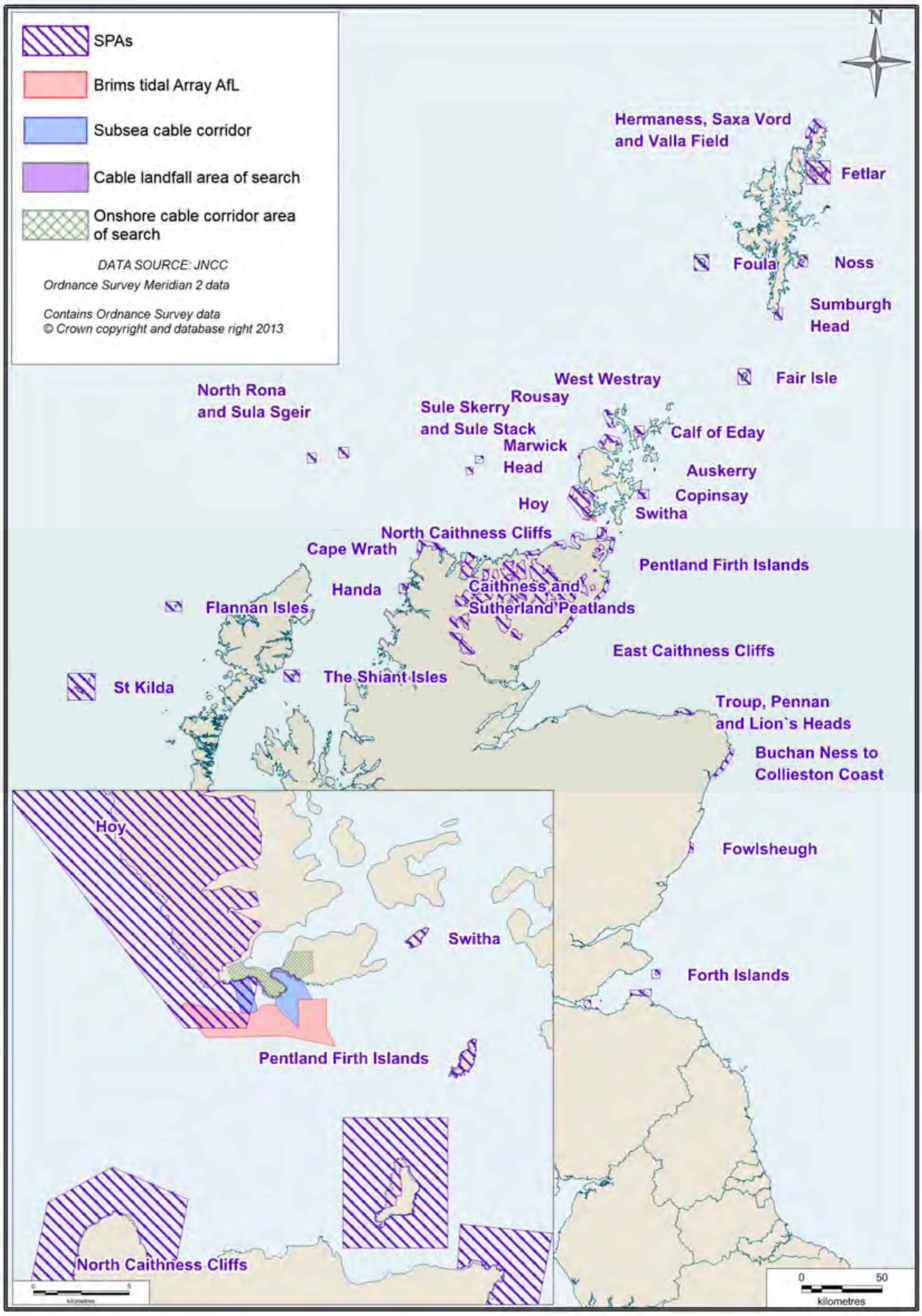


Figure 2. Special Protection Areas screened in the HRA. IN addition, Ronas Hill Ramsar Site was also screened for completeness.

Table 2. Foraging range met-data metrics used to determine theoretical connectivity. Values taken from Thaxter *et al.* 2012 and BirdLife Seabird Foraging Database

Species	Mean foraging range (km)	Mean max foraging (MMFR) range (km)	Mean max foraging range +10% of MMFR	Max foraging range (km)	95% cumulative frequency (approx km)
Black-throated diver	4.5	9.0	9.9	9.0	no data
Red-throated diver	4.5	9.0	9.9	9.0	no data
Northern fulmar	47.5	400.0	440.0	580.0	375
Manx shearwater	171.7	330.0	363.0	400.0	375
European storm-petrel	60.0	91.7	100.9	120.0	no data
Leach's storm-petrel	60.0	91.7	100.9	120.0	no data
Northern gannet	92.5	229.4	252.3	590	325
Great cormorant	5.2	25.0	27.5	35.0	no data
European shag	5.9	14.5	16.0	17.0	17
Arctic skua	6.4	62.5	68.6	75.0	no data
Great skua	35.8	86.4	95.0	219.0	no data
Great black-backed gull	10.5	61.1	67.2	92.0	no data
Herring gull	10.5	61.1	67.2	92.0	no data
Lesser black-backed gull	71.9	141.0	155.1	181.0	no data
Common gull	25.0	50.0	55.0	50.0	no data
Black-legged kittiwake	24.8	60.0	66.0	120.0	60
Common tern	4.5	15.2	16.7	30.0	23
Sandwich tern	11.5	49.0	53.9	54.0	no data
Roseate tern	12.2	16.6	18.3	30.0	no data
Arctic tern	7.1	24.2	26.6	30.0	17
Common guillemot	37.8	84.2	92.6	135.0	65
Razorbill	23.7	48.5	53.4	95.0	25
Black guillemot					no data
Atlantic puffin	4.0	105.4	115.9	200.0	65

Table 3. Predicted vulnerability of seabirds to tidal arrays, based on Furness *et al*. 2012.

Species	**Vulnerability to tidal arrays**
Black-throated diver	Moderate
Red-throated diver	Moderate
Northern fulmar	Very low
Manx shearwater	Very low
European storm-petrel	Very low
Leach's storm-petrel	Very low
Northern gannet	Very low
Great cormorant	High
European shag	Very low
Arctic skua	Very low
Great skua	Very low
Great black-backed gull	Very low
Herring gull	Very low
Lesser black-backed gull	Very low
Common gull	Very low
Black-legged kittiwake	Very low
Common tern	Very low
Sandwich tern	Low
Roseate tern	Very low
Arctic tern	Low
Common guillemot	High
Razorbill	High
Black guillemot	High
Atlantic puffin	Moderate

Table 4. The indicative use of the survey area in the breeding season by seabird species.

Species	Breeding season use of survey area
Black-throated diver	None
Red-throated diver	Scarce
Northern fulmar	Very common
Manx shearwater	Common
European storm-petrel	Uncommon
Leach's storm-petrel	None
Northern gannet	Common
Great cormorant	None
European shag	Common
Arctic skua	Common
Great skua	Very common
Great black-backed gull	Uncommon
Herring gull	None
Lesser black-backed gull	None
Common gull	None
Black-legged kittiwake	Very common
Common tern	None
Sandwich tern	None
Roseate tern	None
Arctic tern	Common
Common guillemot	Very common
Razorbill	Very common
Black guillemot	Uncommon
Atlantic puffin	Very common

Table 5. Matrix to determine if the proposed development has potential to cause a LSE on designated site breeding seabird qualifying features on the basis of a species' indicative use, vulnerability to tidal arrays and the strength of theoretical connectivity between the anticipated impact footprint and the site in question. 'Yes' indicates potential for LSE, 'No' indicates no potential for LSE.

Abundance of species in Survey Area	**Vulnerability of species to tidal arrays**	**Theoretical Connectivity to SPA**			
		High	**Moderate**	**Low**	**None**
Very common	High	Yes	Yes	Yes	No
Very common	Medium	Yes	Yes	No	No
Very common	Low / V. low	Yes	No	No	No
Common	High	Yes	Yes	No	No
Common	Medium	Yes	No	No	No
Common	Low / V. low	No	No	No	No
Uncommon	High	Yes	No	No	No
Uncommon	Medium	No	No	No	No
Uncommon	Low / V. low	No	No	No	No
Rare	High	No	No	No	No
Rare	Medium	No	No	No	No
Rare	Low / V. low	No	No	No	No

Table 6. Summary of potential LSE of qualifying species at breeding seabird SPAs and Ramsar sites within 400km of Brims AFL area and a 4km maritime buffer. A tick symbol indicates potential for LSE.

Site	Red-throated diver	Fulmar	Manx shearwater	Eur. storm-petrel	Gannet	Shag	Arctic skua	Great skua	Great black-b. gull	Herring gull	Kittiwake	Arctic tern	Common guillemot	Razorbill	Black guillemot	Puffin	Barnacle Goose	Total
Auskerry SPA																		
Buchan Ness to Collieston Coast SPA		✓																1
Caithness and Sutherland Peatlands SPA							✓											1
Calf of Eday SPA		✓									✓		✓					3
Cape Wrath SPA		✓											✓	✓		✓		4
Copinsay SPA		✓									✓		✓					3
East Caithness Cliffs SPA		✓									✓		✓	✓		✓		5
Fair Isle SPA		✓											✓			✓		3
Fetlar SPA		✓																1
Flannan Isles SPA		✓																1
Forth Islands SPA		✓																1
Foula SPA		✓														✓		2
Fowlsheugh SPA		✓																1
Handa SPA		✓											✓					2
Hermaness, Saxa Vord and Valla Field SPA		✓																1
Hoy SPA	✓	✓					✓	✓			✓		✓			✓		7
Marwick Head SPA											✓		✓					2

Site	Red-throated diver	Fulmar	Manx shearwater	Eur. storm-petrel	Gannet	Shag	Arctic skua	Great skua	Great black-b. gull	Herring gull	Kittiwake	Arctic tern	Common guillemot	Razorbill	Black guillemot	Puffin	Barnacle Goose	Total
Mingulay and Berneray SPA		✓																1
North Caithness Cliffs SPA		✓									✓		✓	✓		✓		5
North Rona and Sula Sgeir SPA		✓														✓		2
Noss SPA		✓														✓		2
Papa Westray SPA																		
Pentland Firth Islands SPA												✓						1
Ronas Hill Ramsar site		✓																1
Rousay SPA		✓									✓		✓					3
Rum SPA																		
St Kilda SPA		✓																1
Sule Skerry and Sule Stack SPA					✓								✓			✓		3
Sumburgh Head SPA		✓																1
Switha SPA (onshore footprint)																	✓	1
The Shiant Isles SPA		✓																1
Troup, Pennan and Lion`s Heads SPA		✓											✓					2
West Westray SPA		✓											✓	✓				3
Grand Total	1	25	0	0	1	0	2	1	0	0	7	1	13	4	0	9		64

3.2 SAC

3.2.1 Marine mammal connectivity

Grey seal *Halichoerus grypus,* harbour seal *Phoca vitulina*, and bottlenose dolphin *Tursiops truncatus* are Annex II species that are a primary reason for site selection of SACs. Grey seal are known to forage up to 145km from their haul out sites (Thompson *et al.* 1996). Harbour seal generally range less widely than grey seal; foraging within 60km or so of their haul out sites (Thompson and Miller 1990). Bottlenose dolphins are observed all around the coast of north Scotland with sightings concentrated at Lybster Point (East Caithness), Dunnet Bay and Thurso Bay, possibly enhanced by greater observer effort (Evans *et al.,* 2011).

Telemetry studies reported in SMRU (2011) give an insight into the routes taken by seals. There is a huge amount of individual variation between animals but the range of each species is apparent. Figures 3 and 4 (from SMRU, 2011) show some of the telemetry results. Telemetry results and information on foraging ranges is taken into account in Table 7.

The first year of dedicated marine mammal surveys have been undertaken at the site alongside bird surveys. Harbour and grey seals have been regularly sighted (NRP 2013). No bottle nose dolphin have been sighted to date. Although these surveys provide useful data on the species present in the AfL area, they will not inform connectivity.

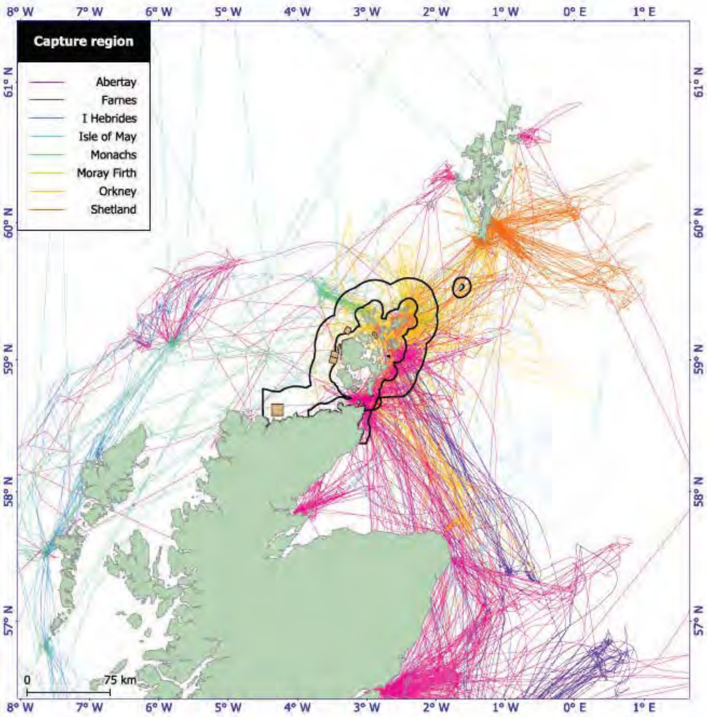


Figure 3. 44 grey seals tagged with SMRU Argos and SMRU GSM/GPS tags which at least once entered the PFOSA. (source: SMRU, 2011)

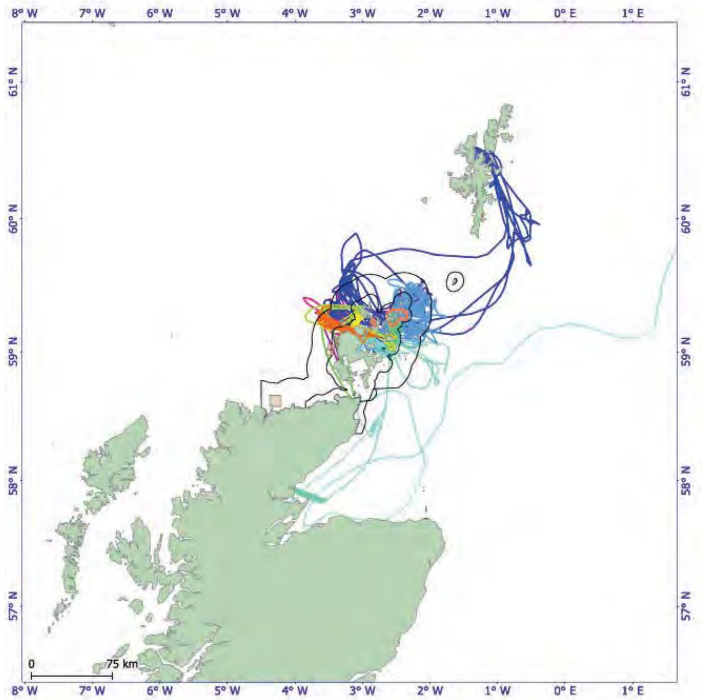


Figure 4. 17 harbour seals tagged with SMRU Argos tags, which at least once entered the PFOSA. The tracks are colour coded by individual seal. All but two of the seals were tagged in the northern Isles (Sanday, Eynhallow, Rousay and Stronsay of Orkney). The remaining two (show by triangles) were tagged in the Moray Firth. (source: SMRU, 2011)

3.2.2 Atlantic salmon connectivity

Slaski *et al.* (2013) identifies that there is very limited data on salmon fisheries due to the difficulty to acquire data but suggests, given the wide ranging nature of salmonids it is likely that salmon migrate past the AfL area on their way to natal spawning rivers on the mainland of Scotland.

Malcolm *et al.,* 2010 provides a review of available information on migratory routes. The wide geographic distribution of arrival locations and natal rivers results in highly variable directions of movement for a given location (Figure 5). Atlantic salmon passing through the AfL may therefore be travelling to natal rivers on the north, east or west of Scotland. In the absence of certainty a wide range of SACs are screened in for further consideration (Table 7).

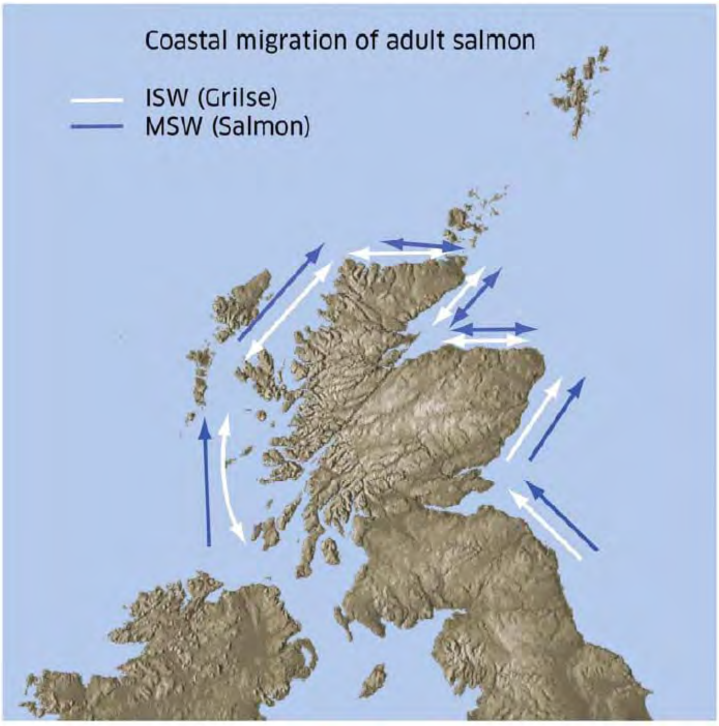


Figure 5: Migration routes of adult Atlantic salmon around Scotland (source: Malcolm *et al.,* 2010)

3.2.3 SAC screening

The EIA team has considered the proposals in relation to HRA and undertaken an initial assessment of the potential effects of the proposals on each site, the qualifying features, conservation objectives and site integrity. The results of this process are presented in Table 7.

Table 7: Screening of potential effects on SAC site integrity

Protected site	Annex I Habitat – primary reason	Annex I Habitat – qualifying feature	Annex II Species – primary reason	Annex II Species – qualifying feature	Approx. distance to AfL (km)	Comment
Berriedale and Langwell (SAC)	None	None	Atlantic salmon	None	80	Potential LSE It is theoretically possible that Atlantic salmon from this SAC pass through the area proposed for deployment.
River Oykel (SAC)	None	None	Freshwater pearl mussel	Atlantic salmon	150	Potential LSE It is theoretically possible that Atlantic salmon from this SAC pass through the area proposed for deployment.
River Moriston (SAC)	None	None	Freshwater pearl mussel	Atlantic salmon	310	Potential LSE It is theoretically possible that Atlantic salmon from this SAC pass through the area proposed for deployment.
River Spey (SAC)	None	None	Freshwater pearl mussel, Sea lamprey, Atlantic salmon Otter	None	120	Potential LSE It is theoretically possible that Atlantic salmon from this SAC pass through the area proposed for deployment.
River Thurso (SAC)	None	None	Atlantic salmon	None	25	Potential LSE It is theoretically possible that Atlantic salmon from this SAC pass through the area proposed for deployment.
River Borgie SAC)	None	None	Freshwater pearl mussel	Atlantic salmon, Otter	65	Potential LSE It is theoretically possible that Atlantic salmon from this SAC pass through the area proposed for deployment.

Protected site	Annex I Habitat – primary reason	Annex I Habitat – qualifying feature	Annex II Species – primary reason	Annex II Species – qualifying feature	Approx. distance to AfL (km)	Comment
River Naver (SAC)	None	None	Freshwater pearl mussel, Atlantic Salmon	None	65	Potential LSE It is theoretically possible that Atlantic salmon from this SAC pass through the area proposed for deployment.
Little Gruinard River (SAC)	None	None	Atlantic Salmon	None	200	Potential LSE It is theoretically possible that Atlantic salmon from this SAC pass through the area proposed for deployment.
Langavat (SAC)	None	None	Atlantic Salmon	None	230	Potential LSE It is theoretically possible that Atlantic salmon from this SAC pass through the area proposed for deployment.
River Dee (SAC)	None	None	Freshwater pearl mussel, Atlantic Salmon Otter	None	215	Potential LSE It is theoretically possible that Atlantic salmon from this SAC pass through the area proposed for deployment.
Moray Firth (SAC)	None	Sandbanks which are slightly covered by sea water all the time	Bottlenose dolphin	None	95	Potential LSE It is theoretically possible that dolphins from this SAC forage/utilise the area proposed for deployment.
Faray and Holm of Faray (SAC)	None	None	Grey seal	None	75	Potential LSE It is theoretically possible that seals from this SAC forage/utilise the area proposed for deployment.

Protected site	Annex I Habitat – primary reason	Annex I Habitat – qualifying feature	Annex II Species – primary reason	Annex II Species – qualifying feature	Approx. distance to AfL (km)	Comment
Sanday (SAC)	Reefs	Sandbanks which are slightly covered by sea water all the time, Mudflats and sand flats not covered by sea water at low tide	Common seal	None	80	Potential LSE It is theoretically possible that seals from this SAC forage/utilise the area proposed for deployment.
Dornoch Firth and Morrich More SAC	Estuaries Mudflats & sandflats *Salicornia* Atlantic salt meadows Dunes	Sandbanks which are slightly covered by seawater Reefs	Common seal Otter	None	125	No Potential LSE Given the limited foraging range of common seal it is not likely that common seals from this SAC travel to the Pentland Firth
North Rona (SAC)	None	Reefs, Vegetated sea cliffs of the Atlantic and Baltic coasts, Submerged or partially submerged sea caves	Grey seal	None	155	Potential LSE It is theoretically possible that seals from this SAC forage/utilise the area proposed for deployment.
Isle of May (SAC)	None	Reefs	Grey seal	None	320	Potential LSE It is theoretically possible that seals from this SAC forage/utilise the area proposed for deployment.

Protected site	Annex I Habitat – primary reason	Annex I Habitat – qualifying feature	Annex II Species – primary reason	Annex II Species – qualifying feature	Approx. distance to AfL (km)	Comment
Berwickshire and North Northumberland Coast (SAC)	Mudflats and sandflats not covered by seawater at low tide, Large shallow inlets and bays, Reefs, Submerged or partially submerged sea caves	None	Grey seal	None	340	Potential LSE It is theoretically possible that seals from this SAC forage/utilise the area proposed for deployment.
Hoy (SAC)	Vegetated sea cliffs of the Atlantic and Baltic coasts, Natural dystrophic lakes and ponds, Northern Atlantic wet heaths with Erica tetralix, Alpine and Boreal heaths, Blanket bogs	European dry heaths, Petrifying springs with tufa formation (Cratoneurion, Alkaline fens, Calcareous rocky slopes with chasmophytic vegetation	None	None	4	Potential LSE Depending on the route and location of onshore infrastructure chosen. Further consideration of these habitats may be required.

3.2.4 Summary

The following SACs were therefore identified as those requiring consideration in relation to HRA:

- Berriedale and Langwell (SAC)
- River Oykle (SAC)
- River Moriston (SAC)
- River Spey (SAC)
- River Thurso (SAC)
- River Borgie SAC)
- River Naver (SAC)
- Little Gruinard River (SAC)
- Langavat (SAC)
- River Dee (SAC)
- Moray Firth (SAC)
- Faray and Holm of Faray (SAC)
- Sanday (SAC)
- North Rona (SAC)
- Isle of May (SAC)
- Berwickshire and North Northumberland Coast (SAC)
- Hoy (SAC)

This list is supported by the Scoping Opinion received for the Westray South Tidal project in 2011 and the letter from SNH (2nd November 2012) which discussed HRA Screening.

4 NEXT STEPS

Following submission to OIC, Marine Scotland and SNH, it is proposed that this is followed by a workshop to finalise the scope of the on-going HRA taking into account the research conducted by the time of the workshop on the nature of the device, knowledge of potential interactions/non interactions with wildlife and potential for source – pathway – receptor interaction. The EIA team will then prepare further information as and when necessary to inform the ongoing HRA process. It is anticipated that the next stage of the EIA team's assessment to inform the HRA will pay particular reference to:

- Bird species behaviour with particular reference to foraging depths;
- Consideration of behaviour and site use by common and grey seals; and
- Migratory routes of Atlantic salmon.

5 REFERENCES

Evans, P.G.H., Baines, M.E. & Coppock, J. (2011). Abundance and behaviour of cetaceans and basking sharks in the Pentland Firth and Orkney Waters. Report by

Hebog Environmental Ltd & Sea Watch Foundation. *Scottish Natural Heritage Commissioned Report No.419.*

Furness, R. W., Wade , H. M., Robbins, A. M. C., and Masden, E. A. 2012 . Assessing the sensitivity of seabird populations to adverse effects from tidal stream turbines and wave energy devices. - ICES Jo urnal of Ma rine Science, 69: 1466-1479

JNCC. Notes on data parameter s for SMP online database downloadable at: http://jncc.defra.gov.uk/page-4460

JNCC. 2011. Spatial/summar y data for UK Special Protection Areas (SPAs). Joint Nature Conservation Committee. http://jncc.defra.gov.uk/page-1409. Last update d 5 September 2011. Accessed 20 November 2011.

JNCC 2001. The UK SPA network: its scope and content. Volume 3. Site accounts. Joint Nature Conservation Committee.

JNCC. 2011. Spatial/summary data for UK Ramsar sites (RAMSARs). Joint Nature Conservation Committee. http://jn cc.defra.gov.uk/page-2392. Last u pdated 31 August 2007. Accessed 20 November 2011.

JNCC. 2011. Spatial/summary data for UK SACs, SCIs and cSACs. Joint Natur e Conservation Committee. http://jn cc.defra.gov.uk/page-2392. Last u pdated 31 August 2007. Accessed 20 November 2011.

Malcolm I.A., Godfrey J., Youngson A.F. (2010). Review of migratory routes and behaviour of Atlantic salmon, sea trout and European eel in Scotland's coastal environment: implications for the development of marine renewables. *Scottish Marine and Freshwater Science Volume 1 No 14*

NRP 2013. Cantick Head Marine Wildlife Sur veys: March to August 2012 Interim report (1st Interim Report). Natural Research Projects Ltd unpublishe d report to SSER.

Slaski, R.J, Hirst, D and Gray, S (20 13). PFOW wave and tidal stream projects and migratory salmonids.

SMRU Ltd (2011). Utilisation of spa ce by grey and harbour seals in th e Pentland Firth and Orkney waters. Scottish Natural Heritage Commissioned Report No. 441

The Crown Estate. 2011. L ease boundary shapefile downloaded fro m http://www.thecrownestate.co.uk/marine/downloads/

Thompson, P. M. and Miller, D. 1990. Summer forgaing activity and movements of radio-tagged common seals (Phoca vitulina) in the Moray Firth, Scotland. Journal of Applied Ecology, 63, 24-30.

Thompson, P.M, McCo nnell, B.J., Tollit, D.J., Mackay, A., Hunter, C., Racey, P.A. 1996. Comparative distribution, movements and diet of harb our and grey seals from the Moray Firth, N.E. Scotland. Journal of Applied Ecology. 33: 1572-1584.

6 ANNEX 1

Brims Tidal project summary of orni thology screening of sites designated at international level. Screening is based on t heoretical connectivity, vulnerability to tidal arrays and a species' use of the Area of Interest - full details in text.

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
Hoy SPA	3	2	Red-throated diver	N.I.P. of an Annex 1 species	56 pairs	High	n.a.	Moderate	Rare	Small population	Yes*
			Northern fulmar	I.I.B.A. component only	35000 pairs	High	High	Very low	Very common		Yes
			Arctic skua	I.I.B.A. component only	59 pairs	High	n.a.	Very low	Common	Small population, declining	Yes
			Great skua	I.M.P. of a non-Annex 1 species	1900 pairs	High	n.a.	Very low	Very common		Yes
			Great black-backed gull	I.I.B.A. component only	570 pairs	High	n.a.	Very low	Uncommon		No
			Black-legged kittiwake	I.I.B.A. component only	3000 pairs	High	High	Very low	Very common	Declining	Yes
			Common guillemot	I.I.B.A. component only	13400 pairs	High	High	High	Very common		Yes
			Atlantic puffin	I.I.B.A. component only	3500 pairs	High	High	Moderate	Very common		Yes

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
Pentland Firth Islands SPA	5	5	Arctic tern	N.I.P. of an Annex 1 species	1200 pairs	High	High	Low	Common		Yes
North Caithness Cliffs SPA	7	7	Northern fulmar	I.I.B.A. component only	14700 pairs	High	High	Very low	Very common		Yes
			Black-legged kittiwake	I.I.B.A. component only	13100 pairs	High	High	Very low	Very common	Declining	Yes
			Common guillemot	I.M.P. of a non-Annex 1 species	26994 pairs	High	High	High	Very common		Yes
			Razorbill	I.I.B.A. component only	2680 pairs	High	High	High	Very common		Yes
			Atlantic puffin	I.I.B.A. component only	1750 pairs	Moderate	Moderate	Moderate	Very common		Yes
Caithness and Sutherland Peatlands SPA	15	15	Red-throated diver	N.I.P.	89 pairs	None	n.a.	Moderate	Rare	Small population	No
			Black-throated diver	N.I.P.	25 pairs	None	n.a.	Moderate	None		No
			Arctic skua	N.I.P.	39 pairs	Moderate	n.a.	Very low	Common	Small population, declining	Yes*

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
Copinsay SPA	28	27	Northern fulmar	I.I.B.A. component only	1615 pairs	High	High	Very low	Very common		Yes
			Great black-backed gull	I.I.B.A. component only	490 pairs	Moderate	n.a.	Very low	Uncommon		No
			Black-legged kittiwake	I.I.B.A. component only	9550 pairs	Moderate	Moderate	Very low	Very common	Declining	Yes
			Common guillemot	I.I.B.A. component only	19731.5 pairs	High	High	High	Very common		Yes
Marwick Head SPA	39	36	Black-legged kittiwake	I.I.B.A. component only	7700 pairs	Moderate	Moderate	Very low	Very common	Declining	Yes
			Common guillemot	I.M.P. of a non-Annex 1 species	24388 pairs	Moderate	Moderate	High	Very common		Yes
East Caithness Cliffs SPA	40	37	Northern fulmar	I.I.B.A. component only	15000 pairs	High	High	Very low	Very common		Yes
			Great cormorant	I.I.B.A. component only	230 pairs	None	n.a.	High	None		No
			European shag	I.M.P. of a non-Annex 1 species	2345 pairs	None	None	Very low	Common		No
			Black-legged kittiwake	I.M.P. of a non-Annex 1 species	31930 pairs	Moderate	Moderate	Very low	Very common	Declining	Yes
			Herring gull	I.M.P. of a non-Annex 1	9370 pairs	Moderat	n.a.	Very low	None		No

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
				species		e					
			Great black-backed gull	I.I.B.A. component only	800 pairs	Moderate	n.a.	Very low	Uncommon		No
			Common guillemot	I.M.P. of a non-Annex 1 species	71509 pairs	Moderate	Moderate	High	Very common		Yes
			Razorbill	I.M.P. of a non-Annex 1 species	9259 pairs	Moderate	Low	High	Very common		Yes
			Atlantic puffin	I.I.B.A. component only	1750 pairs	Moderate	Moderate	Moderate	Very common		Yes
Auskerry SPA	43	41	European storm-petrel	N.I.P. of an Annex 1 species	3600 pairs	High	n.a.	Very low	Uncommon		No
			Arctic tern	N.I.P. of an Annex 1 species	780 pairs	None	None	Low	Common		No
Calf of Eday SPA	62	52	Northern fulmar	I.I.B.A. component only	1955 pairs	Moderate	Moderate	Very low	Very common		Yes
			Great cormorant	I.I.B.A. component only	223 pairs	None	n.a.	High	None		No
			Great black-backed gull	I.I.B.A. component only	938 pairs	Moderate	n.a.	Very low	Uncommon		No
			Black-legged kittiwake	I.I.B.A. component only	1717 pairs	Moderate	Low	Very low	Very common	Declining	Yes

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
			Common guillemot	I.I.B.A. component only	8472.15 pairs	Moderate	Moderate	High	Very common		Yes
Rousay SPA	62	39	Northern fulmar	I.I.B.A. component only	1240 pairs	Moderate	Moderate	Very low	Very common		Yes
			Arctic skua	I.I.B.A. component only	130 pairs	Moderate	n.a.	Very low	Common	Small population, declining	No
			Black-legged kittiwake	I.I.B.A. component only	4900 pairs	Moderate	Low	Very low	Very common	Declining	Yes
			Arctic tern	N.I.P. of an Annex 1 species	1000 pairs	None	None	Low	Common		No
			Common guillemot	I.I.B.A. component only	7102 pairs	Moderate	Moderate	High	Very common		Yes
West Westray SPA	68	53	Northern fulmar	I.I.B.A. component only	1400 pairs	Moderate	Moderate	Very low	Very common		Yes
			Arctic skua	I.M.P. of a non-Annex 1 species	78 pairs	Moderate	n.a.	Very low	Common	Small population, declining	No
			Black-legged kittiwake	I.I.B.A. component only	23900 pairs	Low	Low	Very low	Very common	Declining	No

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
			Arctic tern	N.I.P. of an Annex 1 species	1200 pairs	None	None	Low	Common		No
			Common guillemot	I.M.P. of a non-Annex 1 species	28274 pairs	Moderate	Low	High	Very common		Yes
			Razorbill	I.I.B.A. component only	1304 pairs	Low	Low	High	Very common		Yes
Sule Skerry and Sule Stack SPA	78	77	Northern gannet	I.M.P. of a non-Annex 1 species	4890 pairs	High	High	Very low	Common		Yes
			European storm-petrel	N.I.P. of an Annex 1 species	1000 pairs	Moderate	n.a.	Very low	Uncommon		No
			Leach's storm-petrel	N.I.P. of an Annex 1 species	5 pairs	Moderate	n.a.	Very low	None		No
			European shag	I.I.B.A. component only	874 pairs	None	None	Very low	Common		No
			Common guillemot	I.I.B.A. component only	6298 pairs	Moderate	Low	High	Very common		Yes
			Atlantic puffin	I.M.P. of a non-Annex 1 species	43380 pairs	Moderate	Low	Moderate	Very common		Yes
Papa Westray SPA	81	64	Arctic skua	I.I.B.A. component only	135 pairs	Moderate	n.a.	Very low	Common	Small population, declining	No

Designated site	Distance (km) By sea	Distance (km) Direct	Qualifying species	Qualifying reason	Population size	Theoretical Connectivity Method 1	Theoretical Connectivity Method 2	Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
			Arctic tern	N.I.P. of an Annex 1 species	1950 pairs	None	None	Low	Common		No
Cape Wrath SPA	95	95	Northern fulmar	I.I.B.A. component only	2300 pairs	Moderate	Moderate	Very low	Very common		Yes
			Black-legged kittiwake	I.I.B.A. component only	9700 pairs	Low	Low	Very low	Very common	Declining	No
			Common guillemot	I.I.B.A. component only	9179 pairs	Low	Low	High	Very common		Yes
			Razorbill	I.I.B.A. component only	1206 pairs	Low	Low	High	Very common		Yes
			Atlantic puffin	I.I.B.A. component only	5900 pairs	Moderate	Low	Moderate	Very common		Yes
Fair Isle SPA	125	116	Northern fulmar	I.I.B.A. component only	35210 pairs	Moderate	Moderate	Very low	Very common		Yes
	125		Northern gannet	I.I.B.A. component only	1166 pairs	Moderate	Moderate	Very low	Common		No
	125		European shag	I.I.B.A. component only	1100 pairs	None	None	Very low	Common		No
	125		Arctic skua	I.I.B.A. component only	110 pairs	None	n.a.	Very low	Common	Small population, declining	No

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
	125		Great skua	I.I.B.A. component only	110 pairs	Low	n.a.	Very low	Very common		No
	125		Black-legged kittiwake	I.I.B.A. component only	18160 pairs	None	None	Very low	Very common	Declining	No
	125		Arctic tern	N.I.P. of an Annex 1 species	1120 pairs	None	None	Low	Common		No
	125		Common guillemot	I.M.P. of a non-Annex 1 species	25165 pairs	Low	Low	High	Very common		Yes
	125		Razorbill	I.I.B.A. component only	2278 pairs	None	None	High	Very common		No
	125		Atlantic puffin	I.I.B.A. component only	23000 individuals	Low	Low	Moderate	Very common		Yes
Troup, Pennan and Lion`s Heads SPA	130	130	Northern fulmar	I.I.B.A. component only	4400 pairs	Moderate	Moderate	Very low	Very common		Yes
			Herring gull	I.I.B.A. component only	4200 pairs	None	n.a.	Very low	None		No
			Black-legged kittiwake	I.I.B.A. component only	31600 pairs	None	None	Very low	Very common	Declining	No
			Common guillemot	I.M.P. of a non-Annex 1 species	29902 pairs	Low	Low	High	Very common		Yes
			Razorbill	I.I.B.A. component only	3216 pairs	None	None	High	Very		No

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
									common		
Handa SPA	134	120	Northern fulmar	I.I.B.A. component only	3500 pairs	Moderate	Moderate	Very low	Very common		Yes
			Great skua	I.I.B.A. component only	66 pairs	Low	n.a.	Very low	Very common		No
			Black-legged kittiwake	I.I.B.A. component only	10732 pairs	None	None	Very low	Very common	Declining	No
			Common guillemot	I.M.P. of a non-Annex 1 species	76105 pairs	Low	Low	High	Very common		Yes
			Razorbill	I.M.P. of a non-Annex 1 species	10432 pairs	None	None	High	Very common		No
North Rona and Sula Sgeir SPA	155	155	Northern fulmar	I.I.B.A. component only	11500 pairs	Moderate	Moderate	Very low	Very common		Yes
			European storm-petrel	N.I.P. of an Annex 1 species	1000 pairs	None	n.a.	Very low	Uncommon		No
			Leach's storm-petrel	N.I.P. of an Annex 1 species	2750 pairs	None	n.a.	Very low	None		No
			Northern gannet	I.M.P. of a non-Annex 1 species	9000 pairs	Moderate	Moderate	Very low	Common		No
			Great black-backed	I.I.B.A. component only	730 pairs	None	n.a.	Very low	Uncommon		No

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
			gull								
			Black-legged kittiwake	I.I.B.A. component only	5000 pairs	None	None	Very low	Very common	Declining	No
			Common guillemot	I.M.P. of a non-Annex 1 species	28944 pairs	None	None	High	Very common		No
			Razorbill	I.I.B.A. component only	1541 pairs	None	None	High	Very common		No
			Atlantic puffin	I.I.B.A. component only	5300 pairs	Low	Low	Moderate	Very common		Yes
Buchan Ness to Collieston Coast SPA	167	163	Northern fulmar	I.I.B.A. component only	1765 pairs	Moderate	Moderate	Very low	Very common		Yes
			Herring gull	I.I.B.A. component only	4292 pairs	None	n.a.	Very low	None		No
			European shag	I.I.B.A. component only	1045 pairs	None	None	Very low	Common		No
			Black-legged kittiwake	I.I.B.A. component only	30452 pairs	None	None	Very low	Very common	Declining	No
			Common guillemot	I.I.B.A. component only	8640 pairs	None	None	High	Very common		No
Sumburgh Head SPA	168	157	Northern fulmar	I.I.B.A. component only	2542 pairs	Moderate	Moderate	Very low	Very common		Yes
			Black-legged	I.I.B.A. component only	1366 pairs	None	None	Very low	Very	Declining	No

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
			kittiwake						common		
			Arctic tern	N.I.P. of an Annex 1 species	700 pairs	None	None	Low	Common		No
			Common guillemot	I.I.B.A. component only	10720 pairs	None	None	High	Very common		No
Foula SPA	170	159	Red-throated diver	N.I.P. of an Annex 1 species	11 pairs	None	n.a.	Moderate	Rare	Small population	No
			Northern fulmar	I.I.B.A. component only	46800 pairs	Moderate	Moderate	Very low	Very common		Yes
			Leach's storm-petrel	N.I.P. of an Annex 1 species	50 pairs	None	n.a.	Very low	None		No
			European shag	I.M.P. of a non-Annex 1 species	2400 pairs	None	None	Very low	Common		No
			Arctic skua	I.I.B.A. component only	133 pairs	None	n.a.	Very low	Common	Small population, declining	No
			Great skua	I.M.P. of a non-Annex 1 species	2170 pairs	Low	n.a.	Very low	Very common		No
			Black-legged kittiwake	I.I.B.A. component only	3840 pairs	None	None	Very low	Very common	Declining	No

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
			Arctic tern	N.I.P. of an Annex 1 species	1100 pairs	None	None	Low	Common		No
			Atlantic puffin	I.M.P. of a non-Annex 1 species	48000 pairs	Low	Low	Moderate	Very common		Yes
			Common guillemot	I.M.P. of a non-Annex 1 species	25125 pairs	None	None	High	Very common		No
			Razorbill	I.I.B.A. component only	4154 pairs	None	None	High	Very common		No
Noss SPA	196	191	Northern fulmar	I.I.B.A. component only	6350 pairs	Moderate	Moderate	Very low	Very common		Yes
			Northern gannet	I.M.P. of a non-Annex 1 species	7310 pairs	Moderate	Moderate	Very low	Common		No
			Great skua	I.M.P. of a non-Annex 1 species	410 pairs	Low	n.a.	Very low	Very common		No
			Black-legged kittiwake	I.I.B.A. component only	7020 pairs	None	None	Very low	Very common	Declining	No
			Common guillemot	I.M.P. of a non-Annex 1 species	30619 pairs	None	None	High	Very common		No
			Atlantic puffin	I.I.B.A. component only	2348 individuals	Low	Low	Moderate	Very common		Yes

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
The Shiant Isles SPA	216	206	Northern fulmar	I.I.B.A. component only	6820 pairs	Moderate	Moderate	Very low	Very common		Yes
			European shag	I.M.P. of a non-Annex 1 species	1780 pairs	None	None	Very low	Common		No
			Black-legged kittiwake	I.I.B.A. component only	1800 pairs	None	None	Very low	Very common	Declining	No
			Common guillemot	I.I.B.A. component only	12315 pairs	None	None	High	Very common		No
			Razorbill	I.M.P. of a non-Annex 1 species	7337 pairs	None	None	High	Very common		No
			Atlantic puffin	I.M.P. of a non-Annex 1 species	76100 pairs	None	None	Moderate	Very common		No
Fowlsheugh SPA	231	211	Northern fulmar	I.I.B.A. component only	1170 pairs	Moderate	Moderate	Very low	Very common		Yes
			Herring gull	I.I.B.A. component only	3190 pairs	None	n.a.	Very low	None		No
			Black-legged kittiwake	I.M.P. of a non-Annex 1 species	34870 pairs	None	None	Very low	Very common	Declining	No
			Common guillemot	I.M.P. of a non-Annex 1 species	40140 pairs	None	None	High	Very common		No
			Razorbill	I.I.B.A. component only	3886 pairs	None	None	High	Very		No

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
									common		
Ronas Hill – North Roe and Tingon Ramsar site	233	213	Red-throated diver	N.I.P.	50 pairs	None	n.a.	Moderate	Rare	Small population	No
			Northern fulmar	N.I.P.	6710 pairs	Moderate	Moderate	Very low	Very common		Yes
			Arctic skua	N.I.P.	114 pairs	None	n.a.	Very low	Common	Small population, declining	No
			Great skua	N.I.P.	227 pairs	Low	n.a.	Very low	Very common		No
			Black guillemot	N.I.P.	774 individuals	None	n.a.	High	Uncommon		No
Fetlar SPA	254	234	Northern fulmar	I.I.B.A. component only	9500 pairs	Moderate	Moderate	Very low	Very common		Yes
			Arctic skua	I.I.B.A. component only	130 pairs	None	n.a.	Very low	Common	Small population, declining	No
			Great skua	I.M.P. of a non-Annex 1 species	512 pairs	None	n.a.	Very low	Very common		No
			Arctic tern	N.I.P. of an Annex 1	520 pairs	None	None	Low	Common		No

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
				species							
Flannan Isles SPA	260	260	Northern fulmar	I.I.B.A. component only	4730 pairs	Moderate	Moderate	Very low	Very common		Yes
			Leach's storm-petrel	N.I.P. of an Annex 1 species	100 pairs	None	n.a.	Very low	None		No
			Black-legged kittiwake	I.I.B.A. component only	2780 pairs	None	None	Very low	Very common	Declining	No
			Common guillemot	I.I.B.A. component only	14693 pairs	None	None	High	Very common		No
			Razorbill	I.I.B.A. component only	2117 pairs	None	None	High	Very common		No
			Atlantic puffin	I.I.B.A. component only	4400 pairs	None	None	Moderate	Very common		No
Hermaness, Saxa Vord and Valla Field SPA	277	248	Red-throated diver	N.I.P. of an Annex 1 species	28 pairs	None	n.a.	Moderate	Rare	Small population	No
			Northern fulmar	I.I.B.A. component only	19539 pairs	Moderate	Moderate	Very low	Very common		Yes
			Black-legged kittiwake	I.I.B.A. component only	922 pairs	None	None	Very low	Very common	Declining	No
			European shag	I.I.B.A. component only	450 pairs	None	None	Very low	Common		No

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
			Northern gannet	I.M.P. of a non-Annex 1 species	12000 pairs	Low	Moderate	Very low	Common		No
			Great skua	I.M.P. of a non-Annex 1 species	630 pairs	None	n.a.	Very low	Very common		No
			Common guillemot	I.I.B.A. component only	16750 pairs	None	None	High	Very common		No
			Atlantic puffin	I.M.P. of a non-Annex 1 species	25400 pairs	None	None	Moderate	Very common		No
Forth Islands SPA	317	288	Northern fulmar	I.I.B.A. component only	798 pairs	Moderate	Moderate	Very low	Very common		Yes
			Great cormorant	I.I.B.A. component only	200 pairs	None	n.a.	High	None		No
			European shag	I.M.P. of a non-Annex 1 species	2887 pairs	None	None	Very low	Common		No
			Northern gannet	I.M.P. of a non-Annex 1 species	34400 pairs	Low	Moderate	Very low	Common		No
			Lesser black-backed gull	I.M.P. of a non-Annex 1 species	2920 pairs	None	n.a.	Very low	None		No
			Herring gull	I.I.B.A. component only	6600 pairs	None	n.a.	Very low	None		No
			Black-legged kittiwake	I.I.B.A. component only	8400 pairs	None	None	Very low	Very common	Declining	No

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
			Roseate tern	N.I.P. of an Annex 1 species	9 pairs	None	n.a.	Very low	None		No
			Common tern	N.I.P. of an Annex 1 species	800 pairs	None	None	Very low	None		No
			Arctic tern	N.I.P. of an Annex 1 species	540 pairs	None	None	Low	Common		No
			Sandwich tern	N.I.P. of an Annex 1 species	22 pairs	None	n.a.	Low	None		No
			Common guillemot	I.I.B.A. component only	16000 pairs	None	None	High	Very common		No
			Razorbill	I.I.B.A. component only	1400 pairs	None	None	High	Very common		No
			Atlantic puffin	I.M.P. of a non-Annex 1 species	21000 pairs	None	None	Moderate	Very common		No
Rum SPA	325	264	Red-throated diver	N.I.P. of an Annex 1 species	11 pairs	None	n.a.	Moderate	Rare	Small population	No
			Manx shearwater	I.M.P. of a non-Annex 1 species	61000 pairs	Moderate	Moderate	Very low	Common		No
			Black-legged kittiwake	I.I.B.A. component only	1500 pairs	None	None	Very low	Very common	Declining	No

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
			Common guillemot	I.I.B.A. component only	2680 pairs	None	None	High	Very common		No
St Kilda SPA	328	325	Northern fulmar	I.I.B.A. component only	62800 pairs	Moderate	Moderate	Very low	Very common		Yes
			Manx shearwater	I.I.B.A. component only	5000 pairs	Moderate	Moderate	Very low	Common		No
			European storm-petrel	N.I.P. of an Annex 1 species	850 pairs	None	n.a.	Very low	Uncommon		No
			Leach's storm-petrel	N.I.P. of an Annex 1 species	5000 pairs	None	n.a.	Very low	None		No
			Northern gannet	I.M.P. of a non-Annex 1 species	60400 pairs	Low	Low	Very low	Common		No
			Great skua	I.M.P. of a non-Annex 1 species	270 pairs	None	n.a.	Very low	Very common		No
			Black-legged kittiwake	I.I.B.A. component only	7830 pairs	None	None	Very low	Very common	Declining	No
			Common guillemot	I.I.B.A. component only	15209 pairs	None	None	High	Very common		No
			Razorbill	I.I.B.A. component only	2553 pairs	None	None	High	Very common		No

Designated site	Distance (km)		Qualifying species	Qualifying reason	Population size	Theoretical Connectivity		Vulnerability (Furness *et al* 2012)	Use of Area of Interest	Additional considerations	Potential LSE
	By sea	Direct				Method 1	Method 2				
			Atlantic puffin	I.M.P. of a non-Annex 1 species	155000 pairs	None	None	Moderate	Very common		No
Mingulay and Berneray SPA	359	339	Northern fulmar	I.I.B.A. component only	10450 pairs	Moderate	Moderate	Very low	Very common		Yes
			European shag	I.I.B.A. component only	720 pairs	None	None	Very low	Common		No
			Black-legged kittiwake	I.I.B.A. component only	8600 pairs	None	None	Very low	Very common	Declining	No
			Common guillemot	I.I.B.A. component only	20703 pairs	None	None	High	Very common		No
			Razorbill	I.M.P. of a non-Annex 1 species	11323 pairs	None	None	High	Very common		No
			Atlantic puffin	I.I.B.A. component only	4000 pairs	None	None	Moderate	Very common		No

* conclusion based on additional considerations

Notes

1. MMFR (km) from Thaxter, C. B., Lascelles, B., Sugar, K., Cook, A. S. C. P., Roos, S., Bolton, M., Langston, R. H. W. & Burton, N. H. K. 2012. Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. Biological Conservation. doi: 10.1016/j. biocon. 2011.12.009. No estimates of MMFR for European storm-petrel therefore MMFR for Leachs storm-petrel used. No estimates in Thaxter et. al.2012 for great black-backed gull so estimate taken from Ratcliffe, N., Phillips, R. A. & Gubbay, S. 2000. Foraging ranges of UK seabirds from their breeding colonies and its implication for creating marine extensions to colony SPAs. Unpublished report to Birdlife International. Royal Society for the Protection of Birds. Sandy.
2. Population counts for SPAs taken from JNCC 2001. The UK SPA network: its scope and content. Volume 3. Site accounts. Joint Nature Conservation Committee. No population counts are given for I.I.B.A. component only qualifiers so in these cases counts are from JNCC. 2011. Spatial/summary data for UK Special Protection Areas (SPAs). Joint Nature Conservation Committee. http://jncc.defra.gov.uk/page-1409. Counts of guillemot and razorbill given as 'individuals on land' in the spatial/summary data have been converted to pairs by mulipying counts by 0.67 based on Harris, M.P. 1989. Variation in the correction factor used for converting counts of individual guillemots Uria aalge into breeding pairs. Ibis, 131: 85-93. This correction is the same as that used in the JNCC Seabird Monitoring Programme (SMP) online database.

Appendix C:
Preliminary Hazard Analysis for Brims Tidal array

Preliminary Hazard Analysis
Brims Tidal Array
(Technical Note)

Prepared by:	Anatec Limited
Presented to:	Brims Tidal Array Limited
Date:	16.08.2013
Revision No.:	03
Ref.:	A2455-BTAL-PHA-1

Anatec	**Aberdeen Office**	**Cambs Office**
Address:	Cain House, 10 Exchange St, Aberdeen AB11 6PH, UK	Braemoor, No. 4 The Warren, Witchford, Ely CAMBS, CB6 2HN
Tel:	01224 253721	+44 1353 669977
Fax:	0709 2367306	0709 2367306
Email:	aberdeen@anatec.com	cambs@anatec.com

This study has been carried out by Anatec Ltd on behalf of Brims Tidal Array Limited (BTAL). The assessment represents Anatec's best judgment based on the information available at the time of preparation. The content of the document should not be edited without approval from Anatec. Any use which a third party makes of this report is the responsibility of such third party. Anatec Ltd accepts no responsibility for damages suffered as a result of decisions made or actions taken in reliance on information contained in this report.

TABLE OF CONTENTS

1. Introduction

1.1 Background

Brims Tidal Array Limited (BTAL) is a 50-50 joint venture between OpenHydro Tidal Technologies and SSE Renewables UK Limited (SSER).

Anatec was commissioned by BTAL to carry out a Preliminary Hazard Analysis (PHA) for the proposed Brims Tidal Array (BTA), south of Orkney.

A site off the south coast of South Walls was originally identified. Following the signing of the Agreement for Lease (AfL), tidal resource assessment surveys were carried out to characterise the resource in more detail. These surveys suggested that the commercially developable resource lay west of the AfL area, in 60-80m water depths, off Brims Ness at the south of Hoy. Therefore, the Developers re-defined the AfL area boundary. The overall area of the footprint remains the same, with 80% of the area for investigation shifted to the west and the remaining 20% overlapping with the original site.

Figure 1.1 presents a chart overview of the original and revised AfL area, highlighting the move to the west.

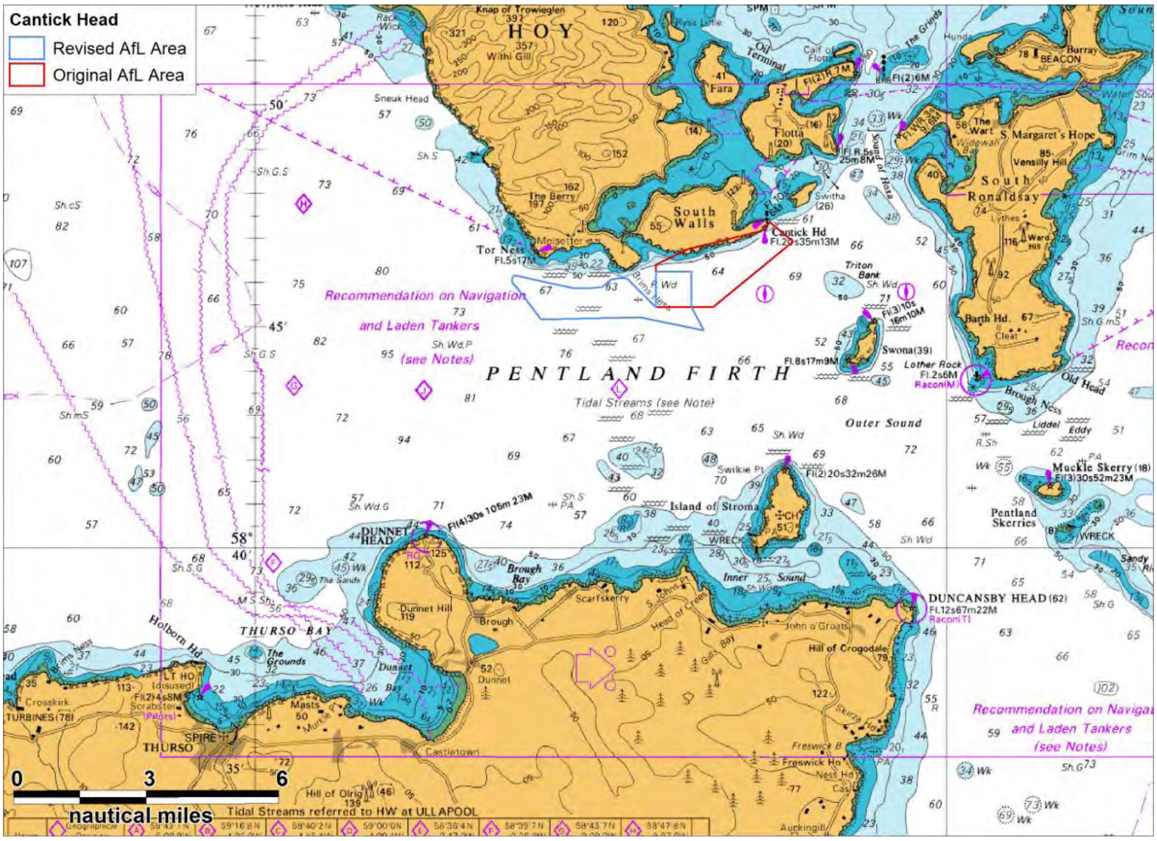


Figure 1.1 General Chart Overview of Revised Brims Tidal Array AfL Area

1.2 Objectives

The objectives of the work were as follows:

- Identify the navigational features of the area
- Perform a baseline vessel activity review (including AIS survey data)
- Review recent maritime incident data
- Consult with navigational stakeholders about the proposed development
- Perform a preliminary hazard analysis
- Propose an appropriate scope and methodology for the Navigation Risk Assessment

1.3 Abbreviations

The following abbreviations are used in this report.

AfL	-	Agreement for Lease
AIS	-	Automatic Identification System
ALARP	-	As Low As Reasonably Practicable
BTA	-	Brims Tidal Array
BTAL	-	Brims Tidal Array Limited
DfT	-	Department for Transport
DP	-	Dynamic Positioning
DWT	-	Deadweight Tonnage
EMEC	-	European Marine Energy Centre
GT	-	Gross Tonnes
GRT	-	Gross Registered Tonnage
HAT	-	Horizontal Axis Turbine
IALA	-	International Association of Lighthouse Authorities
ICES	-	International Council for the Exploration of the Seas
IMO	-	International Maritime Organisation
km	-	Kilometre
MAIB	-	Marine Accident Investigation Branch
MCA	-	Maritime and Coastguard Agency
MCZ	-	Marine Conservation Zone
MEHRA	-	Marine Environmental High Risk Area
MS-LOT	-	Marine Scotland Licensing Operations Team
MW	-	Mega Watts
nm	-	Nautical Mile (1,852 metres)
NLB	-	Northern Lighthouse Board
NRA	-	Navigation Risk Assessment
OCT	-	Open-Centre Turbine
ODBOA	-	Orkney Dive Boat Operator’s Association
OFA	-	Orkney Fisheries Association
OFS	-	Orkney Fishermen’s Society
OIC	-	Orkney Islands Council
OREI	-	Offshore Renewable Energy Installations
PBD	-	Project Briefing Document

PHA	-	Preliminary Hazard Analysis
PLN	-	Port Letter Number
RNLI	-	Royal National Lifeboat Institution
RYA	-	Royal Yachting Association
SSER	-	Scottish and Southern Energy Renewables UK Limited
SPA	-	Special Protection Area
UKHO	-	United Kingdom Hydrographic Office
VMS	-	Vessel Monitoring Service
VTS	-	Vessel Traffic Service

ICES Rectangle — Sea area of 30 minutes latitude by one-degree (60 minutes) longitude used in the UK and internationally to record fisheries statistics such as catch and effort.

Subsquare — One quarter of an ICES Rectangle.

Patrol — A patrol within a specific ICES Rectangle where details on all fishing vessels within the Rectangle at that time are logged by surveillance aeroplane and/or patrol vessel.

Sighting — Vessel logged within a specific ICES Rectangle during a surveillance patrol. Each vessel is identified by name and registration (confidential information not released), and its activity and position (latitude and longitude to one hundredth of a minute) are recorded.

2. Description of Project

2.1 Introduction

This section presents details on the location of the proposed BTA project and the planned tidal energy technology to be used. The development strategy is to deliver a fully commissioned 200MW tidal energy project by 2023. Within this, the Developers intend to undertake an early phase build out of up to 60MW. Construction of Phase 1 would commence in 2019, with build out of Phase 2 to be completed by the end of 2023.

Further information is available in the Environmental Scoping Report.

2.2 Project Boundary

The new BTA area of search lies off Brims Ness at the south of Hoy. 80% of the area for investigation was shifted to the west and the remaining 20% overlaps with the original site. A chart overview of the revised AfL area is presented in Figure 2.1. The AfL area is approximately 3.2nm^2 (11km^2).

The northeastern extent of the AfL area overlaps the Limit of Orkney Harbours, with OIC Marine Services being the Harbour Authority, therefore, Orkney Marine Services will be a key stakeholder.

The southestern boundary of the AfL area is approximately 0.9nm (1600m) from the recommended track for deep-draughted vessels to and from Scapa Flow via the Sound of Hoxa.

The charted water depths within the new AfL area vary between 63 and 89 metres (depths are reduced to chart datum which is approximately the level of lowest astronomical tide).

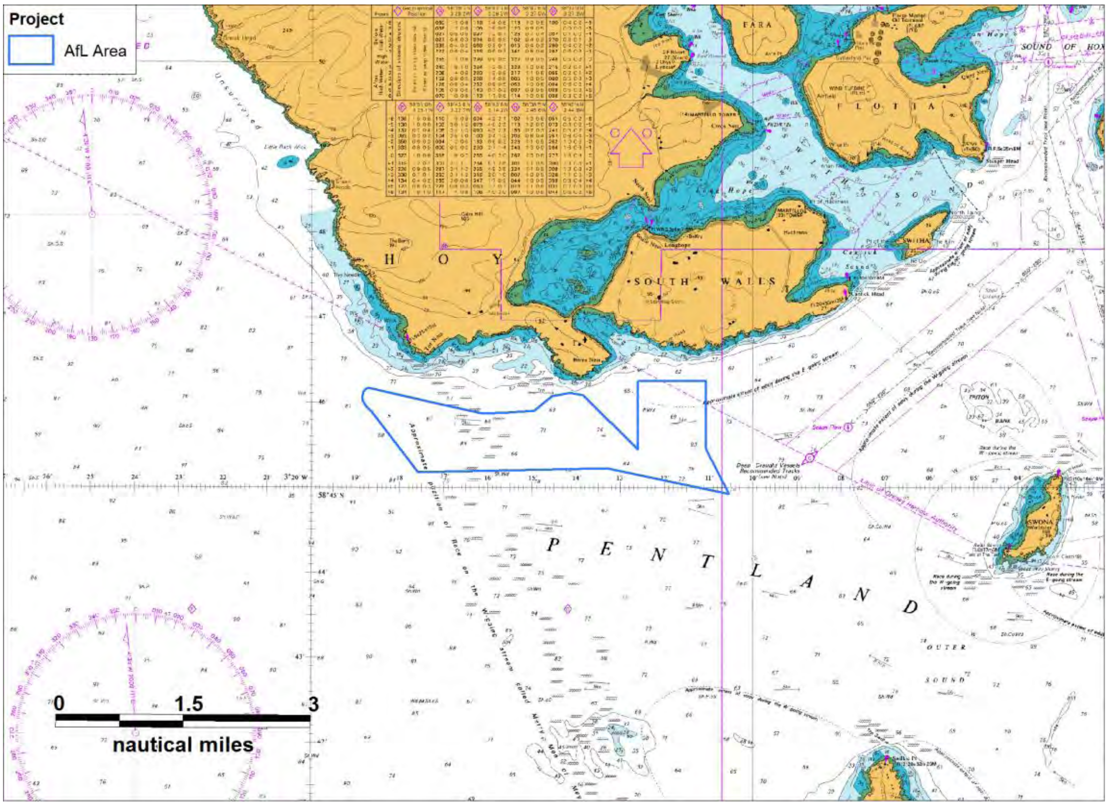


Figure 2.1 Chart Overview of Brims Tidal Array AfL Area

2.3 Preferred Technology

The preferred technology for use on BTA is OpenHydro's Open-Centre Turbine (OCT), illustrated in Figure 2.2.

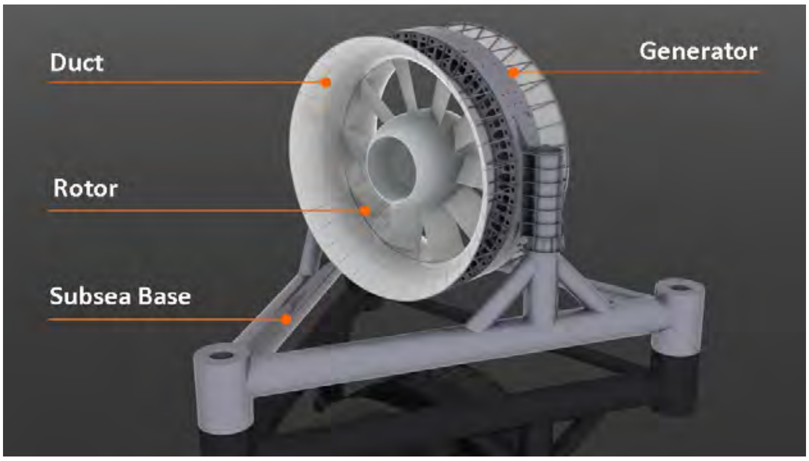


Figure 2.2 Open-Centre Turbine

The OCT is a bi-directional shrouded horizontal axis turbine (HAT) and is a simple device with four key components; a horizontal axis rotor, a direct-drive permanent magnet generator, a hydrodynamic duct and a subsea gravity base type support structure.

It is anticipated that the OCTs installed will have an outer diameter of up to 20m, which would mean a maximum turbine height up to 27m above the seabed. The size of the subsea base will depend on the site design characteristics but is likely to have a footprint of the order of 30-50m wide. Each device would be capable of generating at least 1 MW. The location, spread and layout of devices and infrastructure will be determined through detailed planning, informed by the EIA, NRA and stakeholder consultation.

The support structure for the OCT is an unpinned gravity base structure, which is installed along with the turbine as one assembly. Figure 2.3 presents the subsea base arrangement. It is likely to have three to four legs and a footprint of 30-50m. Final dimensions would be determined during a detailed design process. This type of support structure allows for rapid installation and facilitates the ease of potential relocation and removal / decommissioning of the turbines (which is effectively the reverse of the installation technique).

Figure 2.3 Subsea Base

There is a specialist methodology for installing OCTs, allowing all preparatory works to be performed in harbour. Mobilisation takes place from a harbour facility located within 24 hours of site. Lyness in Orkney and Scrabster in Caithness are possible locations which might be considered for siting a mobilisation base.

Once mobilisation is complete, a custom-design heavy lift barge is loaded with an OCT and its supporting subsea base, and towed to the site. Figure 2.4 presents the *OpenHydro Triskell* vessel, capable of deploying 16m OCTs. Other vessel types will also be required for operations, including a tug and various support boats.

Figure 2.4 Installation Barge

On site, the OCT and subsea base will be lowered, as one unit, to the seabed, as described in Figure 2.5. This method allows a single installation to be completed in less than one hour.

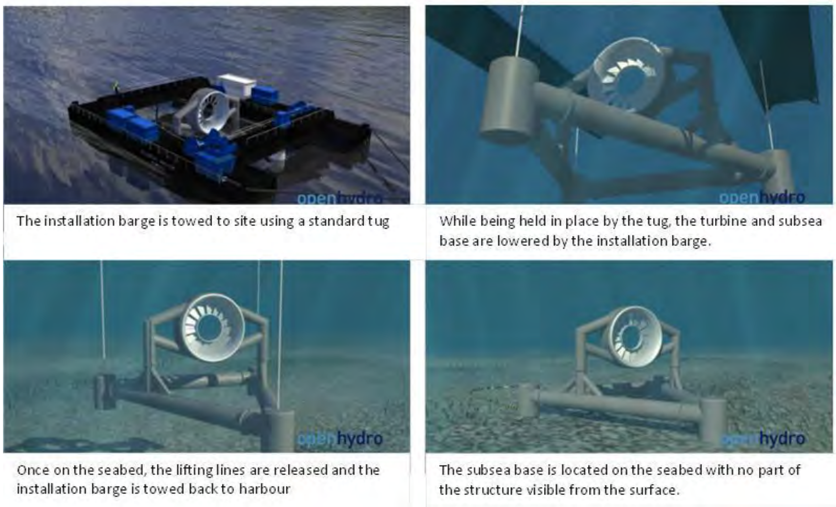


Figure 2.5 Deployment Methodology

2.4 Alternative Technology

Due to continuous evolution of turbine technology design, several alternative turbine types and support structures could be options for the development phase of the project. This includes un-shrouded Horizontal Axis Turbines that resemble wind turbines with blades rotating around a central nacelle. Commercial scale devices in development have rotor diameters of up to 20m. Some examples of un-shrouded device types are illustrated below (more details are provided in the Scoping Report).

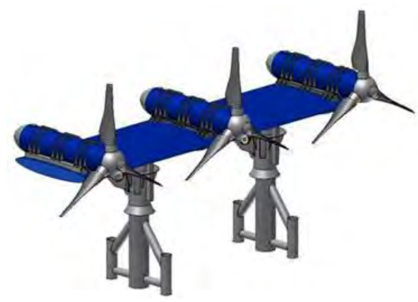
		
TGL Alstom	**Andritz Hydro Hammerfest**	**MCT Seagen U**

Figure 2.6 Examples of Alternative Technologies

As can be seen, some of these devices have a single turbine per installation and some have multiple turbines per installation.

Several support structure designs associated with different turbine types are being considered as an alternative choice. Floating structure, gravity base structure, braced monopole and monopole foundation (drilled socket in the seabed) may be suitable. In case of alternative technology, the final choice of support structure would be made post-consent.

Alternative technologies may require different installation techniques. For example, monopiles would most likely involve a DP vessel although jackup barges may also be considered. Significant effects and a worst case scenario associated with all methods of installation and range of support structures will be discussed in the EIA process and NRA.

Removal technology will be a reversal of the selected installation process and will be required to comply with the decommissioning plan prepared by the developer.

2.5 Operation and Maintenance

Turbines and ancillary equipment such as cables will be inspected and remedial work carried out as required. The work falls into three categories: periodic overhauls, scheduled maintenance and unscheduled maintenance.

For the preferred technology, when servicing is required, the turbine system, including the subsea base, will be brought to the surface where the existing turbine will be removed and a new turbine immediately installed in its place. The recovery technique involves the deployment barge used for installation. The previous turbine will be refurbished onshore and become available to swap with another unit. There will be minimal planned turbine maintenance intervals of five years.

For major maintenance or modification of the alternative technologies, the turbine would be removed from the support structure (or both components together) using a reverse of the installation procedure. Where the turbines and the gravity base structures are incorporated into one unit the whole unit would be removed. A DP-equipped vessel with a heave compensated crane or a purpose build deployment vessel would most likely be used for these tasks.

2.6 Decommissioning

At the end of the project's operational life, approximately 20-25 years, the site will be repowered or decommissioned.

A decommissioning programme will be developed as required by the Energy Act 2004 and in line with DECC 2011 guidelines, prior to the commencement of installation and updated nearer the time of decommissioning.

The decommissioning process for most tidal energy converters will essentially be a reversal of the installation process and will follow the agreed decommissioning plan. Where possible, it is anticipated that all support structures will be completely removed from the site. Monopiles or pins would most likely be cut as close as possible to the seabed.

2.7 Electrical Infrastructure

A specialised cable lay vessel would be used to install all subsea cables. More than one vessel may be employed in cable laying activity at any one time.

Where the seabed has a suitable covering of sediment it may be possible to use a cable plough or a jetting system to install the cable between 1-1.5m below the seabed. In other areas the cables may be laid directly onto the seabed, in which case armoured protection is likely to be used, such as ductile iron sheathing. In some areas the use of concrete mattresses or overlaying of rock may need to be considered to secure and protect some areas of the cable.

Connection of the offshore arrays to the grid will be through one or more export cables to shore. For Phase 1 of the development it is envisaged that there will be a requirement for between 1 to 3 export cables, with one cable leading from each sub-sea hub or offshore substation back along the seabed towards the most suitable landfall location. There are a number of landfalls currently being considered including either side of Aith Hope, the coastline south of Melsetter House and the coastline around Brims Ness.

2.8 Offshore Hub

One or more offshore hubs may be required by the project. This would involve the installation of a platform-type structure within or adjacent to the AfL area, either mounted on the seabed or on a surface piercing structure. A surface-piercing structure may be part of a turbine installation or a separate structure, either supported by a jacket structure or alternatively a moored, floating structure.

3. Navigational Features

The waters around Orkney (excluding the Pentland Firth and Scapa Flow) are within an IMO-adopted Area to be Avoided (ATBA), which was established to protect this sensitive coastline following the *Braer* incident. To avoid the risk of pollution and damage to the environment, all vessels over 5,000 GT carrying oil or other hazardous cargoes in bulk, should avoid this area. The AfL area does not fall within the ATBA (as the ATBA excludes the Pentland Firth and Scapa Flow), it begins approximately 0.6nm north of the AfL area.

Orkney Islands Council (OIC) Marine Services administers 29 Orkney Harbour Areas for which it is the Competent Harbour Authority. The Council exercises its jurisdiction through a Director of Marine Services. The AfL area is in proximity to the Limit of Orkney Harbours and the north eastern part of the AfL area (approximately 0.08nm^2) lies within it.

Within 5nm of the AfL area there are four ports; Longhope and Lyness Pier on Hoy, and Sutherland Pier and Gibraltar Pier on Flotta. The local ferry berths overnight at Longhope Pier and the lifeboat is stationed on its own berthing pontoon. Sutherland Pier is used mainly by the tugs and workboats that serve the Flotta Oil Terminal. Lyness Pier recently underwent redevelopment of the quays and shore side facilities to enable it to be used as a hub for the assembly and maintenance of renewable energy devices. Lyness may be considered as the site for a mobilisation base for this project.

Marine Services operate a Vessel Traffic Service (VTS) from the Harbour Authority Building at Scapa. They presently have three radar sites:

- Sandy Hill covering Scapa Flow and the Pentland Firth
- Scapa covering the body of Scapa Flow
- Kirkwall covering Kirkwall Harbour and approaches

The VTS technology has been upgraded during 2011-12 and further radar scanners are planned to be added. However, the existing scanner at Sandy Hill provides good coverage of the Brims area.

Pilotage is compulsory within the Competent Harbour Authority areas for passenger vessels over 65m in length, all other vessels over 80m overall length, all vessels under tow where the combined overall length of the towing vessel and the vessel being towed is over 65m, all vessels over 300 GRT carrying persistent oils in bulk.

A submarine cable area lies north east of the AfL area, between the islands of South Walls and Flotta. Mariners are advised not to anchor or trawl in the vicinity of submarine cables. This area also contains foul in the form of wire hawsers.

Approximately 0.9nm east of the AfL area are recommended tracks for deep-draught vessels. The channels and deep-water tracks between the Pentland Firth and Scapa Flow are those recommended by the Orkney Harbours Navigation Service for tankers under pilotage proceeding to or from the Flotta Oil Terminal. Due to possible tidal effects, vessels may need to steer noticeably different courses from those shown in order to maintain the recommended tracks. Radar surveillance of these channels is continuously maintained by VTS.

Chart notes advise that laden tankers not bound to or from Flotta and Scapa Flow should not use the Pentland Firth in restricted visibility or adverse weather. At other times there may be a case for transiting with the tide to reduce the time spent in the Firth, although they should be aware of very strong tidal streams and sets within the area. Difficulties can be encountered when transiting either with or against the tide. Masters should ensure that a close watch is kept at all times on the course, speed and position of vessels.

Tor Ness on Hoy, approximately 0.5nm north of the AfL area, has been identified as a Marine Environmental High Risk Area (MEHRA) by the UK Government, i.e., an area of environmental sensitivity and at high risk of pollution from ships. The Government expects mariners to take note of MEHRAs and either keep well clear or, where this is not practicable, exercise an even higher degree of care than usual when passing nearby.

Tidal streams, with eddies and turbulence, run strongly through the Pentland Firth and in the approaches to Scapa Flow. There is an eddy depicted within the northeastern extent of the AfL area which occurs during the east-going stream. The Merry Men of Mey, which runs during the west-going stream, runs through the western extent of the AfL area.

Figure 3.1 presents the main navigational features in the vicinity.

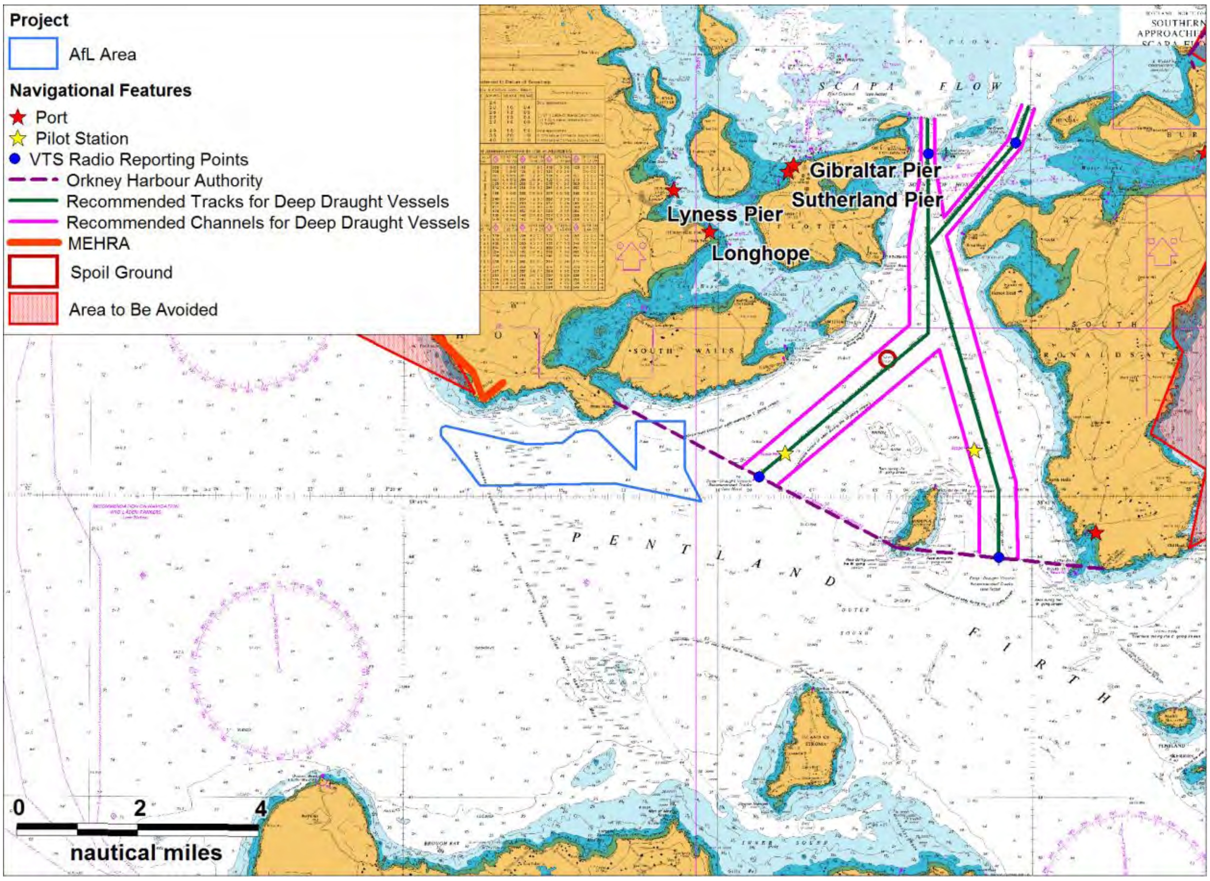


Figure 3.1 Navigational Features

4. Baseline Vessel Activity Analysis

4.1 AIS Shipping Activity

This section presents AIS data in proximity to the AfL area for two separate 28 day periods in summer and winter 2010.

AIS is now fitted on the vast majority of commercial ships operating in UK waters including all ships of 300 GT and upwards engaged on international voyages, all passenger ships, and larger fishing vessels[1]. It is also carried by a proportion of small vessels voluntarily, including a proportion of fishing and recreational vessels.

Plots of all the tracks recorded within 5nm of the AfL area during the summer and winter periods, colour-coded by vessel type, are presented in Figure 4.1 and Figure 4.2, respectively.

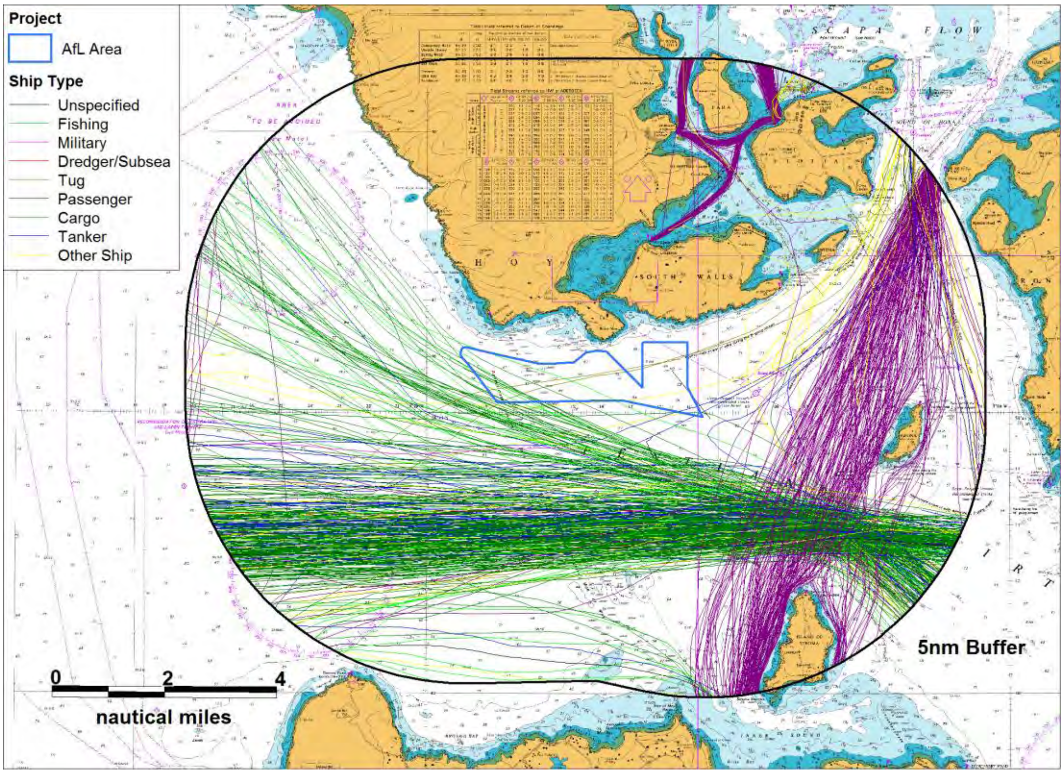


Figure 4.1 AIS Tracks by Type – 28 Days in Summer 2010

[1] At the time of the survey in 2010 the requirement (under EU Directive) was for fishing vessels of 45m length and over to broadcast on AIS. This has since been extended to all fishing vessels ≥ 24m from 31 May 2012.

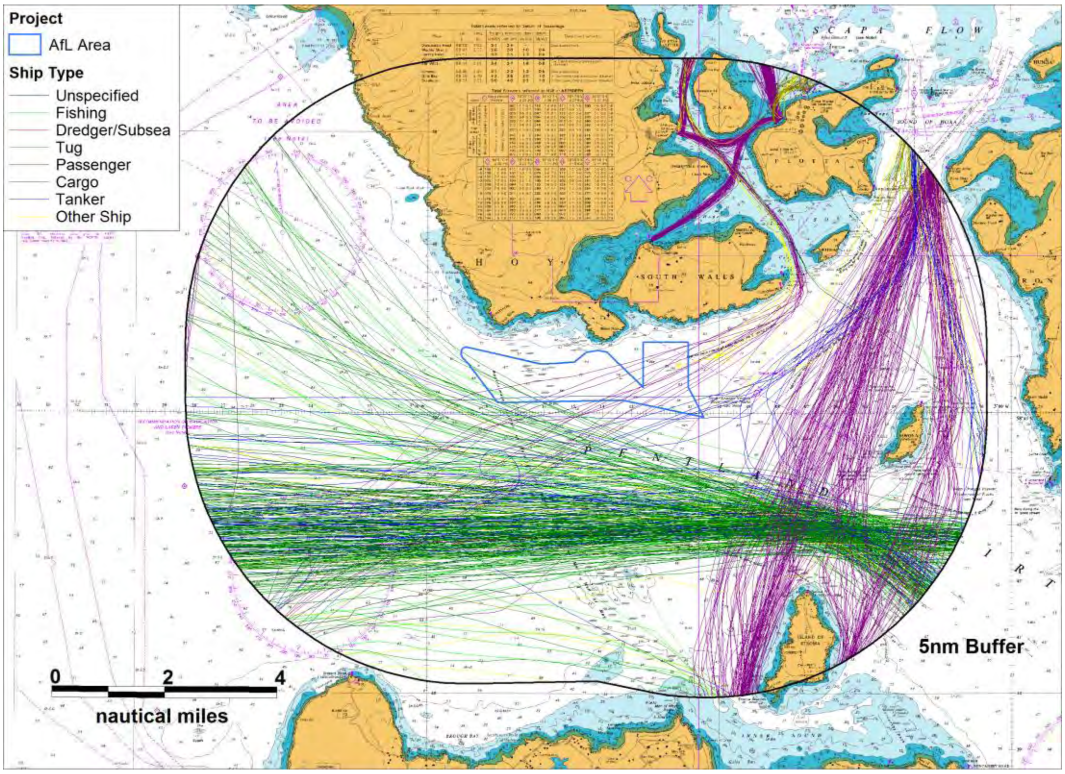


Figure 4.2 AIS Tracks by Type – 28 Days in Winter 2010

During the summer period there was an average of 20 unique vessels per day passing within 5nm, with a maximum of 32 on the busiest day, 17th July 2010. Twenty-two vessels were recorded intersecting the AfL area during the survey. On average 1 to 2 vessels per day were crossing the AfL area, with majority of tracks being cargo (54%) and fishing vessels (18%).

In the winter period, an average of 18 unique vessels per day were tracked within 5nm, with 27 on the busiest day, 14th November 2010. In the winter period, an average of 18 unique vessels per day were tracked within 5nm, with 27 on the busiest day. Twenty-four vessels were recorded intersecting the AfL area during the survey. On average 1 to 2 vessels per day were crossing the AfL area, with majority of tracks being passenger ferries (42%) and cargo vessels (29%).

Figure 4.3 presents the ship type distribution (excluding 1% unspecified in each period) within 5nm of the AfL area.

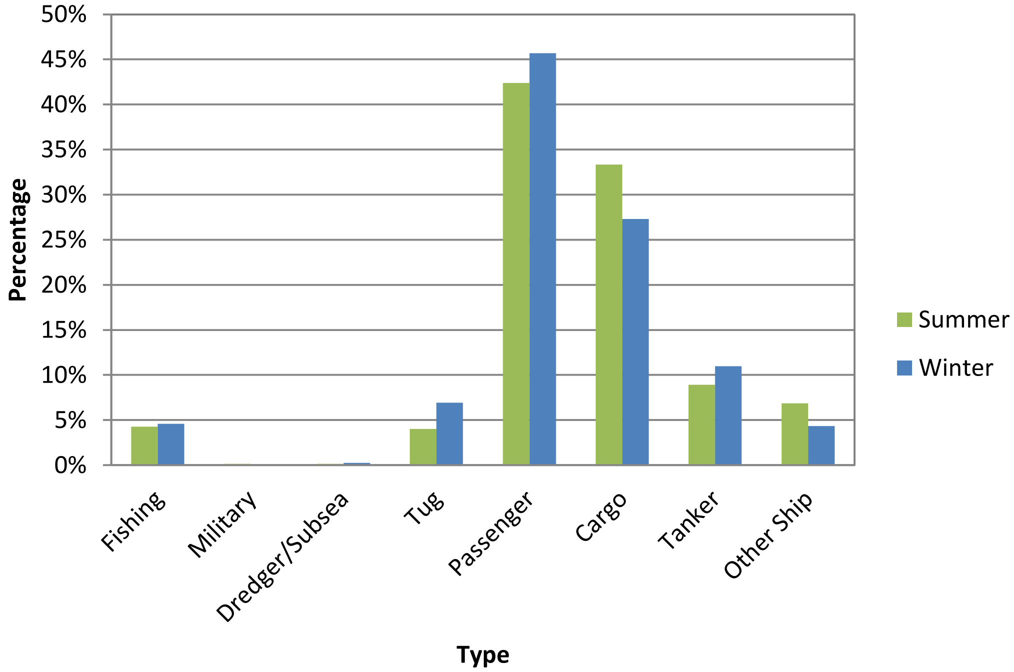


Figure 4.3 Vessel Types identified in proximity to the AfL Area

Overall, 44% of vessels identified during the combined survey period (summer and winter 2010) were passenger vessels. The majority of the passenger vessel tracks were made by the *Pentalina* which transited east of the AfL area between Gills Bay in Caithness and St Margaret's Hope on Orkney, making typically 3 return trips per day. The *Hamnavoe* ferry was also tracked crossing the former AfL area when routeing between Scrabster and Stromness via Scapa Flow, particularly in winter. The normal route is west of Hoy and via Hoy Mouth with the alternative route via Scapa Flow being taken for the comfort of passengers, particularly when heading northbound to Stromness during strong westerlies and ebb tide.

Approximately 30% of vessels were cargo ships, the vast majority transiting through the Outer Sound of the Pentland Firth.

Plots of the tracks within 5nm of the AfL area during summer and winter, colour coded by vessel length and vessel draught, are presented in Figure 4.4 to Figure 4.7.

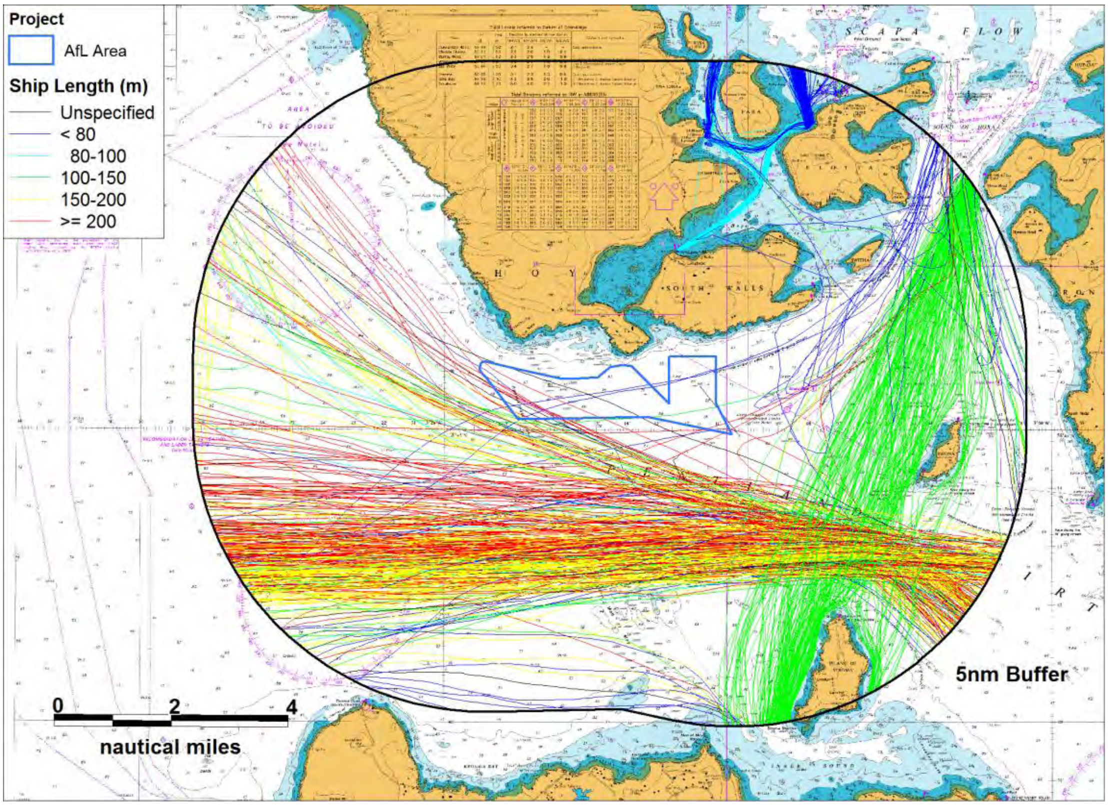


Figure 4.4 Summer 2010 AIS Tracks by Length

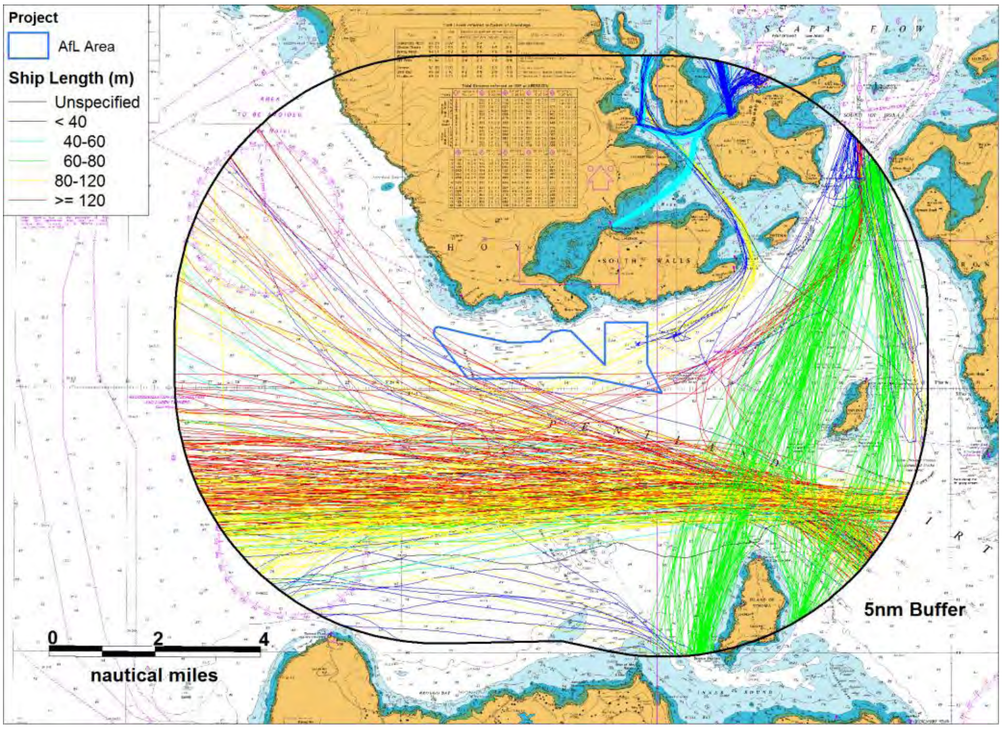


Figure 4.5 Winter 2010 AIS Tracks by Length

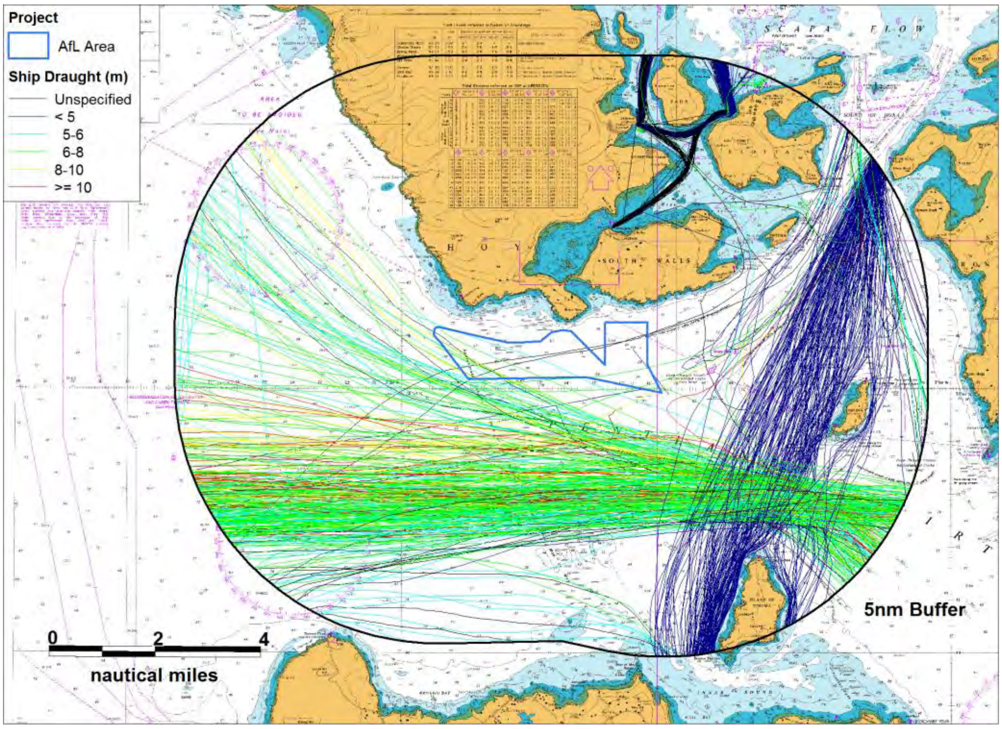


Figure 4.6 Summer 2010 AIS Tracks by Draught

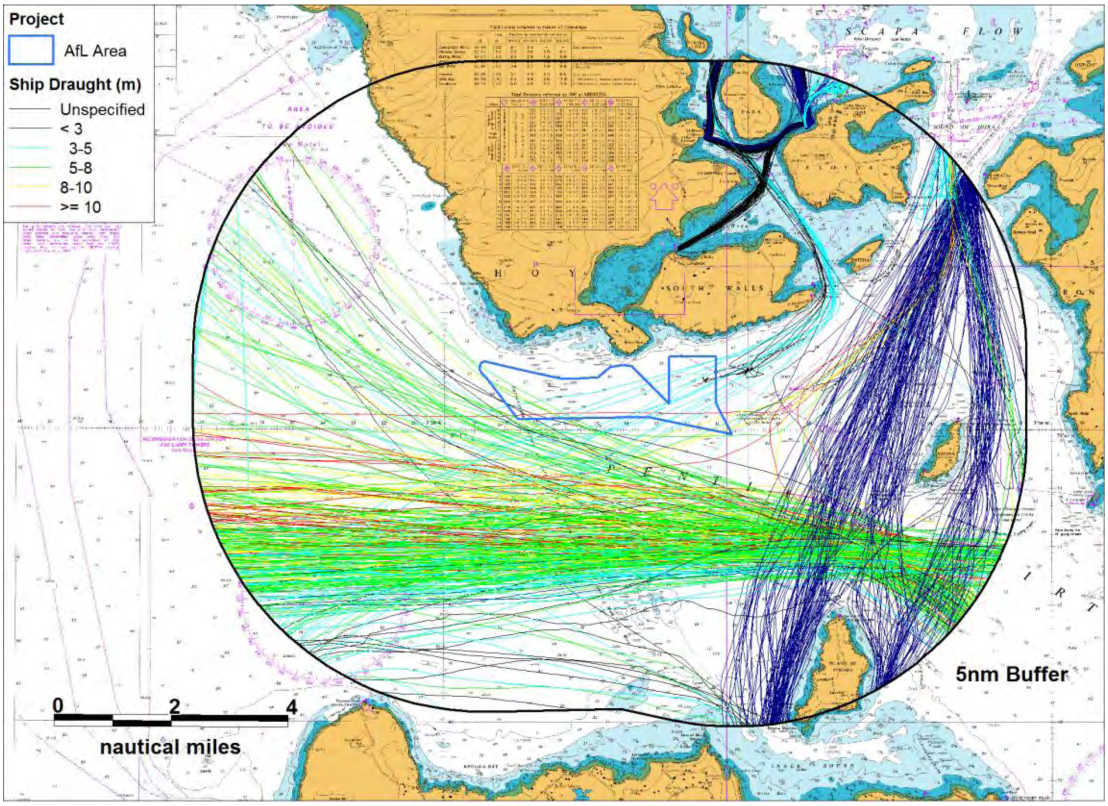


Figure 4.7 Winter 2010 AIS Tracks by Draught

In the summer period, the longest vessels were the container ships *OOCL Montreal* at 294m, bound for Montreal transiting the Outer Sound between Montreal and Hamburg. The container vessel *OOCL Montreal* was also the longest vessel recorded during the winter survey, tracked three times transiting the Outer Sound.

The deepest draught vessel during the summer survey was the tanker *Navion Europa*, at 15.8m, bound for Rotterdam and transiting east of the AfL area of search. The bulk carrier *Yeoman Bridge*, with a draught of 14m, was the deepest draught vessel tracked during the winter period, transiting through the Outer Sound to Isle of Grain, UK.

Other large vessels included tankers associated with the Flotta Oil Terminal identified to be using the recommended channels in and out of Scapa Flow.

4.2 Fishing Vessel Activity

The AIS data presented above included a number of fishing vessel tracks. At the time of the AIS surveys fishing vessels of 45m length and above were mandatorily required to broadcast on AIS under EU Directive. This will be extended to vessels 15m and above by summer 2014, and a growing proportion of fishing vessels have been observed to be carrying AIS voluntarily.

This section reviews longer-term sources of fishing vessel activity data in the form of sightings and satellite data.

4.2.1 Sightings Data

Data on fishing vessel sightings were obtained from Marine Scotland Compliance who monitor the fishing industry in Scottish waters through the deployment of patrol vessels and surveillance aircraft.

Each patrol logs the positions and details of fishing vessels within the ICES statistical Rectangle and Subsquare being patrolled. All vessels are logged, irrespective of size, provided they can be identified by their Port Letter Number (PLN). However, it is possible that patrols may not always be able to sight and log very small, inshore fishing vessels.

The AfL area is located within ICES Rectangle 46E6, Subsquare 2 (46E6/2) (see Figure 4.9). Data for the whole Rectangle has been analysed.

The numbers of fishing vessel sightings, surveillance patrols and hence average sightings per patrol within each ICES Subsquare encompassing the proposed site in the five-year period 2006-10 are presented in the table and bar chart below.

Table 4.1 Average Sightings per Patrol (2006-10)

ICES Subsquare	Sightings	Patrols	Sightings per Patrol
46E6/1	62	453	0.14
46E6/2	52	453	0.11
46E6/3	135	453	0.30
46E6/4	97	453	0.21

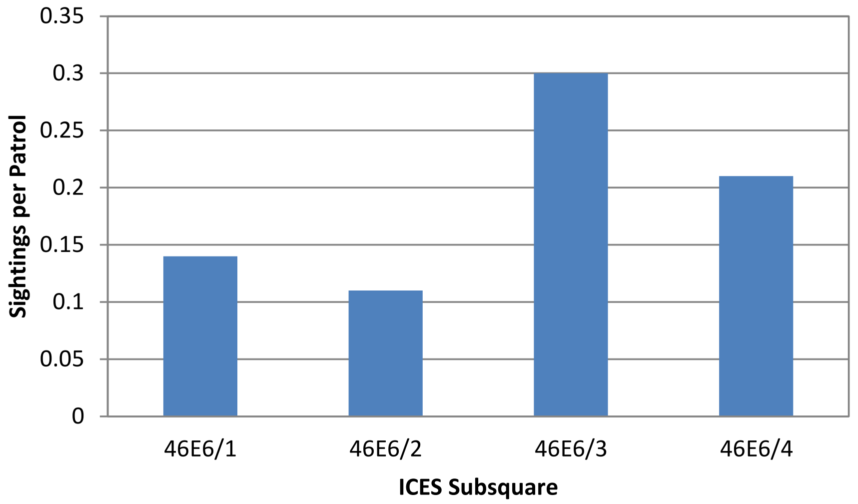


Figure 4.8 Average Fishing Vessel Sightings per Surveillance Patrol (2006–10)

Subsquare 46E6/2 containing the AfL area had an average of 0.11 sightings per patrol, i.e., about one vessel per 9 patrols.

The sightings data were imported into a GIS for mapping and analysis. A plot of the vessel sighting locations, colour-coded by gear type, is presented in Figure 4.9.

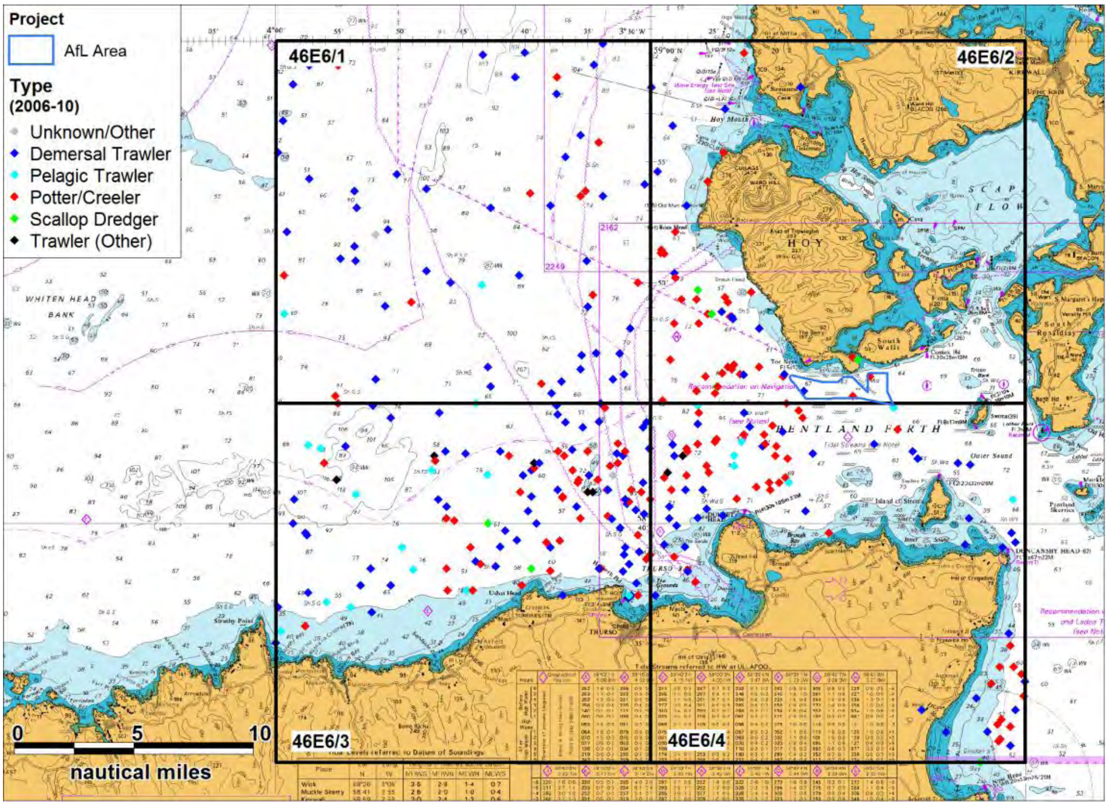


Figure 4.9 Fishing Vessel Sighting Locations

The main fishing type overall was demersal trawler (49%). The next most common type of fishing vessel was potter/creeler (40%).

In terms of vessel nationality, the vast majority of fishing vessels within Rectangle 47E6 were UK-registered (90%).

The fishing vessels colour-coded by activity when sighted are presented in Figure 4.10.

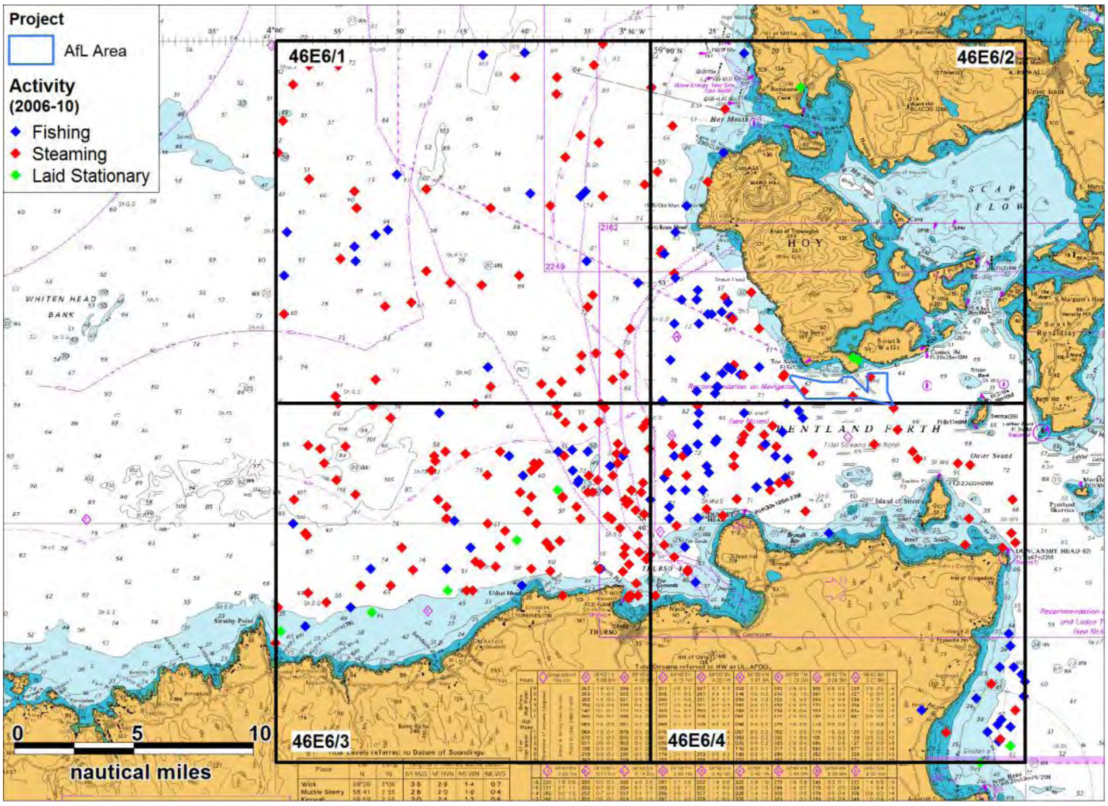


Figure 4.10 Fishing Vessel Sightings by Activity

34% of vessels sighted were fishing, i.e. gear deployed, 64% were steaming (transiting to/from fishing grounds), and 3% were laid stationary (vessels at anchor or pair vessels whose partner vessel is taking the catch whilst the other stands by). Two stationary vessels were sighted in Aith Hope.

The length distribution of fishing vessels sighted in ICES Rectangle 46E6 is presented in Figure 4.11. Overall, approximately half were above 15m in length.

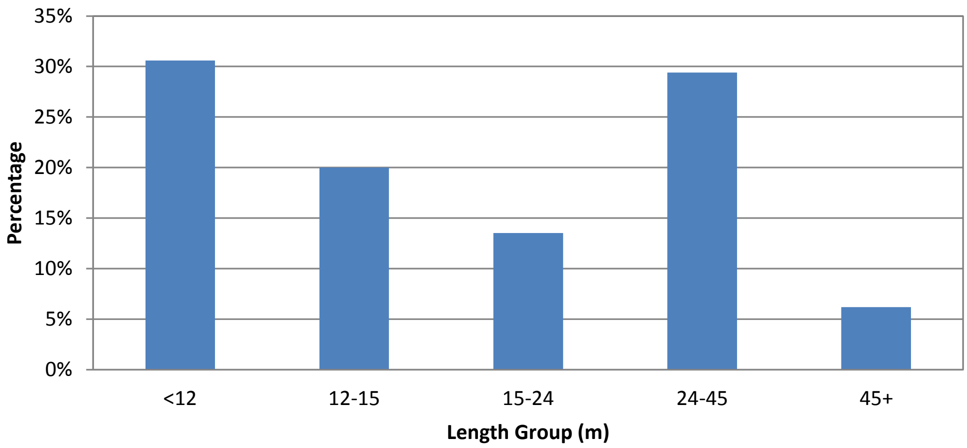


Figure 4.11 Fishing Vessel Sightings by Length Group (2006–10)

4.2.2 Satellite Data Analysis

Fishing vessel satellite tracking (or VMS) data was provided by Marine Scotland Compliance. Only UK vessel activity data was available. Based on the sightings analysis, UK vessels of 15m length and over represent approximately half of the vessel activity recorded during sighting patrols.

Plots of vessel positions, colour-coded by speed, are presented for the years 2008-10 in Figure 4.12 to Figure 4.14.

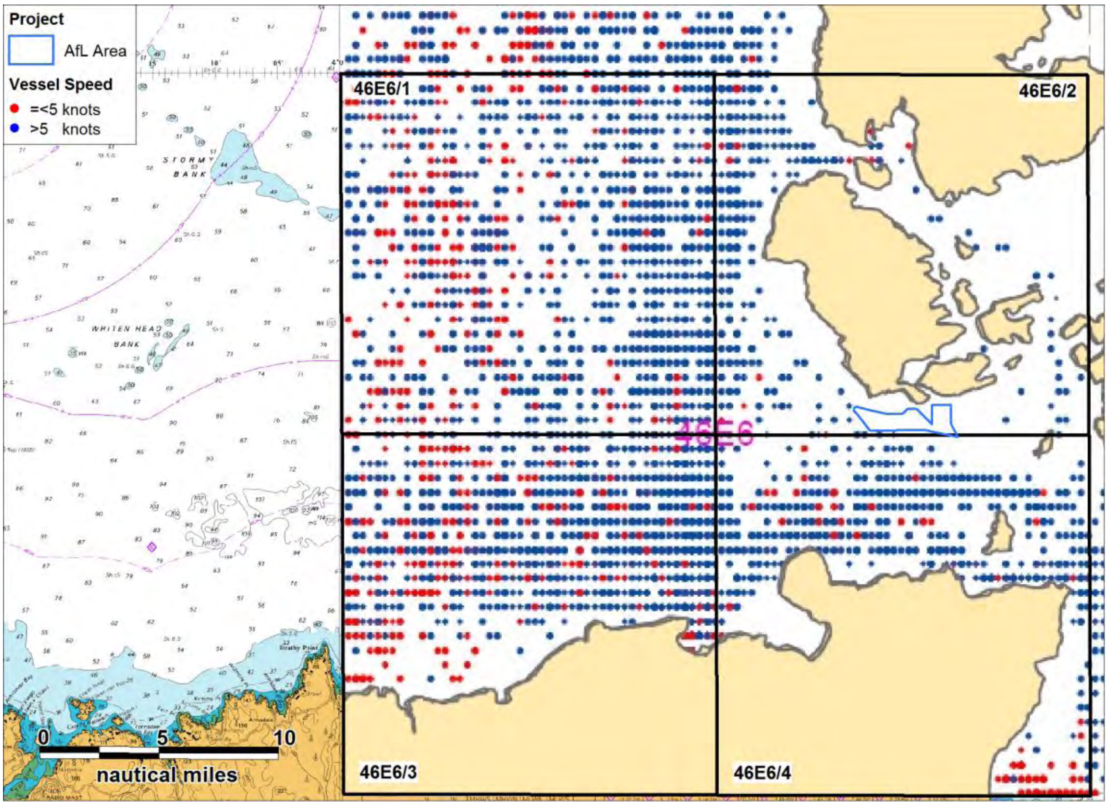


Figure 4.12 Chart of Satellite Fishing Vessel Positions by Speed (2008)

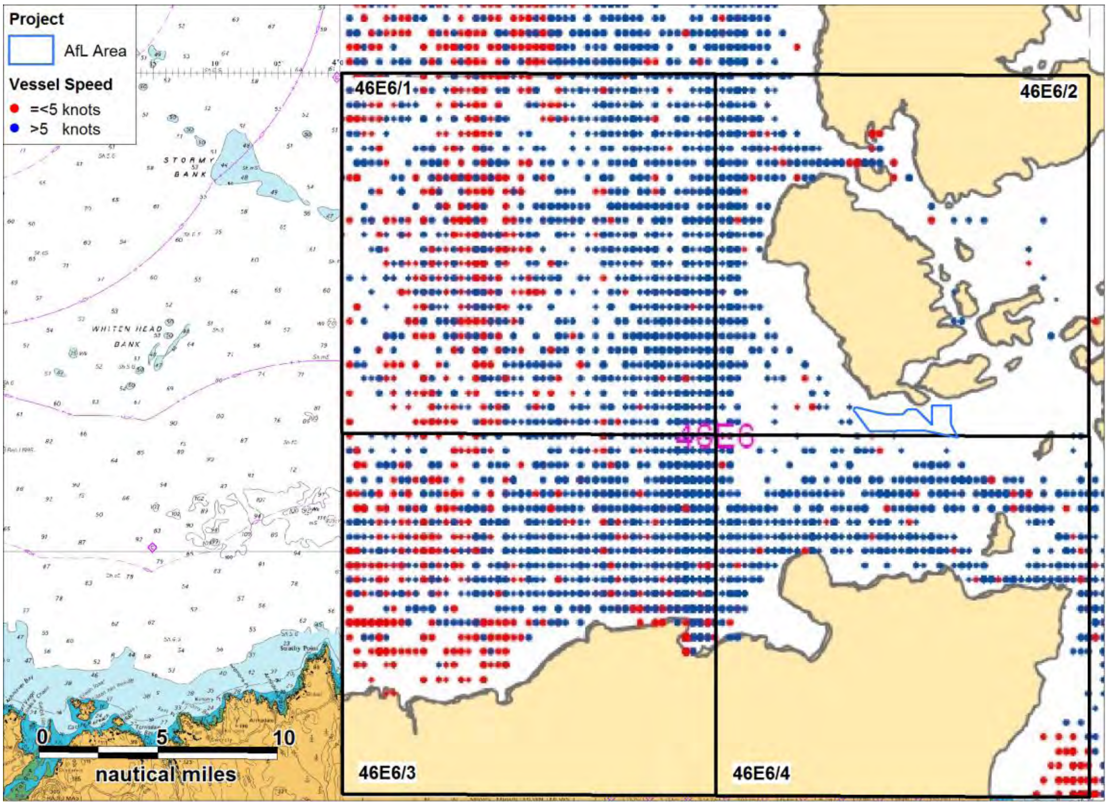


Figure 4.13 Chart of Satellite Fishing Vessel Positions by Speed (2009)

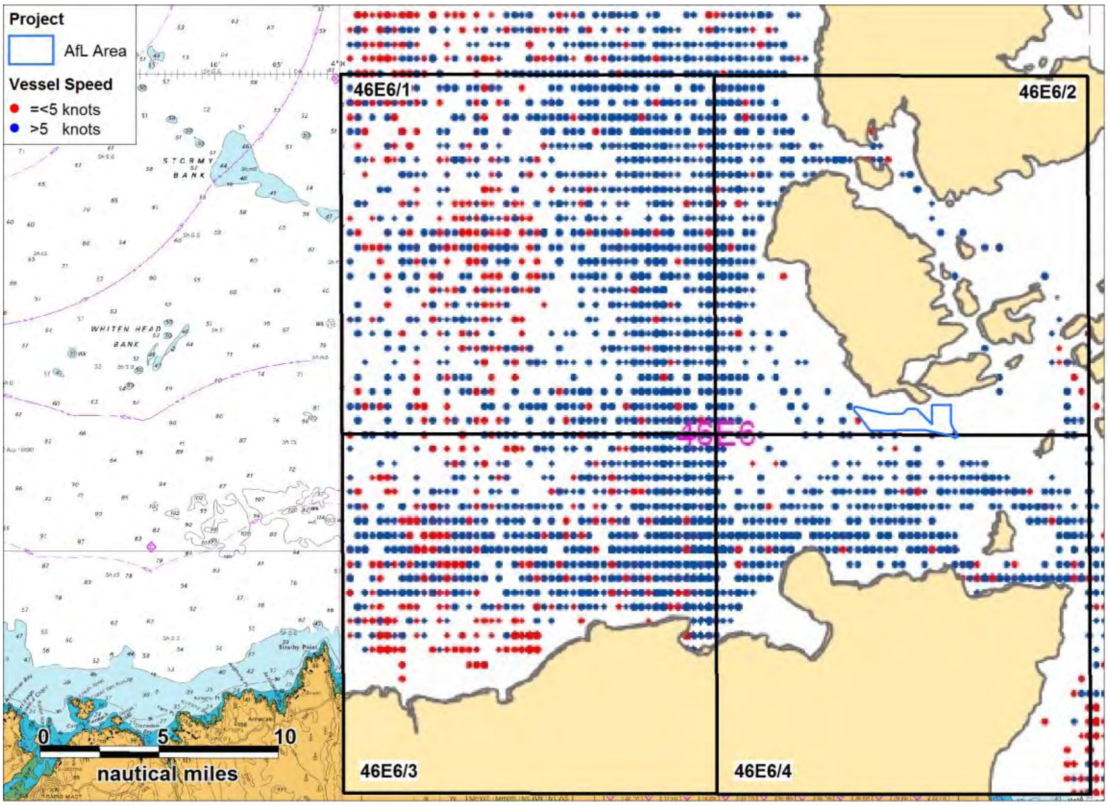


Figure 4.14 Chart of Satellite Fishing Vessel Positions by Speed (2010)

The vast majority of fishing vessel positions were to the west of the AfL area. Most of these were tracked travelling at speeds over 5 knots which indicates they are likely to be steaming on passage, with a minority likely to be actively fishing.

Sightings data indicated that the vessels observed in the vicinity were potter/creelers and scallop dredgers. All fishing vessels sighted in the immediate vicinity were steaming on passage, aside from the two vessels which were using Aith Hope for shelter. The VMS data is consistent with this, suggesting that the majority of vessels in the area are steaming on passage. This includes the demersal trawlers which were sighted west of the AfL area.

4.2.3 ScotMap

Marine Scotland has recently carried out a pilot study in the Pentland Firth and Orkney Waters to gain a more detailed understanding of inshore fishing activity in Scottish Territorial Waters. A draft report has been released (Ref. i).

The draft report indicates that within the AfL area there are 7-11 unique fishing vessels operating, and 4-6 of these are below 10m in length. Further analysis of the final report and underlying data set (where possible) will be undertaken during the Navigation Risk Assessment.

4.3 Recreational Vessel Activity

This section reviews recreational vessel activity within the vicinity of the BTA area of search based on the available desktop information.

4.3.1 RYA Data

The RYA, supported by the Cruising Association, has identified recreational cruising routes, general sailing and racing areas in the UK. This work was based on extensive consultation and qualitative data collection from RYA and Cruising Association members, through the organisations' specialist and regional committees and through the RYA affiliated clubs. The consultation was also sent to berth holder associations and marinas.

The results of this work were published in Sharing The Wind (Ref. ii) and updated GIS layers have been published in the Coastal Atlas (Ref. iii).

A summary plot of the recreational sailing activity and facilities identified in the North East Scotland Sailing Area is presented in Figure 4.15.

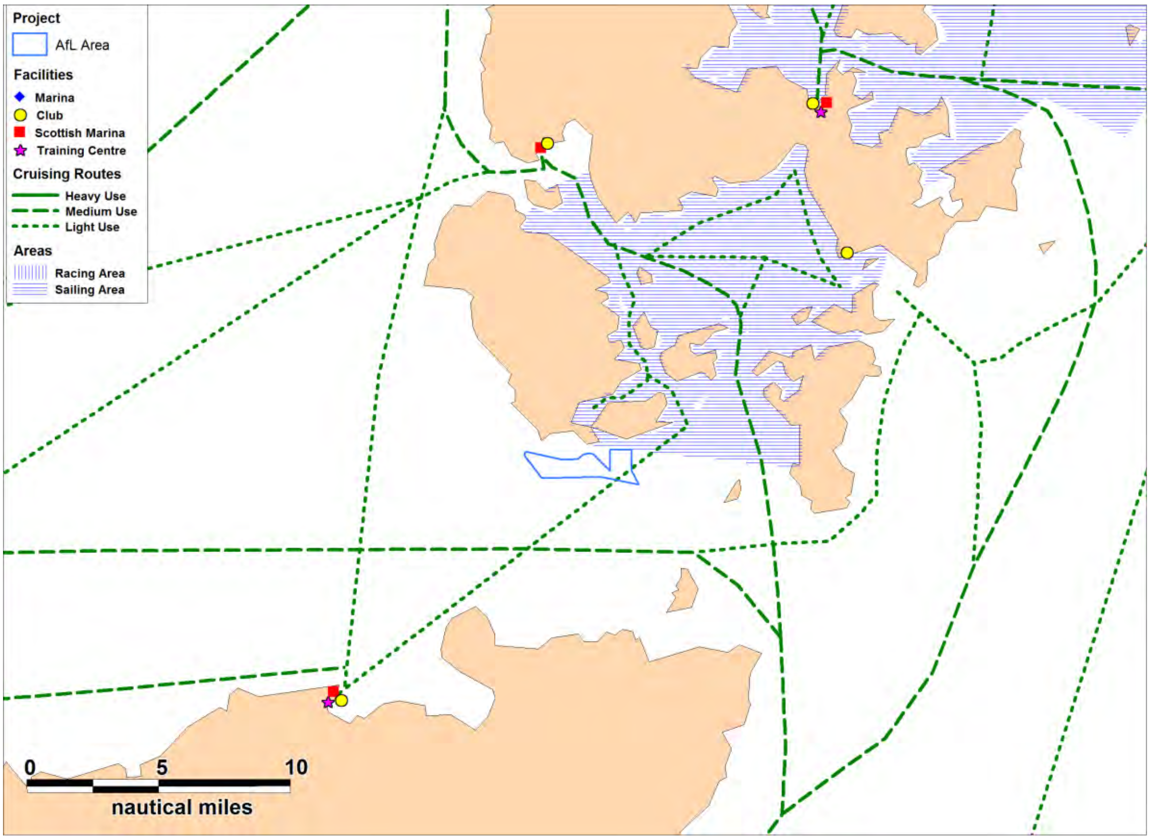


Figure 4.15 Recreational Information for North East Scotland Strategic Area

A more detailed chart of the recreational vessel activity and facilities in the vicinity of the AfL area is presented in Figure 4.16.

Based on the published data, the AfL area lies in close proximity of the North East Scotland Sailing Area and outside of general racing areas identified by the RYA. A light-use[1] cruising route passes through the east part of the AfL area, running between Scrabster Harbour and various routes in the vicinity of Orkney.

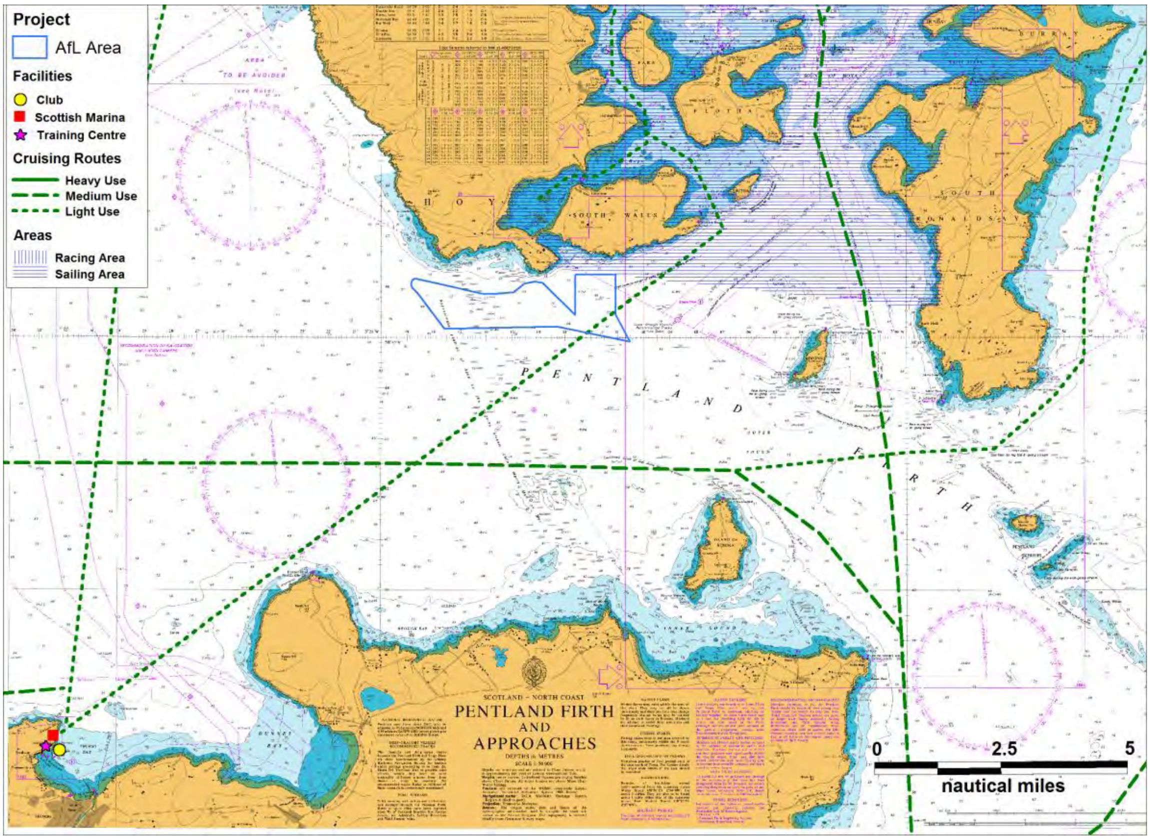


Figure 4.16 Recreational Data in the vicinity of Brims Tidal Array AfL Area

In terms of facilities, the nearest club and training centre (by sea) is the Pentland Firth Yacht Club, approximately 22nm southwest of the AfL area at Scrabster, and the closest marina is Scrabster Harbour.

It should be noted the routes are indicative and the RYA is updating the data as more information becomes available. Marine Scotland carried out a shipping study of the Pentland Firth and Orkney Waters (Ref. iv), which RYA Scotland were heavily involved in. Within this study, it was identified that there is a low density of recreational activity in the vicinity of the Brims Tidal Array AfL area and that the RYA light-use cruising route which passes through the AfL area is rarely used. The Marine Scotland study identified one anchorage area in use by recreational vessels, in Aith Hope to the north of the AfL area.

[1] Recreational boating, both under sail and power is highly seasonal and highly diurnal. A light use recreational route is classified by the RYA as a route known to be in common use but which does not qualify for medium or heavy classification. A medium use recreational route is classified as a popular route on which some recreational craft will be seen at most times during daylight hours.

4.3.2 Clyde Cruising Club Sailing Directions

The Clyde Cruising Club produces Sailing Directions for various areas of Scotland. The publication covering Orkney Waters (Ref. v), which was complied with local knowledge, includes information for recreational sailors using the Pentland Firth and Scapa Flow areas.

Wick to Long Hope

The tide turns northwest off Duncansby Head -0105 (+0115 Dover). Departure should be timed from Wick to reach point 1nm east of Duncansby Head at slack water.

i. With a west wind less than a force 4, the passage can be safely made. A good course should be made for Lother Rock and the west-going ebb from north of Muckle Skerry should be picked up. Passage should be made north of Switha.
ii. With an east wind, the directions above should be followed, but Little Skerry should be steered towards. Passage should be made close west of Muckle Skerry, then the above should be followed again. It must be remembered that the ebb tide sets west towards Swona and, if it is likely to be difficult to clear the north end of Swona, this must be realised early and Swona passed to the south well clear of Tarf Tail. In general, when 2 cables north of Clett of Swona one will be in the northwest-going ebb stream.

Long Hope to Wick

The east-going stream along the south coast of South Walls begins +0435 Aberdeen (-0530 Dover), and in Outer Sound between Swona and Stroma at +0505 Aberdeen (-0500 Dover). The last of the inshore west-going stream stops in mid-firth. On passing Cantick Head light house heading south, the lighthouse should be kept 2 cables off until it is abeam to westward. The last of the inshore ebb (west-going) stream should be used to reach Aith Hope. The main flood in the Outer Sound should be waited for. Almost due south should then be steered for to ensure passing through the Outer Sound in mid-channel. Southeast should be headed for to pass mid-way between Duncansby Head and the Pentland Skerries to avoid Duncansby Race which forms on the flood and extends 1nm offshore.

Scapa Flow

It is necessary to keep aware of inter-island and mainland ferry traffic. Anchorage can be found in the southwest approach, in Aith Hope which is entered between Brims Head and Aith Head. Shelter can be found in depths of 4-11m in sand off the former Longhope Lifeboat Station. The Ayre is an artificial causeway linking Hoy to South Walls.

5. Review of Historical Maritime Incidents

5.1 Introduction

This section reviews maritime incidents that have occurred within 5nm of the AfL area in recent years.

The analysis is intended to provide a general indication as to whether the area of the proposed development is currently low or high risk area in terms of maritime incidents. If it was found to be a particular high risk area for incidents, this may indicate that the development could exacerbate the existing maritime safety risks in the area.

Data from the following sources has been analysed:

- Marine Accident Investigation Branch (MAIB)
- Royal National Lifeboat Institution (RNLI)

(It is noted that the same incident may be recorded by both sources.)

5.2 MAIB

All UK-flagged commercial vessels are required to report accidents to MAIB. Non-UK flagged vessels do not have to report unless they are within a UK port/harbour or within UK 12 mile territorial waters and carrying passengers to or from a UK port (including those in inland waterways). However, the MAIB will record details of significant accidents of which they are notified by bodies such as the Coastguard, or by monitoring news and other information sources for relevant accidents. The Maritime and Coastguard Agency, harbour authorities and inland waterway authorities also have a duty to report accidents to MAIB.

The locations[1] of accidents, injuries and hazardous incidents reported to MAIB within 5nm of the AfL area between January 2001 and December 2010 are presented in Figure 5.1, colour-coded by type. A total of 27 unique incidents were recorded over the 10 year period, an average of 2-3 per year.

[1] MAIB aim for 97% accuracy in reporting the locations of incidents.

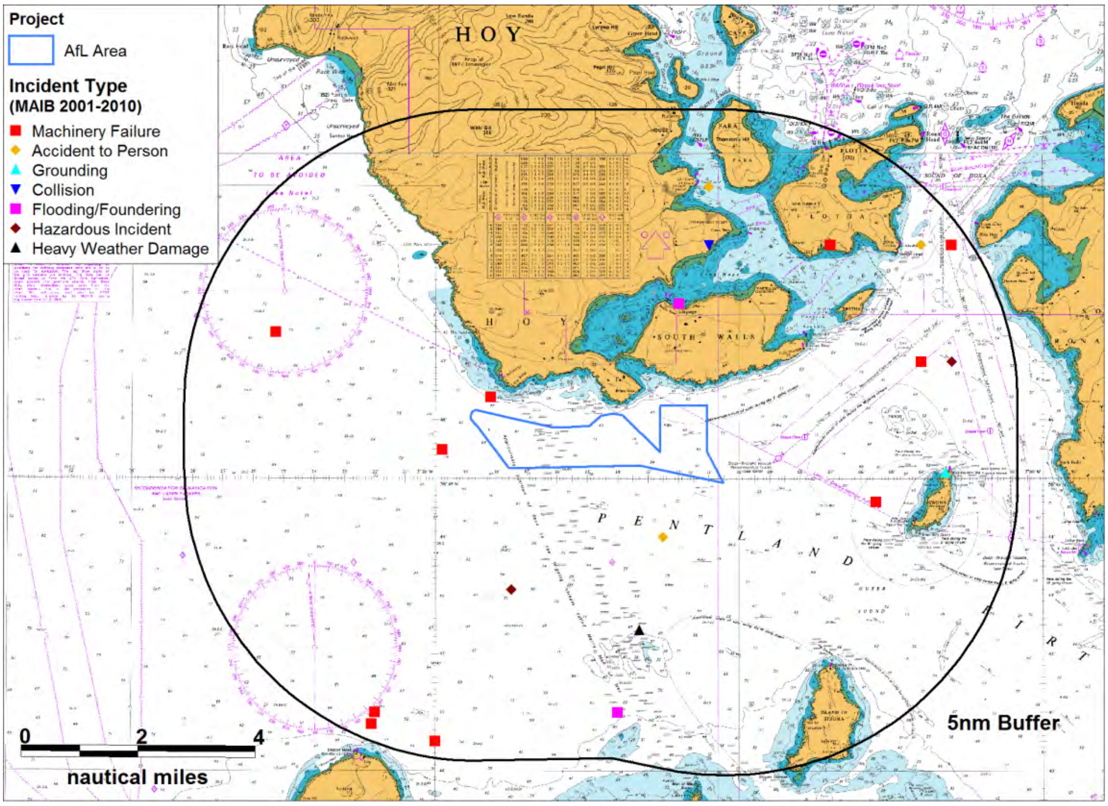


Figure 5.1 MAIB Incident Locations by Type within 5nm of AfL Area

The overall distribution by incident type is summarised in Figure 5.2. The most common types were machinery failure (39%) and accident to person (21%).

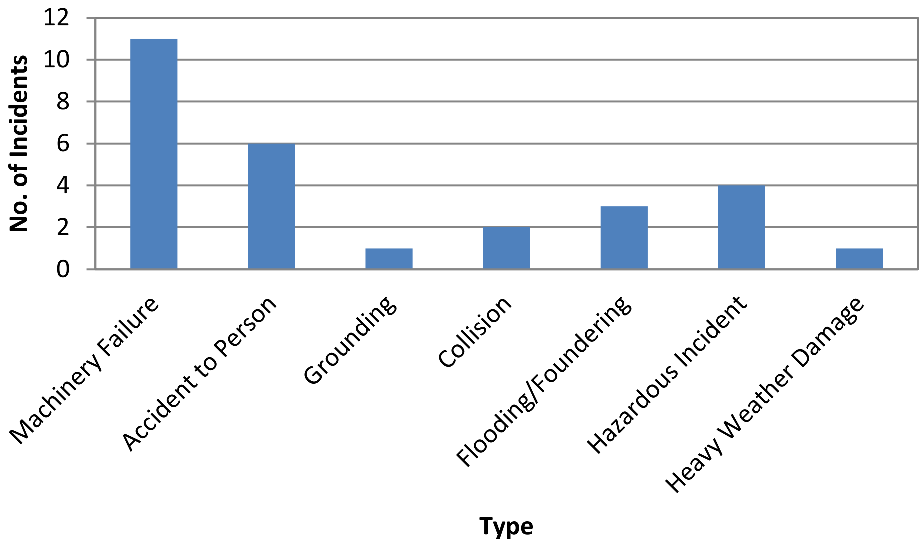


Figure 5.2 MAIB Incidents by Type within 5nm of AfL area (2001-2010)

No incidents were reported within the AfL area over the 10 years analysed. The closest incident to the AfL area occurred approximately 0.3nm north. On 9th July 2006 a single handed potter suffered engine failure and was recovered under tow by the RNLI. On 7th April 2005, approximately 0.86nm west to the AfL Area a trawler suffered machinery failure when its fishing gear became entangled in its propeller. The vessel was towed to sheltered waters by a fishing vessel and to a safe haven by a harbour tug.

Data on RNLI lifeboat responses within 5nm of the AfL area in the ten-year period between 2001 and 2010 have been analysed. A total of 29 launches to 24 unique incidents were recorded by the RNLI (excluding hoaxes and false alarms), i.e., an average of two per year with a range of 2-3 per year.

Cross-referencing by date and location, five of the RNLI incidents were also recorded in the MAIB data.

Figure 5.3 presents the geographical location of incidents colour-coded by casualty type.

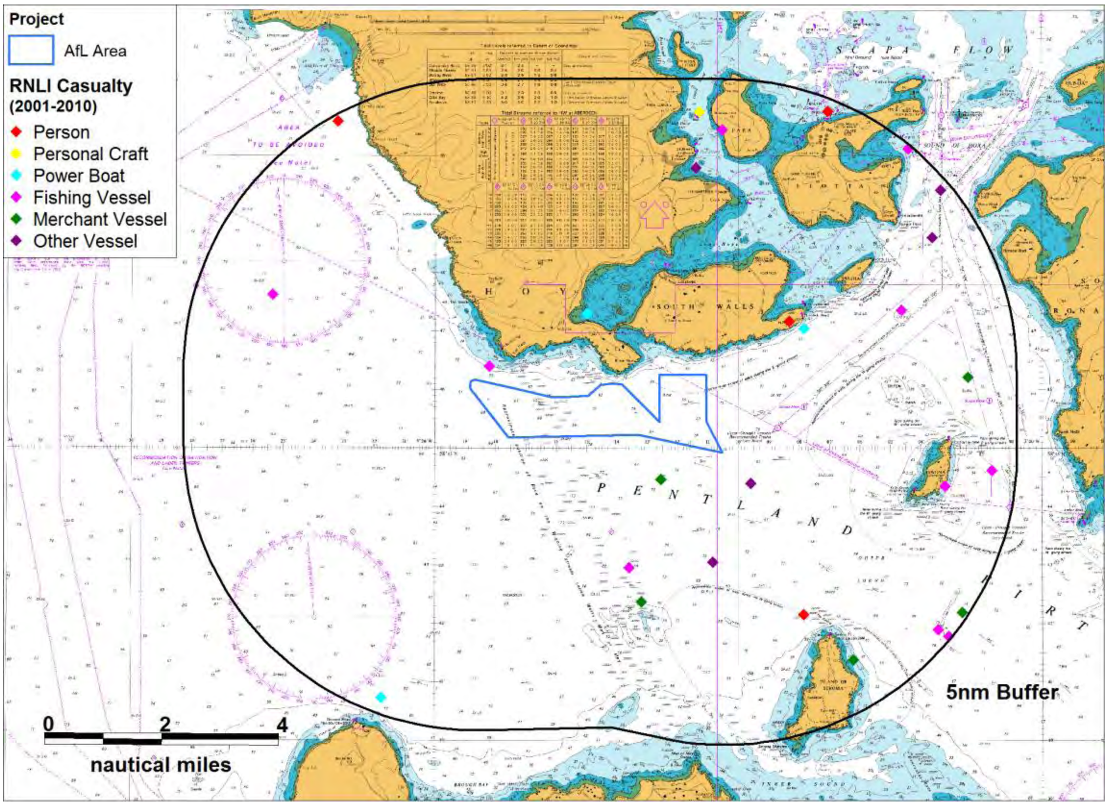


Figure 5.3 RNLI Incidents by Casualty Type within 5nm of the AfL Area

No incidents were recorded within the AfL area over the 10 years analysed. The closest incident occurred just north of the AfL area off the coast of Tor Ness on 9th July 2006, when a fishing vessel suffered machinery failure.

The overall distribution by casualty type is summarised in Figure 5.4. The most common vessel types involved were fishing vessels and merchant vessels, accounting for 34% and 21%, respectively, of all incidents.

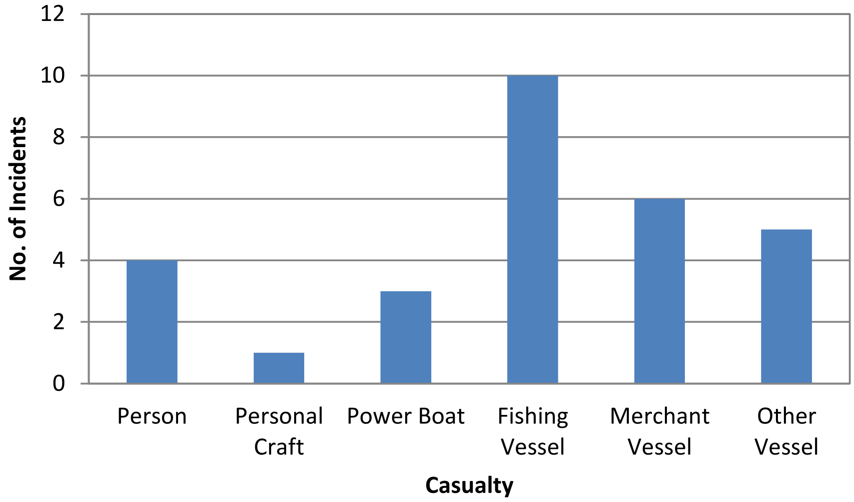


Figure 5.4 RNLI Incidents by Casualty Type within 5nm of the AfL Area (2001-2010)

The reported causes are summarised in Figure 5.5. The two mains causes were person in danger (48%) and machinery failure (38%).

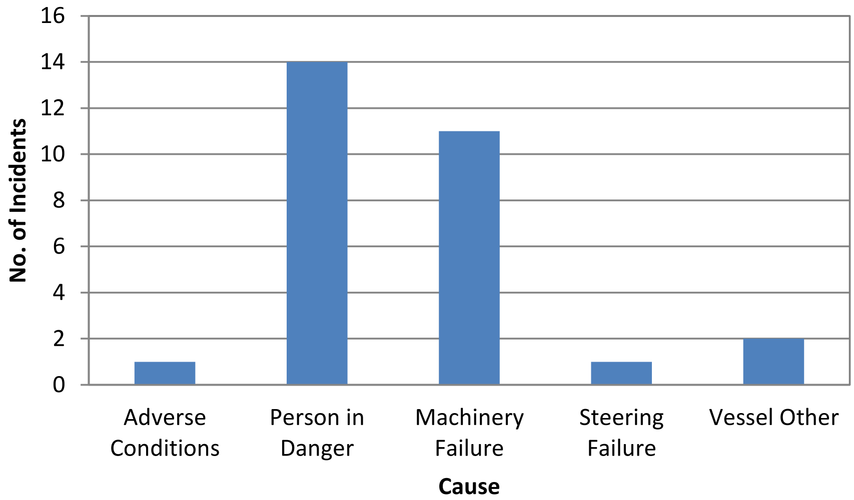


Figure 5.5 RNLI Incidents by Cause within 5nm of the AfL area (2001-2010)

Incidents were responded to by Longhope, Thurso and Stromness RNLI stations. Longhope uses the ALB Tamar class vessel, *Helen Comrie*. The Thurso lifeboat is the ALB Severn class vessel, *The Taylors*. Stromness RNLI operates *Violet, Dorothy and Kathleen*, the Severn class ALB.

6. Stakeholder Consultation

6.1 Introduction

This section summarises the responses to the Project Briefing Document (PBD) relevant to shipping and navigation as well as feedback obtained from consultation carried out by Anatec with navigational stakeholders to date.

Note, the stakeholder consultation is mainly based on the original AfL area and OpenHydro technology. However, meetings on the revised site and alternative technologies were held with Orkney Fisheries Association and OIC Marine Services in July 2013.

6.2 Project Briefing Document Responses

The PBD was circulated widely to national and local stakeholders in May 2012. The document included a brief overview of shipping and navigation in the area extracted from an early draft of the PHA.

The key responses to the PBD relating to shipping and navigation are summarised in Table 6.1. (Note: The name at that time was Cantick Head, which has been retained below.)

Table 6.1 Stakeholder Responses to Project Briefing Document

Stakeholder	Response
MS-LOT	• It is noted that fishing activity is shown for vessels over 15m from VMS and MS Compliance sources. • Marine Scotland has recently undertaken a fisheries mapping project (ScotMap) which aimed to identify areas of fishing activity in the Pentland Firth and Orkney waters. This targeted mainly non-VMS (<15m vessels) and the report should be available within the next few months. This should be consulted to provide a better understanding of the AfL area. • A targeted study of smaller vessels would also be beneficial. • Cumulative impacts of Phase I will have to be assessed in the Phase II ES.
Marine Scotland Science	• Data provided on fishing vessel activity suggested to show that there are a large amount of demersal vessels in the area. These are unlikely to be fishing and most are likely to be transiting through/across the Pentland Firth. • ScotMap report should be consulted.
MCA	• The ES should supply detail on the possible impact on navigational issues for both commercial and recreational craft, including collision risk, navigational safety, risk management and emergency response, marking and lighting of site and information to mariners, effect on small craft navigational and communication equipment, the risk to drifting recreational craft in adverse weather or tidal conditions, the likely squeeze of small craft into the routes of larger commercial vessels. • A Navigational Risk Assessment will need to be submitted in accordance with MGN 371 (and 372) and the DTI/DfT/MCA Methodology for Assessing Tidal Arrays (and Wind Farms). The MGN 371 checklist format

Stakeholder	Response
	should be appended to the submission. • The NRA needs to relate to a safe Under Keel Clearance (UKC), which should allow for the worst case scenario in terms of vessel draught to safely navigate through the area. • Cumulative and in combination effects will require consideration. • Casualty information from the RNLI and MAIB should be analysed. • Reference should be made to any Marine Conservation Zones (MCZs) established or planned within the area. • The Rochdale Envelope should be used if final layout and capacity has not been concluded prior to the release of the ES. • Any reference to IALA recommendations on the marking of tidal array should refer to O-139 Edition 1 December 2008 which replaced all previous versions. • Radar and manual observations should be included in addition to AIS to ensure that smaller vessels are recorded. • Recreational activities should be considered. • Any application for operational safety zones will need to be formally submitted for review. • Consideration will need to be given to site size and location on SAR resources and Emergency Response & Co-operation Plans (ERCoP) including identified emergency towing and potential guard vessel provisions that may be required by the developer/operator. • Particular attention should be paid to cabling routes and burial depth. An anchor penetration study may be necessary.
NLB	• Necessary marking and lighting recommendations will be made in a formal response through the Marine Licensing process. • Initially propose that turbines will not require any navigational marks as it is intended to install in 60-80m of water. • Discourage the use of an offshore substation to connect the array to shore. If considered essential it is advised to be positioned as far north as possible within the AfL area. This will require to be marked and lit for the safety of navigation. A decision on the appropriate marks and lights shall be taken once the specifications of the structure are supplied but will be based on O-139 IALA guidelines. • May also be necessary to mark the landfall site of the export cable routes, depending on the location chosen. • NRA to be in accordance with MGN 371. • In addition to AIS / radar information, further validation of statistics by gathering data regarding vessels under 15m and leisure users at a local level, will enable a more complete NRA. • Risk Assessment to include a workshop approach with local users of the area and Orkney Harbours for hazard identification and mitigation. • All navigational marking and lighting of the site and associated marine infrastructure will require Statutory Sanction of the NLB prior to deployment.

Stakeholder	Response
	• Whilst device(s) are in their operation/maintenance phase, they should be actively monitored, and a contingency plan be in place to respond to any reported catastrophic failure events which could result in any part of the device(s) breaking loose and becoming a buoyant hazard. The contingency plan should include the transmission of local Radio Navigation Warnings.
OIC	• OIC Marine Services (Harbour Authority) should be part of the regulator group. As the Statutory Harbour Authority any impacts or potential impacts on the harbour areas should be assessed early in the process. • Flotta oil terminal and Longhope RNLI would be useful additional stakeholder consultees given their proximity to the site.
OFS & OFA	• Wish stakeholders to be kept informed of any changes in the AfL search area boundaries. • Movement further west will need to take into account any blocking or limiting of access to Brims Ness.
NorthLink Ferries*	• Main concern is whether there will be an exclusion zone as the area is frequently transited in winter when there is heavy westerly swell present. • Assumed that deployment will happen during periods of favourable weather when the easterly route will not be used. • Once the turbines are in position, they should be of a depth that will not affect the ferries. • November 2010 does not represent particularly frequent use of Cantick Sound route as it was not one of the more common periods of strong westerlies, and the route will be used more frequently at times. • The AIS information provided showed very little traffic going through the area, when it is an area used fairly regularly to avoid or catch the tide depending on whether it is ebbing or flowing. • Marker buoys during development could prove dangerous to vessels navigating the Pentland Firth as there would be a high chance of them breaking loose. • When approaching Cantick Sound from the southwest, vessels sometimes pass through the AfL area. It may appear that the vessels could keep south, but due to the complex mix of tidal and swell conditions in the area they occasionally transit closer to the South Walls coastline than might be expected. This is particularly the case when avoiding strong ebb tides in order to reduce delay and improve passenger comfort. This is part of NorthLink's 'local knowledge' accrued through several years' experience on the route. • NorthLink are glad to see that there is the possibility that the AfL area may be moved further west past Brims Ness. • Require clarification whether vessels will be allowed to navigate through the area outwith the construction stage, or whether there will be an exclusion zone in place.

* Ferry operator has changed to Serco NorthLink Ferries from 5 July 2012.

6.3 PHA Consultation Meetings

Meetings were held with key national and local stakeholders during the PHA work for the original (Cantick Head) AfL. Updated meetings on the new Brims Tidal Array site and alternative technology were held with OFA and OIC Marine Services in July 2013. Key comments from all the meetings are presented in Table 6.2.

Table 6.2 Stakeholder Comments at Meetings

Stakeholder	Meeting Comments
MS-LOT	• List of stakeholders for the project, including navigational stakeholders, was reviewed. • Noted that MS's Marine Renewable Facilitators Group includes the MCA and NLB. Agreed that direct approach could be made where considered necessary provided MS were provided with feedback.
MCA & DfT	• Have some concerns regarding 3rd party verification of devices being developed. • Issues regarding underkeel clearance and the mariner's perception of risk, particularly at different states of tide. "Appetite for risk" may be changing as a result of projects and test devices being developed. Previously vessels tended to avoid development areas altogether, but this might not be the case in future. • Potential concerns regarding cable burial depths and protection and the on-going monitoring, based on some experience of remedial work undertaken on some of the east coast offshore wind farms. • For further consultation, official documents will go through Marine Scotland, but technical queries can be discussed directly with MCA. • Stated that in the context of Marine Guidance Note 371, the proposal would have to be considered as a major development and therefore a dedicated radar/AIS survey would likely be required. A further review will be taken on completion of the PHA. • UKHO input would be required on the markings of developments on charts.
OIC Marine Services	• The AfL area currently overlaps Harbour Limits. Anything on the seabed within the Harbour Limits would need a works licence. It is expected that the actual development will be west of the Harbour Limits with the exception of the possible cable landfall at Aith Hope. • The proximity of the site will mean that Marine Services will have a strong interest and it will be important that the NRA deals with specific in-combination issues, such as the coordination of activities on the site when a tanker is approaching Scapa Flow from the west. • Tanker draught could be up to 22 metres. Tankers will follow the recommended track in calmer conditions but in adverse conditions they may take a different angle in and out. • Alternative technology ,including potential surface-piercing structures, will need full consideration in the NRA. Intelligent site layout will be needed. • Scapa VTS has good coverage of the site from their radar and AIS located on Sandy Hill. However, tracking of smaller (non-AIS) targets in the area

Stakeholder	Meeting Comments
	is variable and depends on weather, sea state, size and shape of target, etc. Also radar-only vessels cannot normally be identified. Vessels under 12m do not need to report to Scapa. • Marine Services provided an update on their facilities including the upgrades at Lyness, Hatston and Copland's Dock in Stromness. • OIC Marine Services are working on a five year Port Infrastructure Plan. The more information they can get from developers on their potential needs, the better.
Orkney Fisheries Association (OFA)	• The name change, new AfL area, potential for alternative technology and new timings for development were discussed. • Hoy fishermen (based in Longhope) and Burray fishermen use creels in the area. Names of individuals were discussed, both within and independent of OFA. • Attention was also drawn to the Orkney Sustainable Fisheries project and the ScotMap work which gives a general indication of the fishing in the area. • South of Brims area is quite exposed so not many fishermen would risk gear in the area. Some may use it at certain periods, but seasonal and weather dependent.
RYA Scotland (Orkney Coastwatcher)	• Stromness around Hoy is a popular transit, taking about 10-12 hours depending on direction of travel. It can be done clockwise or anti-clockwise, depending on the tide. Clockwise is generally easier, but if the tides are not timed correctly then the Merry Men of Mey could be running on the ebb. It is recommended to reach Tor Ness around the ebb, crossing the Merry Men of Mey at slack water. • Recreational craft tend to stay reasonably close to the shore to enjoy coastline features, typically a couple of cables (approx.350-400m). • Transits are mainly carried out in summertime. It is difficult to estimate numbers. One local skipper in Stromness identified who would do this transit. Also might be some visitors to Stromness from further afield. Yachts during transit could also be solo sailors or groups. • VHF reception is good in this area. Mobile telephone reception is unknown. • Other yachts could pass near the proposed area, e.g. vessels crossing the Pentland Firth, the closest which would be those crossing to/from Scrabster. Crossing from Orkney to Scrabster would normally be on the ebb tide and yachts would tend to pass west of Hoy. For the northbound crossing from Scrabster to Orkney, vessels could go west of Hoy or via Scapa Flow (in flood tide). On the latter route they would pass between Switha and South Walls and may cross the original AfL area. This is illustrated in the RYA Cruising Atlas as a 'light-use' cruising route. Moving the AfL area west, makes this less of an issue. • OpenHydro turbines will be on the seabed with a planned clearance of more than 30m. No risk of yacht keel interaction at these depths. The only issue would be during installation when surface vessels may pose a temporary obstruction, or if there was an offshore substation on the

<table>
<tr><th>Stakeholder</th><th>Meeting Comments</th></tr>
<tr><td></td><td>surface.
There are no significant recreational issues with the (original) site, provided it is depicted on charts, information is circulated via the appropriate methods, such as inclusion in the Clyde Cruising Club Sailing Directions, and any surface features or working vessels are adequately marked and lighted.</td></tr>
<tr><td>RNLI Stromness</td><td>Anatec review of the RNLI call-out data for the ten-year period 2001-10 showed that most of the call-outs had been from the nearest RNLI station at Longhope. A couple were responded to by Stromness lifeboat, possibly due to the Longhope lifeboat being away at the time or undergoing repair. In one case the Stromness lifeboat was carrying out exercises in the Pentland Firth and was in the vicinity of the incident.
The two nearest Stromness incidents to the AfL area were reviewed:
On 16 March 2008, the Northern Explorer rigid inflatable boat (RIB) suffered a machinery failure and needed assistance. This was a charter vessel taking passengers on sightseeing tours. The incident occurred 2.3 nautical miles south of South Walls. (Note: The Northern Explorer subsequently sank off Stroma in 2011.)
On 3 June 2009, a person became ill on a dive vessel. This vessel had been diving at the wreck of the fishing trawler, James Barrie, which is located towards the southern end of the Sound of Hoxa.
One RNLI incident was recorded within the original AfL area. This was recorded by RNLI as a machinery failure on a power boat, although it is believed it may have been a dive vessel. A nearby incident on the south coast of South Walls involved a person on the cliff who was threatening to jump. Both of these incidents were responded to by Longhope station.
It is not thought that BTAL Project will pose any problems for the RNLI. Longhope is a relatively quiet station so if incidents increased due to the development, e.g. operational accident during installation, it will not be affecting an already busy station.
A contact person was provided for the Longhope station to allow further consultation during the NRA.
Few vessels are believed to shelter in Aith Hope, between South Wells and Hoy.</td></tr>
<tr><td>Orkney Dive Boat Operator’s Association (ODBOA)</td><td>The majority of the dive boats in ODBOA mainly operate within Scapa Flow. Only about four venture further afield; Jean Elaine, Sharon Rose, Karin and Halten.
There are a few wrecks in the Sound of Hoxa but this would be quite a long trip from Stromness. Most of the boats go as far as the wreck of the James Barrie trawler and no further.
There is nothing much of interest to divers in the vicinity of the AfL area. It is very rare to go on a transit around Hoy for sight-seeing. Most dive boats go as far as the Old Man of Hoy for this.
If crossing the Pentland Firth, this would be done further west or east of the AfL area.
Aith Hope is a potential shelter but it is not considered to be too important.</td></tr>
</table>

Stakeholder	Meeting Comments
	• No problems with proposed development. The turbines will be well under the water and if the surface substation option was to go ahead it should not be a concern, provided it is marked and lit.
Kirkwall Kayak Club	• Kayakers do not pass near Brims very often. They may occasionally take a trip circumnavigating Hoy, or part of it, such as Houton to Rackwick Bay, or anti-clockwise from Rackwick into Aith Hope (and then carry the kayaks over the causeway into Longhope) or further round the south from South Walls. • Such trips are most likely to take place during summer weekends, perhaps once or twice per year (up to 3-4 per year). Ideal conditions are high pressure, no wind and neap tides. In calm conditions, kayakers can go further out from shore to benefit from the tide but they can also stay close (within 100-200m) to avoid an opposing tide. • There are likely to be fewer than ten people in the group for such trips. • Some kayakers cross the Pentland Firth, e.g., Brough Ness to Duncansby Head can be done in 1.5 hours. Some groups come to Brough Bay in Caithness and cross the Pentland Firth. These may pass west of Hoy or into Scapa Flow. There used to be an annual event with groups camping on Orkney before returning. • Overall, tidal sites are not such an issue to kayakers as wave sites since they are under the water. The key mitigation is to circulate information during installation works via Notices to Mariners, etc. • Questioned whether eddies could be created at the site by the underwater devices, similar to that an underwater rock might create. No specific modelling for this site as yet but other work has indicated wake effects would be minimal.

7. Preliminary Hazard Analysis

7.1 Introduction

This section provides a preliminary review of the vessel exposure and potential navigational hazards associated with the BTA proposal based on the existing vessel activity in the area identified from the baseline data collection and consultation. Potential mitigation measures to control the hazards are also discussed.

7.2 Overview of Vessel Exposure

From the baseline data collection and local consultation it was identified that several vessel types currently pass through and near the AfL area and to the west. The most frequently recorded vessels intersecting the AfL area were the passenger ferry *Hamnavoe* (when weather routeing via Scapa Flow), the cargo vessel *Dettifoss* and the fishing vessel *Selfoss*. Cargo vessels passed through the Outer Sound of the Pentland Firth, to the south of the AfL area.

Tankers passed south and east of the AfL area, using the recommended channel for deep-draught Vessels to/from Scapa Flow. Moving the AfL area west has increased the distance from the recommended channel. A review of other data sets identified some fishing, tug and recreational vessel activity in the area.

The MCA have published guidance to mariners operating in the vicinity of offshore renewable energy installations (OREI) (Ref. vi). The guidance notes that, unlike wind farms, tidal energy systems may not be clearly visible to the mariner. Some installations are totally submerged while others may only protrude slightly above the sea surface. For BTA there will be adequate under keel clearance for all vessel types, although there may also be a surface offshore substation(s).

The MCA guidance suggests three options, in simple terms, for mariners operating in OREI areas:

a. Avoid the area completely
b. Navigate around the edge
c. In the case of a wind farm, navigate, with caution, through the array

The last option specifically mentions wind farms but it is considered also to apply to tidal farms where the under keel clearance permits navigation over the submerged devices and / or array layouts permit navigation between devices.

The choice will be influenced by a number of factors including the vessel's characteristics (type, tonnage, draught, manoeuvrability, etc.), the weather and sea conditions. The guidance suggests that where there is sufficient sea room it is prudent to avoid the area completely.

The choice will also depend on the navigational features of the area, for example, the sea room and water depth available at the edges of the development.

For the BTA site, complete avoidance of the area is not thought to be necessary, due to the fact the devices are expected to be under the water. If the preferred OpenHydro technology is used, it is likely that there will be ample under keel clearance for all vessels in the area. If alternative technology is used, further work on the under keel clearance will be needed.

There will be navigational issues affecting all vessels associated with any surface-piercing elements of the development, including the offshore substation, if required, as well as working vessels during installation, maintenance, and decommissioning.

A discussion of specific hazards and how they will be addressed within the NRA is presented below for the main operational phases of the BTA.

7.3 Hazard Review

7.3.1 Normal Operations

During normal operations, if the offshore substation is required, this will present a fixed collision hazard to vessels. It is straightforward to assess this hazard based on the installation location and dimensions, vessel activity, etc. This is also the case for any other surface-piercing elements of the design.

For submerged devices, more detailed information will be used to assess the under keel clearance and the risk of a subsea collision, including:

- Vessel Static Draughts
- Wave Heights
- Tidal Heights
- Squat
- Surge

To assist with under keel clearance assessment, the MCA have produced a draft policy for the Nautical and Offshore Renewables Energy Liaison (NOREL) Group (Ref. vii),

Any changes in vessel routeing due to the development, e.g., displacement of vessels around a substation, will influence the probability of vessels encountering (and colliding) with one another in the area. A comparison will be made between the current and predicted routeing and associated collision risk levels will be modelled.

There is also a potential hazard to vessels in the area should any part of the development fail and become detached / lose station. The object, if buoyant, could pose a collision hazard to passing vessels both within and beyond the development boundary. This hazard will be assessed within the NRA taking into account measures for alerting and recovery.

Finally, the subsea cabling could present a snagging hazard to fishing gear and vessel anchors. Once the options are finalised these hazards will be assessed based on the vessel activity in the area and the planned protection measures.

7.3.2 Installation, Maintenance and Removal

For all vessels operating in the area there will be risks during installation, removal and to a lesser extent maintenance, when there will be additional vessels in and around the development, some of which may have restricted manoeuvrability. This will extend beyond the development in the case of cable-laying operations.

This introduces a collision hazard (vessel-to-vessel) as well as potential obstruction to normal routes beyond the development area.

This will be assessed within the NRA based on the best available information on the likely technologies, areas of operation, number and types of vessels involved, base ports, duration of operations and weather limits.

7.4 Mitigation Measures

Appropriate risk control measures will be developed during the NRA to address the risks during all phases of operation to ensure they are reduced to a level as low as reasonably practicable (ALARP).

There are a large number of measures that can be applied to help control navigation risks, many of which are now standard industry practice such as:

- Depiction on Charts
- Marking and Lighting
- Circulation of Notices to Mariners
- Fisheries Liaison

Discussions will be held with national and local stakeholders, such as the MCA, NLB, UKHO and OIC Marine Services, to ensure these and other measures are implemented as effectively as possible for the BTA, taking into account vessel activity.

As noted in the consultation, Marine Services in particular have a strong interest and the NRA will deal with specific in-combination issues, such as the coordination of activities on the site when a tanker is approaching Scapa Flow from the west.

Other mitigation measures will be identified during the Hazard Review Workshop, which is discussed further in Section 8.

8. Proposed Methodology – Navigation Risk Assessment

The Navigation Risk Assessment methodology will principally be based on the following:

- Department for Energy and Climate Change (DECC) Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms (2005); and

- Maritime and Coastguard Agency (MCA) Marine Guidance Notice 371 (MGN 371) Offshore Renewable Energy Installations (OREIs) – Guidance on UK Navigational Practice, Safety and Emergency Response Issues.

(It is noted these documents are under revision. The latest versions will be used in the assessment.)

The DECC (formerly DTI) methodology, prepared in association with the MCA and DfT, provides a template for preparing the navigation risk assessment. The methodology is centred on risk controls and the feedback from risk controls into risk assessment. It requires a submission that shows that sufficient risk controls are, or will be, in place for the assessed risk to be judged as broadly acceptable or tolerable with further controls or actions. The methodology includes:

- defining a scope and depth of the submission proportionate to the scale of the development and the magnitude of the risk;
- estimating the 'base case' level of risk;
- estimating the 'future case' level of risk;
- creating a hazard log;
- defining risk control and creating a risk control log;
- predicting 'base case with project' level of risk; and
- predicting 'future case with project' level of risk.

The key features of the Marine Safety Navigational Risk Assessment Methodology are risk assessment (supported by appropriate techniques and tools), creating a hazard log, defining the risk controls (in a Risk Control Log) required to achieve a level of risk that is broadly acceptable (or tolerable with controls or actions), and preparing a submission that includes a Claim, based on a reasoned argument, for a positive consent decision.

The MCA guidance MGN 371 highlights issues that need to be taken into consideration when assessing the impact on navigational safety from offshore renewable energy developments in the UK. Specific annexes that address particular issues include:

- Annex 1: Site position, structures and safety zones;

- Annex 2: Developments, navigation, collision avoidance and communications;

- Annex 3: MCA's windfarm shipping template for assessing windfarm boundary distances from shipping routes;
- Annex 4: Safety and mitigation measures recommended for OREI during construction, operation and decommissioning; and

- Annex 5: Search and Rescue (SAR) matters.

One of the key requirements of MGN 371 is the collection of maritime traffic survey data of appropriate duration, including seasonal and tidal variations. This is to record all vessel movements in and around the project site and its vicinity. The method and timetable for data collection will be agreed with the MCA in advance to ensure it meets their requirements.

Once the area for deployment of devices is identified, further consultation will be carried out to discuss the planned device layouts, technology and siting of the offshore substation, if applicable.

Local stakeholders representing all the different maritime interests, including ports, fishing, shipping, recreation and emergency services, will be invited to the Hazard Review Workshop, which is a key part of the NRA and a practical method of identifying additional risk controls.

Other key guidance and reference materials that will be used in the Navigation Risk Assessment are listed below:

- MCA Marine Guidance Notice 372 (2008). Guidance to Mariners Operating in the Vicinity of UK OREIs.

- IALA Recommendation O-139 On The Marking of Man-Made Offshore Structures, 1st Edition December 2008;

- DECC Guidance Notes on Applying for Safety Zones around Offshore Renewable Energy Installations;

- IMO Guidelines for Formal Safety Assessment (FSA);

9. References

i Marine Scotland (2012). Draft report on ScotMap, the Inshore Fishing Study Pilot in Pentland Firth and Orkney Waters. Available at: http://www.scotland.gov.uk/Resource/0039/00396598.pdf [Accessed 28 June 2013].

ii RYA, Sharing the Wind, 2004.

iii UK Coastal Atlas of Recreational Boating; Recreational Cruising Routes, Sailing and Racing Areas around the UK Coast; Second Edition by RYA; Supported by Trinity House.

iv Marine Scotland (2012). Shipping Study of the Pentland Firth and Orkney Waters. Available at: http://www.scotland.gov.uk/Resource/0041/00410623.pdf [Accessed 28 June 2013].

v Clyde Cruising Club Sailing Directions and Anchorages – Part 5; N and NE Scotland and Orkney Islands; Clyde Cruising Club Publications Ltd, 2010.

vi MCA Marine Guidance Notice 372, Guidance to Mariners Operating in the Vicinity of UK OREIs, August 2008

vii NOREL NAV SUB Group December 2012, Draft Under Keel Clearance- Policy Paper "Guidance to Developers in Assessing Minimum Water Depth Over Devices".