Costa Head Wave Farm Limited

Scoping Report

Offshore Project Infrastructure

Rev								
0.1	Prepared By	LW & PT	Checked By	LF, KS, JT & PC	Approved By	PC & KS	Date of Issue	**May 2012**

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COSTA HEAD WAVE FARM LIMITED - REQUEST FOR SCOPING OPINION

Costa Head Wave Farm Limited is seeking a Scoping Opinion for the offshore elements of the proposed Costa Head wave 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 interest in the proposed development. The Scoping being sought is for the array, subsea export cables and all offshore project infrastructure below Mean High Water Springs (MHWS).

The onshore aspects of the development will be subject to a separate Screening Opinion request under the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011.

This Scoping Report has been produced by Xodus Group in line with relevant guidance and recent consultation with Marine Scotland, its advisory bodies and other key stakeholders. A description of the proposed development along with SSER's proposed approach to the EIA and NRA is provided.

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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 wave energy converters that are positioned within close proximity of each other.
Benthic communities	Species that live on the seabed.
Cable landfall area of search	Area in which subsea cables will reach the foreshore.
Cumulative effects	The overall effects of a number of different proposals of any other projects.
Environmental Impact Assessment	Process to facilitate the identification and assessment of the potential environmental impacts associated with the development.
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 wave array 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 individual converters within the wave array(s) to one another.
Landfall site	Location at which the subsea cables come ashore.
MARPOL	MARPOL (short for marine pollution) is the International Convention for the Prevention of Pollution from Ships.
Natura site	Natura is the term given to Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) which are internationally important sites designated under European legislation.
Pentland Firth and Orkney Waters	A strategic area that has been identified as having significant renewable energy resources. The Pentland Firth and Orkney Waters was the area included in the UK's first leasing round for wave and tidal projects. Areas of seabed have been made available for Agreement for Lease in order for companies to generate marine renewable energy.
Project Briefing Document	A document produced and sent to stakeholders prior to preparation of the Scoping Report to provide an introduction to the proposed development.
Special Area of Conservation	Site designated under the EC Habitats Directive.
Scottish Territorial Waters	Waters extending 12 nautical miles from Mean High Water Springs within which the Scottish Government has responsibility for marine planning.
Special Protection Area	Sites designated in accordance with Article

	4 of the EC Birds Directive.
Subsea cable corridor area of search	Area identified as being of most likely potential for the selection of subsea cable routes.
Wave Energy Converter (WEC)	A device which converts the kinetic energy of sea waves into electrical energy.

ACRONYMS

ADCP	Acoustic Doppler Current Profiler
AfL	Agreement for Lease
AIS	Automatic Identification System
BAP	Biodiversity Action Plan
BGS	British Geological Survey
CHWFL	Costa Head Wave Farm Limited
CIA	Cumulative and In-combination Assessment
COWRIE	Collaborative Offshore Wind Research into the Environment
DECC	Department of Energy and Climate Change
DEFRA	Department of the Environment, Food and Rural Affairs
DG	Distributed Generation
DP	Drilling Programme
DTI	Department of Trade and Industry
EIA	Environmental Impact Assessment
EMEC	European Marine Energy Centre
EMMP	Environmental Mitigation and Monitoring Plan
ENVID	Environmental Issues Identification
EPS	European Protected Species
ES	Environmental Statement
EU	European Union
GCR	Geological Conservation Review
GIS	Geographic Information System
GW	Giga Watt
HIE	Highlands and Islands Enterprise
HRA	Habitat Regulations Appraisal
HVDC	High Voltage Direct Current

ICES	International Council for Exploration of the Sea
IEMA	Institute of Environmental Management and Assessment
IMO	International Maritime Organisation
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
MCA	Maritime and Coastguard Agency
MESH	Mapping European Seabed Habitats
MGN	Maritime Guidance Note
MLWS	Mean Low Water Springs
MHWS	Mean High Water Springs
MMFR	Mean Maximum Foraging Range
MoD	Ministry of Defence
MPA	Marine Protected Areas
MRFG	Marine Renewables Facilitators Group
MS	Marine Scotland
MS-LOT	Marine Scotland Licensing Operations Team
MW	Mega Watt
nm	Nautical Mile
NLB	Northern Lighthouse Board
NPF	National Planning Framework
NSA	National Scenic Area
NRA	Navigational Risk Assessment
OFA	Orkney Fisheries Association
OFS	Orkney Fisherman's Society
OIC	Orkney Islands Council
ORCA	Orkney Research Centre for Archaeology
OREF	Orkney Renewable Energy Forum
OS	Ordnance Survey

PEXA	Practice and Exercise Areas
PFOW	Pentland Firth and Orkney Waters
PHA	Preliminary Hazard Analysis
PMRA	Protection of Military Remains Act
RNLI	Royal National Lifeboat Institute
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
SCI	Sites of Community Importance
SEA	Strategic Environmental Assessment
SEPA	Scottish Environment Protection Agency
SFF	Scottish Fishermen's Federation
SHEPD	Scottish Hydro Electric Power Distribution
SHETL	Scottish Hydro Electric Transmission Limited
SLVIA	Seascape and Landscape Visual Impact Assessment
SMRU	Seal Mammal Research Unit
SNH	Scottish Natural Heritage
SPA	Special Protection Area
SSER	Scottish and Southern Energy Renewables
SSSI	Site of Special Scientific Interest
TCE	The Crown Estate
UKHO	United Kingdom Hydrographic Office
VLA	Vertical Load Anchor
VMS	Vessel Management System
WEC	Wave Energy Converter
WHS	World Heritage Site

1 INTRODUCTION

1.1 Background

1.1.1 Overview of Costa Head Wave Farm Limited

Costa Head Wave Farm Limited (CHWFL) is a joint venture partnership between Alstom and SSE Renewables UK Limited (SSER). CHWFL was incorporated with the aim of harnessing wave energy to generate clean, renewable energy from Orkney waters on a commercial scale.

Alstom is a global leader in the world of power generation, power transmission and rail infrastructure and sets the benchmark for innovative and environmentally friendly technologies. Alstom has a substantial shareholding in Scottish renewable energy company AWS Ocean Energy, providing the company with the financial strength to expand its operations and accelerate the development of its AWS-III wave energy converter technology.

SSER is a wholly owned subsidiary of the SSE Group, which has an installed generation capacity of over 11 GW, including almost 2.5 GW of renewable energy, and supplies energy to over 10 million customers across the UK and Republic of Ireland. SSE is one of the UK's leading offshore renewable energy developers, with an interest in a pipeline of more than 10 GW of development projects, including 800 MW of wave and tidal energy projects in the Pentland Firth and Orkney Waters (PFOW).

1.1.2 Agreement for Lease

CHWFL holds an exclusive Agreement for Lease (AfL) on a 24 km^2 area of the seabed approximately 5 km to the north of Mainland Orkney (Figure 1.1). This AfL was granted through The Crown Estate (TCE) PFOW leasing round for commercial wave and tidal energy projects. This was the world's first seabed leasing round and was designed to enable marine energy developers to investigate the potential for the installation of tidal turbines and wave energy converters around the UK's coastlines. Initial studies of the site have shown an area defined by significant wave resource, low current velocities and even ground conditions suitable for the installation of AWS-III wave energy converters.

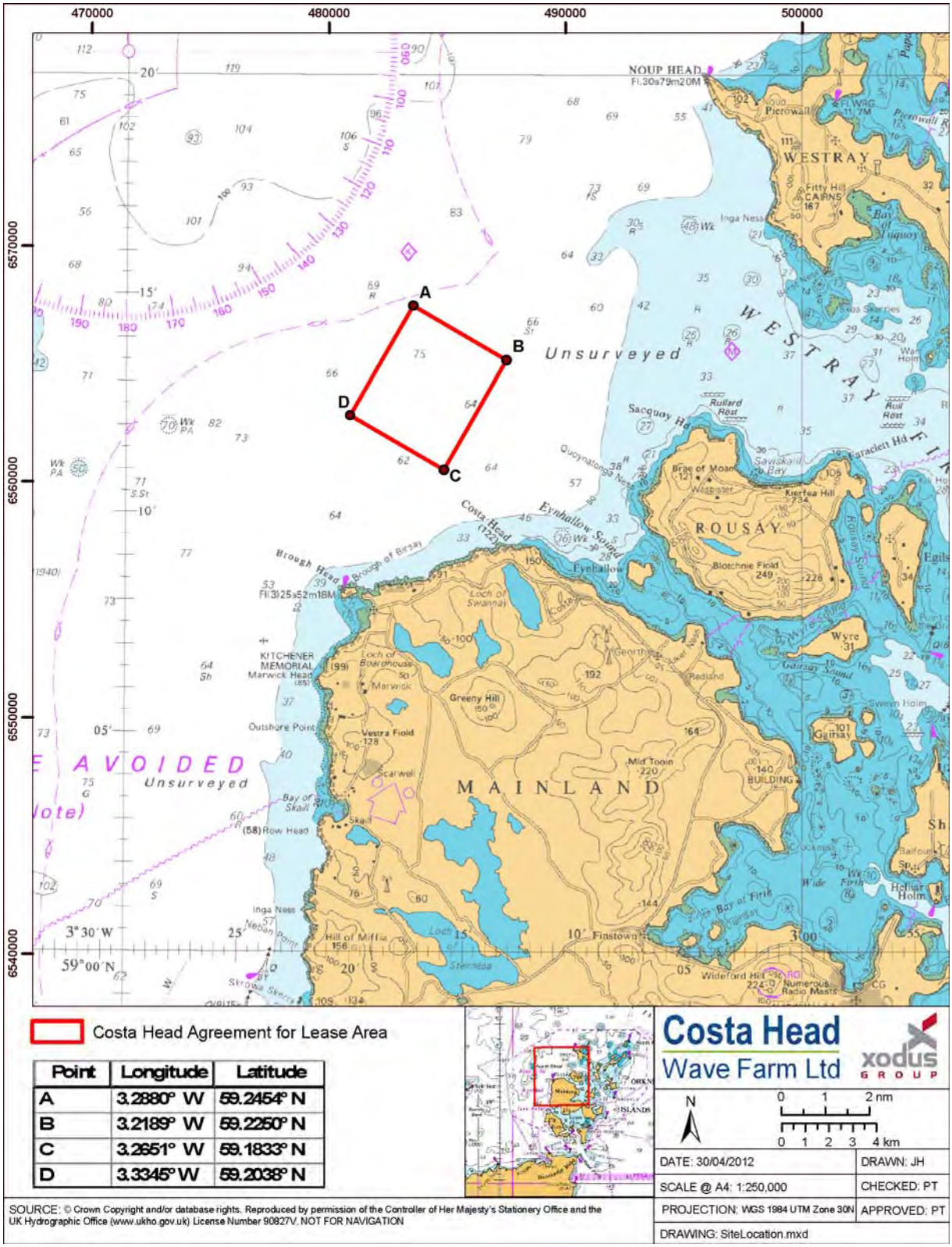

Figure 1.1 Costa Head AfL Area

The AfL provides CHWFL with an initial 5 year exclusive development period, in respect of other renewable energy developers, and as such is not a licence or consent to install wave energy converters within the site. Securing such regulatory permissions is a condition imposed by The Crown Estate before a long term lease would be entered into. CHWFL is currently undertaking site investigation and project development planning activities, including the Environmental Impact Assessment (EIA) and Navigational Risk Assessment (NRA) processes. These assessments are required as part of the consenting process relevant to a development of this type and scale.

1.2 Document Purpose

This Scoping Report has been prepared by CHWFL in order to support the development of a wave farm array in the AfL area with a total capacity of up to 200 MW and represents a formal request for a Scoping Opinion from Marine Scotland in consultation with the relevant statutory consultees. The Scoping Opinion being sought is for the array, subsea export cables and all offshore development infrastructure below MHWS.

The onshore aspects of the development will be subject to a separate Screening Opinion request under the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011.

The Scoping Report has been produced to facilitate the identification and assessment of the potential environmental impacts associated with the offshore development. It identifies the potential interactions there may be between the proposed development and the environment in order to establish studies and/or surveys that might be required in order to better understand these interactions.

Scoping is one of the initial stages of the EIA process. The EIA process identifies the areas of a project or development where significant environmental effects may occur and outlines mitigation or management techniques aimed at reducing or offsetting these effects. CHWFL wishes to seek feedback and advice on any particular environmentally or socially important issues associated with the proposed development.

1.3 Development Strategy

1.3.1 Overall Strategy

The array will be installed in two distinct phases. It is proposed that Phase 1 will be the installation of a 10 MW array comprising up to 4 wave energy converters, with Phase 2 potentially bringing the total installed capacity up to 200 MW. It is anticipated that the proposed Phase 2 array will occupy the majority of the 24 km^2 AfL area shown in Figure 1.2.

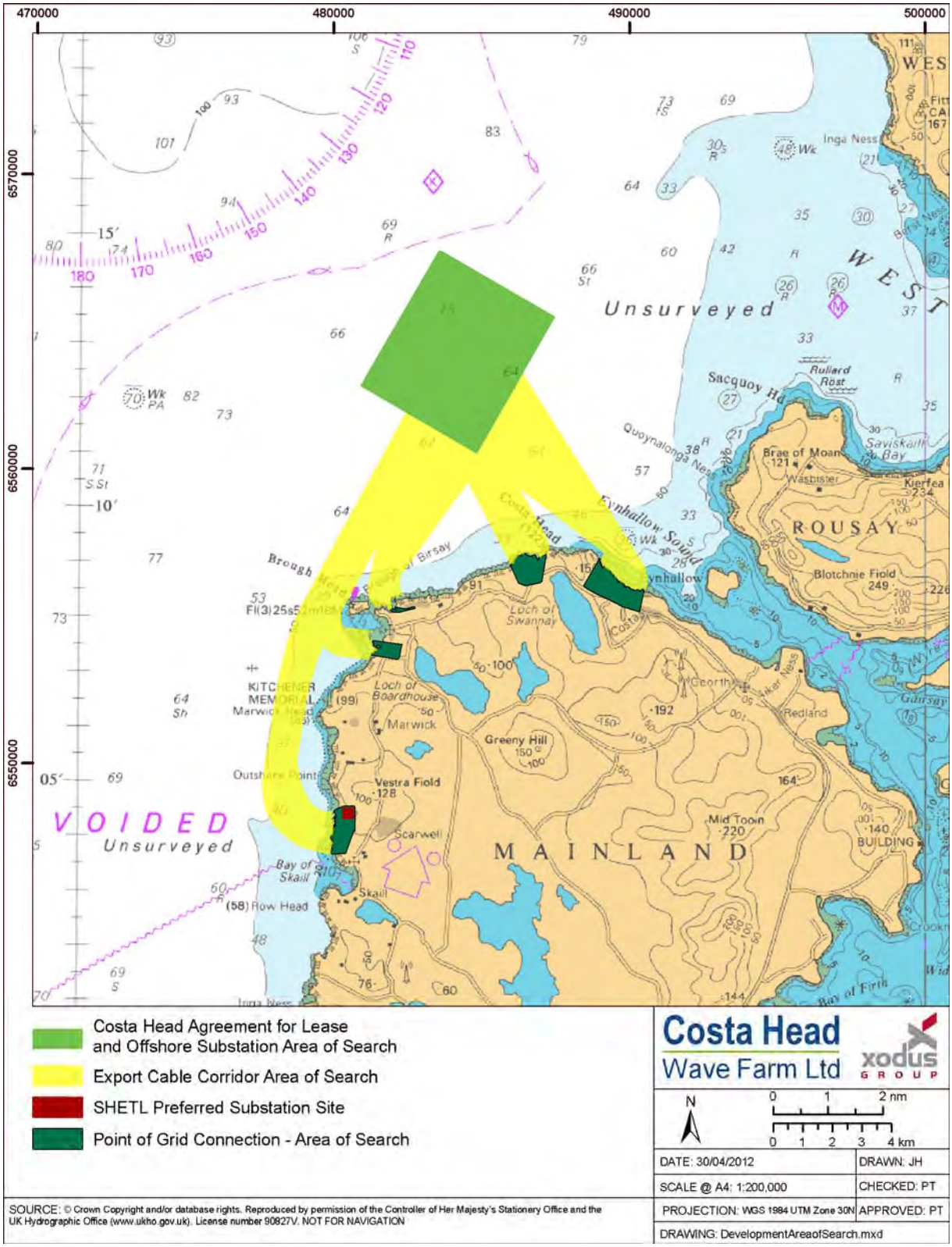

Figure 1.2 Costa Head AfL including areas of search for the export cable and landfall

Figure 1.2 also shows the export cable areas of search, the cable landfall areas of search and the Scottish Hydro Electric Transmission Limited (SHETL) preferred substation location.

In working to identify the areas required for each phase, the following factors are among those which will inform the process:

- Stakeholder consultation;
- Navigational safety;
- Wave energy resource distribution and power across the AfL area;
- Environmental constraints;
- Development of AWS-III technology;
- Mooring options;
- Installation approach;
- Economic analysis; and
- Grid connection location.

The location and layout of the wave energy converters and associated development infrastructure will therefore be determined through design, planning and informed by the EIA, NRA and stakeholder consultation.

1.3.2 Development Timelines

Separate consent and licence applications will be submitted for each phase. It is proposed that as a minimum, the necessary consent and licence applications to build Phase 1 and its supporting infrastructure will be submitted in Q3 2013. It is anticipated that the consent and licence applications for Phase 2 will subsequently be submitted in 2016.

Figure 1.3 provides a high level overview of the development process. This outlines a phased approach to post consent build-out.

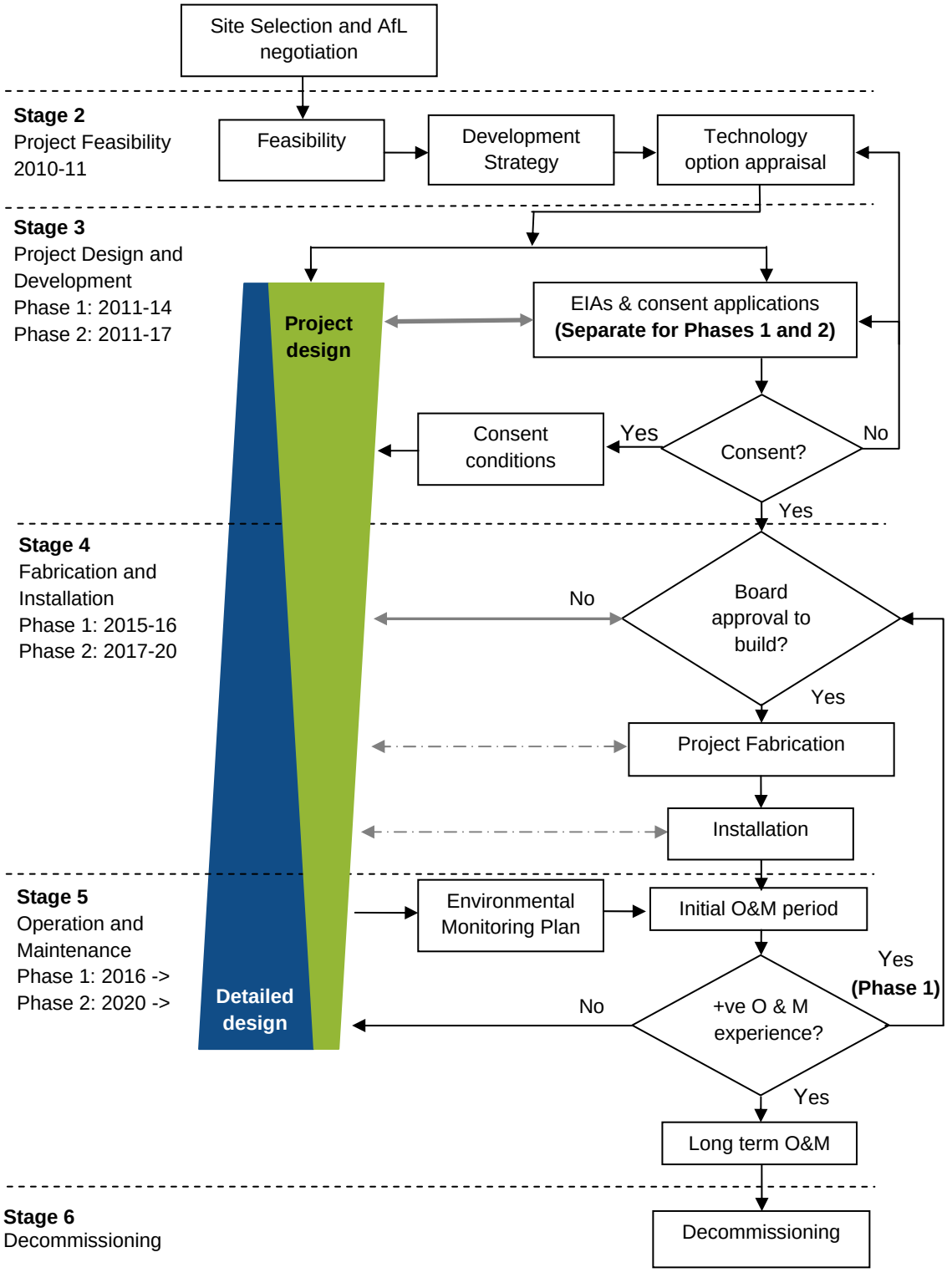

Figure 1.3 Costa Head – Phased Development Timelines

1.4 Development Overview

CHWFL plans to install AWS-III wave energy converters at the proposed Costa Head Wave Farm. This technology is still under development; initial trials have been undertaken and the technology development company AWS Ocean Energy is working towards deployment of a full scale prototype in 2014.

The AWS-III is a toroidal (ring shaped), self-reacting, multi-cell, floating wave energy converter (WEC) that harnesses power from offshore sea waves to generate renewable electricity. Reinforced flexible diaphragms convert wave action to pneumatic power which in turn is converted to electricity by turbine-generator sets. A feature of the AWS-III technology is that there are no exposed moving parts in the water; this is expected to increase the operational life and reliability of the mechanical and electrical equipment and potentially reduce the environmental impact.

The wave energy converters will be attached to the seabed using moorings. Electrical infrastructure is required in order to transmit generated power to the end user, this will comprise inter array cabling between converters and export cabling to shore. It is intended that any offshore substation for Phase 2 of the proposed development would be installed within the AfL area. Within the scope of the development CHWFL is not intending to construct a substation onshore.

Figure 1.2 illustrates the area of search within which the export cable route is expected to be installed. There are currently a number of potential export cable landfall options identified for the Costa Head Wave Farm development that are being considered for each phase. The landfall location will be identified based on environmental, technical and economic criteria as part of the site design process.

1.5 Document Structure

Below is a summary of the structure and content of the following sections in the Scoping Report. There are questions posed throughout the document that CHWFL would like stakeholders to consider when compiling their response to this Scoping Report.

Section 2 – Approach to Scoping and EIA	Describes an overview of the Scoping and EIA process.
Section 3 – Policy and Legislative Context	Summarises national, regional and local policies and legislation related to marine renewables.
Section 4 – Development Description	A detailed description of the proposed development including device structures, timescales, technology and infrastructure.
Section 5 – Physical Characterisation and Impact Assessment	Describes the physical environment in the proposed development area as well as describing the potential impacts, data gaps and EIA strategy.
Section 6 – Biological Characterisation and Impact Assessment	Describes the biological environment in the proposed development area as well as describing the potential impacts, data gaps and EIA strategy.
Section 7 – Human Characterisation and Impact Assessment	Describes the human environment in the proposed development area as well as describing the potential impacts, data gaps and EIA strategy.
Section 8 – Cumulative and In-combination Impacts	Considers the approach to the Cumulative and In-combination Assessment (CIA), key topics to be considered and major projects to be included in the CIA.
Section 9 – Stakeholder Engagement	Summarises consultation undertaken during scoping and presents the overall proposed consultation strategy.
Section 10 – Summary and Conclusions	Summarises the detail provided in the Scoping Report, commitments to EIA and mitigation and monitoring stated. Also includes what has been scoped out of the EIA and all the questions presented throughout the Scoping Report.

2 APPROACH TO SCOPING AND EIA

2.1 Introduction

The Environmental Impact Assessment (EIA) process identifies the areas of a project or development where significant environmental effects may occur and outlines mitigation measures or management techniques aimed at reducing or offsetting these effects. Several different EIA Regulations (section 3) enforce the EIA requirements in relation to the development. The associated Navigational Risk Assessment (NRA) addresses the potential navigational issues and feeds into the overall EIA.

The purpose of the EIA and associated NRA process is to:

- Identify likely significant effects to be taken into account by the relevant decision maker;
- Integrate environmental considerations into the project planning and design activities in order to achieve a high standard of environmental performance for the development; and,
- Consult with stakeholders and address their concerns.

The scope of the EIA and NRA is to assess the impact of the following:

- The installation and operation of up to 200 MW of AWS-III wave energy converters in the Costa Head AfL;
- The installation of cable connections between the wave energy converters and the foreshore;
- Operation and maintenance of the offshore aspects of the development; and,
- Decommissioning.

2.2 EIA Scoping and Navigational PHA

The Scoping Report (and accompanying navigational PHA) will form part of CHWFL's written request to Marine Scotland for their opinion as to the information to be provided in the Environmental Statement (ES) for the development. Following receipt of the Scoping Opinion each issue raised will be reviewed and implications for the overall development and EIA considered.

2.3 Consideration of Design Options (Rochdale Envelope)

Throughout the EIA process the approach will be to assess the maximum potential impacts (also sometimes referred to as a 'worst case'). This approach has been established through relevant case law and is referred to as the 'Rochdale Envelope'. These case precedents have established a custom and practise that has evolved in relation to projects where the final design is not available at the consent application stage. This approach has been confirmed by the courts and endorsed by the Scottish Government as enabling the legal requirements of the relevant EIA regulations to be complied with, as long as appropriate conditions are placed in the resulting consents to ensure that the maximum potential likely impacts will not be exceeded by the final built development, and will not give rise to a likely significant effect on the environment that has not been assessed.

The commercial wave energy industry is rapidly evolving, with ongoing improvements' in WEC technology, infrastructure and installation techniques. The Rochdale Envelope approach provides essential flexibility to enable projects to take full advantage of these improvements. To commit to a detailed development design at consent application stage would also prevent the development benefiting from the lessons learned from other work being done in the wave industry, including the continued testing of the proposed wave technology. The Rochdale Envelope approach allows the detailed design of the development to vary within specific defined parameters.

2.4 Survey Deploy and Monitor Policy

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 by the Scottish Government to enable efficient, sustainable deployment of tidal turbines and wave energy converters; CHWFL awaits the publication of the policy.

2.5 Approach to Onshore Application

CHWFL is proposing a limited amount of onshore infrastructure for this development to enable it to connect into the existing grid network and/or SHETL substation. Due to the likely small scale of this infrastructure CHWFL will be submitting a Screening Opinion request to the Local Authority (Orkney Islands Council) to determine what documentation will be required to accompany the planning application. The onshore elements of the development are therefore outwith the scope of the opinion requested through this Scoping Report.

It should be noted that options relating to the rebuilding of grid infrastructure which presently exists on Orkney would not be carried out by SSER as they are neither the owner nor

operator of these assets. SHEPD is the owner and operator of the existing Orkney grid which is classified as a distribution network; whilst both SHEPD and SSER have the same parent company (SSE), 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 SHETL which is the part of SSE which owns and operates the transmission network, of which there is presently none in Orkney. As with SHEPD, SHETL is regulated by OFGEM.

3 POLICY AND LEGISLATIVE CONTEXT

3.1 The Need for Renewable Energy

The UK has committed to sourcing 15% of its total energy needs from renewable sources by 2020 under the 2009 Directive on Renewable Energy (2009/28/EC) including electricity, heat and transport. The UK and Scottish Governments have also made legally binding commitments through the Climate Change Act 2008 and the Climate Change (Scotland) Act 2009.

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

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

3.2 Energy Policy

3.2.1 International Energy Context

The Kyoto Protocol (to the United Nations Framework Convention on Climate Change (1997)) forms the highest level of international agreement on Climate Change across 189 States. In 2005 it set binding targets for 37 industrialised countries and the European community for reducing greenhouse gas emissions by an average of 5% against 1990 levels over the five-year period 2008-2012.

At a European level, Directive 2001/77/EC, on the “Promotion of Electricity Produced from Renewable Energy Sources in the Internal Electricity Market", was adopted in September 2001. Among other measures, it requires under Article 3 that Member States take appropriate steps to encourage greater consumption of renewable electricity in conformity with national indicative targets.

In January 2008 the European Commission published the "20 20 by 2020" package (COM(2008)30 final). This package proposed committing the EU to a 20% reduction in its greenhouse gas emissions and to achieving a target of deriving 20% of the EU’s final energy consumption from renewable sources by 2020. In order to achieve the overall European Union (EU) renewable energy target of 20% the proposal included individual targets for each Member State (with the UK’s proposed target being 15%). In January 2008, the European

Commission proposed binding legislation to implement the 20-20-20 targets. The "climate and energy package" was agreed by the European Parliament and Council in December 2008 and became law in June 2009. The Renewable Energy Directive (2009/28/EC) also provides for European Climate Change Opportunity, where the Commission set the emissions reduction target at 20% "rising to 30% if there is an international agreement".

3.2.2 National Policy

UK Energy Policy

The UK's agreed (legally binding) target under the Kyoto Protocol is to reduce greenhouse gas emissions (comprising six gases, including carbon dioxide) by 12.5% compared to 1990 levels, averaged over the period 2008 to 2012. The Climate Change Act 2008 introduces into UK law a legal requirement on the UK Government to cut emissions by 80% compared to 1990 levels by 2050. 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 (DECC, 2012).

Scottish Energy Policy

The Scottish Government has signalled its commitment to tackling climate change and strong support for renewable energy development through both legislation and policy. The Climate Change (Scotland) Act 2009 imposes a legal commitment on the Scottish Government to reduce emissions by 42% from 1990 levels by 2020 and 80% by 2050.

In July 2011 the Scottish Government published the 2020 Routemap for Renewable Energy in Scotland. This document builds upon the 2009 Scottish Renewables Action Plan. The Scottish Government's stated objective is for the equivalent of 100% of Scotland's electricity demand to be generated from renewable sources by 2020, with an aim of Scotland generating twice as much electricity as it needs (50% from renewables and 50% from conventional sources) and exporting as much as it consumes. The Marine Energy Roadmap (Scottish Government, 2011a) highlights the key role marine renewables will play in meeting these targets and objectives.

3.3 Marine Planning Framework

3.3.1 Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009

The Marine (Scotland) Act 2010 created a new legislative and management framework for the marine environment within Scottish Territorial Waters (0 to 12 nautical miles). This follows the UK Marine and Coastal Access Act 2009 under which Scottish Ministers have devolved authority for marine planning and conservation powers in the offshore region (12 to 200 nautical miles).

3.3.2 Marine Policy Statement - UK

The UK Marine Policy Statement (MPS) applies to all UK waters and has been adopted by the UK Government, the Scottish Government, the Welsh Assembly Government and the Northern Ireland Executive.

The function of the MPS is to provide the framework for preparing Marine Plans and taking decisions affecting the marine environment. All national and regional marine plans must be in conformity with the MPS.

The objectives of the MPS are given as:

- "Promote sustainable economic development;
- Enable the UK's move towards a low-carbon economy, in order to mitigate the causes of climate change and ocean acidification and adapt to their effects;
- Ensure a sustainable marine environment which promotes healthy, functioning marine ecosystems and protects marine habitats, species and our heritage assets; and,
- Contribute to the societal benefits of the marine area, including the sustainable use of marine resources to address local social and economic issues."

The MPS emphasises the importance of renewable energy and recognises the importance of considering marine renewable projects in marine planning, stating that "Contributing to securing the UK's energy objectives, while protecting the environment, will be a priority for marine planning".

3.3.3 National and Regional Marine Plans

Under the Marine (Scotland) Act 2010 and Marine and Coastal Access Act 2009 the Scottish Government must prepare a National Marine Plan for Scottish Territorial Waters and the offshore zone. The Scottish Government may also choose to prepare Regional Marine Plans.

The National Marine Plan is being developed to clarify the overall objectives which provide the basis for managing Scotland's marine environment. A pre-consultation draft of the National Marine Plan was published in March 2011 and the responses to the consultation were published in a document in July 2011. The responses are now being evaluated although it is hoped to publish a final version in the spring/summer of 2012.

Regional marine boundaries for the Regional Marine Plans are in the process of being formulated. These are expected to be finalised in line with the publication of the National Marine Plan. Thereafter, the Regional Marine Plan preparation process will be undertaken.

A framework for the Pentland Firth and Orkney Waters Marine Spatial Plan was published in 2011. The document sets out the framework for future development of the Pentland Firth and Orkney Waters Marine Spatial Plan. It summarises existing and proposed uses of the seas and shows how these uses may impact on each other. The document also sets out draft Regional Locational Guidance for the development of wave and tidal resources and identifies the development site (referred to as Hoy/Mainland/Rousay) as a suitable site for wave development (Marine Scotland *et al*, 2010).

3.3.4 Marine Protected Areas

Marine Protected Areas (MPAs) are a requirement of the Marine (Scotland) Act 2010. The purpose of MPAs is to afford protection to particular features of the marine environment. There are three categories of MPA, namely Nature Conservation MPAs, Demonstration and Research MPAs and Historic MPAs. The Scottish Government is currently consulting on suitable areas for Nature Conservation MPAs. This has resulted in 31 locations identified for possible designation as MPAs. There are two of these potential sites within close proximity to the proposed development area. The North-West Orkney MPA search location and Hoy MPA search location, approximately 2 km to the north and 20 km to the south, respectively. The North-West Orkney MPA search location has been chosen due to the area containing suitable sandeel habitat and very high densities of sandeel larvae (Scottish Government, 2012b). The Hoy MPA search location has been chosen due to the presence of horse mussel (*Mytilus edulis*) beds, maerl beds and black guillemot (*Cepphus grylle*) (Scottish Government, 2012c). Nature Conservation MPAs are scheduled to be approved by the Scottish Government in late 2012.

Historic Scotland recently consulted (consultation closed on 27th January 2012) on the proposed process for the selection, designation and management of Historic MPAs (HMPAs). It is expected that the final guidelines on selection, designation and management of HMPAs will be published in the first half of 2012. Initial candidate sites are likely to be sites already protected under the Protection of Wrecks Act 1973 and Ancient Monuments and Archaeological Areas Act 1979.

3.4 Terrestrial Planning Framework

The principal planning legislation is contained within and derived from The Town and Country Planning (Scotland) Act 1997. Statutory planning control under the Town and Country Planning (Scotland) Act 1997 extends to MLWS. The Marine (Scotland) Act

extends up to MHWS so there is a degree of overlap between the marine and terrestrial planning frameworks.

The most relevant of terrestrial planning policies that may apply when addressing this overlap, for the elements of the proposed development which may occur on the foreshore, are those stated within the local statutory development plans including the Orkney Structure Plan and the Orkney Local Plan (together to be superseded by the Orkney wide Local Development Plan during 2012).

3.4.1 Statutory Development Plan Policies

The Orkney Structure Plan provides the spatial framework for development across the Orkney Islands. The Plan contains general policies which are applied to most types of development and policies which are more specific to a location or type of development, e.g. Renewables.

The Orkney Local Plan provides more site specific and detailed policies to augment the Structure Plan. However, it has limited policies that are directly relevant to the development. The Local Plan is broadly supportive of renewable energy projects and contains similar guidance to policy SP/U6 of the Structure Plan regarding renewable energy development.

3.5 Environmental Impact Assessment Legislation

The purpose of the EIA Directive (Council Directive 85/337/EEC as amended by Council Directive 97/11/EEC) is to ensure that the competent authority, in relation to development that is likely to have significant effects on the environment, has appropriate information to enable it to come to a decision on whether or not to grant consent. The EIA Directive sets out procedures that must be followed for such projects before they can be given 'development consent'.

If a development is deemed to need an EIA, environmental information must be provided by the developer in the form of an ES. The competent authority cannot grant consent for an EIA development without taking into account an ES.

The Directive is legally transposed into Scots Law via statutory instruments known as Regulations. The following Regulations are applicable to the development:

3.5.1 Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000

These Regulations are relevant to those elements of the development which require Section 36 consent under the Electricity Act 1989, i.e. the wave energy converters.

3.5.2 The Marine Works (Environmental Impact Assessment) Regulations 2007

These Regulations are relevant to those elements of the development which require a marine license under the Marine (Scotland) Act 2010, i.e. the wave energy converters, device moorings, inter array cables and export cable(s) to shore.

3.6 Habitats Directive

The European Habitats Directive (92/43/EEC) and Birds Directive (79/409/EEC) are transposed into Scots Law by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in 2004, 2007 and 2008).

European sites protected under this legislation include SPA, SAC and RAMSAR sites. The European Habitats Directive (92/43/EEC) aims to promote the maintenance of biodiversity by requiring EU Member States to maintain or restore representative natural habitats and wild species at a favourable conservation status, through the introduction of robust protection for those habitats and species of European importance.

3.6.1 Habitats Regulations Appraisal and Appropriate Assessment

Habitats Regulations Appraisal (HRA) is an iterative process which aims to determine likely significant effects and if necessary assess adverse impacts on the integrity of European sites.

Appropriate Assessment is one stage of this process. A competent authority shall make an Appropriate Assessment of the implications for a site in view of that site's conservation objectives, before deciding to undertake or give any consent, permission or other authorisation for, a plan or project which:

- Is likely to have a significant effect on a European site in the UK (either alone or in combination with other plans or projects); and,
- Is not directly connected with or necessary to the management of the site.

The need for Appropriate Assessment extends to plans or projects out with the boundary of the site in order to determine their implications for the interests protected within the site. Competent authorities need to identify the qualifying interests and the conservation objectives for each European site involved in an Appropriate Assessment. The first stage of the HRA process is screening to identify the Natura 2000 sites that will require an Appropriate Assessment. Appendix D presents the proposed approach to HRA screening with initial screening outcomes.

3.6.2 European Protected Species

For any European Protected Species (EPS), 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. It is also an offence to deliberately or recklessly obstruct access to a breeding site or resting place of any such animal, or otherwise to deny the animal use of the breeding site or resting place. In addition, it is an offence to disturb such an animal in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which it belongs. For cetaceans (dolphins, porpoises and whales) only, there is a more general offence deliberately or recklessly to disturb these creatures. The damage or destruction of a breeding site or resting place of any EPS of animal is an offence of strict liability. An EPS Licence is required for any activity that might result in disturbance to an EPS.

3.7 Consent Applications

Table 1 provides a list of the consent applications that will be supported by the ES.

Works	Consent	Description	Determining Authority
Wave energy converters	Section 36 consent under the Electricity Act 1989	Section 36 consent is required for development of offshore generating stations over 1 MW within Scottish territorial waters.	Scottish Ministers (through Marine Scotland)
Converters, moorings, inter-array cables and export cable(s) to shore	Marine licence under Section 25 of the Marine (Scotland) Act 2010	Consent under a Marine Licence covers construction and deposit of structures below Mean High Water Springs (MHWS). This covers the following areas of the development: • Deposit of objects on the seabed, e.g. moorings and cables; • The deposit of objects under the seabed, e.g. cables to shore with directionally drilled boreholes; and (if required), • Construction on and under the seabed, e.g. drilling for mooring piles (if required)	Scottish Ministers (through Marine Scotland)

Converters, moorings, inter-array cables and export cable(s) to shore	Energy Act 2004	Once the development is granted Section 36 consent, the Department of Energy and Climate Change (DECC) will request production of a Decommissioning Programme (DP) which must be approved prior to the commencement of installation.	Secretary of State (DECC)

Table 1 Consent applications

As described in section 2 the onshore elements of the development will be the subject of a Screening Opinion request to the Local Authority.

Q1. Have all the regulatory requirements that should be taken into account for the offshore aspects of the development been identified?

4 DEVELOPMENT DESCRIPTION

4.1 Introduction

The development description aims to provide an overview of the anticipated technical components, associated operations and activities for Phase 1 the installation of a 10MW array comprising up to 4 wave energy converters, and Phase 2 which will potentially bring the installed capacity up to 200MW. This description is based on current information; however the development is in the early stages of design and, as the development progresses, some aspects may be subject to change.

Through this Scoping Report CHWFL is seeking feedback and advice on the environmental impacts associated with the following project infrastructure described within this chapter:

Offshore infrastructure;

- Proposed AWS-III wave energy device technology;
- Proposed mooring arrangements;
- Electrical infrastructure;
- Subsea cables (inter-array and export to shore); and,
- Offshore substation (for Phase 2); and,
- Export cable landfall at MHWS.

The following operations are outlined:

- Construction and installation of offshore structures;
- Construction of onshore infrastructure;
- Operation and maintenance; and,
- Decommissioning.

Figure 1.2 illustrates the proposed development and areas of search for the offshore and cable landfall components of the development that will be considered within the EIA. As part of the ongoing site design process, offshore infrastructure locations, cable routes and landfalls will be identified within the areas of search based on environmental, technical and economic criteria. Onshore constraints will be considered when selecting export cable landfall locations.

There are also a number of technical components that will support the proposed development which will not be developed by CHWFL, and which therefore will not be considered within the CHWFL consent applications. These may include:

- Any upgrade to or addition to the existing electricity infrastructure or associated works, including any existing or proposed substations on Orkney. It is anticipated at this stage that the onshore works at the point of connection (i.e. substation or switching station etc) for both phases of the proposal would be undertaken by SHETL/SHEPD and they would reinforce/upgrade the existing infrastructure to accommodate the required capacity.
- Onshore lay down and maintenance facilities, and
- Any port/harbour upgrade/development or associated works which may be required to facilitate construction or operation and maintenance activities.

4.2 Development Infrastructure

4.2.1 AWS-III Wave Energy Converter

Figure 4.1 Visualisation of an AWS-III farm at sea on a calm day

The AWS-III WEC (shown Figure 4.1) is a self-reacting multi-cell floating wave energy converter that harnesses power from off-shore sea waves to generate renewable electricity. Diaphragms convert wave action to pneumatic power which in turn is converted to electricity by turbine-generator sets.

The converter comprises a number of structurally identical cells in typically a toroidal (ring shape) configuration, with each cell a buoyant vessel (see Figure 4.2 below). A diaphragm located on the outside edge of each cell converts the motion of waves into air movement within the device. The diaphragm is made from a specifically developed complex of synthetic fabrics and marine coatings; the coatings type is commonly used in marine products such as inflatable boats. The air is constrained within ducting, and forced through turbo-generators and power conditioning equipment drive systems to generate grid compliant electrical power.

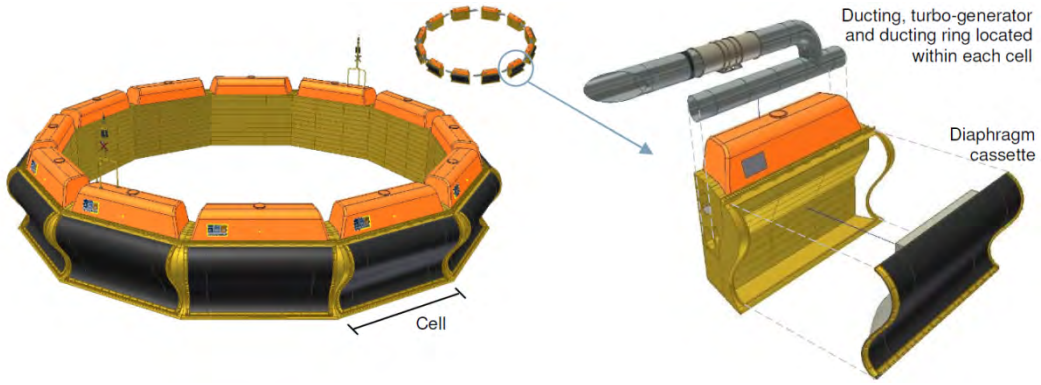

Figure 4.2 General 3D arrangement of device and exploded view of one of twelve cells (Source: AWS Ocean)

Important note: the device shown here comprises 12 cells and has a dodecagon shape; however this is purely illustrative at this stage and the number of cells and overall device shape may change as the design evolves.

A steel structure supports the floating cells and contains the electrical and mechanical equipment including the diaphragm cassettes. The diaphragms are the primary interface of the device, each diaphragm and its associated parts are known as the cassette. A continuous air duct ring runs around the inside of the main structure as illustrated in Figure 4.3. Above this, ducting connects this ring to the inner space of the diaphragm cassettes through the turbo-generators. There is one turbo-generator per cell.

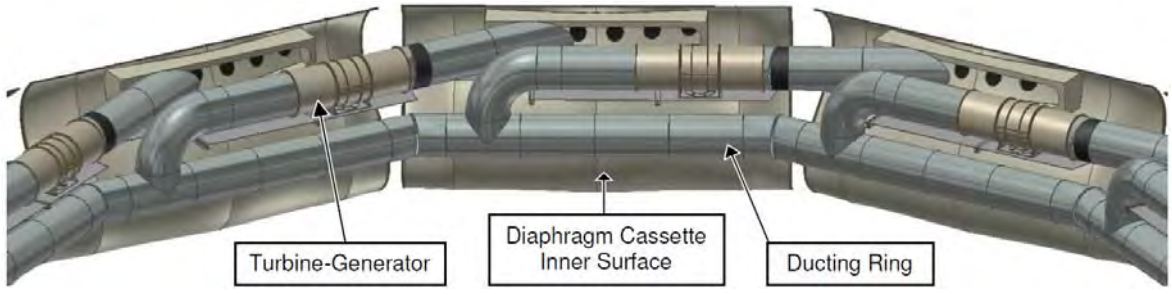

Figure 4.3 Ducting schematic with main structure removed (Source: AWS Ocean)

The diaphragms are the only exposed moving part. This feature of the design is expected to increase the operational life and reliability of the mechanical and electrical equipment. The device contains a number of independent power generating cells, which allow for

redundancy in case of failure, and will also provide a natural degree of smoothing to the generated power output.

Northern Lighthouse Board (NLB) will provide formal advice on colour and marking. For further information please refer to the PHA at Appendix E.

The AWS-III will be equipped with a step-up transformer in order to allow power export from an individual device with voltage of typically 11 to 33kV. Each of the cells can be individually isolated, and the device can remain operational following failure of a small number of the cells, with a proportional loss in performance, until a suitable weather window allows for repairs to be carried out.

Each device has several decks as shown in Figure 4.4 overleaf; the upper deck contains the turbo-generators and main electrical systems and the lower deck contains the other plant and machinery and the ducting ring. The draught of the device is controlled by sea water ballast tanks contained in the base of the device.

As AWS-III is a floating vessel with a displacement (excluding ballast) in the region of 2000 tonnes, systems are required to ensure its stability and watertight integrity. Self priming reversible ballast pumps will alter the draft of the device if required relative to the sea surface. Sea water will be used for ballast. Any seawater leakage will be removed from the inner cassette space by bilge pumps.

The AWS-III device will be watertight. The device has been designed with a large reserve buoyancy, and has good sea keeping characteristics. Each of the cells is an individual compartment, which have further sub compartments which further enhance the seaworthiness of the device.

Converters will enter ‘survival mode’ when waves exceed a design condition of significant wave height (Hs) of 6 m. In this mode the valves to the pneumatic ducts are closed to minimise any ingress of water in the event of critical damage to the diaphragms.

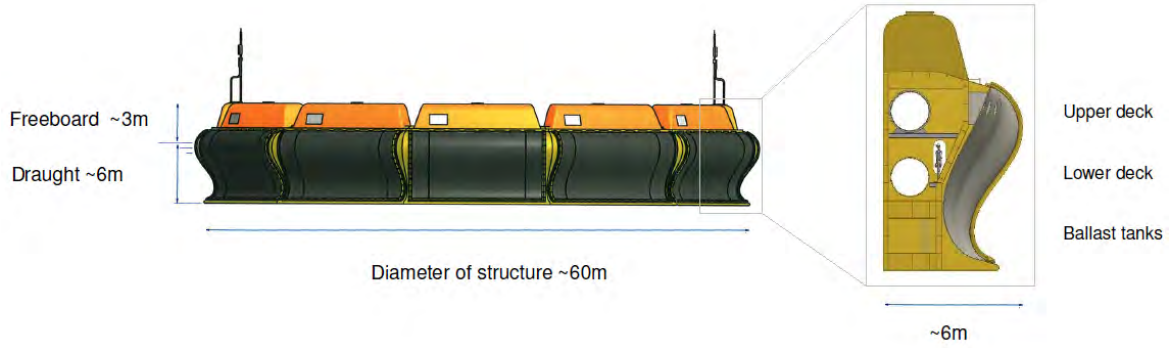

Figure 4.4 Illustrative AWS-III Dimensions (Source AWS Ocean)

As the design is not frozen; indicative dimensions shown in Figure 4.4 are subject to change.

4.2.2 Cathodic Protection and Antifouling

Sacrificial anode-type cathodic protection will be used as corrosion control for the device. Appropriate anti-fouling coatings will be used on the structure and diaphragms.

4.2.3 Oils and Fluids

The following fluids will be used in the ancillary system of the AWS-III:

- Air turbines: lubricating oil (a few hundreds of litres), possibly cooling water with additives against corrosion (a few hundreds of litres)
- Blowers for re-pressurization of the air system: lubricating oil – a few litres.
- Batteries: dry type, no fluid.

Bunds will be used to contain contaminants as per MARPOL requirements. Leaks and spills will be cleared using relevant spill equipment during periodic maintenance.

4.2.4 Mooring Arrangements

At this stage of the development the mooring design is under development. The following illustrations show two initial mooring arrangements being considered.

Multi-tether "Admiralty Type" mooring:

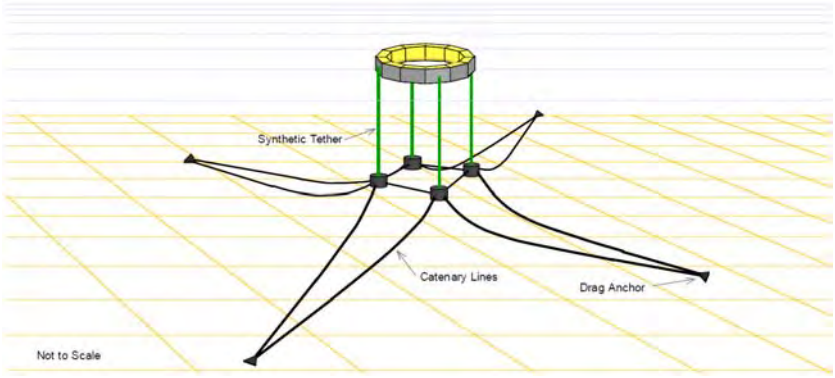

Figure 4.5 Multi-tether mooring

The multi-tether "Admiralty Type" mooring illustrated in Figure 4.5 offers good potential for a viable mooring design. The mooring system allows the use of drag embedment anchors and combines semi-taught tethers with chain catenaries. The arrangement comprises:

- Four vertical synthetic tethers attached to the device which are connected to and tensioned by a lump mass (provided by four clump weights or via one steel/concrete ring);
- Four sets of twin chain lines used to connect each anchor point to the vertical tethers; and,
- Four drag embedment anchors.

Taut synthetic mooring with vertical load anchors (VLA):

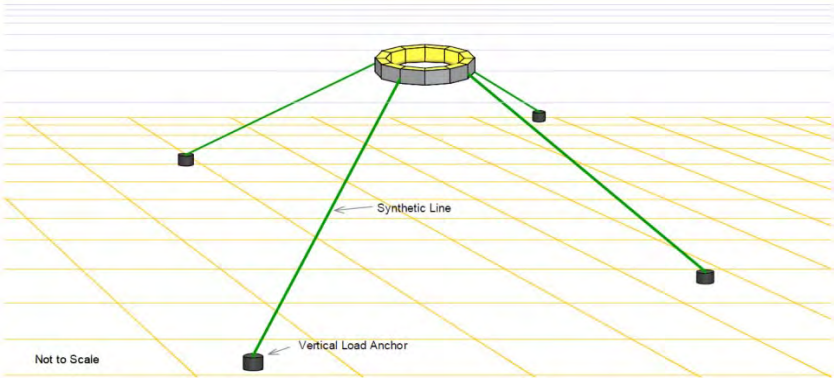

Figure 4.6 Taut synthetic mooring with vertical load anchors (VLA)

The mooring architecture illustrated in Figure 4.6 allows a higher density of device layout in an array and relies on the development of specific synthetic lines. The arrangement comprises:

- Four synthetic lines; and,
- Four VLAs or piles.

The number of anchors and lines could increase to ensure sufficient redundancy in the system. This is unlikely to exceed eight per system.

CHWFL is currently undertaking a review of the potential design options in order to select the optimal approach.

4.2.5 Anchoring

There are a range of industry standard anchoring solutions available that could be used to hold the AWS-III converters on station at the Costa Head site. At this stage of the development a number of anchor technologies are being considered which include:

- Drag embedment anchors;
- Piles;
- Vertical Load Anchors (VLA); and
- Gravity based anchors.

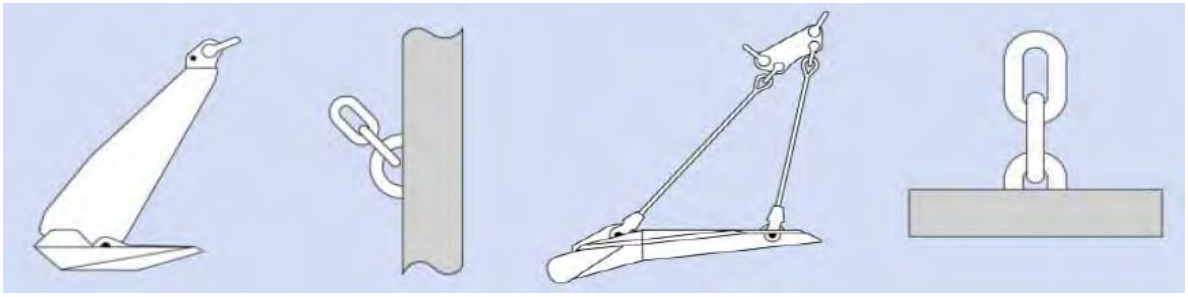

Figure 4.7 Anchoring solutions being considered

The anchors listed above and illustrated in Figure 4.7 each have specific requirements and performance according to seabed condition. Further seabed investigations at the Costa Head site will inform engineering studies of the potential anchor solutions to allow selection of the optimal approach.

4.2.6 Offshore Electrical Infrastructure

Electrical infrastructure is required in order to transmit generated power to the end user. This section outlines the offshore electrical components required for Phase 1 and Phase 2 of the proposed development.

4.2.6.1 Subsea Cables – Inter-array

The AWS-III converters installed in both Phase 1 and Phase 2 will be inter-connected in arrays. Each device will export power via its own 11 to 33kV inter-array cable. A number of factors including seabed conditions, mooring arrangement and anchoring solution will influence the number, length, spacing and configuration of inter-array cables.

For Phase 1 the inter-array cabling configuration is likely to comprise one of two configurations:

1. Individual umbilical cables per device; or
2. A single umbilical used to connect multiple/all the converters in a daisy chain type arrangement.

For Phase 2, it is likely that a number of interconnected daisy chains will be used to connect the converters within the array.

4.2.6.2 Offshore Substation

For Phase 1 it is anticipated that the inter-array cables from each device will connect to an export cable to shore either via one of the converters or in a subsea terminal box.

For Phase 2, it is expected that an offshore substation located within the AfL area will be used to bring multiple lower voltage inter-array cables together, with the power then being exported from the offshore substation to shore via higher voltage power export cables. This is most likely to be a fixed seabed mounted platform, however a floating structure has not been ruled out at this stage.

4.2.6.3 Subsea Cables – Export to Shore

For Phase 1 it is expected that one export cable will be used to transmit generated power to the chosen landfall location. For Phase 2 it is anticipated that a number of cables (but in a single corridor) may be required.

4.2.7 Onshore Landfall and Grid Connection

Although the onshore aspects of the project will be subject to a separate planning application high level details have been included here for completeness of the project description.

There are currently a number of potential export cable landfall options and grid connection route corridors identified for the Costa Head Wave Farm development that are being

considered for each phase (as shown in Figure 1.2). Further work is required on the onward grid connection but it is likely that CHWFL will seek a point of connection at the export cable landfall location into existing/reinforced onshore grid infrastructure.

There would be signs erected at the cable landfall marking the presence of an electricity cable. Examples of these can be seen at a number of locations on Orkney where the existing subsea inter-island cables are located.

4.2.8 Development Boundary Markers

Prior to the AWS-III technology being installed at the Costa Head Wave Farm the site must be prepared. This work will include the installation of development boundary markers, such as cardinal marker buoys, to signify the location of the development site to marine traffic. NLB will provide formal advice but for further information please see the PHA at Appendix E.

4.3 Construction and Installation

The installation method(s) for the offshore components described above are outlined in the following sections:

4.3.1 AWS-III Wave Energy Converters

It is anticipated that the AWS-III converters will be assembled at a shipyard or similar facility located close to the coast. Once a device has been constructed and undergone initial commissioning it will be floated to enable towing to site. A mooring system (potentially pre-installed to save time) will allow the device to be towed into position and secured. The installation of the mooring system can be undertaken independently of the device deployment to reduce the length of weather window required.

It is expected that a local lay up or safe haven will be required close to the site. Towage speeds are relatively low and weather windows suitable for installation can be infrequent so to maximise installation opportunities (shortest journey) a temporary lay-up close to the site, such as Scapa Flow, will be important. The units would be safely anchored in a similar fashion to a ship until required for installation.

Ocean-going tugs with appropriate bollard pull capacity will be used for the tow-out of each device. Separate anchor handling vessels will be required for the installation and pre-tensioning of the mooring and anchoring system.

4.3.2 Subsea Cables – Inter Array

A specialised cable lay vessel would be used to install all subsea cables (similar to that shown in Figure 4.8). More than one vessel may be employed in cable laying activity at any one time.

Figure 4.8 Cable ship Galathea

Where the seabed has a suitable covering of sediment it may be possible to use a cable plough or a jetting system to bury the cable, typically between 1m and 1.5m depth below the seabed. Where cables are not able to be buried, the use of concrete mattresses or overlaying of rock may need to be considered to secure and protect some areas of the cable.

4.3.3 Subsea Cable – Export to Shore

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.

4.3.4 Offshore Substation

Installation of a seabed mounted central offshore substation required for Phase 2 could involve the use of heavy lift vessels. Cables from shore and from the converter arrays would typically be conveyed onto this platform via J-tubes. If the substation is on a floating structure then this could be towed into place without the need for heavy lift vessels, although anchor handling tugs will be required for the installation and pre-tensioning of the mooring and anchoring system.

4.3.5 Onshore Landfall

The subsea cable would be brought onshore at the landing site and, depending on site conditions, would be winched or pulled ashore.

There are two main options for constructing a landfall:

- Direction 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.

The method(s) employed for the cable landfall for each phase will be informed by a number of factors including environmental and engineering constraints, planning guidance and consultation. Depending on the landfall method and characteristic of the site, it may be necessary to protect the subsea cable in the intertidal area. The protection is likely to be provided by burying the cables in specialised ducts.

4.4 Commissioning

The commissioning activities for the offshore components of Phase 1 and Phase 2 are outlined in the following sections. It should be noted that whilst the activities for both phases are broadly similar, it is expected that the 10 MW array that will be installed and commissioned in a single year. The commissioning of Phase 2 which may include up to 80 AWS-III converters will cover an extended period over 2 – 3 years. This simply reflects the logistical and seasonal constraints that will inevitably apply to a large scale wave development.

4.4.1 AWS-III Wave Energy Converters

The individual AWS-III converters will have been pre-commissioned at the assembly facility to ensure that all equipment is properly installed and operating. Auxiliary, navigation, and hotel systems (ship keeping) will have been operated using shore power from temporary connections.

Following towage and installation of the moorings at Costa Head the converters will be connected to their respective cables and on-site commissioning completed.

4.4.2 Subsea Cables

The offshore cables (inter-array and export) will be checked for electrical integrity at the time of laying, but this will be rechecked as part of commissioning works. This will ensure that the equipment is correctly installed and operating as designed.

4.4.3 Offshore Substation

The substation will be pre-commissioned prior to delivery to site and final commissioning undertaken off-shore in-situ, using temporary power supplies if required before connection to the export cable and on-shore grid.

Once the individual “groups” of AWS-III converters have been installed and commissioned, they can be connected to the substation and full functionality checked under the required operational and fault conditions. The power can then be exported to the grid following confirmation of the power quality.

4.5 Operation and Maintenance

4.5.1 Wave Energy Converters

During Costa Head's operational phase the AWS-III wave energy converters will be inspected and remedial work carried out as required. This work falls into three categories:

- **Periodic overhauls** – A maintenance overhaul will be undertaken on the converters typically every five years. This may, on some occasions, require converters to be removed from the water. In this instance the converters will have to be released from their moorings and towed to suitable facilities for maintenance, before being redeployed. The planned five-yearly maintenance is expected to include structural inspection and testing, replacement of diaphragms, reapplication of paint and other corrosion and anti fouling systems and servicing and testing of all mechanical and electrical equipment.

- **Scheduled maintenance** – In-situ maintenance will be undertaken on the converters, typically once a year and during the summer period, when access to the device is easier due to better weather conditions. Vessel mooring points will be located on the converters to facilitate access. Access to the interior of each device will be through watertight hatches on each cell. Annual maintenance is expected to include visual damage inspection of the main structures, replacement of consumable parts, minor servicing of all mechanical equipment and replacement of minor parts, if required.

- **Unscheduled maintenance** – Generally the converters will be unmanned during operation so in the event of an unexpected fault. Access will be required using a support vessel.

It is expected that the operation of the site will be undertaken from a remote control centre, some distance from the site. A series of sensors will be incorporated into the converters which will allow this centre to react where required, such as turning equipment on and off and operating valves.

4.5.2 Moorings

The mooring system will be designed to avoid the need for frequent adjustments; however, it will be necessary to carry out routine inspections of the device mooring fixtures and fittings to ensure that no degradation has occurred. This will require a support vessel to take the inspection team to the converters. It will also be necessary to carry out an inspection of the underwater mooring and anchoring system using an ROV. Inspection periods will be adjusted with operational experience.

4.5.3 Subsea Cable (Inter-array and Export to Shore)

In general, a subsea cable requires little ongoing maintenance. Inclement weather and direct impact from fishing gear or anchors can cause damage to the cable. Recovery and repair of a subsea cable can be difficult, which can result in a subsea cable having a shorter life span that a cable of comparable distance on land. 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.

4.5.4 Offshore Substation

The offshore substation proposed for Phase 2 would most likely be designed to be operated as an unmanned installation. It is expected that routine maintenance would be conducted either by vessel or possibly helicopter transfer of personnel. 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 heavy lift vessels/ barges.

4.6 Ports, Harbours and other Local Facilities

Considering the impact of weather windows on a maintenance schedule, it is likely that a local base will be used. Such a facility would provide an area where complete converters can be taken to allow easier access to carry out maintenance. A minimum requirement for such a facility will be a workshop with quayside access for a single device and workboats.

At this early stage dry docks and slipways are being considered. These facilities would allow converters to be taken out of the water for full underwater hull inspection, painting, anode replacement etc.

4.7 Decommissioning

There are a number of factors and options that will determine the decommissioning strategy for the proposed Costa Head Wave Farm. The most likely decommissioning options will be considered and assessed as part of the EIA and NRA processes and reported in the ES.

A decommissioning programme, (including the assessment of environmental impacts associated with the decommissioning phase) will be developed as required by the Energy Act 2004. The programme will be drafted prior to the commencement of installation and updated nearer the time of actual decommissioning once specific details of the decommissioning procedures are available.

CHWFL plans to design the development installations to be removable by ‘reverse construction’ methods, typically:

- The AWS-III converters will be towed to port to remove parts for reuse and recycling as appropriate.
- Where possible, it is anticipated that all moorings will be completely removed from the site.
- Subsea cables may either be removed, or left in situ. 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.
- At the end of its lifespan the offshore 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 and returned to land for recycling or disposal.

5 PHYSICAL CHARACTERISATION AND IMPACT ASSESSMENT

5.1 Introduction to Baseline Characterisation and Impact Assessment

The following sections (5, 6 and 7) follow a consistent structure which aims to describe the baseline environment based on readily available sources and early feedback from consultation, identify data gaps and how further data will be collected, and identify any surveys or studies that may need to be completed as part of the baseline environment characterisation strategy. This will either involve project specific data collection by CHWFL or sourcing of further data from other organisations (as indicated in the data gap tables). Potential impacts have also been identified and a subsequent impact assessment strategy has been proposed.

For each potential impact that has been identified a potential significance has been assigned in order to help inform what further work is required during the EIA. Table 2 shows the impact significance key that has been adopted to categorise each potential impact.

	No effect, and therefore scoped out of EIA
	Low/negligible effect, unlikely to be significant, and therefore scoped out of EIA
	Medium or unknown effect requiring further data and/or assessment
	Potentially significant effect requiring detailed investigation in the EIA
	Beneficial

Table 2 Impact Significance Key

5.2 Physical Processes and Sediment Dynamics

5.2.1 Baseline Environment

5.2.1.1 Bathymetry

Although detailed geotechnical survey work has not been carried out a number of surveys have included all or part of the AfL area and export cable route areas. During the EIA this data will be analysed further. A review of ground conditions prior to the PFOW leasing round (Halcrow, 2009) described the ground conditions in the Costa Head area as gently undulating with occasional small ridges. The depths in the AfL area are thought to range from approximately 60 – 75 m, gently sloping in a southeast – northwest direction.

Along the export cable routes the bathymetry is expected to become more irregular comprising largely of rock steps with steep slopes and a number of large crevices and seabed rises. This is echoed by the coastline.

5.2.1.2 Tide and Wave Regime

Orkney lies close to the boundary between the North Atlantic and North Sea tidal systems. The interaction of the two systems results in a dynamic and energetic tidal regime, this flow is modified by local conditions of water depth and topography (Marine Scotland, 2010). In the vicinity of the proposed development peak tidal current flow on a mean spring tide is 0.26 – 0.75 m/s and 0.11 – 0.25 m/s on a mean neap tide (ABPmer *et al*, 2008).

The wave climate in Orkney waters is dominated by the passage of low pressure systems from west to east across the North Atlantic. Generally the highest waves approach Orkney from westerly directions; this is also the predominant wave direction (Marine Scotland, 2010). The significant wave height in the vicinity of the development exceeds 1 m for 75% of the year and 2.5 m for approximately 25% of the year and the annual mean significant wave height ranges from 2.01 – 2.25 m (BODC, 1998). To provide in-situ wave data, scientific monitoring equipment was deployed by CHWFL in March 2012.

5.2.1.3 Seabed Sediment and Geology

The north coast of the west mainland of Orkney comprises sheer cliffs and distinct geos, gloups and stacks interspersed with occasional sandy beaches (Scott *et al*, 2005).

The underlying geology of the area is made up of Middle Old Red Sandstone of the Devonian age (Barne *et al*., 1997). The AfL area has generally sandy superficial sediments with some gravels and sediment thicknesses up to or exceeding 10 m (Halcrow, 2009).

The coastal areas, which encompass the export cable route, have been identified as infralittoral coarse sediment (JNCC, 2010a and MESH, 2012).

5.2.1.4 Coastal Geology

The exposed cliffs surrounding the area comprise most likely siltstones and fine grained sandstones. These rocks are characterised by well developed layering, gentle folding and strongly accentuated jointing. The same rocks are expected to create the bulk of the bedrock exposed on the seabed within the proposed development area.

Irregularly spaced faults are often significant features of the Old Red Sandstone rocks. The fault lines create preferential erosional zones that aid the formation of deep troughs both on the seabed and in the cliff face.

5.2.2 Data Gaps

It is proposed that baseline conditions regarding physical processes can be further defined to sufficient detail by completing the tasks outlined in the table below:

Data Requirement	Outline Survey or Data Collection Method (CHWFL)	Other Data Sources
Bathymetric / geophysical site conditions	Geophysical survey to provide detailed mapping of the seabed	Marine Scotland surveys of all commercial wave AfL areas. The Crown Estate near-shore surveys of the northwest coastline of Mainland Orkney. MCA multi-beam bathymetry studies from 2007 around the northwest coastline of Mainland Orkney.
Characterisation of the coastal geology and its present rate/state of erosion	Walkover survey to appraise the current nature of coastal morphology in the region.	ICIT cliff surveys.
Baseline wave and tidal conditions	CHWFL is engaged in a programme of Waverider Buoy and ADCP deployments. The 2 Waveriders (deployed in March 2101) provide data describing the wave climate and the ADCPs (to be deployed Q2/Q3 2012) will provide information on the principal tidal current regime at the site.	-

5.2.3 Potential Impacts

Possible impacts along with the potential significance of effect on physical processes are considered in the table below:

Potential Impact	Phase			Comment/Justification	Scoped into EIA?
	C/I	O/M	D		
Changes to near and far field wave and current regime				It is unclear based on presently available information whether changes in the seabed morphology due to the presence of seabed infrastructure	Yes

Potential Impact	Phase			Comment/Justification	Scoped into EIA?
	C/I	O/M	D		
				would have a significant impact on the near and far field wave and current regime.	
Scouring				Scouring may occur around the mooring anchors and any other seabed infrastructure. This will only be a potential issue in areas of seabed sediment.	Yes
Changes to sediment regime - physical structures				Changes in sediment regime due to physical presence of converters and seabed infrastructure influencing the natural course of sediment transport in the area.	Yes
Changes to sediment regime - energy extraction				Changes in sediment regime due to extraction of wave energy.	Yes
Disturbance and re-suspension of seabed sediments				Vessel and device mooring requirements may cause disturbance and re-suspension of sediments. There may also be some drilling mud and rock discharges at the seabed if drilled piles required for anchoring and/or cable landfall directionally drilled with the potential for contamination of sediment.	Yes
Effects on coastal geology due to changes in sediment regime				Indirect effects on coastal geology e.g. longshore drift, erosion or sediment deposition, from changes in current regimes from presence and operation of the converters.	Yes

5.2.4 Impact Assessment Strategy

It is proposed that the following impact assessment strategy is applied to address those impacts that have been scoped into the EIA, including those impacts for which the potential level of significance is unknown:

Potential Impact	Assessment Method	Relevant Strategic Research
All impacts	A desk study on seabed and coastal morphology in the region, combined with outputs from the geophysical and benthic ecology surveys will provide a basis for assessment of the potential impacts relating to the offshore physical environment. This will inform any requirement for modelling of physical processes. Physical processes modelling (if deemed necessary following further investigation) may be undertaken to show the potential effects energy extraction will have on physical processes and sediment dynamics.	-

5.3 Air and Climate

5.3.1 Baseline Environment

5.3.1.1 Meteorology

The Orkney climate 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 (Marine Scotland, 2010).

The mean winter air temperature varies around 6°C. In summer, mean temperatures vary around 13°C (UKHO, 2004). The average maximum yearly temperature for the region is 10 - 11°C (Met Office 30-year data).

Precipitation in the west of Orkney can occur on as many as 25 days per month in winter and on 15 – 20 days per month in summer (UKHO, 2004). Quantity and duration of rainfall is highly variable.

In winter months, winds of force 5 or greater are reported around 70% of the time. In the summer, winds of force 5 or greater are experienced for around 30% of the time (UKHO, 2004). In April wind direction is highly variable through winds from the west and south-west are still more frequent (UKHO, 2004). The western and northern parts of Northern Scotland are, on average, the windiest in the UK, being fully exposed to the Atlantic. The frequency and depth of these depressions is greatest in the winter, particularly during December and

February, and this is when mean wind speeds and gusts (short duration peak values) are strongest (Met Office 30-year data).

The greatest likelihood of fog is in the summer (April-September) when moist air moves in from the south (UKHO, 2004) and is most likely associated with winds from the south-west. Fog may be experienced around 3 – 5% of the time in summer and less than 2% of the time in the winter (UKHO, 2004).

5.3.1.2 Air Quality

Generally, the air quality is classified as good in Orkney and no areas within Orkney have been identified as Air Quality Management Areas. There are a number of factors which contribute to this including low volumes of traffic, predominance of agricultural land practices, limited industrial processes and low population densities. Orkney is also remote from any other significant areas of population density.

5.3.2 Potential Impacts

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

Potential Impact	Phase			Comment/Justification	Scoped into EIA?
	C/I	O/M	D		
Atmospheric emissions from vessels				Vessels used will emit gasses such as carbon dioxide, sulphur oxides and nitrogen oxides. This will have an impact in the immediate vicinity, but is not considered to be significant.	No

There will only be minor atmospheric emissions associated with the development; this will be temporary and negligible. No potentially significant impacts have been identified. Air quality has therefore been scoped out of the EIA.

5.4 Sediments and Water Quality

5.4.1 Baseline Environment

5.4.1.1 Water Quality

The quality of the waters around Orkney is reflected by the oceanographic regime. Orkney is located on the edge of the North Atlantic Current which assists in the dilution and dispersal of any contaminants or pollutants that enter coastal waters (Marine Scotland, 2010). There are no bathing beaches designated for the coast of Orkney however SEPA (2008) classify the water in the vicinity of the proposed development as good.

5.4.1.2 Sediment Quality

The development area is in an area defined as being at non-significant risk of sediment contamination (Faber, Maunsell and Metoc, 2007). During the first and second world wars mines were laid in the waters around Orkney, known mined areas have been cleared but it is possible that a small number of undetonated converters still exist on the seabed (Faber, Maunsell and Metoc, 2007).

5.4.2 Data Gaps

It is proposed that baseline conditions regarding sediments and water quality can be further defined to sufficient detail by completing the tasks outlined in the table below:

Data Requirement	Outline Survey or Data Collection Method (CHWFL)	Other Data Sources
Data on sediment quality within the development area	Grab sampling (and subsequent analysis) as part of a benthic ecology survey will provide data on the baseline sediment quality. Consultation with SEPA and Marine Scotland will identify any requirements for water quality analysis.	SEPA River Basin Management Plans (SEPA, 2009). Marine Scotland.

5.4.3 Potential Impacts

Possible impacts along with the potential significance of effects on sediment and water quality are considered in the table below:

Potential Impact	Phase			Comment / Justification	Scoped into EIA?
	C/I	O/M	D		
Pollution of sediment from marine leaks and spills (converters, associated infrastructure and vessels)				Although construction industry good practices and procedures will be followed there remains the potential for contamination of sediment.	Yes
Pollution of the offshore water environment				Although construction industry good practices and procedures will be followed there remains the potential for pollution of the offshore water environment.	Yes
Pollution from anti-foulant leaching				Risk of pollution from anti-foulant leaching is not deemed to be significant. Design is likely to limit anti-foulant use to critical areas only.	No

5.4.4 Impact Assessment Strategy

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

Potential Impact	Assessment Method	Relevant Strategic Research
Pollution of sediment from marine leaks and spills (converters, associated infrastructure and vessels)	A desk-based accidental events impact assessment will examine the potential for events to occur which might have a significant impact through pollution of sediment and the offshore water environment.	-
Pollution of the offshore water environment		

Q2. Do the studies proposed for characterisation and assessment of effects on the physical environment look appropriate and complete?

Q3. Are there any sources of key environmental information not identified which should be consulted to inform the EIA?

6 BIOLOGICAL CHARACTERISATION AND IMPACT ASSESSMENT

6.1 Intertidal and Benthic habitats

6.1.1 Baseline Environment

6.1.1.1 Habitat Protection

Data from Mapping European Seabed Habitats (MESH) identifies the seabed in the offshore substation area of search and subsea cable corridor area of search as circalittoral coarse sediment (MESH, 2012).

There are seven marine habitats listed on the Orkney Local Biodiversity Action Plan that may be encountered in the study area; these are sand dunes, strandline, coastal vegetated shingle, saltmarsh, saline lagoons, seagrass meadows and aeolianite (Orkney Local Biodiversity Action Plan, 2007).

There have been no offshore Special Areas of Conservation (SAC) or Sites of Community Importance (SCI) Annex I habitats identified within the Costa Head Wave Farm vicinity.

The Scottish Government is currently consulting on suitable areas for Nature Conservation MPAs. This has resulted in 31 locations identified for possible designation as MPAs. There are two of these potential sites within close proximity to the proposed development area. The North-West Orkney MPA search location and Hoy MPA search location, approximately 2 km to the north and 20 km to the south, respectively. The North-West Orkney MPA search location has been chosen due to the area containing suitable sandeel habitat and very high densities of sandeel larvae (Scottish Government, 2012b). The Hoy MPA search location has been chosen due to the presence of horse mussel (*Mytilus edulis*) beds, maerl beds and black guillemot (*Cepphus grylle*) (Scottish Government, 2012c). Nature Conservation MPAs are scheduled to be approved by the Scottish Government in late 2012.

6.1.1.2 Agreement for Lease Area

Recent survey data provides an overview of the habitats and species likely to be recorded within the AfL area (Moore & Roberts, 2011). In addition, video data are available on the Marine Scotland website (Marine Scotland, 2012). Survey data were collected at depths between approximately 70 and 80 m.

Both rock and mixed sediment habitats have been recorded within the AfL area (Moore & Roberts, 2011). Additional video data indicate habitats within this area comprise coarse gravel with cobble and boulders. Patches of cobble and boulder interspersed with patches of sand were recorded at some sites (Marine Scotland, 2012).

The predominant substratum consisted of scattered cobbles and boulders on coarse sand with gravel and pebbles. In some areas sediment present appeared to be a thin veneer over extensive rock. Circalittoral rock in this location was found to support a fairly coarse encrusting community of coralline algae, serpulid worms and bryozoans (CR.MCR.EcCr.FaAlCr). Gulleys and other sand-influenced areas were characterised by dense *Flustra foliacea* (CR.MCR.EcCr.FaAlCr.Flu). Areas of scattered cobbles, pebbles and gravel on sand supported a sparse fauna of encrusting serpulid worms and bryozoans on the larger stones (SS.SMx.CMx), supplemented regionally by sparse hydroids and *Flustra foliacea* (SS.SMx.CMx.FluHyd).

6.1.1.3 Export Cable Corridor

Benthic habitats located within the potential export cable corridor areas have been investigated as part of the surveys reported by Moore (2010) and Moore and Roberts (2011). Video data are also available on the Marine Scotland website (Marine Scotland, 2012). Survey data were collected at depths between 20 and 55 m.

The eastern cable corridor extension towards Eynhallow Sound was not covered by the aforementioned surveys. However, the findings of surveys adjacent to Eynhallow Sound indicate similar habitats to those described below.

Surveys of the western cable corridor route along the west coast between the Brough of Birsay and Row Head indicate a range of rock and sedimentary habitats present. Predominant habitats recorded include circalittoral rock or cobble and pebble supporting a sparse encrusting community, areas of sand with little evidence of life, and sandy or mixed substrata with evidence of an infaunal community.

The surveys cited above did not survey shallower that approximately 20 - 25 m. Other sources however, indicate shallow infralittoral kelp habitats are expected to be present to depths of 20-30 m and comprise bedrock and boulders, often as steep or vertical cliffs with caves, crevices, overhangs and gullies (Irving, 1997). Infralittoral kelp habitats were reported around 20-30 m, and consisted mainly of forests (IR.MIR.KR.Lhyp.Ft) and parks (IR.MIR.KR.Lhyp.Pk) of *Laminaria hyperborea*, with an understorey of moderate densities of red algae and *Dictyota dichotoma* (Moore & Roberts, 2011).

Circalittoral rock supported a fairly sparse encrusting community of coralline algae, serpulid worms and bryozoans (CR.MCR.EcCr.FaAlCr), although vertical walls, supported dense fields of *Alcyonium digitatum* (CR.MCR.EcCr.FaAlCr.Adig). High densities of *Caryophyllia smithii* were recorded in places (CR.MCR.EcCr.FaAlCr.Car). Gulleys and other sand-influenced areas were characterised by dense *Flustra foliacea* (CR.MCR.EcCr.FaAlCr.Flu).

Areas of scattered cobbles, pebbles and gravel on sand supported a sparse fauna of encrusting serpulid worms and bryozoans on the larger stones (SS.SMx.CMx), supplemented regionally by sparse hydroids and *Flustra foliacea* (SS.SMx.CMx.FluHyd). Boulder and cobble patches displayed a serpulid and bryozoan encrusting community but accompanied in places by dense *Caryophyllia smithii* (CR.MCR.EcCr.FaAlCr.Car) or with patches of *Flustra foliacea* and *Securiflustra securifrons* (CR.MCR.EcCr.FaAlCr.Flu).

Extensive areas of sediment in the form of rippled fine sand with little surface evidence of life (SS.SSa.CFiSa) were recorded between Marwick Head and Row Head, with some mixed areas of sand (SS.SSa.CFiSa), boulders and cobbles on sand and outcropping bedrock. Homogeneous coarse sand also showed no evidence of infaunal life (SS.SCS.CCS).

Sandy sediments or mixed stony sand substrata predominated beyond the 50 m contour. In the region of Row Head sediments were mostly composed of fine sand, with evidence of the infaunal community including faecal mounds, polychaete casts, bivalve siphons and emergent *Antalis entalis* shells, as well as the possible presence of small burrows, *Lanice conchilega* tubes and sandeels *Ammodytes sp*. (SS.SSa.CFiSa). To the north of Row Head coarse sands, locally in the form of waves, were accompanied by varying proportions of gravel, pebbles, cobbles and boulders, with local concentrations of boulders and cobbles.

6.1.2 Data Gaps

It is proposed that baseline conditions regarding benthic and intertidal habitats can be further defined to sufficient detail by completing the tasks outlined in the table below:

Data Requirement	Outline Survey or Data Collection Method (CHWFL)	Other Data Sources
Intertidal habitats present at potential cable landfalls	Marine intertidal Phase 1 survey to categorise the habitats and establish the species present in the cable landfall area.	Digital data providers and SNH Commissioned survey. Published literature. JNCC. Local knowledge.
Benthic habitats and ecology present in the AfL area and along the export cable corridors to shore	Benthic ecology survey along cable corridor to shore including video footage and photography with targeted grab sampling and analysis as dictated during the survey with input from geotechnical survey data	

6.1.3 Potential Impacts

Possible impacts along with the potential significance of effects on marine and coastal habitats are considered in the table below:

Potential Impact	Phase			Comment / Justification	Scoped into EIA?
	C/I	O/M	D		
Loss of and disturbance to seabed and intertidal habitats and communities				The installation and decommissioning of mooring anchors and other subsea infrastructure (including export cable to shore) has the potential to destroy and disturb existing habitats and communities in the area.	Yes
Indirect effects on seabed and intertidal habitats and communities due to changes in near and far field wave regime and sediment transport				Potential effects due to changes in physical processes and sediment dynamics.	Yes
Colonisation of subsea infrastructure, scour protection and support structures				The presence of subsea infrastructure has the potential to have a positive effect on benthic species and habitats as it provides a hard surface for species to colonise.	Yes
Introduction of marine non-native species				Vessels used during the development may potentially bring in non-native species to the area which can be harmful to existing habitats and species.	Yes
Pollution due to leaks and spills				Although construction industry good practices and procedures will be followed and appropriate emergency procedures will be put in place, details of the fluid inventories for the development are unknown therefore it is not possible to rule that the risk of contamination may not be significant.	Yes

6.1.4 Impact Assessment Strategy

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

Potential Impact	Assessment Method	Relevant Strategic Research
Loss of and disturbance to seabed and intertidal habitats and communities	Impact assessment study looking at the results of the benthic ecology surveys and physical processes and sediment dynamics impact assessment to determine the extent and significance of any potential impacts on benthic and intertidal habitats and communities.	Appendix B – IDs 20 - 27
Indirect effects on seabed and intertidal habitats and communities due to changes in near and far field wave regime and sediment transport		
Colonisation of subsea infrastructure, scour protection and support structures		
Introduction of marine non-native species		
Pollution due to leaks and spills	Accidental events desk study and impact assessment.	-

6.2 Fish and Shellfish Resources

6.2.1 Baseline Environment

6.2.1.1 Fish and Shellfish

A number of different species of fish and shellfish are likely to be encountered in the vicinity of the proposed development, 108 species of marine fish have been recorded off the coast of Orkney (Potts and Swabby, 1997). In addition to the commercially important fish species such as mackerel *Scromber scrombus* and herring *Cluepa harengus*, populations of smaller fish species are likely to be supported by the area around the proposed development site. These species are likely to be an important food source for birds and mammals in the area.

The Orkney Trout Fishing Association (OTFA, 2010) report that there are 22 sea trout systems in Orkney. These systems are spread throughout the mainland and the islands of Hoy and Rousay and are mainly burns which flow into the sea. The Loch of Boardhouse and Loch of Hundland have recently been added to the list systems containing sea trout (pers comm. Malcolm Thompson OTFA, 2010). Although no fish were recorded during surveys of the Burn of Boardhouse a number of anglers and local people have confirmed their presence in this burn (pers comm. OTFA 2010). The Burns of Hullion and Sourin on Rousay have also been identified as sea trout systems (OTFA, 2010).

The River Thurso, on the north of mainland Scotland, has been designated an SAC due to the presence of Atlantic salmon *Salmo salar*. There is a lack of information on the presence

of adult salmon in the waters around Orkney. However, Malcolm *et al* (2010) state that salmon are probably present within and around Orkney as Orkney lies on or near a direct passage to the Scottish mainland from Faroese waters. In addition to this the Boardhouse Hundland system is on the North Atlantic Salmon Conservation Organisation (NASCO) river database as an Atlantic salmon river (NASCO, 2010).

The Costa Head AfL area is part of ICES rectangle 47E6, within this rectangle nursery and spawning grounds have been identified for several species of commercial fishery importance. Table 3 shows the spawning and nursery grounds for species identified within this area (Coull *et al*, 1998 and Ellis *et al*, 2010). Nursery grounds are presumed to be year round.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Anglerfish *Lophius piscatorius*	N	N	N	N	N	N	N	N	N	N	N	N
Blue whiting *Micromessistus poutassou*	N	N	N	N	N	N	N	N	N	N	N	N
Cod *Gadus morhua*	N	N	N	N	N	N	N	N	N	N	N	N
Common skate *Leucoraja erinacea*	N	N	N	N	N	N	N	N	N	N	N	N
Hake *Merluccius merluccius*	N	N	N	N	N	N	N	N	N	N	N	N
Herring *Clupea harengus*	N	N	S/N	S/N	N	N	N	S/N	S/N	N	N	N
Lemon sole *Microstomus kitt*	N	N	N	S/N	S/N	S/N	S/N	S/N	S/N	N	N	N
Ling *Molva molva*	N	N	N	N	N	N	N	N	N	N	N	N
Mackerel *Scomber*	N	N	N	N	N	N	N	N	N	N	N	N

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
scombrus												
Norway lobster *Nephrops norvegicus*	S/N	S/N	S/N	S/N	S/N	S/N	S/N	S/N	S/N	S/N	S/N	S/N
Norway pout *Trisopterus esmakii*	N	N	N	N	N	N	N	N	N	N	N	N
Saithe *Pollachius virens*	N	N	N	N	N	N	N	N	N	N	N	N
Sandeel *Ammodytes marinus*	S/N	S/N	N	N	N	N	N	N	N	N	S/N	S/N
Spotted ray *Raja montagui*	N	N	N	N	N	N	N	N	N	N	N	N
Sprat *Sprattus sprattus*					S	S	S	S				
Spurdog *Squalas acanthias*	N	N	N	N	N	N	N	N	N	N	N	N
Whiting *Merlangius merlangus*	N	N	N	N	N	N	N	N	N	N	N	N

S – Spawning, N – Nursery, S/N- Spawning and Nursery

Table 3 Nursery and spawning grounds within ICES rectangle 47E6

The extent of salmonid migratory patterns in the area is unknown.

There are no designated shellfish growing waters near to the proposed site development (Faber Maunsell and Meteoc, 2007).

6.2.1.2 Elasmobranches

The basking shark (*Cetorhinus maximus*) is the second largest fish in the world and the largest to be found in British waters. In the summer months Scottish waters are one of its

favoured feeding grounds (The Wildlife Trust, 2010). The basking shark is protected under the Wildlife and Countryside Act, the Countryside and Rights of Way Act (protection against disturbance and harassment) and under Appendix II of the Convention on International Trade in Endangered Species.

Basking sharks are present in deeper waters off Scotland outside the spring and summer months, although larger shoals do occur, the majority of sightings are of solitary animals and the number of sightings peak in August (Nicholson, 2000). The basking shark is seen only occasionally in Orkney waters (IUCN), when in passage or feeding and therefore although it is possible that they occur in the vicinity of the proposed development the likelihood of encountering a basking shark is low.

There are nineteen sharks and rays that have been recorded in Orkney waters (Potts and Swaby, 1997). The species most likely to be encountered in the AfL is the common skate *Dipturus batis* which is known to have nursery grounds in the area (Ellis *et al*, 2010) and is featured on the Local BAP for Orkney. Skates are arguably one of the most exploited marine fish because of their large size, slow growth rate, low fecundity and late maturity (ICES, 2006).

6.2.2 Data Gaps

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

Data Requirement	Outline Survey or Data Collection Method (CHWFL)	Other Data Sources
Species which utilise the potential development area including: -Migratory movements of species within the area -Over-wintering areas for crustaceans such as lobster/crab -Species which use the area for spawning/nursery grounds -Species with restricted geographical distribution which may be locally abundant -Species of fish/shellfish which	Benthic ecology survey will be the main CHWFL input to this topic. Consideration will be given as to whether underwater noise baseline measurements will be required.	Coull *et al*., 1998 and Ellis *et al.,* 2010 spawning/nursery ground data. Marine Scotland Science – fish landings data and tagging project. Consultation with local fishermen (confirmation of presence, absents, seasonality). Relevant guidance. Inshore Fisheries Group. Local fishermen groups and

Data Requirement	Outline Survey or Data Collection Method (CHWFL)	Other Data Sources
are of significant importance to recreational and commercial fisheries -Fish and shellfish of conservation importance, including those protected under the Wildlife and Countryside Act and their seasonal sensitivities		associations. Scottish Fishermen's' Federation. Local Fishermen's Association. Orkney Skate Trust.

6.2.3 Potential Impacts

Possible impacts along with the potential significance of effect on fish and shellfish are considered in the table below:

Potential Impact	Phase			Comment / Justification	Scoped into EIA?
	C/I	O/M	D		
Noise disturbance to hearing specialists				Noise output from vessels has the potential to disturb hearing specialists such as herring and sprat.	Yes
Electromagnetic effects				The presence of subsea cables and resultant electromagnetic fields has the potential to affect elasmobranches.	Yes
Loss of spawning and nursery grounds				Physical presence of seabed infrastructure such as moorings and cables may disturb spawning grounds in the area.	Yes
Entanglement risk with mooring lines for large fish species				Larger fish species e.g. basking shark may become entangled in mooring lines from vessels (if required) and the converters.	Yes
Smothering of fish habitat				Physical presence of seabed infrastructure such as moorings and cables may disturb, smother and displace crustacean and demersal species, including displacement of available prey to other fish species.	Yes

Potential Impact	Phase			Comment / Justification	Scoped into EIA?
	C/I	O/M	D		
Fish aggregating potential of development				Possible positive effect of physical presence of converters as the area may be utilised by fish species as a nursery/shelter/spawning area.	Yes
Pollution due to leaks and spills				Although construction industry good practices and procedures will be followed and appropriate emergency procedures will be put in place, details of the fluid inventories for the development are unknown therefore it is not possible to rule that the risk of contamination may not be significant.	Yes

6.2.4 Impact Assessment Strategy

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

Potential Impact	Assessment Method	Relevant Strategic Research
All impacts	Desk-based assessment to investigate how the project might impact the species present in the area including a review of the noise and electromagnetic outputs of the development infrastructure and utilisation of the benthic ecology survey to assess potential implications of altering the fish habitat. Underwater noise – consideration will be given as to whether underwater noise modelling is required. EMP – desk study only. Accidental events desk-based impact assessment.	Appendix B – IDs 15 – 17 Normandeau *et al,* 2011

6.3 Marine mammals and reptiles

6.3.1 Baseline Environment

6.3.1.1 Cetaceans

All cetacean species are classed as EPS and are fully protected under the Conservation (Natural Habitats, &c. Regulations 1994 (amended). This protection means it is an offence to intentionally or recklessly kill, injure or capture cetaceans or to disturb or harass them. The cetacean fauna of Orkney is one of the richest in the UK (Sea Watch Foundation, undated). Since 1980 seventeen cetacean species have been recorded around Orkney (Evans *et al*, 2010). Seven species of the UK cetacean are recorded throughout the year or as regular annual visitors. The Sea Watch Foundation report that minke whale *(Balenoptera acutorostrata)*, long-finned pilot whale *(Globicephala melas)*, killer whale *(Orcinus orca)*, Risso's dolphin *(Grampus griseus)*, white-beaked dolphin *(Lagenorhyncus albirostris)* and the harbour porpoise *(Phoecoena phocoana)* are all recorded in the region. Little site specific data regarding cetacean sightings is available for the area of the proposed development however the Orkney Field Club annual bulletin recorded a number of cetacean sightings in the vicinity in 2008. A rare striped dolphin *(Stenella coeruleoalba)* was found dead in Birsay Bay and there was a possible sighting of a stranded individual. Numerous white-beaked dolphins and killer whales were also recorded off the Brough of Birsay and moving north from Marwick Head (Booth, 2008).

6.3.1.2 Pinnipeds

Grey seal (*Halichoerus grypus*) and harbour seals *(Phoca vitulina)* are both resident in UK waters and are listed under Annex II of the EU Habitats Directive. Approximately 45 % of the worlds grey seal population breed in the UK and 90% of these breed at colonies in Scotland, with the main concentrations being in the Outer Hebrides and Orkney. Grey seals in Orkney breed in autumn and pup between September and late November (SCOS, 2011). Scotland holds approximately 88 % of the UK population of harbour seals with Orkney holding a significant proportion of this population (SCOS, 2011).

Grey and harbour seals will feed both in inshore and offshore waters depending on the distribution of their prey, which changes both seasonally and yearly. Both species tend to be concentrated close to shore, particularly during the pupping and moulting season. Seal tracking studies from the Moray Firth have indicated that the foraging movements of harbour seals are generally restricted to within a 40–50 km range of their haul-out sites (Special Committee on Seals, 2007). The movements of grey seals can involve larger distances than those of the harbour seal, and trips of three to four hundred kilometres from one haul-out to another have been recorded (SMRU, 2011).

As part of the Marine (Scotland) Act 2010 a consultation on seal haul out sites around Scotland was carried out. A number of areas are known to be important for harbour seal *Halichoerus grypus* haul out in the vicinity of the proposed development, namely the Bay of Birsay, Eynhallow, the west coast of Rousay and the north-east coast of the west mainland. The nearest harbour seal haul out site is approximately 6.8 km from the proposed development site. Identified grey seal haul out sites are not found in the vicinity of the CHWFL development area.

Major declines of harbour seals have occurred in Orkney in recent years. Counts carried out by the Seal Mammal Research Unit (SMRU) were 15 % lower in 2008 than 2007 and results suggest that the population has decreased by 66 % since 2000 (SCOS, 2011). It is unclear why the population has shown such a significant reduction but a number of suggestions have been made including competition with grey seals, reduced food availability and increasing numbers of killer whales (Bolt *et al*, 2009).

Within Orkney, Sanday is designated as a SAC due to the presence of the largest group of harbour seals at any discrete site in Scotland (35 km away). The Faray and Holm of Faray (21 km away) are also designated as a SAC due to the well-established grey seal breeding colony, the second largest breeding colony in the UK contributing approximately 9% of the annual UK pup production (JNCC, 2012). The CHWFL AfL is located within foraging distances for species at both these sites.

Under the Conservation of Seals Act, 1970, the Natural Environment Research Council (NERC) has a duty to provide scientific advice to government on matters related to the management of seal populations. NERC has appointed the Special Committee on Seals (SCOS) to formulate this advice. In addition, on 31 January 2011, Part 6 of the Marine (Scotland) Act 2010 came into force which seeks to balance seal conservation with sustainable fisheries and aquaculture. Under Part 6 of the Act licences for seal management purposes are issued. To inform the number of licences which can be issued the SCOS calculates the Potential Biological Removal (PBR) figure for grey seals and harbour seals permitted from the Orkney and North Coast Seal Management Area. The PBR is intended to ensure that the total numbers of seals for which licences may be issued in each Seal Management Area do not reach a level that may adversely impact on local seal populations. Each local PBR takes into account the status of the local seal populations for each species and reflects recent population trends.

The calculated PBR figure (as reported by the Scottish Government (2012c)) for grey seals from the Orkney and North Coast Seal Management Area is 959, and for harbour seals is 18. The PBR is the maximum number of animals, not including natural mortalities that may be removed from a marine mammal stock while allowing that stock to reach or maintain its

optimum sustainable population. For 2012 licences have been issued for both seal species. Out of 58 harbour seals applied for, 7 have been granted so far in 2012, and of 475 grey seals applied for 260 have been granted.

6.3.1.3 Otters

Otters *(Lutra lutra)* are classed as EPS and are fully protected under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). It is an offence to deliberately or recklessly capture, injure or kill an otter. They are also UK Biodiversity Action Plan (BAP) species. In coastal habitats otters predominantly forage in waters of 2 m depth (McCafferty, 2005) but have been recorded at depths of up to 15 m (Twelves, 1983).

6.3.1.4 Marine Reptiles

There are five species of marine turtle that have been recorded in the UK and Irish waters; leatherback turtle *(Dermochelys coriacea),* loggerhead turtle (*Caretta caretta*), Kemp's ridley turtle (*Lepidochelys kempii*), hawksbill turtle (*Eretmochelys imbricata*) and the green turtle (*Chelonia mydas*). The leatherback turtle is the only species that is reported annually (Pierpoint, 2000), and has been recorded in Orkney waters in previous years. The loggerhead turtle also has the potential to be sighted in Scottish waters. However, for the whole of the UK and Irish waters only 6 were sighted (dead and alive) in 2004 (Penrose, 2005). The leatherback turtle is protected under UK legislation as well as being of significant conservation importance.

6.3.2 Data Gaps

It is proposed that baseline conditions regarding marine mammals and reptiles can be further defined to sufficient detail by completing the tasks outlined in the table below:

Data Requirement	Outline Survey or Data Collection Method (CHWFL)	Other Data Sources
Determine species present in the area and how they might behave	Site specific marine wildlife surveys to establish use of the area and behaviours of marine mammal and reptile species. Consideration will be given as to whether underwater noise baseline measurements will be required.	APEM Aerial Survey data. Atlas of cetacean distribution in north-west European waters (Reid *et al*, 2003). Data from the Sea Mammal Research Unit (SCANS-II) (Small Cetacean Abundance in the European Atlantic and North Sea). Technical reports on marine mammals from SEA 4 &

Data Requirement	Outline Survey or Data Collection Method (CHWFL)	Other Data Sources
		Offshore Energy SEA. Cetacean and seal volumes of SNH and Marine Scotland's draft document for surveying and monitoring in relation to marine renewables deployments in Scotland . Local biodiversity records. JNCC, SMRU.

6.3.3 Potential Impacts

Possible impacts along with the potential significance of effects on marine mammals and reptiles are considered in the table below:

Potential Impact	Phase			Comment / Justification	Scoped into EIA?
	C/I	O/M	D		
Collision with vessels				There is the potential for collision with vessels in transit to the development area. Due to the low PBR figure for harbour seals this potential impact needs further investigation to determine its significance.	Yes
Noise disturbance				Potential for noise disturbance to marine mammals and reptiles due to development activities e.g. installation of moorings, vessel activity etc.	Yes
Marine mammal entanglement				Marine mammals may become tangled in mooring lines used for vessels (if required) and the converters.	Yes
Reduction of food resource				Physical presence of vessels and converters may reduce food resources and foraging area for marine mammals and reptiles.	Yes

Potential Impact	Phase			Comment / Justification	Scoped into EIA?
	C/I	O/M	D		
Behavioural changes due to physical presence of the development				Physical presence of converters and vessels may alter the behaviour of marine mammals and reptiles in the area e.g. migration routes, breeding etc.	Yes
Pollution due to leaks and spills				Although construction industry good practices and procedures will be followed and appropriate emergency procedures will be put in place, details of the fluid inventories for the development are unknown therefore it is not possible to rule that the risk of contamination may not be significant.	Yes

6.3.4 Impact Assessment Strategy

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

Potential Impact	Assessment Method	Relevant Strategic Research
All impacts	Marine mammal and reptile desk-based impact assessment to determine the likely level of effect the development will have on species, based on information relating to the knowledge of specific species and operation of converters, and anecdotal evidence regarding the potential for entanglement. No modelling is proposed. The potential for underwater noise disturbance from vessels and the operation of converters will be investigated further. Consideration will be given to whether underwater noise modelling will be required. Accidental events desk-based impact assessment.	Appendix B – IDs 1 - 6

6.4 Ornithology

6.4.1 Baseline Environment

6.4.1.1 Offshore

The Orkney region is important for cliff and island nesting birds. Numbers of at least twelve seabird species breeding here exceed 1% of their European populations, i.e. fulmar (*Fulmarus glacialis*), northern gannet (*Morus bassanus*), European shag (*Phalacrocorax aristotelis*), Arctic skua (*Stercorarius parasiticus*), great skua (*Catharacta skua*), common gull (*Larus canus*) and great black- backed gull *(Larus marinus*), black-legged kittiwake (*Rissa trydactyla*), arctic tern (*Sterna paradisaea*), common guillemot (*Uria aalge*), razorbill (*Alca torda*) and black guillemot (*Cepphus grylle*). A number of these species are likely to be found in the vicinity of the proposed development in varying numbers depending on the time of year.

A number of species of seabird have declined in recent years and JNCC (2010b) report declines in fulmar, European shag, Arctic skua, great blacked back gull, black-legged kittiwake, and razorbill. However some species have shown an increase in number including northern gannet, great skua, Arctic tern and common guillemot (JNCC, 2010b). In Orkney there seems to be a high number of black legged kittiwake nests abandoned with dead chicks and built nests left empty. Arctic terns throughout Orkney are failing to raise chicks and the 2010 season saw many pairs failing even to attempt to breed (RSPB, 2010). Reasons for decline are not certain but it has been suggested that warmer water has altered the plankton regime in the Orkney area meaning sand eels are deprived of a food source and as a result Orkney seabirds which rely heavily on sand eels as a food source are declining as they struggle to find a food source (RSPB, 2008).

There are a number of Special Protection Areas (SPAs) in and around Orkney. Theses SPAs have been designated due to bird species and assemblages that are of European importance. Table 4 details the SPAs that are found in the immediate vicinity as well as their reason for designation. It is highly likely that the majority of the species for which these SPAs are designated will be found in or around the Costa Head Wave Farm development area. In addition, due to large foraging ranges for many species there is potential for those from SPAs further away to also use the development area for feeding. However it should be noted that this area will only represent a small area of the birds' potential feeding habitat.

Name	Area	Distance to AfL area (km)	Article 4.1 species	Article 4.2 migratory species	Article 4.2 assemblages
Rousay SPA	633.41	8	Breeding: Arctic tern *Sterna paradisaea*	N/A	Breeding: Seabirds (Arctic tern *Sterna paradisaea*, Arctic skua *Stercorarius Parasiticus*, black-legged kittiwake *Rissa tridactyla*, Northern fulmar *Fulmarus glacialis*, common guillemot *Uria aalge*)
Marwick Head SPA	8.7	10	N/A	Breeding: Guillemot *Uria aalge*	Regularly supporting in excess of 20, 000 individual seabirds (black-legged kittiwake *Rissa tridactyla*, common guillemot *Uria aalge*)
West Westray SPA	350.62	14	Breeding: Arctic tern *Sterna paradisaea*	Breeding: Guillemot *Uria aalge*	Regularly supporting in excess of 20, 000 individual Seabirds (razorbill *Alca torda,* black-legged kittiwake *Rissa tridactyla*, Arctic skua *Stercorarius parasiticus,* Northern fulmar *Fulmarus glacialis)*
Hoy SPA	949907	30	Breeding: Peregrine *Falco peregrinus* Red-throated diver *Gavia stellata*	Breeding: Great skua *Catharacta skua*	Regularly supporting in excess of 20, 000 individual seabirds (Atlantic puffin *Fratercula Arctica*, black-legged

Name	Area	Distance to AfL area (km)	Article 4.1 species	Article 4.2 migratory species	Article 4.2 assemblages
					kittiwake *Rissa tridactyla*, Arctic skua *Stercorarius Parasiticus*, Northern fulmar *Fulmarus glacialis*, great black-backed gull *Larus marinus*, common guillemot *Uria aalge*

Table 4 SPAs in the immediate vicinity

6.4.1.2 Onshore

Whilst there will be no direct interaction with onshore protected sites it is recognised that some species, which are qualifying interests for those sites, might forage within the development area. Orkney Mainland Moors SPA is approximately 9 km from the development area. The SPA has been designated due to the regularly supporting populations of European importance of the Annex I species hen harrier *Circus cyaneus*, red-throated diver *Gavia stellata* and short-eared owl *Asio flammeus*. In 2008, the SPA was further extended to include Sleet Moss (SNH, 2012a). The red-throated diver is a species that will potentially use the development area (cable landfall and cable approach to shore).

6.4.2 Data Gaps

Information on baseline conditions regarding birds sufficient to inform the HRA and EIA processes will be assembled from a combination of existing data sources and commissioned survey work as outlined in the table below. APEM aerial survey data will be used to provide regional context for at-sea seabird densities. This data collection has been ongoing since 2010 and covers alternate 2 x 2 km blocks of sea around Orkney and the Pentland Firth.

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

Data Requirement	Outline Survey or Data Collection Method (CHWFL)	Other Data Sources
Distribution, abundance and behaviour of species present	Site specific marine wildlife surveys to establish the use of the area and behaviour of bird species. Consideration will be given as to whether underwater noise baseline measurements will be required.	APEM aerial survey data. Published literature on the behaviour of species. Previously collected data from protected site specific monitoring e.g. SNH, JNCC.

6.4.3 Potential Impacts

Possible impacts along with the potential significance of effect on ornithology are considered in the table below:

Potential Impact	Phase			Comment / Justification	Scoped into EIA?
	C/I	O/M	D		
Entanglement risk with mooring lines				Diving birds may become entangled in mooring lines used for vessels (if required) and the converters.	Yes
Disturbance / displacement due to increased vessel traffic				Physical presence of vessels plus may disturb bird species in the marine environment possibly effecting foraging behaviour.	Yes
Disturbance / displacement due to underwater noise				Underwater noise generated by vessels and the converters may disturb bird species in the marine environment possibly effecting foraging behaviour.	Yes

Potential Impact	Phase			Comment / Justification	Scoped into EIA?
	C/I	O/M	D		
Pollution due to leaks and spills				Although construction industry good practices and procedures will be followed and appropriate emergency procedures will be put in place, details of the fluid inventories for the development are unknown therefore it is not possible to rule that the risk of contamination may not be significant.	Yes

6.4.4 Impact Assessment Strategy

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

Potential Impact	Assessment method	Relevant Strategic Research
All impacts	Desk-based impact assessment establishing the vulnerability of bird species based on their behavioural traits, and assessing this against the proposed development activities. The impact will look at the potential risk of entanglement using anecdotal evidence. No modelling is proposed. The assessment will also aim to establish the likelihood and significance of bird species displacement including the potential for underwater noise outputs from the development to disturb species using the area. Consideration will be given to whether underwater noise modelling will be required. Accidental events desk-based impact assessment.	Appendix B – IDs 7 - 14

6.5 Conservation

Special protection is given to a number of species and habitats that are considered to be of prime importance for conservation under European Directives and supporting UK and Scottish legislation.

Of international, European, importance, a network of sites known as the Natura network holds representatives of these important species and habitats. Natura sites include Special Protection Areas (SPAs), designated for their populations of bird species, and Special Areas of Conservation (SACs), designated for their importance for wildlife other than birds. Additionally, also of international importance, Ramsar sites are wetlands of international importance designated under the Ramsar convention.

UK legislation includes further protection of those sites which are of national interest for their flora and fauna. These are called Sites of Special Scientific Interest (SSSI). In addition to these local authorities can identify Sites of Local Nature Conservation Importance.

Under the regulations regarding the Natura network, there is a requirement for the Competent Authority to consider the potential effects of any proposed plan or project upon the primary and qualifying features of Natura sites as well as the relevant conservation objectives.

A number of sites designated for their conservation importance exist in Orkney and in proximity to the proposed development (Figure 6.1). Table 5 lists the sites shown on the figure and provides a brief description of why they are designated. In addition to these sites in closest proximity to the development, other more distant Natura sites may be potentially impacted by the development.

Appendix D presents the proposed approach to HRA screening including seeking advice on the foraging distances to be used for each bird species and the methodology for screening seal, fish, freshwater pearl mussel and terrestrial SACs.

Q4. Do the studies proposed for characterisation and assessment of effects on the biological environment look appropriate and complete?

Q5. Are there any sources of key environmental information not identified which should be consulted to inform the EIA?

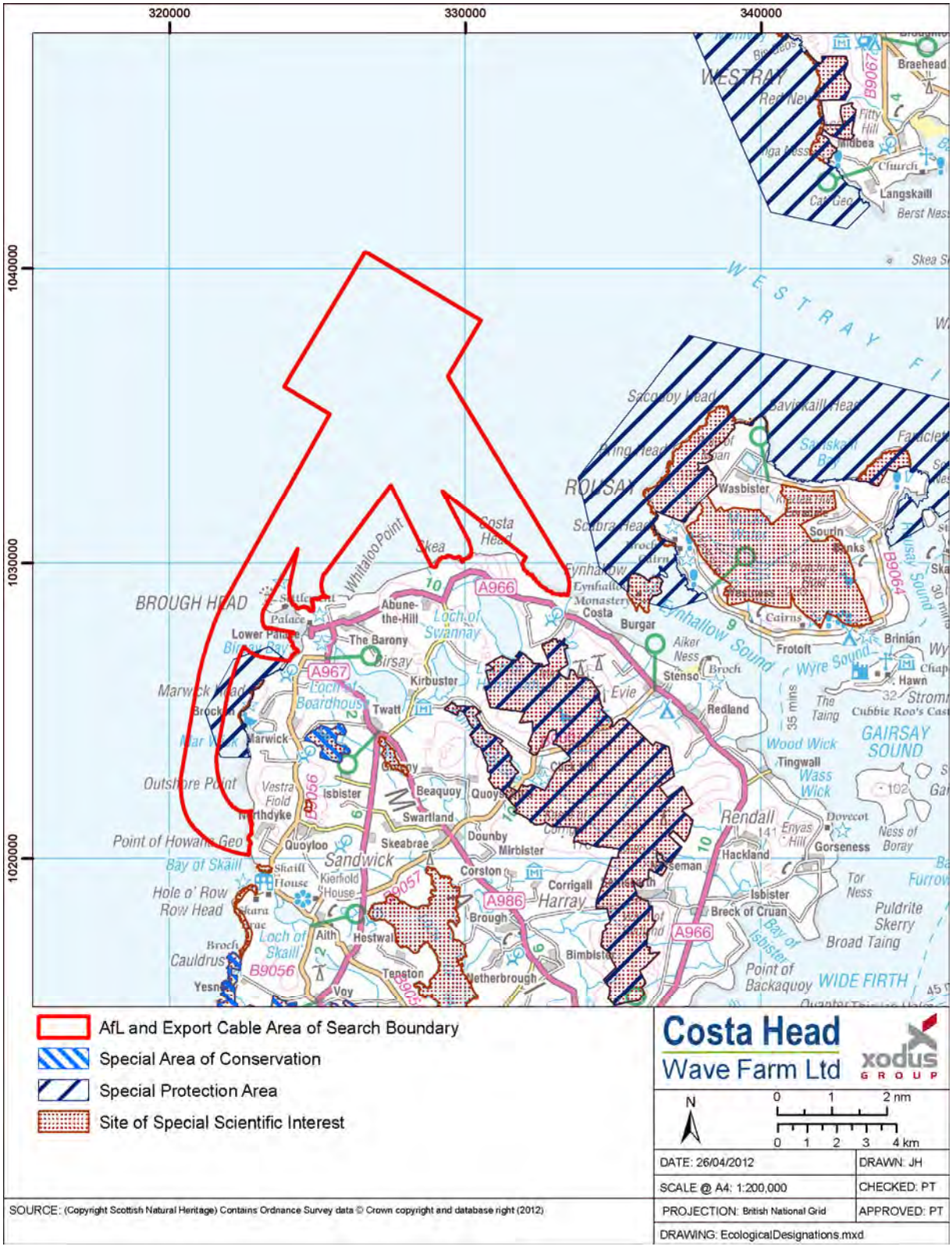

Figure 6.1 Conservation designations within the vicinity of Costa Head

Site	SPA	SAC	SSSI	GCR	Reason for Designation
Rousay	✓		✓		The SPA consists of sea cliffs and areas of maritime heath and grassland in the northwest and northeast of the island. The boundary of the SPA overlaps with the boundary of Rousay SSSI, and the seaward extension extends approximately 2 km into the marine environment. Rousay qualifies under Article 4.1 by regularly supporting a population of European importance of the Annex 1 species Arctic tern (Sterna paradisaea) (average of 790 pairs in the five year period between 1991 and 1995; 2% of the British population). Rousay SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. The site regularly supports about 30,000 seabirds including nationally important populations of Arctic tern (790 pairs, 2% of the British population), Arctic skua (Stercorarius parasiticus) (130 pairs; 4% of the British population), black-legged kittiwake (Rissa tridactyla) (4,900 pairs; 1% of the British population), common guillemot (Uria aalge) (10,600 individuals, 1% of the British population) and Northern fulmar (Fulmarus glacialis) (1,240 pairs, 0.2% of British population).
West Westray	✓		✓		West Westray SPA is an 8 km stretch of sea cliffs, together with adjacent grassland and heathland, along the west coast of the island of Westray in Orkney. The cliffs support large colonies of breeding auks and kittiwakes while the grassland and heathland areas support breeding colonies of skuas and terns. The boundary of the SPA overlaps with that of the West Westray SSSI, and the seaward extension extends approximately 2km. West Westray qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species: Arctic tern (Sterna paradisaea) (1,140 pairs; 3% of the British breeding population). The SPA also qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: common guillemot (Uria aalge) (42,150 individuals, 1.2% of the North Atlantic biogeographic population).

Site	SPA	SAC	SSSI	GCR	Reason for Designation
					The SPA further qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. West Westray regularly supports 113,000 seabirds including nationally important populations of the following species: razorbill (Alca torda) (1,946 individuals, 1% of the British population); black-legged kittiwake (Rissa tridactyla) (23,900 pairs, 5% of the British population); Arctic skua (Stercorarius parasiticus) (78 pairs; 2% of the British population) and Northern fulmar (Fulmarus glacialis) (1,400 pairs, 0.2% of the British population).
Marwick Head	✓				The Marwick Head Special Protection Area is a 2 km stretch of sea cliffs, and adjacent coastal waters, along the west coast of Orkney Mainland. The cliffs support large colonies of breeding seabirds. The boundary of the Special Protection Area overlaps the boundary of Marwick Head SSSI, and the seaward extension extends approximately 1 km into the marine environment. Marwick Head qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: common guillemot (Uria aalge) (37,700 individuals 1.1% of the western European biogeographic population). Marwick Head SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 75,000 seabirds including nationally important populations of the following species: black-legged kittiwake (Rissa tridactyla) (7,700 pairs, 2% of the GB population) and common guillemot (37,700 individuals, 4% of the GB population).
Orkney Mainland Moors	✓		✓		Orkney Mainland Moors SPA comprises four areas of moorland on Mainland, Orkney. The predominant habitats include extensive areas of blanket bog, acid grassland, wet and dry heath, acidic raised-mire and calcareous valley mire. Acid conditions predominate but botanically rich alkaline flushes occur. Sheltered valleys and dales support willow scrub, tall-herb and flush vegetation. There are several small oligotrophic lochs on the site.

Site	SPA	SAC	SSSI	GCR	Reason for Designation
					The boundaries of the SPA are coincident with those of West Mainland Moorlands SSSI (including the extension at Sleet Moss), Glims Moss & Durkadale SSSI, Orphir & Stenness Hills SSSI, and Keelylang & Swartabeck Burn SSSI. Orkney Mainland Moors SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species hen harrier (Circus cyaneus) (average of 28 breeding females, 5.9% of British population; average of 13 wintering individuals between 1994 and 1998, 2% of British population), red-throated diver (Gavia stellata) (average of 18 breeding pairs, 2% of British population), and short-eared owl (Asio flammeus) (average of 19 breeding pairs between 1993 and 1995, 2% of British population). The hen harrier population on this site is one of the largest and the densest in Britain. The short- eared owl is widely dispersed across its British distribution and Orkney Mainland Moors is one of the few sites to support significant numbers.
Loch of Isbister and the Loons		✓	✓		Heavily grazed heather of ornithological interest, fens and breeding bird assemblage including Pintail (*Anas acuta*). This is also an RSPB Reserve.
Stromness Heaths and Coasts		✓	✓	✓	14 km of the coastline of the west of Mainland Orkney is included in the Stromness Heaths and Coasts SSSI, SAC and Geological Conservation Review (GCR). The site is internationally and nationally important for examples of vegetated sea cliffs including maritime grasslands and dry dwarf-shrub heaths such as northern maritime and oceanic upland heath. The alkaline fens are also regarded as of international importance. The cliffs in the region (for which it is designated a GCR site) provide good examples of the Devonian Old Red Sandstone, fossilised remains and coastal erosion.

Table 5 Local conservation designations

7 HUMAN ACTIVITIES

7.1 Population and Development

7.1.1 Baseline Environment

The population of Orkney is dispersed throughout the county in numerous small settlements, small holdings and dwellings with infrequent larger population centres. Since 2002, the population of Orkney has been slowly increasing from a figure of 19,210 in 2002 to an estimated population of 19,973 in 2009 (OIC, 2010).

The CHWFL AfL area is located approximately 5 km northwest of Mainland Orkney, 15 km west of the island of Rousay, and 20 km southeast of the island of Westray. The islands of Westray and Rousay have populations of around 600 and 200 respectively. The western coasts of these islands are generally rugged with no significant settlements.

The north and west coasts of Mainland Orkney are generally sparsely populated where the export cables could come onshore. The largest centre of population is in Birsay at Palace.

Along the coasts of Westray, Rousay and the northwest of Mainland, Orkney Local Development Plan Policy C3 generally applies. Development in areas within coastal settlements (e.g. Palace) will generally be permitted subject to other Local Development Plan policies. Within the coastal zone (where there are no settlements) development will only be permitted where it can be demonstrated that a coastal location is essential to the development, it will not have a significant impact on the built or natural heritage or character of the coast and where public access to the coast will be protected or even enhanced.

7.1.2 Data Gaps

It is proposed that baseline conditions regarding population and development can be further defined to sufficient detail by completing the tasks outlined in the table below:

Data Requirement	Outline Survey or Data Collection Method (CHWFL)	Other Data Sources
Population numbers and distribution through settlements	Consultation with business organisations, OIC and HIE.	OIC and HIE statistics. Census data. Commissioned research into the economic impacts of marine renewable energy projects (Crown Estate).
Supply chain capability and capacity		
Employment sector and wages		

7.1.3 Potential Impacts

Possible impacts along with the potential significance of effects on population and development are considered in the table below:

Potential Impact	Phase			Comment / Justification	Scoped into EIA?
	C/I	O/M	D		
Local employment and business opportunities				There will be significant opportunities for local residents and business to become involved at various stages of the development.	Yes

7.1.4 Impact Assessment Strategy

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

Potential Impact	Assessment Method	Relevant Strategic Research
All impacts	Socio-economic impact assessment to determine how the development might impact on the communities in Orkney. This could include questionnaire surveys.	Appendix B – IDs 29-31

7.2 Commercial Fisheries

7.2.1 Baseline Environment

The Costa Head Wave Farm AfL area is part of ICES rectangle 47E6. Scottish sea fisheries statistics for 2010 show that the Costa Head area is targeted for demersal, pelagic and shellfish species (Table 6). Table 7 states the monthly effort in the ICES rectangle 47E6 including the value and tonnage of total species landed (Scottish Government, 2011c).

Species	Value (£)	Liveweight Quantity (tonnes)
Demersal	3,141,548	1,530.6
Pelagic	1,316,378	2,853.3
Shellfish	1,994,335	883.3
Total	6,452,261	5,249.1

Table 6 Monetary value and liveweight tonnage of species in ICES Rectangle 47E6 in 2010 (Scottish Government, 2011c)

Month	Value (£)	Quantity (tonnes)	Effort (days)
January	235,838	116.8	83.9
February	490,472	223.7	92.7
March	436,516	198.5	81.1
April	288,914	132.2	77.1
May	514,472	279.7	159.1
June	362,943	218.7	112.0
July	578,824	543.7	89.8
August	1,370,905	2,306.4	127.2
September	423,802	173.9	118.9
October	396,420	177.7	73.7
November	842,545	677.1	172.6
December	510,610	200.9	79.9

Table 7 Monthly monetary value, liveweight quantity and days of effort in 2010 (Scottish Government, 2011c)

Over fifty different species were landed from ICES rectangle 47E6, value and quantity of species landings over twenty tonnes are included in Table 8.

Species	Value (£)	Quantity (tonnes)
Cod *Gadus morhua*	491,955	241.8
Crabs (C.P.Mixed Sexes) *Cancer pagurus*	418,270	382.6
Crabs - Velvet (Swim) *Necora puber*	591,295	218.0
Green Crab *Carcinus maenas*	14,990	26.0
Gurnards – Red *Chelidonichthys cuculus*	12,967	21.0
Haddock *Melanogrammus aeglefinus*	430,108	360.4
Herring *Clupea harengus*	1,106,729	2,416.5
Horse Mackerel *Trachurus* spp	209,000	418.0
Ling *Molva molva*	33,161	24.9
Lobsters *Homarus gammarus*	310,845	30.5
Megrim *Lepidorhombus* spp	572,794	192.2
Monks or Anglers *Lophiidae*	1,229,919	363.2
Norway Lobster *Nephrops norvegicus*	141,709	39.1
Plaice *Pleuronectes platessa*	22,261	31.5
Saithe *Pollachius virens*	32,118	37.3
Scallops *Pecten maximus*	88,689	44.8
Squid *Loligo* spp	413,427	136.3
Whiting *Merlangius merlangus*	176,131	150.0
Witch *Glyptocephalus cynoglossus*	32,771	25.6

Table 8 Main species (> 20 tonnes) landed in ICES rectangle 47E6 in 2010 (Scottish Government, 2011c)

Based on Vessel Monitoring Data (VMS) data gathered by the Scottish Directorate on fishing activity between 01/01/2006- 31/12/2008, there is little evidence of fishing activity by boats greater than 15 m within the AfL area; it is instead concentrated further offshore from the

proposed development area. It is acknowledged that this data does not account for smaller creeling vessels which are generally greater than 15 m in length and not required to carry AIS.

Creeling occurs in the coastal waters all around Orkney. This fishing method involves placing long lines of creels (pots) on the seabed with a buoyed clump weight at each end. Lines may consist of up to 50 creels on a line of over 1,000 m in length. The line is normally laid parallel to land, relatively close to the shoreline in waters up to 30 m in depth, though creeling in greater depths does occur. Creels are normally recovered, checked and re-laid daily. Creel fishermen use boats of less than 15 m for creeling operations. Although the exact locations of creeling in Orkney is not formally documented Birsay Bay and the waters off Costa Head are both known locally and through site visits to be used by creel fishermen and provide predominantly a catch of crab and lobster.

7.2.2 Data Gaps

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

Data Requirement	Outline Survey or Data Collection Method (CHWFL)	Other Data Sources
Establish the level and types of fishing that exist in the proposed development area and along potential cable corridors	Consultation with OFA and local fishermen to determine the use of the development area. Liaise with lobster hatchery and local experts in shellfish behaviour with regards to artificial habitats.	Marine Scotland inshore fisheries and tagging Study. OIC Marine Services. Fisheries statistics.
Establish any fishing 'hot spots' and the use patterns of these areas within the development area		
Number and type of fishing vessels that use transit the development area to reach other fishing grounds		

7.2.3 Potential Impacts

Possible impacts along with the potential significance of effects on commercial fisheries are considered in the table below:

Potential Impact	Phase			Comment / Justification	Scoped into EIA?
	C/I	O/M	D		
Loss of access to fishing grounds				The wider area is regularly used by commercial and recreational fishermen.	Yes
Navigational risk to commercial fisheries due to development activity and presence of infrastructure				Parts of the AfL area and the surrounding area are used as transit routes for fishing vessels to/from fishing grounds.	Yes
Damage caused to fishing gear due to physical presence of development				There is a risk of fishing gear snagging due to the physical presence of the converters and associated offshore infrastructure.	Yes
Change in abundance of targeted species				The deployment of converters in the AfL area may provide shelter and nursery areas for different commercial fish species.	Yes

7.2.4 Impact Assessment Strategy

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

Potential Impact	Assessment Method	Relevant Strategic Research
All impacts	Commercial fisheries impact assessment - desk-based study and consultation with local fishermen to determine what the implications of any disruption to fishing activity might be and how this may be mitigated. Navigational Risk Assessment.	Appendix B – IDs 29-31, 17, 18 & 19

7.3 Shipping and Navigation

7.3.1 Baseline Environment

The Preliminary Hazard Analysis (PHA) (available at Appendix E) has summarised Automatic Identification System (AIS) data from two 28 day periods in summer and winter 2010. The vessels recorded included a mixture of fishing vessels, tugs, passenger vessels, cargo ships and 'other ships'.

Based on fishing vessel satellite tracking (VMS data) UK vessels of over 15 m in length represent around three quarters of the vessel activity. During the period 2008 to 2010 the vast majority of these vessels seen near to the development area were recorded to the west of the AfL area itself and were generally on passage (at speeds greater than 5 knots).

In addition to commercial traffic picked up by AIS and VMS it is known that the AfL and export cable route areas will be used by local and recreational fishermen and other recreational vessels such as cruising yachts. Further detail and analysis of the baseline is contained within the PHA at Appendix E.

7.3.2 Data Gaps

It is proposed that baseline conditions regarding shipping and navigation can be further defined to sufficient detail by completing the tasks outlined in the table below:

Data Requirement	Outline Survey or Data Collection Method (CHWFL)	Other Data Sources
Commercial vessel traffic in the development area Recreational vessel traffic in the development area	Collection of maritime traffic survey data of appropriate duration, including seasonal and tidal variations to record all vessel movements in and around the project site and its vicinity. Consultation with local skippers, fishermen and other key organisations including cruise liner service promoters and captains.	Automatic Instrument Systems (AIS) and VMS. Maritime and Coastguard Agency. Chamber of Shipping. Royal Yachting Association. Royal National Lifeboat Institute. OIC Marine Services. Fisheries statistics.

7.3.3 Potential Impacts

Possible impacts along with the potential significance of effects on shipping and navigation are considered in the table below:

Potential Impact	Phase			Comment / Justification	Scoped into EIA (addressed in NRA)?
	C/I	O/M	D		
Collision risk with work vessels and converters				The work vessel(s) and converters could pose a surface collision risk and an obstruction to navigation for all vessels, irrespective of their draught.	Yes
Vessel traffic re-routing due to presence of work vessels and associated safety zones				There is the potential for work vessels and their associated safety zones to restrict the sea room available to vessels transiting to or from the Westray Firth.	Yes
Working vessel getting into difficulty				There is a risk a working vessel gets into difficulty due to adverse conditions, e.g. strong tides and heavy seas, either when working in the Project Area of heading to and from the site.	Yes
Loss of station				If part of a device loses station it could pose a risk to other vessels navigating in the area.	Yes
Anchor interaction				There is a risk of anchor interaction with moorings and other subsea infrastructure.	Yes

7.3.4 Impact Assessment Strategy

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

Potential Impact	Assessment Method	Relevant Strategic Research
All impacts on shipping and navigation	Full Navigational Risk Assessment.	Appendix B – IDs 18 & 19

7.4 Ports and Harbours

7.4.1 Baseline Environment

The nearest ports to the proposed development area are at Stromness located approximately 20 km south, and Kirkwall located approximately 30 km to the south east. There are two harbour areas at Kirkwall; Hatston and Kirkwall.

Hatston Pier has several large berth areas and is used by the Northlink Ferry Services for their route between Aberdeen, Orkney and Shetland. The pier is also extensively utilised by marine renewable energy developers testing at the EMEC tidal test site. This activity has the potential to increase in the near future.

Kirkwall Pier is used mostly by inter-island ferries, fishing vessels, merchant vessels, recreational craft and shallow draft cruise liners. The slipway and piers are important bases for many of these vessels and the harbour area and approaches are always busy. There is also a marina located within Kirkwall harbour which has 95 berths for vessels up to 20 m. During summer months the marina is particularly busy, but recreational craft present all year round.

Improvements to Stromness port facilities have been approved to upgrade its facilities to support small vessels. Stromness port is currently used by the Stromness to Scrabster ro-ro passenger ferry, the MV Hamnavoe, OIC inter island ferry to Graemsay and North Hoy, some small work vessels and numerous dive boats. The port is used on a daily basis throughout the year. In addition its marina, although smaller than the one in Kirkwall, is popular with visiting recreational craft throughout the summer.

Other port facilities around Orkney which are being extended specifically to support the marine renewables industry are those at Lyness (accessed through Scapa Flow).

7.4.2 Data Gaps

It is proposed that baseline conditions regarding ports and harbours can be further defined to sufficient detail by completing the tasks outlined in the table below:

Data Requirement	Outline Survey or Data Collection Method (CHWFL)	Other Data Sources
Port use patterns and available facilities	Consultation with OIC Marine Services.	Orkney Ports Handbook.

7.4.3 Potential Impacts

Possible impacts along with the potential significance of effect on ports and harbours are considered in the table below:

Potential Impact	Phase			Comment / Justification	Scoped into EIA (addressed in NRA)?
	C/I	O/M	D		
Increase in vessel movements at harbour facilities and in Scapa Flow				An increase in activity due to this development and other renewable energy projects in Orkney will result in increased vessel movements at harbour facilities and in and around Scapa Flow.	Yes

7.4.4 Impact Assessment Strategy

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

Potential Impact	Assessment Method	Relevant Strategic Research
Increase in capacity and vessel movements at harbour facilities and in Scapa Flow	Navigational Risk Assessment	Appendix B – 18 & 19

7.5 Tourism and Recreation

7.5.1 Marine

Tourism is an important industry in Orkney. There are a number of tourist and recreational marine activities which take place on the islands including diving, surfing, fishing, cruise liner visits, sailing and kayaking.

Diving is a popular activity in Orkney with many wrecks to visit around the coastlines. There are also many species of marine flora and fauna that can be observed in the waters. Diving in Orkney is mostly focussed around Scapa Flow to the south of the mainland (Good Dive, 2012).

With regards to surfing, Marwick Bay is frequently visited by local surfers and Birsay Bay and Costa Head are visited albeit infrequently (Orkney Surf Club, 2010 *pers. comm*).

Sailing is also a popular activity in Orkney but there are no marinas or piers in the immediate vicinity of the proposed development area. However, during passage from the west coast of Scotland or between the outer islands of Orkney and between Stromness and Kirkwall some recreational yachts and cruisers are likely to transit near to the AfL area and through the proposed export cable corridor(s).

7.5.2 Coastal

There are a vast number of places to visit in Orkney which attract thousands of visitors to the islands every year. The 'Heart of Neolithic Orkney' World Heritage Site (WHS) in the west of Mainland Orkney captures several archaeological sites including Skara Brae, Maeshowe and the Ring of Brodgar. The boundary of the sensitive area follows the coast of a large area of the west mainland including the coastal area of the proposed development (Historic Scotland, 2008). The sensitive area indicates an area where policies' relating to the potential effects on the Orkney WHS and setting should be taken into account. Many tourists also visit the northwest of Mainland Orkney to visit historic sites such as the Brough of Birsay and the coastal areas for walking and other recreational activities.

The coastal area of the proposed development is very popular with walkers; the west coast walk reaches from Northside to Stromness, the section from Northside to Buckaquoy Point in Birsay is a very popular short walk at all times of year.

Bird watching is a popular past time due to the large seabird colonies attracted to the area by prime nesting sites along the cliffs and adjacent heaths (Land Use Consultants, 1998).

7.5.3 Data Gaps

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

Data Requirement	Outline Survey or Data Collection Method (CHWFL)	Other Data Sources
Establish recreation and level of use in and around the development area	Consultation with stakeholders: SNH OIC Orkney Sailing Club Stromness Sailing Club Royal Yachting Association Orkney Marinas Kirkwall Kayak Club Orkney Surf Club Orkney Tourism Association Landowners Orkney Field Club Visit Scotland Community Councils Orkney Archaeological Trust Historic Scotland	Tourist guides and websites. Recreational organisation websites.

7.5.4 Potential Impacts

Possible impacts along with the potential significance of effect on tourism and recreation are considered in the table below:

Potential Impact	Phase			Comment / Justification	Scoped into EIA?
	C/I	O/M	D		
Impact on residents and visitors				There may be increased pressure on services such as accommodation.	Yes
Increased tourism				There is the potential that a development of this scale may contribute to the marine renewable energy industry in Orkney.	Yes
Impact on marine recreational activities				The physical presence of the converters and associated infrastructure may provide a navigational risk and create an exclusion zone that could affect marine recreational activities.	Yes

Potential Impact	Phase			Comment / Justification	Scoped into EIA?
	C/I	O/M	D		
Noise impacts				There may be an increase in noise in the coastal environment during cable landfall installation. However, due to the temporary nature of installation or decommissioning activities the potential noise impacts are not thought to be significant.	No
Landscape/seascape and visual impact				The presence of the converters and development infrastructure both onshore and offshore may reduce the visual amenity of the area.	Yes
Direct and indirect impacts on recreational activity				Change in wave and current regimes due to the presence of converters could permanently affect wave propagation towards the shore, potentially impacting on local surf spots. Direct impacts caused due to the presence of the converters could affect activities such as sailing, kayaking and diving.	Yes

7.5.5 Impact Assessment Strategy

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

Potential Impact	Assessment Method	Relevant Strategic Research
All impacts	Desk based impact assessment to determine how the development might impact on tourists and recreational users. Seascape, landscape and visual impact assessment.	Marine Scotland study to determine the spatial extent and economic activity of relevant tourism activities.

7.6 Archaeology and Cultural Heritage

7.6.1 Baseline Environment

Consideration of the setting of historic sites needs to be given for the proposed development. The Brough of Birsay may be given particular attention as it is at a popular tourist attraction at a relatively high level and has unobstructed views of the area of the proposed development.

A World Heritage Site (WHS) is classified by the UNESCO World Heritage Committee under the international World Heritage Programme. Sites are conserved for their outstanding natural or cultural importance to the common heritage of humanity. A World Heritage Site Sensitive Area is one in which development is allowed but in line with policies which take into consideration the effect of development on the World Heritage Site. The Heart of Neolithic Orkney WHS is approximately 15 km from the development site and consists of a group of Neolithic monuments comprising of a large chambered cairn (Mae's Howe), two ceremonial stone circles (the Stones of Stenness and the Ring of Brodgar) and a settlement (Skara Brae), along with a number of unexcavated sites. Figure 7.1 shows archaeological and cultural designations within the vicinity of Costa Head.

7.6.2 Marine Archaeology

There are no designated wrecks in the vicinity of the proposed development (Historic Scotland, 2010).

However, there are two wrecks northwest of Marwick head located at around 2.7 km offshore. The HMS Hampshire (classified as non-dangerous) is situated at 59 07.065 N, 03 23.843 W in 68 m of water and is always fully submerged. HMS Hampshire is a war grave and is protected under the Protection of Military Remains Act (PMRA) 1986 and there is a 300 m exclusion surrounding the wreck (PMRA, 1986). The other wreck (un-named) is classed as dangerous (reason as yet unknown) and is also in equally deep water. However, these are much further south of the proposed development area and further west of the potential export cable route corridor.

Orkney has much submerged marine archaeology and is one of the few places in Scotland where such submerged landscapes exist. These landscapes are under increasing threat from offshore developments (Dawson and Wickham Jones, 2007) and as such will need to be a consideration during the EIA.

7.6.3 Coastal Archaeology

The Brough of Birsay, which contains the remains of a complex of Pictish, Norse and later settlement and a Scheduled Ancient Monument (SAM), is within the proposed development

area. The remains of the Earl's Palace, Birsay, is also in the proposed development area. Earl's Palace is also a Scheduled Ancient Monument. There are also several other SAMs and listed buildings in the proposed development area (PASTMAP, 2012).

Skara Brae is approximately 15 km from the proposed development; it is a historic preserved site and a Scheduled Ancient Monument. The surviving extent is vulnerable to coastal erosion (Historic Scotland, 2008) and forms part of the Orkney World Heritage Site (WHS).

There are numerous Scheduled Ancient Monument along the coastal area of the proposed development including the Brough of Birsay settlement, Verron Broch at Costa Head and Quoynalonga and Quandale mounds on Rousay (PASTMAP, 2012).

7.6.4 Data Gaps

It is proposed that baseline conditions regarding archaeology and cultural heritage can be further defined to sufficient detail by completing the tasks outlined in the table below:

Data Requirement	Outline Survey or Data Collection Method (CHWFL)	Other Data Sources
Features of archaeology or cultural heritage importance in the offshore development area	Geophysical survey with magnetometer and sub-bottom profiling data at a resolution suitable for the identification of features of archaeology or cultural heritage importance. Cable landfall walkover survey.	SNH. County Archaeologist. Historic Scotland. Orkney Research Centre for Archaeology. Sites and Monuments Records.

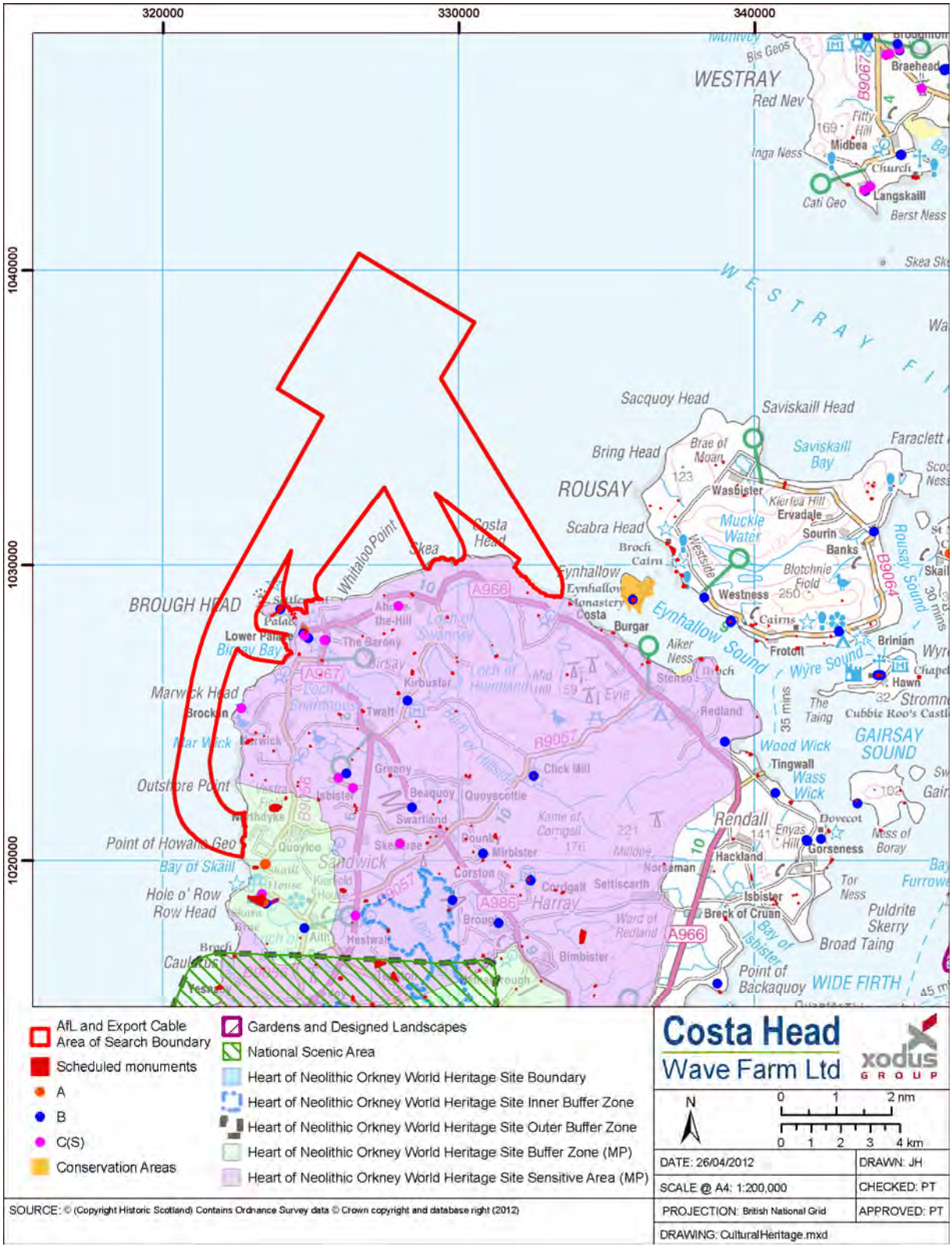

Figure 7.1 Cultural Heritage within the vicinity of Costa Head

7.6.5 Potential Impacts

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

Potential Impact	Phase			Comment / Justification	Scoped into EIA?
	C/I	O/M	D		
Damage to archaeological interests				Potential known and unknown features may be disturbed and damaged.	Yes
Indirect effects on marine archaeology				Changes in hydrological and sediment regime may impact upon known and unknown features.	Yes
Impacts on setting of cultural heritage sites				The visual setting of Scheduled monuments, World Heritage site and historic landscape character may be altered due to the presence of visible offshore infrastructure.	Yes

7.6.6 Impact Assessment Strategy

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

Potential Impact	Assessment Method	Relevant Strategic Research
Damage to archaeological interests	Archaeology and cultural heritage impact assessment using relevant guidance e.g. Institute of Field Archaeologists (2008) and input from a review of the geotechnical survey data and cable landfall walkover survey.	-
Impacts on setting of cultural heritage sites during construction		
Indirect effects on marine archaeology		

7.7 Landscape and Seascape

7.7.1 Baseline Environment

The submergence of the land, coupled with the frequent strong winds and the erosive force of the sea in the area, has been responsible for rapid marine erosion along the exposed coasts with their cliffs, geos, gloups, natural arches and stacks (Land Use Consultants, 1998), which are essential contributors to the identity and perception of Orkney.

The sea is important to the physical and cultural landscapes of Orkney and the meeting of land and sea at the coast and the associated features are key elements in the landscape. Along the western coast, the land meets the sea in a cliff rampart that has been shaped by the action of Atlantic waves. The arches, stacks, geos and gloups are renowned features and essential contributors to Orkneys identity and perception. The lower lying coastal features such as tilted flags, sand dunes and sandy bays are appreciated for recreation and general accessibility (Land Use Consultants, 1998).

The Brough of Birsay is approximately 6.6 km from the proposed development. It is an uninhabited tidal island accessible only at low tide. It is home to the remains of Pictish and Norse settlements. A functional lighthouse is also present on the Brough. These features are all well recognised landmarks in this area (Land Use Consultants, 1998 and Historic Scotland, 2012).

Hills in the proposed development area are generally vegetated by moorland. The dominant land use in much of the west Mainland Orkney is agriculture as such the landscape is noticeably open due to the lack of trees (DECC, 2009).

National Scenic Areas (NSA) are Scotland's only national landscape designation. They are those areas of land considered of national significance on the basis of their outstanding scenic interest which must be conserved as part of the country's natural heritage. They have been selected for their characteristic features of scenery comprising a mixture of richly diverse landscapes including prominent landforms, coastline, sea and freshwater lochs, rivers, woodlands and moorlands. The closest of these to the development is the Hoy and West Mainland NSA, approximately 30 km to the south, covering an area of 14,800 ha. Figure 7.1 shows the presence of the NSA in relation to the Costa Head area. This area has been designated for several reasons including:

- The geology, topography, archaeology and land use;
- The archaeological landscape of World Heritage Status;
- The coastal scenery;

- Sandstone and flagstone as an essence of Orkney;
- A long-settled and productive land and sea;
- The contrast between the fertile farmland and the unimproved moorland;
- A landscape of contrasting curves and lines;
- Land and water in constantly changing combinations under the open sky;
- The high hills of Hoy;
- The townscape of Stromness, its setting and its link with the sea; and,
- The traditional buildings and crofting patterns of Rackwick.

7.7.2 Data Gaps

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

Data Requirement	Outline Survey or Data Collection Method (CHWFL)	Other Data Sources
Landscape and seascape character around the development area and potential landfall areas	SLVIA (field survey) as set out Landscape Institute and the Institute of Environmental Management and Assessment (2002) guidelines. Consultation with Local Authority / stakeholders to identify sensitive viewpoints, including areas of tourism and dwellings.	Landscape, Seascape and Island Character Studies (SNH & Local Authority). Development Plan (OIC, 2011) Consultation outputs. Relevant guidance such as SNH guidance: Marine Aquaculture and the Landscape and Visual Representation of Windfarms (December 2007). Landscape Institute and IEMA guidelines (Wilson, 2007).

7.7.3 Potential Impacts

Possible impacts along with the potential significance of effects on landscape and seascape are considered in the table below:

Potential Impact	Phase			Comment / Justification	Scoped into EIA?
	C/I	O/M	D		
Presence of vessels in development area				Infrastructure on the sea in the development area may have an impact on the seascape and visual amenity from local viewpoints and other users of the marine area.	Yes
Presence of converters					Yes
Presence of marker buoys/lighting, including cable marker					Yes

7.7.4 Impact Assessment Strategy

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

Potential Impact	Assessment Method	Relevant Strategic Research
Presence of vessels in development area	Seascape, landscape and visual impact assessment study including production of zones of theoretical visibility and photomontages of the development to aid understanding of how the development might look once installed.	Appendix B – IDs 28
Presence of converters		
Presence of marker buoys/lighting		

7.8 Other Sea Users

7.8.1 Baseline Characteristics

7.8.1.1 Marine Aggregates

There are no known marine aggregate extraction sites in Orkney and this is a situation which is unlikely to change in the short to medium term future (British Marine Aggregates Producers Association, pers comm., 2010).

7.8.1.2 Submarine Cables and Pipelines

There are no known submarine cables or pipelines in the vicinity of the development (Kingfisher, 2012).

7.8.1.3 Offshore Oil and Gas Activity

There are no licensed blocks in the vicinity of the proposed development.

7.8.1.4 Offshore Renewable Energy

There are currently no other offshore renewable energy developments in the vicinity of the proposed development. However following the Crown Estate leasing round for marine renewables in the Pentland Firth and Orkney waters it is likely that this situation will change. The Brough Head Wave Farm Ltd AfL is the closest to CHWFL AfL. This site an extended area of the coast from approximately the Bight of Mousland to Costa Head, and its closest proximity to the proposed development it is approximately 3.5 km away. A number of other AfLs have been awarded in waters to the west and north of Mainland Orkney and will potentially result in the establishment of marine energy projects over the coming years. Consideration needs to be given to the possible cumulative impacts which may arise due to these developments.

7.8.1.5 Marine Waste Disposal

There are no marine waste disposal sites in the vicinity of the proposed development or planned for the future.

7.8.1.6 Military Use

There are no Naval surface Practice and Exercise Areas (PEXA) or other military danger areas which could be affected by the site (Faber Maunsell and Metoc, 2007). To ensure that no changes in baseline conditions have occurred it is proposed that the MoD continues to be consulted during the EIA process.

7.8.2 Potential Impacts

Possible impacts along with the potential significance of effect on offshore renewable energy developments are considered in the table below:

Potential Impact	Phase			Comment / Justification	Scoped into EIA?
	C/I	O/M	D		
Reduced resource potential due to effects on hydrodynamic regime				Prevailing wave direction not obstructed by other developments.	No

	Phase				
Impact on activities of other users of the sea				Limited other user activity identified other than those already discussed in sections 7.1 to 7.7.	No

No potentially significant impacts have been identified therefore the potential impacts on other sea users have been scoped out of the EIA.

Q6. Do the studies proposed for characterisation and assessment of effects on the human environment look appropriate and complete?

Q7. Are there any sources of key environmental information not identified which should be consulted to inform the EIA?

8 CUMULATIVE AND IN-COMBINATION IMPACTS

The EIA Regulations require that potential cumulative and in-combination effects are taken in to account in the development EIA. The EIA will consider how the proposed development at Costa Head may interact with other ongoing and planned projects and activities. It is recognised that there is the potential for cumulative effects to arise from development, maintenance and operation of the development, adding to existing activities such as fishing and tourism.

Inevitably the assessment of these 'future projects' is dependent upon the level of information available on those projects at the time of undertaking the cumulative assessment. Due to the fact it is expected different levels of detail will be available for different projects, the cumulative impact assessment is proposed to be undertaken qualitatively. Sufficient data is unlikely to be available in the public domain to allow a fully quantified cumulative impact assessment.

Table 9 provides a list of the projects CHWFL proposes to consider from a cumulative and in-combination impact assessment perspective. The location of these projects is shown in Figure 8.1.

Q8. Are you aware of any other proposed developments within the marine licence application process or activities with which the proposed offshore wave development might interact to result in cumulative effects?

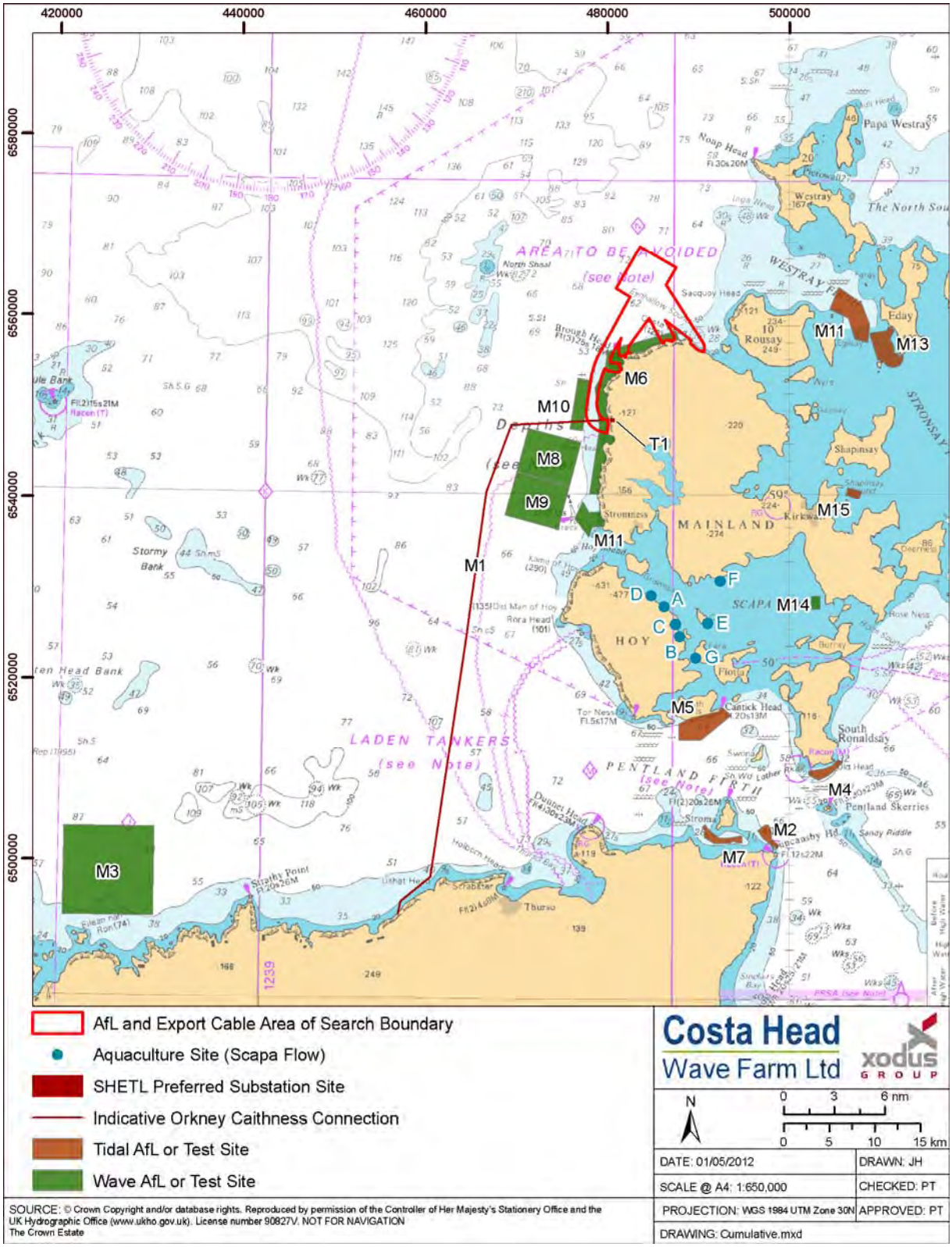

Figure 8.1 Projects identified for cumulative impact assessment

Map ref	Project name	Project developer	High level description of project	Project Status (as at March 2012)	
Onshore projects					
T1	West Coast of Orkney HVDC Connection Converter station	Scottish and Southern Energy Transmission Ltd (SHETL)	600MW converter station and associated substation	Post-scoping	Intended to be operational by 2015/16; construction commencing Q3 2012.
Offshore projects					
M1	West Coast of Orkney 132 kV and HVDC Connection Cable	Scottish and Southern Energy Transmission Ltd (SHETL)	132 kV connection to Caithness (Phase 1), HVDC connection to Peterhead (Phase 2)	Post-scoping	Intended to be operational by 2015/16; construction commencing Q3 2012.
M2	Ness of Duncansby Tidal Energy Project	ScottishPower Renewables UK Limited	95 MW tidal energy development and associated onshore infrastructure	Scoping	EIA scoping opinion request submitted; no information available on when construction will commence
M3	Farr Point Wave Energy Project	Pelamis Wave Power	50 MW wave energy development and associated onshore infrastructure	Scoping	EIA scoping opinion request submitted; Phase 1 (15 MW) expected deployment date of summer 2014; 50 MW expected to be deployed by 2020
M4	Brough Ness	Sea Generation (Brough Ness) Limited	100 MW tidal energy development and associated onshore infrastructure	Pre-scoping	No information available on when construction will commence

Map ref	Project name	Project developer	High level description of project	Project Status (as at March 2012)	
M5	Cantick Head Tidal Energy Project	Cantick Head Tidal Development Limited	200 MW tidal energy development and associated onshore infrastructure	Pre-scoping	EIA scoping report in early stages of preparation; the majority of construction work is not anticipated to commence until after 2015[1]
M6	Brough Head Wave Energy Project	Brough Head Wave Farm Limited	200 MW wave energy development and associated onshore infrastructure	Post-scoping	EIA scoping report in preparation; construction of the initial phase to commence in 2015. Phase 1 application to be submitted in 2012
M7	Meygen Tidal Energy Project	Meygen	Phase 1 – 86 MW tidal turbine array	Post-scoping	EIA Scoping Report Opinion received October 2011
M8	West Orkney North Wave Energy Project	EON Climate & Renewables UK Developments Limited	50 MW wave energy development and associated onshore infrastructure	Pre-scoping	EIA scoping report in early stages of preparation; no information available on when construction will commence
M9	West Orkney South Wave Energy Project	EON Climate & Renewables UK Developments Limited	50 MW wave energy development and associated onshore infrastructure	Pre-scoping	EIA scoping report in early stages of preparation; no information available on when construction will commence
M10	Marwick Head Wave Energy Project	ScottishPower Renewables UK Limited	50 MW wave energy development and associated onshore infrastructure	Scoping	EIA scoping opinion request submitted; no information available on when construction will commence

[1] It is noted that the location of the Cantick Head Tidal Energy project may be relocated further west.

Map ref	Project name	Project developer	High level description of project	Project Status (as at March 2012)	
M11	Westray South Tidal Energy Project	SSE Renewables Developments (UK) Limited	200 MW tidal energy development and associated onshore infrastructure	Post-scoping	EIA Scoping Opinion received; Construction not scheduled to commence before 2015.
M12	Wave Energy test site (Billia Croo, Orkney)	EMEC	Wave energy device test berths with subsea cable connection to an onshore substation	Operational	Operational
M13	Tidal energy test site (Fall of Warness, Orkney)	EMEC	Tidal energy device test berths with subsea cable connection to an onshore substation	Operational	Operational
M14	Intermediate wave energy test site (St Mary's Bay, Orkney)	EMEC	Intermediate wave energy test site providing more gentle conditions for testing than the main wave test site	Operational	The majority of mooring points in position; EMEC awaiting final marine license prior to the first deployments
M15	Intermediate tidal energy test site (Head of Holland, Orkney)	EMEC	Intermediate tidal energy test site providing more gentle conditions for testing than the main tidal test site	Operational	The majority of mooring points in position; EMEC awaiting final marine license prior to the first deployments

Map ref	Project name	Project developer	High level description of project	Project Status (as at March 2012)	
Aquaculture projects					
A	Chalmers Hope salmon cage site	Northern Isles Salmon	Salmon farm	Operational	Operational
B	Pegal Bay	Northern Isles Salmon	Salmon farm	Operational	Operational
C	Lyrawa	Northern Isles Salmon	Salmon farm	Operational	Operational
D	Bring Head	Scottish Sea Farms	Salmon farm	Operational	Operational
E	Cava South	Northern Isles Salmon	Salmon farm	Consented	Planning granted
F	Toyness	Scottish Sea Farms	Salmon farm	Operational	Operational
G	West Fara	Northern Isles Salmon	Salmon farm	Operational	Operational

Table 9 Details of projects considered in cumulative impact assessment

9 STAKEHOLDER ENGAGEMENT

9.1 Approach to Stakeholder Engagement

CHWFL is committed to best environmental practice throughout the entire project lifecycle and this overarching strategy will be maintained as a 'Stakeholder Engagement Plan' and 'Stakeholder Database' (both of which will be live documents) during the project by the Project Manager to incorporate any shift in strategy, amendments to stakeholder roles or contacts etc.

This section describes how external communication and consultation will be managed and co-ordinated as part of the EIA and NRA processes.

Stakeholder engagement is important in the EIA and NRA processes to ensure that as many organisations as possible are made aware of the proposals and have an opportunity to provide feedback and relevant data/information. The purpose of communication and consultation with external organisations is to ensure appropriate and timely engagement is made with the relevant groups, organisations and individuals in order that the necessary processes (e.g. licensing/consenting) are undertaken to a satisfactory outcome; but also to help identify any potential conflicts and opportunities and establish the preferred options that present the lowest risk and most benefit for all concerned.

9.2 Pre-scoping Consultation

Initially, during the PFOW licensing round CHWFL met with local stakeholders. Following this and in advance of preparation of this Scoping Report, CHWFL and its appointed consultants have also met with a number of individuals and organisations. These meetings were set up following distribution of a Project Briefing Document (PBD) which outlined the proposed development and provided opportunity for early feedback.

Appendix C details all the stakeholders that have been identified for the project and the stakeholder group that they are included in, who was sent the PBD and who has indicated a wish not to be consulted further on this project.

The following organisations have met with CHWFL to date, and where appropriate results of discussions have been taken into consideration during scoping:

- Birsay Community Council;
- Cruising Association;
- Department for Transport;
- Marine Scotland (LOT and Compliance);

- Maritime and Coastguard Agency;
- Northern Lighthouse Board;
- OIC Marine Services;
- OIC Planning;
- Orkney Dive Boat Operators Association;
- Orkney Fisheries Association;
- Orkney Fishermen's Society;
- RNLI;
- RYA Scotland; and,
- SNH.

9.3 Stakeholder Identification

It is essential that stakeholders are defined at an early stage of the process in order to facilitate communication and consultation in a way that meets the needs of the development, and the stakeholders. There are two groups of stakeholders which have been identified:

- Regulator Group – includes organisations and individuals that have a legal remit in the issuing of consents, licenses and approvals for the development, and;
- Stakeholder Group – includes organisations that have an interest in the development due to the nature and remit of their objectives and/or activities, and/or geographical location.

9.4 Communication and Engagement Strategy

The following sections outline the current development strategy for ongoing engagement with stakeholders. As the EIA progresses this strategy will be updated as appropriate.

9.4.1 Regulator Group

The Regulator Group consists of the regulating authority Marine Scotland, statutory consultees and selected non-statutory consultees including the following:

- Marine Scotland – Licensing Operations Team (MS-LOT);
- Scottish Environment Protection Agency (SEPA);
- Scottish Natural Heritage (SNH);
- Northern Lighthouse Board (NLB);
- Maritime and Coastguard Agency (MCA);

- Marine Scotland Science (MS-Science);
- Marine Scotland Compliance (MS-Compliance);
- Department of Energy and Climate change (DECC);
- Orkney Islands Council Planning Department (OIC-Planning; and,
- The Crown Estate.

The Regulator Group largely consists of those identified by MS-LOT as key consultees.

To this end the project proposes a strategy which is underpinned by open and frequent discussion and the transfer and sharing of information. The proposed strategy for engaging the Regulator Group is to continue meeting with Marine Scotland on a regular basis providing there is suitable progress in the project worthy of discussion. Where specific issues need to be addressed with the Regulator Group, these meetings will be organised as required. Where several issues may be addressed in one meeting this will be the preference over a number of smaller meetings. CHWFL appreciates the time pressures on organisations and will work to ensure an efficient and acceptable approach to ongoing engagement.

9.4.2 Stakeholder Group

The Stakeholder Group includes organisations with an interest in the development but who are not identified within the Regulator Group. The main objective of engaging the Stakeholder Group, aside from meeting the requirements under the EIA Directive and EIA Regulations regarding consultation, is to ensure that as many organisations as possible are made aware of the development and have an opportunity to provide feedback and relevant data/information. Stakeholder engagement aims to address any concerns and to maximise any potential opportunities that arise throughout the EIA and NRA processes.

Members of the Stakeholder Group would include:

- Non-Statutory Consultees (as identified in the Consultation on Marine Licensing for Scotland under the Marine (Scotland) Act 2010);
- Organisations that have an interest in the development due to the nature and remit of their group objectives and/or activities and also their location; and,
- Local organisations, groups and businesses in the vicinity of the development.

Different members of the Stakeholder Group will be engaged as specific technical issues dictate.

9.5 Public Consultation

The purpose of public consultation is to ensure that the wider community is aware of the proposals and are confident that the project has followed the correct procedures (e.g. EIA, NRA) and have an opportunity to contribute. Public consultation will be undertaken at key stages within the EIA process and meet the requirements of the legislation. This is likely to be in the form of public notices and information sessions although as the development progresses it may be appropriate to consider alternative means of broader public consultation.

Q9. Does the proposed list of consultees outlined in Appendix D reflect the range of stakeholders that should be consulted with for this development?

10 SUMMARY AND CONCLUSIONS

10.1 Introduction

CHWFL proposes to install AWS-III wave energy converters within the area covered by the AfL with an initial installation of 10 MW and subsequent deployment of up to 200 MW. This Scoping Report relates to this initial phase of 10 MW and future phases up to 200 MW. This is dependent on technical, safety, socio-economic and environmental constraints.

This Scoping Report and subsequent Scoping Opinion are seen as an important input into development design and refinement.

10.2 Consultation

CHWFL recognises the benefit to all parties from wide-ranging consultation at all stages of this project. Early consultations have been initiated with key stakeholders and this Scoping Report acts as an important part of this process.

CHWFL intends to develop the consultation process in order to maintain an effective consultation strategy with all stakeholders, both statutory and non-statutory, for the life of the development.

10.3 Environmental Impact Assessment

The Scoping Opinion and ongoing consultation will be used by CHWFL to formulate the scope of the EIA and its necessary surveys and studies.

Best practices will be adopted by CHWFL for the development through an ongoing review of approaches to impact assessments of offshore wave energy arrays.

CHWFL has held preliminary discussions with a number of consultees regarding methods of impact assessment for some of the key issues. This process will be extended further as a result of this Scoping Report.

These preliminary consultations have identified likely key issues resulting from the installation, operation, maintenance and decommissioning of the proposed wave array. These, and others, will be investigated further in the EIA and described in the ES.

10.4 Mitigation and Monitoring Techniques

CHWFL understands the importance of identifying practical and appropriate monitoring and mitigation measures during the EIA process. It is anticipated that these will also be highlighted during the ongoing consultation process as the previous experience of the developers and consultees is utilised.

The wave energy development will be subject to an appropriate environmental mitigation and monitoring plan (EMMP). This EEMP will be informed through the stakeholder consultation process and by the results of the test installations of the wave energy converter.

10.5 Scoping Questions

The complete list of scoping questions which have been presented in this Scoping Report are detailed below. This will aid stakeholders in providing helpful feedback and comment.

Q1. Have all the regulatory requirements that should be taken into account for the offshore aspects of the development been identified?

Q2. Do the studies proposed for characterisation and assessment of effects on the physical environment look appropriate and complete?

Q4. Do the studies proposed for characterisation and assessment of effects on the biological environment look appropriate and complete?

Q6. Do the studies proposed for characterisation and assessment of effects on the human environment look appropriate and complete?

Q3, Q5, Q7. Are there any sources of key environmental information not identified which should be consulted to inform the EIA?

Q8. Are you aware of any proposed developments within the marine licence application process or activities with which the proposed offshore wave development might interact to result in cumulative effects?

Q9. Does the proposed list of consultees outlined in Appendix C reflect the range of stakeholders that should be consulted with for this development?

Q10. At what stage would Marine Scotland / SNH recommend the submission of a formal HRA Screening report?

Q11. Does the approach to HRA screening for SPAs and SACs seem appropriate and complete?

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APPENDIX A CONTENT OF ENVIRONMENTAL STATEMENT

Proposed contents for the Environmental Statement for the CHWFL development.

Part 1 Background

Introduction

An introduction to renewable energy development and wave power in particular. This will include a short overview of the wave resource in Scotland and around Orkney, and will outline the potential benefits of the development.

Policy and Legislation

An overview of the relevant policies, legislation, statutory planning guidance and Development Plan policies which apply to the proposed development.

Site Selection and Alternatives

A description of the site selection process for the CHWFL development. In addition it will describe the main development alternatives studied and the main reasons for choice of this site, taking into account the environmental constraints. It will also highlight the key project design alternatives that have been considered.

Development Description

Details of the site and a description of the proposed development will be discussed. This will include details of the size, layout and design of the site and associated infrastructure. As per the Rochdale Envelope approach it will identify where there may be variations or where designs remain unresolved. This chapter will also outline the construction, operation, maintenance and decommissioning requirements of the development.

Environmental Overview

High level overview, with detail left to impact sections in Part 2.

Part 2 Environmental Impact Assessment

EIA Methodology

An overview of the impact assessment methodology used for the EIA process including scoping and consultation and the identification of key environmental effects. This section will conclude by providing an overview of the ES structure, leading onto a number of EIA study chapters.

EIA Study Chapters

Each of the chapters will be prepared by the relevant expert environmental consultant(s), with supporting technical input provided by the CHWFL Project team. Each chapter will include the following components – exact structure to be determined:

- Introduction.
- Legislative framework and regulatory context.
- Assessment methodology for the topic including a summary of relevant consultation, data sources used and the means of defining the topic study area. Should there be any data gaps and uncertainties identified these will be noted.
- Description of existing baseline conditions.
- Assessment of the nature, magnitude, duration and significance of the likely effects of the construction/installation, operation, maintenance and decommissioning of the proposed development on the specific topic.
- Mitigation.
- Residual Impact.
- Cumulative and in-combination Impacts.

Part 3 Conclusions and Commitments

Environmental Mitigation and Monitoring Plan

Concluding Statement
References
Appendices

APPENDIX B STRATEGIC RESEARCH AND STUDIES

There are a variety of strategic studies planned or underway (not proposed to be undertaken by CHWFL), which will generate data and information relevant to the assessment of impacts from the development. The list of research and studies has been compiled from regulatory bodies and relevant organisations in order to aid in the EIA process. Some studies may not be directly relevant to wave energy converters but have been included to present the overall picture of environmental related research in the marine renewable energy sector.

ID	Title	Lead Organisation	Description	Status (as of March 2012)
Marine Mammals				
1	Utilisation of space by grey and harbour seals in the Pentland Firth and Orkney Waters	SNH	To determine space use by Orkney Harbour and Grey Seals in the PFOW using existing data on seal movements and haul outs and therefore considering the implications for these species of installing marine renewable developments, particularly tidal turbines.	Completed
2	Review of abundance and distribution of Basking Sharks and Cetaceans in PFOW	SNH	To collate existing information on cetaceans and basking shark distribution and abundance within the PFOW so as to inform the consenting process and to specify future field survey work required where existing information is scarce or inadequate.	Completed
3	Estimating collision risk between Harbour Porpoises and marine renewable energy devices	MS	To investigate whether existing marine mammal acoustic deterrent devices (ADDs) could be used to mitigate collision risks in Scottish waters. To do these measurements ambient sound in Scottish seas will be undertaken. These will then be input together with sources level of existing acoustic deterrent devices (pingers, ADDs etc.) to an acoustic warning model developed by SAMS to assess their effectiveness.	Ongoing
4	Acoustic outputs of tidal turbines and marine mammal responses	SNH	To determine the capacity of marine mammals (seals and cetaceans) to 'hear' tidal turbines in high energy environments where such devices will be deployed and, thereby, take evasive action.	Ongoing
5	Development and establishment of a	TBC	Build upon existing and UK and Scottish Marine Mammal recording,	Under dev

ID	Title	Lead Organisation	Description	Status (as of March 2012)
	marine mammal stranding scheme in PFOW		recovery and inspection of marine mammals stranded upon beaches in the PFOW as a means of gauging the collision risk (if any) presented by turbines to these species. Such a scheme will also provide a means of addressing allegations about the causes of death of mammals that become stranded should they arise.	
6	EMEC Monitoring Programme	TBC	EMEC marine mammal monitoring programme under development to utilise existing monitoring data and gather new data.	Under dev
Birds				
7	Review techniques to detect seabird presence and movement below the sea surface and determine potential application in the vicinity of tidal turbines	SNH	This will be a preliminary investigation into the feasibility of underwater detection systems. The ability to detect birds depends in part on bird size, their physical properties of the seawater in which they are swimming. Work will focus on the potential use of visual detection systems (underwater cameras), active systems such as sonar, other approaches to monitoring such as strain gauges or any other potentially suitable technique. A short report will be produced identifying the system(s) that offer potential field testing, taking into account technical feasibility, availability 'off the shelf' and circumstances whereby their function will be compromised.	Ongoing
8	Assessment methodology for determining cumulative impacts of marine renewable energy devices on marine birds	SNH	Review of existing approaches to the assessment of cumulative impacts, particular draft guidance on the onshore environment and draft guidance being prepared for the offshore wind sector to COWRIE. A draft guidance document will be prepared which identifies a suitable approach to the assessment and determination of cumulative impacts on marine birds arising from offshore wave and tidal turbine technology. The draft guidance will be used by SNH for further consultation and discussion with stakeholders in government, other regulatory authorities as well as NGOs and industry.	Ongoing
9	Assessment methodology for determining collision risk of marine renewable energy devices on marine	SNH	Development of an encounter rate model. It is expected that this will be written in an appropriate format that is likely to be both widely available and simple to use.	Ongoing

ID	Title	Lead Organisation	Description	Status (as of March 2012)
	birds		Suitable encounter rate model based on known biology of relevant species. Suggest default avoidance rate for these species Recommend suitable field based methodology for the collation of data that is suitable for use in a bespoke model Identify other parameters	
10	The determination of foraging range and diving depths in the PFOW wave and tidal resources area	SNH	Seabird surveys can demonstrate the presence of particular species and relevant measures of abundance in particular development locations, but there is a need to determine the breeding colony origin of these individuals' as well as additional / alternative areas that are used for feeding and other maintenance activities. The importance of this lies, especially, in the need to determine connectivity between designated sites (especially SPAs) and areas that may be proposed for renewable energy developments. The purpose of this work is to design an outline of the work required to undertake this.	Ongoing
11	Methodology for surveys of marine birds in and around the sea areas proposed for wave and tidal energy developments off the west coast of Scotland	SNH	Seabird surveys can demonstrate the presence of particular species and relevant measures of abundance in particular locations, using various types of survey (shore-based, boas-based and aerial surveys being the principal sources of such information). Understanding the distribution of seabirds in these areas will provide the basis for marine spatial plans as well as assisting with individual development proposals. The purpose of this work is to design an outline of the work required to do this.	Ongoing
12	Seabird surveys in the PFOW	MS	To conduct field surveys to establish the utilisation of sea space by sea birds in the Orkney / Pentland areas focusing on areas with potential for marine energy generation.	Ongoing
13	Assessing movements of seabirds in relation to marine renewable energy devices	ERI	The project will investigate the movements of, and habitat use, by seabirds from SPAs in the PFOW and assess the potential environmental impacts of the proposed development.	Ongoing
14	EMEC Monitoring Programme	TBC	EMEC bird monitoring programme under development to utilise	Under dev

ID	Title	Lead Organisation	Description	Status (as of March 2012)
			existing monitoring outputs and gather new data.	
Fish				
15	Review of migratory routes and behaviours of Atlantic salmon, sea trout and European eel in Scotland's coastal environment: implications for the development of marine renewables	MS	To help establish the potential for interactions between turbine arrays and salmon entering SACs.	Complete
16	Literature review of the effects of EMF and noise arising from marine renewable developments on Atlantic salmon, sea trout and European eel	SNH	To conduct a literature review on the effects of EMF and noise on migratory routes and behaviour of Atlantic salmon, sea trout and European eel in the marine environment. Gaps in current knowledge and research requirements will also be identified.	Complete
17	Monitoring of the fishery in a no-take zone established at EMECs wave test site at Billia Croo, Orkney	MS	To investigate the effects of a no-take zone established around wave energy devices at te EMEC test site and thereby contribute to our understanding on the potential effects of marine energy deployments on fish and fisheries.	Ongoing
Shipping and Navigation				
18	Shipping and navigation	MS	To determine volume and routes of different types of shipping in order to identify the need for setting priority areas for shipping and renewables.	Ongoing
19	Cumulative Navigational Risk Assessment	TBC	Currently investigating the potential to undertake a Navigational Risk Assessment for the PFOW region.	Under dev
Marine Habitats				
20	Analysis and assessment of marine habitats and species surveyed by Marine Scotland in PFOW	SNH	To review photographs and video footage of seabird habitats in areas of wave and tidal power resource in the Pentland Firth and Orkney to describe the species and habitats present and identify any which may be sensitive to such developments.	Complete
21	Bathymetric surveys of wave and tidal	MS	To generate high resolution bathymetric maps of the seabed in areas of	Complete

ID	Title	Lead Organisation	Description	Status (as of March 2012)
	power resource areas in Orkney and the Pentland Firth		wave and tidal resources in the Pentland Firth and Orkney to describe the species and habitats present and identify any which may be sensitive to such developments.	
22	Sensitivity of biogenic reef forming organisms and commercially important benthic invertebrate in the area of marine renewable development	ERI	Objective is to determine the principal behavioural / physiological responses of a number of organisms which are either of commercial interest and / or biogenic reef-forming species, and therefore hotspots of biodiversity, to predicted disturbances of wave / tidal energy devices (through determining responses to sedimentation). By gaining a better understanding of biological responses at species level the emerging RE industry will be better informed with respect to potential commercial and biodiversity impact.	Ongoing
23	EMEC Monitoring Programme	TBC	EMEC programme under development to characterise benthic impacts.	Under dev.
24	Benthic and Intertidal surveys on west and north coast of Orkney	ICIT, SuperGen	Benthic and intertidal surveys on west and north coast of Orkney	Ongoing
25	Bathymetry surveys off west coast of Orkney	The Crown Estate	Bathymetry surveys off west coast of Orkney	Ongoing
Generic and Cross-Cutting Research				
26	Review of potential impacts of wave and tidal renewables developments on Scotland's marine environment	MS	To identify what is known about the impacts of wave and tidal energy devices in the marine environment and gather additional knowledge that will i) inform the development of guidance and requirements for monitoring ii) aid in the delivery of a marine renewables research strategy that is complimentary to other national and international research programmes.	Published
27	Guidance on survey and monitoring in relation to marine renewable deployments in Scotland	SNH	To develop baseline survey and monitoring protocols and guidance (for marine mammals, seabirds and benthic habitats) that can be adapted or applied directly by developers deploying wave or tidal turbines in Scottish waters to a) inform the HRA processes b) detect and describe the principal natural heritage impacts that such devices might have.	Draft published

ID	Title	Lead Organisation	Description	Status (as of March 2012)
Landscape and Seascape				
28	Seascape Research and Modelling	MS	To model impact upon seascape of planned renewable activities. To determine economic value of seascape and any change in this as a result of renewable activities.	Ongoing
Social and Economic				
29	Tourism and recreation	MS	To determine the spatial extent and economic activity of relevant tourism activities.	Ongoing
30	Socio – economic	MS	To determine costs and benefits of renewable activities.	Ongoing
31	Wave and Tidal Energy in the Pentland Firth and Orkney Waters: How the Projects Could be Built	The Crown Estate	Building the 1,600 MW of projects by 2020 will require several billion pounds of investment in the electricity generation equipment, balance of plant and supporting infrastructure (such as electricity networks, ports and harbours). The prospect therefore raises significant commercial opportunities for businesses, as well as economic development potential for Scotland, the regions surrounding the projects and local communities	Complete

APPENDIX C STAKEHOLDER LIST

The table below lists stakeholders that have been identified for the Costa Head Wave Farm project. There are three groups of stakeholders that have been identified; Marine Renewables Facilitators Group, Marine Scotland Stakeholder Group and Other SSER Stakeholders.

This table also shows which organisations were sent a copy of the Project Briefing Document and from that which organisations have indicated they do not wish to be consulted further in respect of this development.

	Identifies which group each stakeholder is part of.

Organisation	Stakeholder Group			Sent a copy of the Project Briefing Document	Continue or discontinue consultation with this organisation on the CHWFL development
	Marine Renewables Facilitators Group	Marine Scotland Stakeholder Group	Other CHWFL Stakeholders		
Association of Salmon Fishery Boards				✓	✓
Association of Scottish Shellfish Growers				✓	✓
British Airports Authority				×	✓
Birsay Community Council				✓	✓
British Geological Society				×	✓
British Marine Aggregate Producers Association				✓	×
British Marine Federation				×	✓
British Ports Association				✓	✓
British Trout Association				✓	✓
Butterfly Conservation				×	✓
Biological Records Centre				×	✓
BT (Network Radio Protection)				✓	✓
Botanical Society of the British Isles				×	✓
Carbon Trust				×	✓
Chamber of Shipping				✓	✓
Civil Aviation Authority				✓	✓
Community Energy Scotland				×	✓

Organisation	Stakeholder Group			Sent a copy of the Project Briefing Document	Continue or discontinue consultation with this organisation on the CHWFL development
	Marine Renewables Facilitators Group	Marine Scotland Stakeholder Group	Other CHWFL Stakeholders		
Community Woodlands Association				×	✓
COSLA				×	✓
County Archaeologist				✓	✓
Crofters Commission				×	✓
Crown Estate				×	✓
Cruising Association (national)				×	✓
Cruising Association (local)				✓	✓
Cycling Scotland				×	✓
DECC (decommissioning)				✓	✓
Defence Estates				✓	✓
Department for Transport				✓	✓
Department of Business Innovation Skills				×	✓
EMEC				✓	✓
Energy Saving Trust				×	✓
Environmental Concern Orkney				✓	✓
Evie and Rendall Community Council				✓	✓
Explorer Fast Sea Charters				×	✓
Federation of Scottish Aquaculture Producers (Scottish Aquaculture Research Forum)				✓	✓
Fishermen's Association Limited				✓	✓
Forestry Commission				×	✓
Forestry Enterprise				×	✓
Friends of the Earth (Scotland)				✓	✓
Greenpeace				✓	✓
Health and Safety Executive				✓	✓
Hebridean Whale and Dolphin Trust				✓	✓
Highlands and Islands Airport Limited				×	✓
Highlands and Islands Enterprise				×	✓
Historic Scotland				✓	✓
ICIT				×	✓
International Tanker Owner's Pollution Federation (ITOPF)				✓	✓

Organisation	Stakeholder Group			Sent a copy of the Project Briefing Document	Continue or discontinue consultation with this organisation on the CHWFL development
	Marine Renewables Facilitators Group	Marine Scotland Stakeholder Group	Other CHWFL Stakeholders		
Inshore Fisheries Groups		■		✓	✓
Joint Nature Conservation Committee (JNCC)		■		✓	×
Joint Radio Company		■		✓	✓
Kirkwall Kayak Club			■	×	✓
Kirkwall and St Ola Community Council			■	×	✓
Mallaig and Northwest Fishermen's Association			■	×	✓
Marine Conservation Society (MCS)		■		✓	✓
Marine Safety Forum		■		✓	✓
Marine Scotland - LOT	■			✓	✓
Marine Scotland Science	■			✓	✓
Maritime and Coastguard Agency (MCA)	■			✓	✓
Ministry of Defence			■	✓	✓
MP for Orkney			■	✓	✓
MSP for Orkney			■	✓	✓
National Air Traffic Services (NATS)	■			✓	✓
National Grid			■	×	✓
National Trust for Scotland		■		✓	✓
Nautical Archaeology Society			■	✓	✓
NFU (Scotland)			■	×	✓
North District Fisheries Board			■	✓	✓
Northern Lighthouse Board	■			✓	✓
Northlink Ferries			■	×	✓
Energy North			■	×	✓
OBC Shipping Limited			■	×	✓
Ofcom			■	×	✓
Orkney Business Ring			■	×	✓
Orcadian Wildlife			■	×	✓
Orkney Archaeological Trust/ Orkney Archaeology Society			■	✓	✓
Orkney Biodiversity Records Centre (OBRC)			■	✓	✓

Organisation	Stakeholder Group			Sent a copy of the Project Briefing Document	Continue or discontinue consultation with this organisation on the CHWFL development
	Marine Renewables Facilitators Group	Marine Scotland Stakeholder Group	Other CHWFL Stakeholders		
Orkney Community Council Liaison				✓	✓
Orkney Creel Fishermen's Association				✓	✓
Orkney Dive Boat Operators Association				✓	✓
Orkney Field Club				✓	✓
Orkney Fisheries Association				✓	✓
Orkney Fisherman's Society				✓	✓
Orkney Islands Council - Council Convenor				✓	✓
Orkney Islands Council - Councillor Stromness and South Isles				✓	✓
Orkney Islands Council - Councillor Stromness and South Isles				✓	✓
Orkney Islands Council - Councillor West Mainland				✓	✓
Orkney Islands Council - Councillor West Mainland				✓	✓
Orkney Islands Council (OIC) - Biodiversity Officer				✓	✓
Orkney Islands Council (OIC) - Environmental Health				✓	✓
Orkney Islands Council (OIC) - Planning				✓	✓
Orkney Islands Council (OIC) - Roads				✓	✓
Orkney Islands Council Marine Services				✓	✓
Orkney Islands's Charters				×	✓
Orkney Island Holidays				×	✓
Orkney Marinas				×	✓
Orkney Mussels Ltd				×	✓
Orkney Renewable Energy Forum (OREF)				✓	✓
Orkney Research centre for Archaeology (ORCA)				×	✓
Orkney Sailing Club				✓	✓
Orkney Sea Angling Association				✓	✓
Orkney Sea Kayak Association				✓	✓

Organisation	Stakeholder Group			Sent a copy of the Project Briefing Document	Continue or discontinue consultation with this organisation on the CHWFL development
	Marine Renewables Facilitators Group	Marine Scotland Stakeholder Group	Other CHWFL Stakeholders		
Orkney Seal Rescue				✓	✓
Orkney Shellfish				×	✓
Orkney Sub Aqua Club				×	✓
Orkney Surf Club				✓	✓
Proposed Marine Planning Partnerships (MPP) - of Scottish Marine Regions (represent recreation, conservation and commercial interests of their area)				×	✓
Orkney Tourism Group				✓	✓
Orkney Trout Fishing Association				✓	✓
Orkney Zero Waste				×	✓
Pentland Ferries				×	✓
Pentland Firth Tidal Energy Project				×	✓
Ramblers Association				×	✓
Rousay, Egilsay and Wyre and Gairsay Community Council				✓	✓
Royal Commission on the Ancient and Historical Monuments				✓	✓
Royal National Lifeboat Institute (RNLI) Head office				✓	✓
Royal National Lifeboat Institute (RNLI) (Stromness)				✓	✓
Royal National Lifeboat Institute (RNLI) (Kirkwall)				✓	✓
Royal National Lifeboat Institute (RNLI) (Longhope)				✓	✓
Royal National Lifeboat Institute (RNLI) (Scotland)				✓	✓
Royal Society for the Protection of Birds (RSPB) (local)				✓	✓
Royal Society for the Protection of Birds (RSPB) (national)				✓	✓

Organisation	Stakeholder Group			Sent a copy of the Project Briefing Document	Continue or discontinue consultation with this organisation on the CHWFL development
	Marine Renewables Facilitators Group	Marine Scotland Stakeholder Group	Other CHWFL Stakeholders		
Royal Yachting Association (RYA Scotland) (local)				✓	✓
Royal Yachting Association (RYA Scotland) (national)				✓	✓
Sail Orkney				✓	✓
Salmon Net Fishing Association				✓	✓
Scapa Scuba				×	✓
Scottish Aquaculture Research Forum				✓	✓
Scottish Association for Marine Science (SAMS)				×	✓
Scottish Boating Alliance				✓	✓
Scottish Canoe Association				✓	✓
Scottish Coastal Forum				×	✓
Scottish Environment Link				✓	✓
Scottish Environmental Protection Agency (SEPA)				✓	✓
Scottish Federation of Sea Anglers				✓	✓
Scottish Fisheries Protection Agency (MS Compliance)				✓	✓
Scottish Fishermen's Federation (SFF)				×	✓
Scottish Gas Network				×	✓
Scottish Government Directorate for the Built Environment Planning Decisions Division				×	✓
Scottish Government Rural Environment Directorate				×	✓
Scottish Government Rural Payments and Inspections Directorate				×	✓
Scottish Natural Heritage (National)				×	✓
Scottish Natural Hertiage (SNH) (marine)				✓	✓
Scottish Natural Hertiage (SNH) (terrestrial)				✓	✓
Scottish Pelagic Fishermen's Association				✓	✓
Scottish Renewables Forum				✓	✓

Organisation	Stakeholder Group			Sent a copy of the Project Briefing Document	Continue or discontinue consultation with this organisation on the CHWFL development
	Marine Renewables Facilitators Group	Marine Scotland Stakeholder Group	Other CHWFL Stakeholders		
Scottish Rural Property & Business Association				×	✓
Scottish Salmon Producers Association				×	✓
Scottish Sea Angling Conservation Network				×	✓
Scottish Sub Aqua Club				×	✓
Scottish Surfing Federation				×	✓
Scottish Water				×	✓
Scottish White Fish Producers				×	✓
Scottish Wildlife Trust				×	✓
Sea fish Industry Authority				×	✓
Sea Mammal Research Unit				×	✓
Sport Scotland				×	✓
Sula Diving				×	✓
Surfers Against Sewage (SAS)				✓	✓
Surfing GB				✓	✓
The Fisheries Committee				✓	✓
Transport Scotland				✓	✓
UK Cable Protection Committee				✓	✓
UK Civil Aviation Authority				×	✓
UK Marine Management Organisation				✓	×
UK Hydrographic Office				✓	✓
UK Oil and Gas				✓	✓
Verona Boat Trips				×	✓
Visit Orkney				✓	✓
Visit Scotland				✓	✓
Voluntary Action Orkney				×	✓
Westray Community Association				×	✓
Westray Community Council				✓	✓
Whale and Dolphin Conservation Society				✓	✓
Wild About Orkney Tours				×	✓
World Wildlife Fund For Nature Scotland				✓	✓

APPENDIX D APPROACH TO HRA SCREENING (MARINE)

Regulatory Context

In Scotland, under provision 48 of the Conservation (Natural Habitats, &c.) Regulations 1994, 'the Habitats Regulations', which translate Article 6(3) of the EC Council Directive 92/43/EEC 1992, 'the Habitats Directive', and Directive 2009/147/EC, 'the Birds Directive' into British law, it requires that:

> *"A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which -*
>
> *a. is likely to have a significant effect on a European site in Great Britain (either alone or in combination which other plans or projects), and*
>
> *b. is not directly connected with or necessary to the management of the site, shall make an appropriate assessment of the implications for the site in view of that site's conservation objectives."*

The competent authority would only be able to agree to the proposals if it is demonstrated that the project, either alone or in combination with other projects or plans, will not adversely affect the integrity of the sites unless, in the absence of alternative solutions, the project must be required for imperative reasons of overriding public interest. In the case of CHWFL's proposal, MS-LOT will act as the competent authority for the offshore aspects of the development.

HRA Screening Methodology

As outlined above, the focus of the screening process will be on the qualifying interests and the associated conservation objectives of Natura 2000 sites likely to be affected by the proposed development. The screening process will identify a list of protected sites which require a more detailed appraisal to establish whether they will be adversely affected by the development. The proposed methodology is in accordance with published guidance from SNH (2010) and the European Commission (2000). The following sections summarise the proposed screening approach for the marine interests. HRA screening for the terrestrial aspects of the project will be covered separately.

A formal HRA screening report will be submitted for Marine Scotland and SNH consideration at an appropriate stage of the project.

SPA Screening

HRA screening for breeding seabirds will be undertaken using the most recently published 'mean maximum foraging ranges' of seabirds as detailed in Thaxter *et al* (2012) with the aid of GIS software. This gives a measure of up to how far seabirds typically travel from their colony to forage during the breeding season. The use of mean maximum foraging ranges (MMFR) is commonly recommended by SNH as a way of screening which seabird colonies may be potentially affected by a development. As the SPAs may cover quite large areas and the development proposal also covers a moderate area, the distance in the analysis is the closest, at-sea, distance between the development area and the terrestrial part of the SPA (as this is the foraging distance for birds from the SPA colony) under consideration; measuring this way ensures that the screening errs on the side of caution. The screening analysis assumes that seabirds take the shortest sea route between a colony and the development area.

The screening process will not consider possible connectivity between the development area and SPA populations outside the breeding season, a time when seabirds wander widely. It is possible that seabirds from additional SPAs located beyond the MMFR from the development could use the development area on migration or during the winter. However, from what is known about the ornithology of the site to date it is unlikely that effects on migrant and over-wintering seabirds from more distant SPA populations will turn out to be an issue that gives rise to any serious concerns and therefore these sites will not require Appropriate Assessmnet.

Table D1 presents the list of SPAs which will require further consideration under HRA for the CHWFL development. Figure D1 presents the outcome of this screening exercise on a map for context.

The list of SPAs will be further rationalised following the results of wildlife surveys currently being conducted around the AfL area by CHWFL.

ID	Site	Distance (km)	Species	MMFR (km)	Qualifying Reason (Note 1)	Population Count	
1	Orkney Mainland Moors SPA	8	Red-throated diver	9	N.I.P. of an Annex 1 species	18	pairs
2	Rousay SPA	8	Arctic tern	24	N.I.P. of an Annex 1 species	790	pairs
			Black-legged kittiwake	60	I.I.B.A. component only	4,900	pairs
			Arctic skua	63	I.I.B.A. component only	130	pairs
			Common guillemot	84	I.I.B.A. component only	10,600	individuals
			Northern fulmar	400	I.I.B.A. component only	1,240	pairs
3	Marwick Head SPA	10	Black-legged kittiwake	60	I.I.B.A. component only	7,700	pairs
			Common guillemot	84	I.M.P. of a non-Annex 1 species	37,700	individuals
4	West Westray SPA	12	Arctic tern	24	N.I.P. of an Annex 1 species	1,140	pairs
			Razorbill	49	I.I.B.A. component only	1,946	individuals
			Black-legged kittiwake	60	I.I.B.A. component only	23,900	pairs
			Arctic skua	63	I.I.B.A. component only	78	pairs
			Common guillemot	84	I.M.P. of a non-Annex 1 species	42,150	individuals
			Northern fulmar	400	I.I.B.A. component only	1,400	pairs
5	Calf of Eday SPA	25	Great cormorant	25	I.I.B.A. component only	223	pairs
			Black-legged kittiwake	60	I.I.B.A. component only	1,717	pairs
			Common guillemot	84	I.I.B.A. component only	12,645	individuals
			Northern fulmar	400	I.I.B.A. component only	1,955	pairs
6	Hoy SPA	31	Black-legged kittiwake	60	I.I.B.A. component only	3,000	pairs
			Arctic skua	63	I.I.B.A. component only	59	pairs
			Common guillemot	84	I.I.B.A. component only	13,400	pairs
			Atlantic puffin	105	I.I.B.A. component only	3,500	pairs
			Northern fulmar	400	I.I.B.A. component only	35,000	pairs

ID	Site	Distance (km)	Species	MMFR (km)	Qualifying Reason (Note 1)	Population Count	
7	Copinsay SPA	51	Black-legged kittiwake	60	I.I.B.A. component only	9,550	pairs
			Common guillemot	84	I.I.B.A. component only	29,450	individuals
			Northern fulmar	400	I.I.B.A. component only	1,615	pairs
8	North Caithness Cliffs SPA	60	Black-legged kittiwake	60	I.I.B.A. component only	13,100	pairs
			Common guillemot	84	I.M.P. of a non-Annex 1 species	38,300	individuals
			Atlantic puffin	105	I.I.B.A. component only	1,750	pairs
			Northern fulmar	400	I.I.B.A. component only	14,700	pairs
9	Sule Skerry and Sule Stack SPA	62	Common guillemot	84	I.I.B.A. component only	6,298	pairs
			Leach's storm-petrel	92	N.I.P. of an Annex 1 species	5	pairs
			Atlantic puffin	105	I.M.P. of a non-Annex 1 species	46,900	pairs
			Northern gannet	229	I.M.P. of a non-Annex 1 species	5,900	pairs
10	East Caithness Cliffs SPA	92	Atlantic puffin	105	I.I.B.A. component only	1,750	pairs
			Northern fulmar	400	I.I.B.A. component only	15,000	pairs
11	Fair Isle SPA	96	Atlantic puffin	105	I.I.B.A. component only	23,000	individuals
			Northern gannet	229	I.I.B.A. component only	1,166	pairs
			Northern fulmar	400	I.I.B.A. component only	35,210	pairs
12	Cape Wrath SPA	109	Northern fulmar	400	I.I.B.A. component only	2,300	pairs
13	Foula SPA	118	Northern fulmar	400	I.I.B.A. component only	46,800	pairs
14	Sumburgh Head SPA	132	Northern fulmar	400	I.I.B.A. component only	2,542	pairs
15	North Rona and Sula Sgeir SPA	142	Northern gannet	229	I.M.P. of a non-Annex 1 species	10,400	pairs
			Northern fulmar	400	I.I.B.A. component only	11,500	pairs
16	Handa SPA	144	Northern fulmar	400	I.I.B.A. component only	3,500	pairs
17	Noss SPA	167	Northern gannet	229	I.M.P. of a non-Annex 1 species	6,860	pairs
			Northern fulmar	400	I.I.B.A. component only	6,350	pairs

ID	Site	Distance (km)	Species	MMFR (km)	Qualifying Reason (Note 1)	Population Count	
18	Ronas Hill – North Roe and Tingon Ramsar site	175	Northern fulmar	400	N.I.P.	6,710	Apparently occupied sites
19	Troup, Pennan and Lion`s Heads SPA	187	Northern fulmar	400	I.I.B.A. component only	4,400	pairs
20	Buchan Ness to Collieston Coast SPA	215	Northern fulmar	400	I.I.B.A. component only	1,765	pairs
21	Fetlar SPA	217	Northern fulmar	400	I.I.B.A. component only	9,500	pairs
22	The Shiant Isles SPA	226	Northern fulmar	400	I.I.B.A. component only	6,820	pairs
23	Hermaness, Saxa Vord and Valla Field SPA	229	Northern gannet	229	I.M.P. of a non-Annex 1 species	16,400	pairs
			Northern fulmar	400	I.I.B.A. component only	19,539	pairs
24	Flannan Isles SPA	266	Northern fulmar	400	I.I.B.A. component only	4,730	pairs
25	Fowlsheugh SPA	280	Northern fulmar	400	I.I.B.A. component only	1,170	pairs
26	St Kilda SPA	334	Northern fulmar	400	I.I.B.A. component only	62,800	pairs
27	Forth Islands SPA	369	Northern fulmar	400	I.I.B.A. component only	798	pairs
28	Mingulay and Berneray SPA	369	Northern fulmar	400	I.I.B.A. component only	10,450	pairs

Table D1 Designated sites screened in at present stage

*Note 1: I.I.B.A. refers to 'Internationally important bird assemblage'; N.I.P. refers to 'Nationally important population'; I.M.P. refers to 'Important migratory population'. * values from Thaxter et al. 2012*

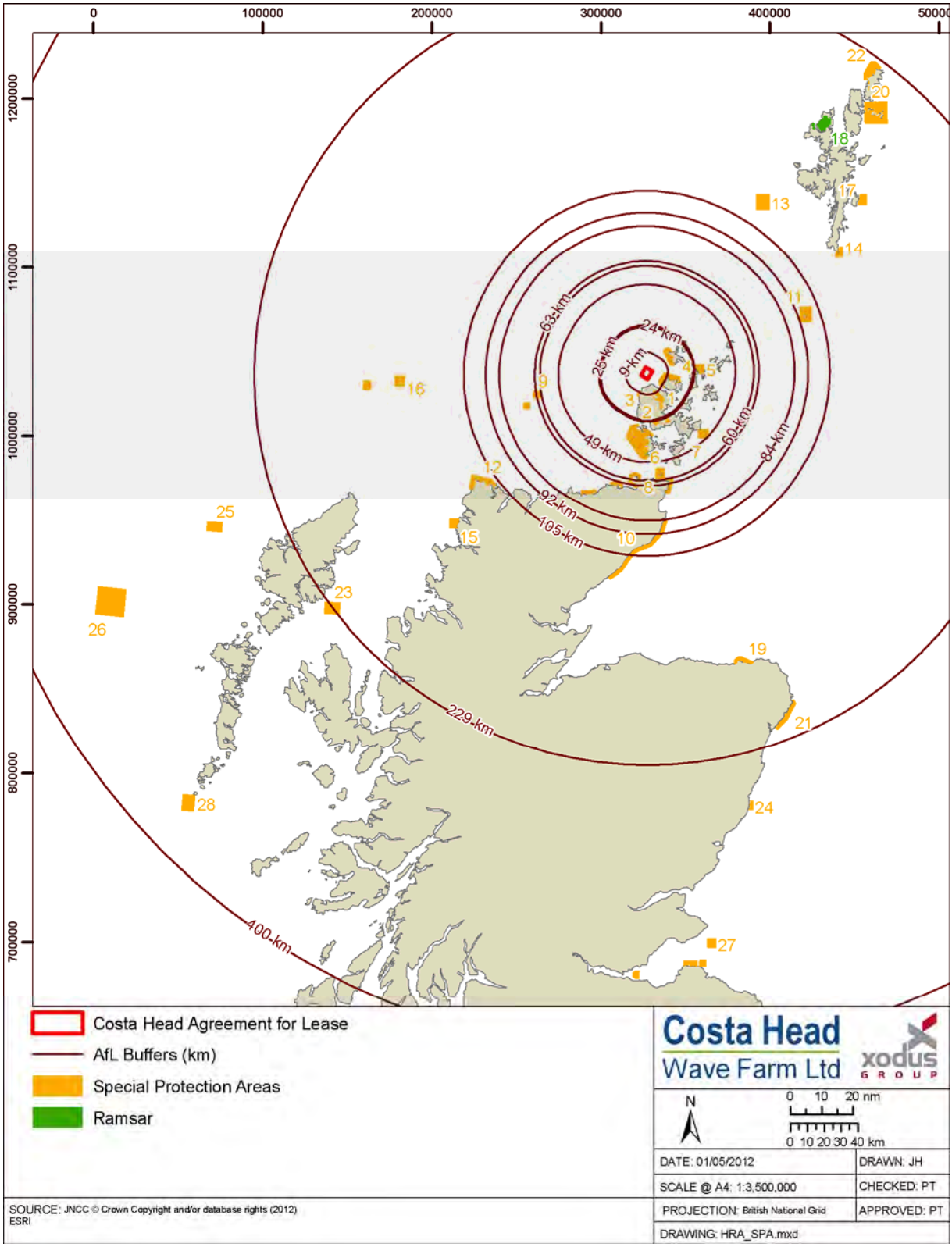

Figure D1 SPAs identified according to foraging ranges as stated in Table D1

Mammal SAC Screening

HRA screening for marine mammal species will be undertaken using published data on the maximum distances different mammal species typically travel from resident sites and/or breeding locations. The distances used for the assessment are detailed in Table D2. As with birds, due to the fact the SACs cover quite large areas and the development proposal covers only a moderate area, the distance used in the analysis is the closet at sea distance between the development and the SAC site boundary. The screening analysis assumes that mammals will take the shortest sea route between a resident site and/or breeding location and the development area.

Foraging distances for seals and harbour porpoise are derived from Hammond *et al.,* (2001) which provides background information on marine mammals within the Orkney Strategic Environmental Assessment are (SEA2).

Bottlenose dolphins have been documented to exhibit permanent home ranges and seasonal migrations. They generally forage as solitary individuals in coastal waters, although the cooperative herding of prey by larger groups has occasionally been observed (Wilson *et al.,* 1997; Wells & Scott, 1999). It has been suggested that foraging in deeper waters requires group cooperation often involving over 15 individuals. The extent of seasonal migration exhibited by bottlenose dolphins can vary greatly between populations, with some exhibiting little or no seasonal migration and others displaying movements of up to hundreds of kilometres such as the Moray Firth population where individuals may range as far south as the Northumberland coast (Evans *et al.,* 2003). Based on this, and for the purposes of initial HRA screening, a distance of 300 km has been assumed for the maximum distance that bottlenose dolphins may travel from the Moray Firth SAC.

Table D3 presents the list of SPAs which will require further consideration under HRA for the CHWFL development. Figure D2 presents the outcome of this screening exercise on a map for context.

Although other marine mammal species may be recorded in the area, they are not qualifying features of SACs and therefore will not be considered further in the HRA screening.

Species	Distance of travel from resident site / breeding location (km)
Grey seal (*Halichoerus grypus*)	350
Harbour seal (*Phoca vitulina*),	70
Harbour porpoise (*Phocoena phocoena*)	100
Bottlenose dolphins (*Tursiops truncates*)	300

Table D2 SAC marine mammals, terrestrial mammals and foraging distances

ID	Site	Distance (km)	Species	Foraging Range (km)	Qualifying Reason
1	Faray and Holm of Faray	21	Grey seal	350	Annex II Primary Species
2	Sanday	34	Harbour seal	70	Annex II Primary Species
			Harbour porpoise	100	Annex II Qualifying Species
3	Moray Firth	121	Bottlenose dolphin	300	Annex II Primary Species
			Grey seal	350	Annex II species present
4	North Rona	141	Grey seal	350	Annex II Primary Species
5	Lochs Duich, Long and Alsh Reefs	245	Grey seal	350	Annex II species present
6	Loch nam Madadh	282	Grey seal	350	Annex II species present
7	North Uist Machair	282	Grey seal	350	Annex II species present
8	Sound of Arisaig (Loch Ailort to Loch Ceann Traigh)	296	Grey seal	350	Annex II species present
9	Firth of Tay & Eden Estuary	302	Grey seal	350	Annex II species present
10	Monach Islands	309	Grey seal	350	Annex II Primary Species
11	South Uist Machair	312	Grey seal	350	Annex II species present
12	St Kilda	330	Grey seal	350	Annex II species present
13	Isle of May	335	Grey seal	350	Annex II Primary Species
14	Treshnish Isles	349	Grey seal	350	Annex II Primary Species

Table D3 Screening outcome for SACs

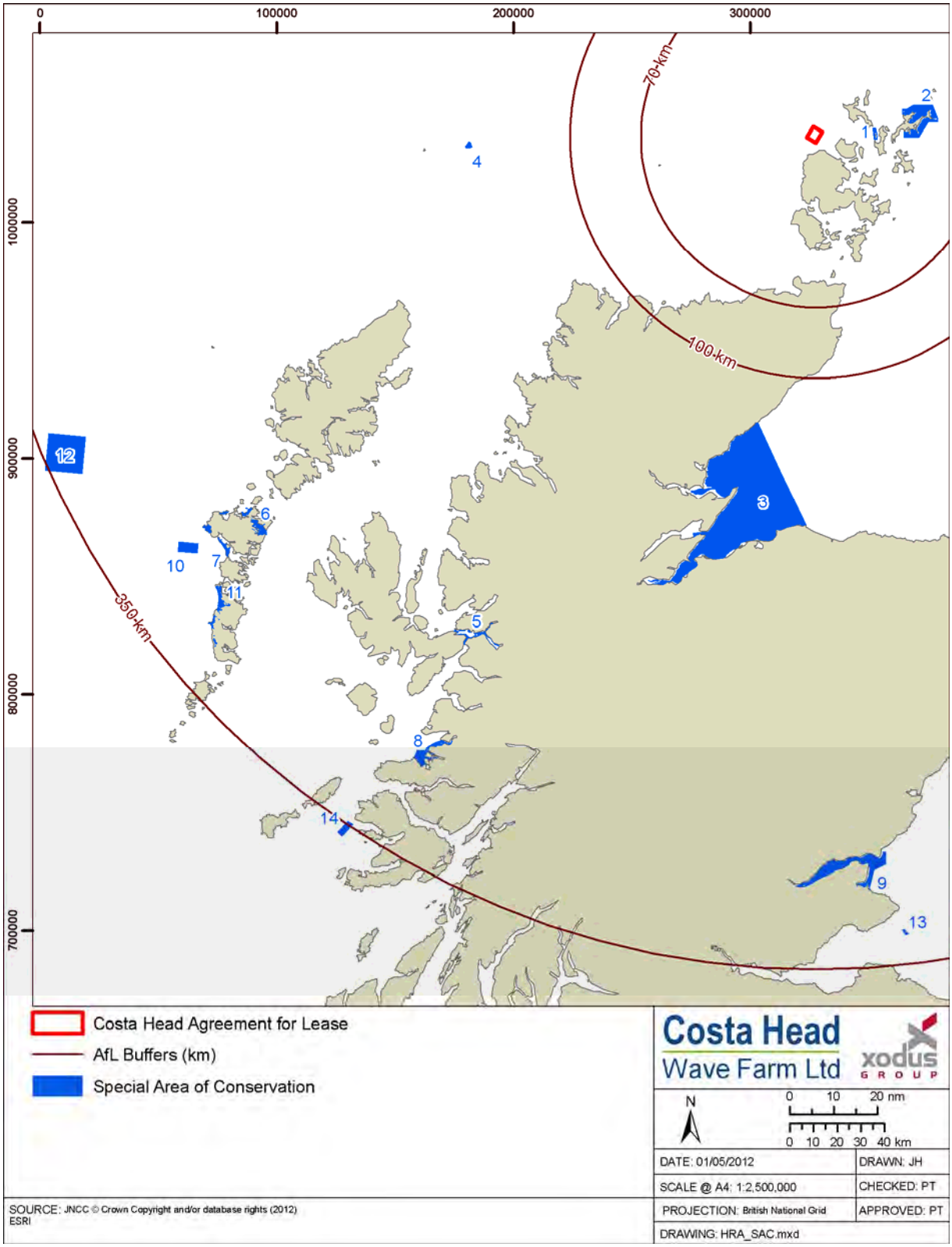

Figure D2 SACs within the foraging ranges listed in Table D2

Fish and Freshwater Pearl Mussel SAC Screening

Prior to undertaking screening for fish and freshwater pearl mussel clarification is sought from SNH on the proposed approach, which is detailed below.

In order to screen which fish and freshwater pearl mussel SACs may require appropriate assessment the following is proposed:

- Salmon and Sea Lamprey - If migration routes of salmon smolts and adults are shown to bring them within the zone of influence of the project and connectivity between the salmon populations and the site is considered likely, these populations will be considered for Appropriate Assessment. If migration routes for sea lamprey bring them within the zone of influence of the development and connectivity between the sea lamprey populations and the site is considered likely, these populations will be considered for Appropriate Assessment.

- Freshwater Pearl Mussel - The life cycle of the freshwater pearl mussel is dependent on the presence of salmonids. Freshwater pearl mussel are dependent on the viability of salmon populations and will therefore be considered for Appropriate Assessment where potential connectivity with salmon populations are demonstrated.

SPAs and marine mammal SACs have been initially screened for the purposes of this report and to demonstrate the approach and will be the subject of a formal HRA screening report at a later date. Due to the lack of clarity in the use of areas by migratory fish species, and the subsequent impact on freshwater pearl mussel, an initial screening exercise for these species has not yet been undertaken.

A review of available data, anecdotal evidence and specialist advice will be used to determine the likelihood of fish migration routes passing through or near to the CHWFL development area and the subsequent potential connectivity with both fish and fresh water pearl mussel SACs. The outcomes will also be presented in the formal HRA screening report described above.

Otters

Although otters may be present in the marine environment they will predominantly forage in waters of 2 – 15 m depth (McCafferty, 2005; Twelves, 1983). For this reason they are only likely to be present in areas of export cable landfall rather than within the CHWFL AfL area. Otters will therefore be addressed in the HRA for the terrestrial components of the project.

Q10. At what stage would Marine Scotland / SNH recommend the submission of a formal HRA Screening report?

Q11. Does the approach to HRA screening for SPAs and SACs seem appropriate and complete?

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APPENDIX E PRELIMINARY HAZARD ANALYSIS (PHA)

Preliminary Hazard Analysis
Costa Head Wave Farm
(Technical Note)

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ABBREVIATIONS

The following abbreviations are used in this report.

AfL	-	Agreement for Lease
AIS	-	Automatic Identification System
ALARP	-	As Low As Reasonably Practicable
ATBA	-	Area to be Avoided
CHWFL	-	Costa Head Wave Farm Limited
DfT	-	Department for Transport
EMEC	-	European Marine Energy Centre
GRT	-	Gross Registered Tonnes
GT	-	Gross Tonnes
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
MEHRA	-	Marine Environmental High Risk Area
MMO	-	Marine Management Organisation
MS LOT	-	Marine Scotland Licensing Operations Team
MW	-	Mega Watts
nm	-	Nautical Mile (1,852 metres)
NLB	-	Northern Lighthouse Board
NRA	-	Navigation Risk Assessment
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
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
UKHO	-	United Kingdom Hydrographic Office
VMS	-	Vessel Monitoring Service
VTS	-	Vessel Traffic Services
WEC	-	Wave Energy Converter
WGS 84	-	World Geodetic System (1984)

1. Introduction

1.1 Background

Costa Head Wave Farm Limited (CHWFL) is a partnership between Alstom and SSE Renewables UK Limited (SSER).

Anatec were commissioned by CHWFL to carry out a Preliminary Hazard Analysis (PHA) for the proposed Costa Head wave energy project, located approximately 5km to the north of Mainland Orkney.

A chart overview of the Agreement for Lease (AfL) area and the export cable corridor area of search being considered is presented in Figure 1.1.

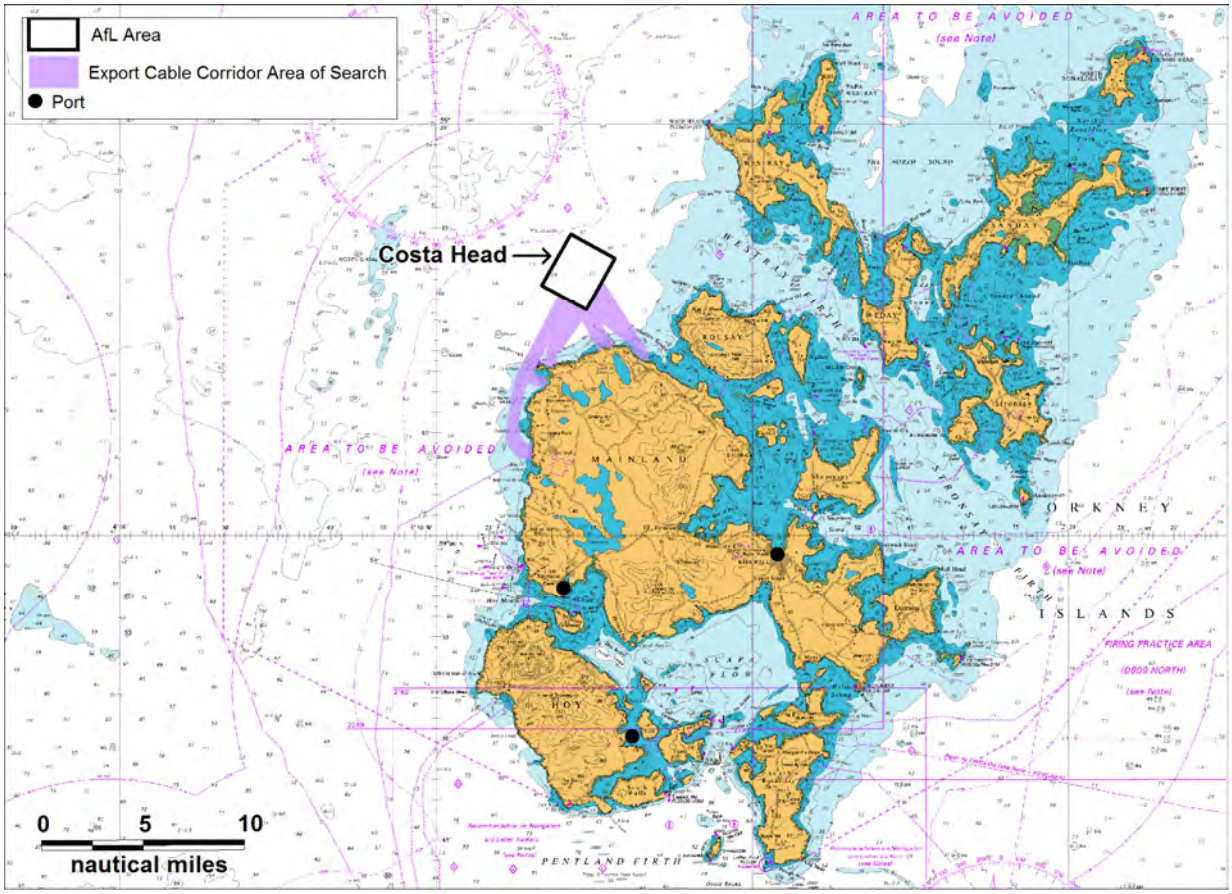


Figure 1.1 General Chart Overview of the Costa Head AfL Area

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

2. Description of Project

2.1 Introduction

This section presents details on the location of the proposed Costa Head project, the planned technology to be used and the stages of development. (More details are provided in the Environmental Scoping Report.)

Under Phase 1 it is proposed to install a 10MW array comprising up to four wave energy converters. Under Phase 2 this will potentially be expanded to bring the installed capacity up to 200MW.

2.2 Project Boundary

The Costa Head Agreement for Lease (AfL) area is situated approximately 2.7nm (5km) north of the Orkney Mainland.

The boundary coordinates of the Costa Head AfL area are presented in Table 2.1.

Table 2.1 Coordinates of Costa Head (WGS 84)

Point	Latitude	Longitude
A	59.2454º N	3.2880º W
B	59.2250º N	3.2189º W
C	59.1833º N	3.2651º W
D	59.2038º N	3.3345º W

A chart overview of the area is presented in Figure 2.1. The area is approximately 7.1nm^2 (24km^2). The charted water depths within the AfL area boundary vary between 60 and 75 metres (depths are reduced to chart datum which is approximately the level of lowest astronomical tide).

The export cable corridor area of search covers a wide area to take into account the potential landfalls being considered on the Orkney Mainland.

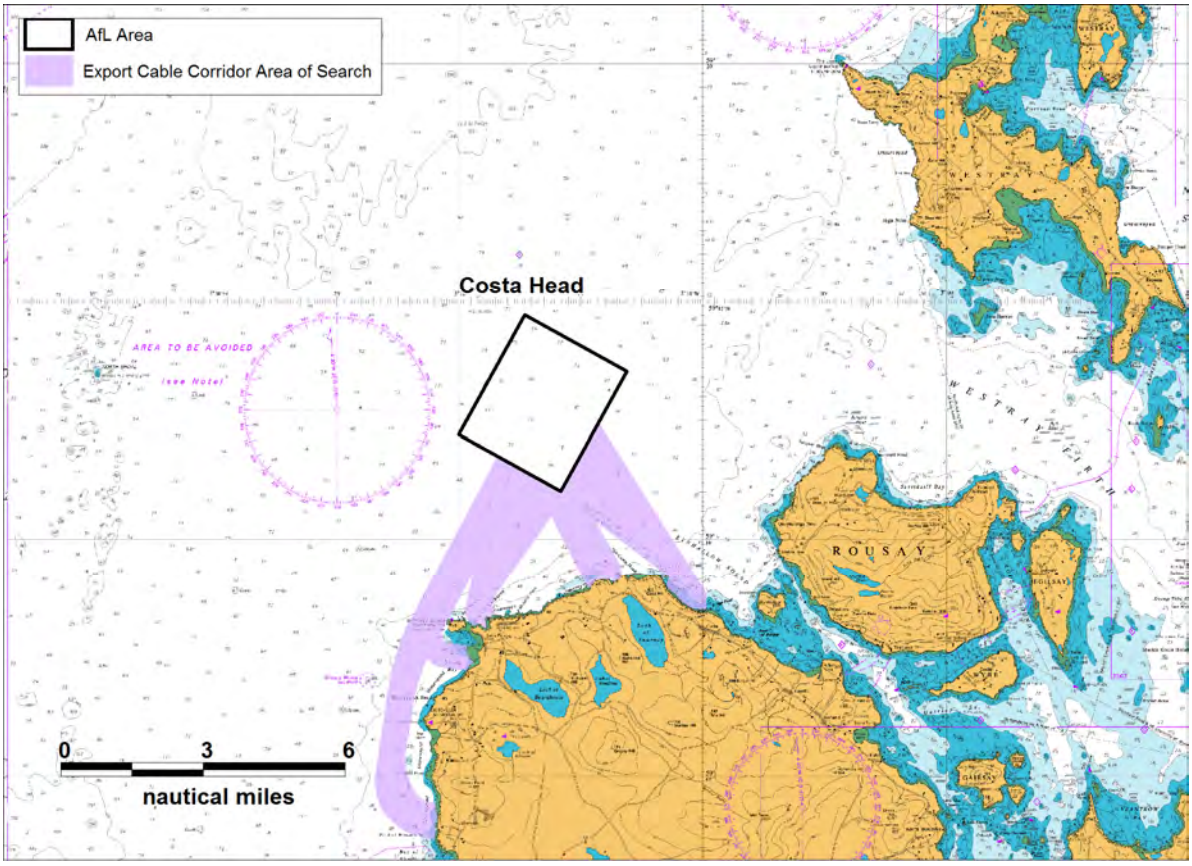


Figure 2.1 Chart Overview of Costa Head Wave Farm AfL Area and Cable Corridor

2.3 Technology

The AWS-III Wave Energy Converter (WEC), presented in Figure 2.2, will be used at Costa Head. This is a self-reacting multi-cell floating wave energy converter that harnesses power from offshore sea waves to generate renewable electricity. Diaphragms convert wave action to pneumatic power which in turn is converted to electricity by turbine-generator sets.

Figure 2.2 Visualisation of an AWS-III Farm at Sea on a Calm Day

The device comprises a number of structurally identical cells in typically a toroidal (ring shape) configuration, with each cell a buoyant vessel (see Figure 2.3 below). A diaphragm located on the outside edge of each cell converts the motion of waves into air movement within the device. The diaphragm is made from a specifically developed complex of synthetic fabrics and marine coatings; the coatings type is commonly used in marine products such as

inflatable boats. The air is constrained within ducting, and forced through turbo-generators and power conditioning equipment to generate grid compliant electrical power.

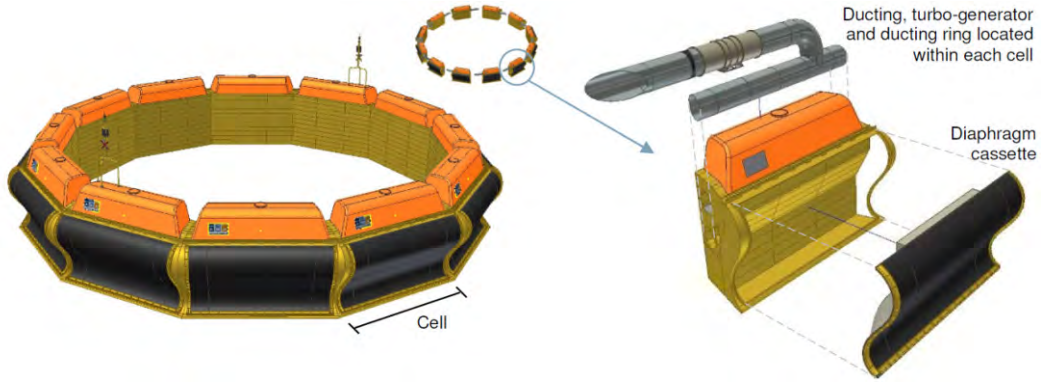


Figure 2.3 General 3D Arrangement of Device and Exploded View of a Cell (Source: AWS Ocean)

The device shown above comprises 12 cells and has a dodecagon shape; however this is purely illustrative at this stage and the number of cells and overall device shape may change as the design evolves. Indicative dimensions are shown in Figure 2.4 but again, these are subject to change.

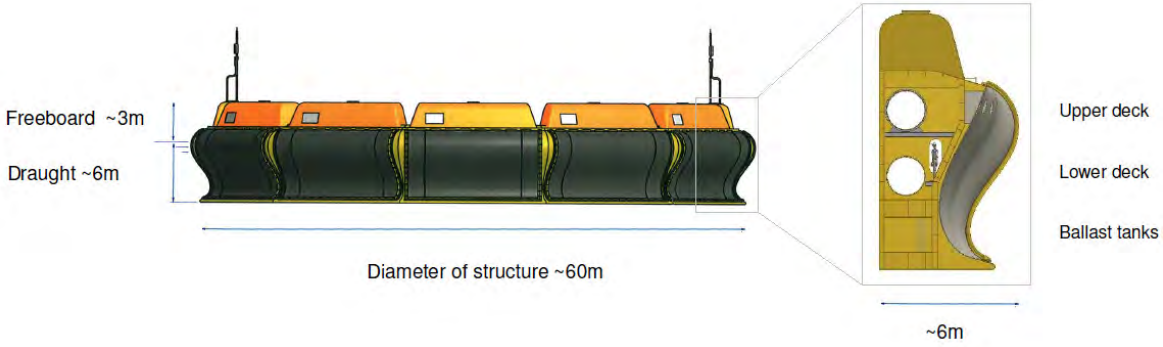
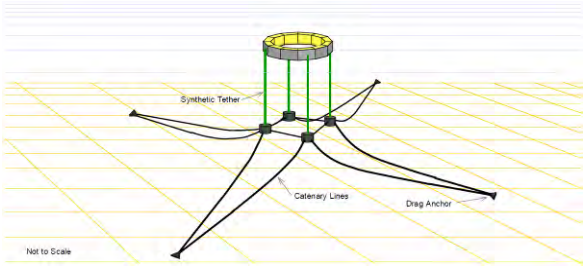


Figure 2.4 Illustrative AWS-III Dimensions (Source AWS Ocean)

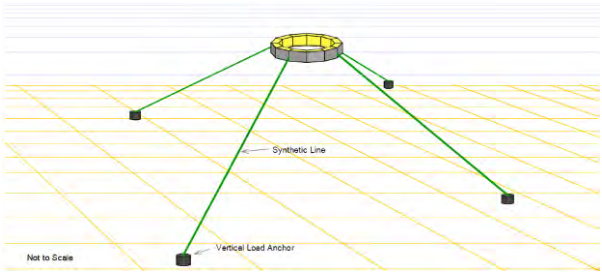
2.4 Mooring Arrangements

At this stage of the project the mooring design is under development. The following illustrations show two initial mooring arrangements being considered.

The number of anchor and lines could increase to ensure sufficient redundancy in the system for the accidental limit state. This is unlikely to exceed eight per system



Multi-tether "Admiralty Type" mooring



Taut synthetic mooring with vertical load anchors

Figure 2.5 Potential Mooring Arrangements

Anchoring solutions being considered include drag embedment anchors, piles, vertical load anchors and gravity based anchors.

2.5 Offshore Cables and Infrastructure

The AWS-III converters installed in both Phase 1 and Phase 2 will be inter-connected in arrays. Each device will export power via its own 11 to 33kV inter-array cable. A number of factors including seabed conditions, mooring arrangement and anchoring solution will influence the number, length, spacing and configuration of inter-array cables.

For Phase 1 the inter-array cabling configuration is likely to comprise one of two configurations:

1. Individual umbilical cables per device; or
2. A single umbilical used to connect multiple/all the converters in a daisy chain type arrangement.

For Phase 2, it is likely that a number of interconnected daisy chains will be used to connect the devices within the array.

For Phase 1 it is anticipated that the inter-array cables from each device will connect to an export cable to shore either via one of the converters or in a subsea terminal box.

For Phase 2, it is expected that a fixed seabed mounted offshore substation located within the AfL area will be used to bring multiple lower voltage inter-array cables together, with the power then being exported from the offshore substation to shore via higher voltage power export cables.

2.6 Construction and Installation

Once a device has been constructed and undergone initial commissioning it will be floated to enable towing to site. A mooring system (potentially pre-installed to save time) will allow the device to be towed into position and secured. The installation of the mooring system can therefore potentially be undertaken independently of the device deployment.

It is expected that a local lay up or safe haven will be required close to the site. Towage speeds are relatively low and weather windows suitable for installation can be infrequent so to maximise installation opportunities (shortest journey) a temporary lay-up close to the site, such as Scapa Flow, will be important. The units would be safely anchored in a similar fashion to a ship until required for installation.

Ocean-going tugs with appropriate bollard pull capacity will be used for the tow-out of each device. Separate anchor handling vessels will be required for the installation and pre-tensioning of the mooring and anchoring system.

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 bury the cable, typically 1-1.5m below the seabed. Where cables are not able to be buried, the use of concrete mattresses or overlaying of rock may need to be considered to secure and protect some areas of the cable.

Installation of a seabed mounted central offshore substation expected to be required for Phase 2 could involve the use of heavy lift vessels.

2.7 Operation and Maintenance

During operation and maintenance, the AWS-III WECs, mooring system, subsea cables and offshore substation shall be inspected and remedial work carried out as required. This will involve vessels visiting the site, though in the case of the substation helicopter visits are also possible. For the converters, scheduled maintenance is expected to be undertaken typically once per year during summer.

Considering the impact of weather windows on a maintenance schedule, it is likely that a local base will be used. Such a facility would provide an area where complete converters can be taken to allow easier access to carry out maintenance. A minimum requirement for such a facility will be a workshop with quayside access for a single device and workboats.

2.8 Decommissioning

A decommissioning programme, (including the assessment of environmental impacts associated with the decommissioning phase) will be developed as required by the Energy Act 2004. The programme will be drafted prior to the commencement of installation and updated nearer the time of actual decommissioning once specific details of the decommissioning procedures are available.

CHWFL plans to design the project installations to be removable by 'reverse construction' methods, typically:

- The AWS-III converters will be towed to port to remove parts for reuse and recycling as appropriate.

- Where possible, it is anticipated that all moorings will be completely removed from the site.
- Subsea cables may either be removed, or left in situ. 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.
- At the end of its lifespan the offshore 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 and returned to land for recycling or disposal.

More details are provided in the Environmental Scoping Report.

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.

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. Although the Costa Wave Energy Development is located outwith any designated Harbour Area, vessel operations associated with the development are very likely to take place within designated harbour areas.

The nearest main ports that could potentially be used by the Project are Kirkwall, approximately 16nm south east of the southern boundary of the AfL, and Stromness, approximately 19.5nm (by water) to the south. At Kirkwall, the maximum size of vessel handled is 250m LOA, 9.5m draught. The maximum size of vessel handled at Stromness is 6m draught. There is to be a new pier development at Copland's Dock in Stromness. Lyness, approximately 25nm (by water), on Hoy, has recently been redeveloped as a hub for the assembly and maintenance of renewable energy devices.

Orkney Vessel Traffic Services (VTS) operate a vessel reporting system using radar, AIS and VHF surveillance from the Harbour Authority Building in Scapa.

The VTS presently have three radar sites for observing traffic:

- Sandy Hill covering Scapa Flow and the Pentland Firth
- Scapa covering the body of Scapa Flow
- Kirkwall covering Kirkwall Harbour and approaches

The VTS is currently being upgraded during 2012, partly funded by an EU grant to support monitoring of renewable energy sites. New radar scanners will be installed on west Mainland Orkney (Black Craig) and Egilsay. Whilst these will not directly cover the Costa Head site, vessels travelling to and from the site from the south will be tracked part of the way. The VTS also has AIS and VHF coverage of the area, including the Costa Head AfL 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.

To the SSW of the Costa Head AfL area is the European Marine Energy Centre (EMEC) Billia Croo Wave Test Site. This site is used to develop and test a variety of marine wave energy converters. The area leased by EMEC from The Crown Estate is shown in Figure 3.1.

It should be noted that only the deeper-water test area is currently delineated on Admiralty Charts. Mariners are advised to avoid passing within this test area, which is marked by cardinal buoys. Charts also note that converters marked by buoys could be located between the deep-water test area (depicted on charts) and the shore.

Southeast of the Costa Head AfL area is the EMEC Fall of Warness Tidal Test Site, which is used to develop and test a range of marine tidal energy devices. Within this area permanent and semi-permanent structures, both active above and below water, mooring anchors, ground work, submarine cables, prototype underwater turbines and marker buoys may be established and removed at any time. The prototype underwater turbines may have structures extending up to 10m above the seabed. Mariners are advised to exercise caution if intending to transit the site.

Tor Ness in Hoy 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.

At 5.5nm southwest of the Costa Head AfL area lies a military wreck (*HMS Hampshire*, sunk in 1916) surrounded by a restricted area of 300m radius.

Figure 3.1 presents the Costa Head AfL area and export cable corridor area of search, relative to the main navigational features.

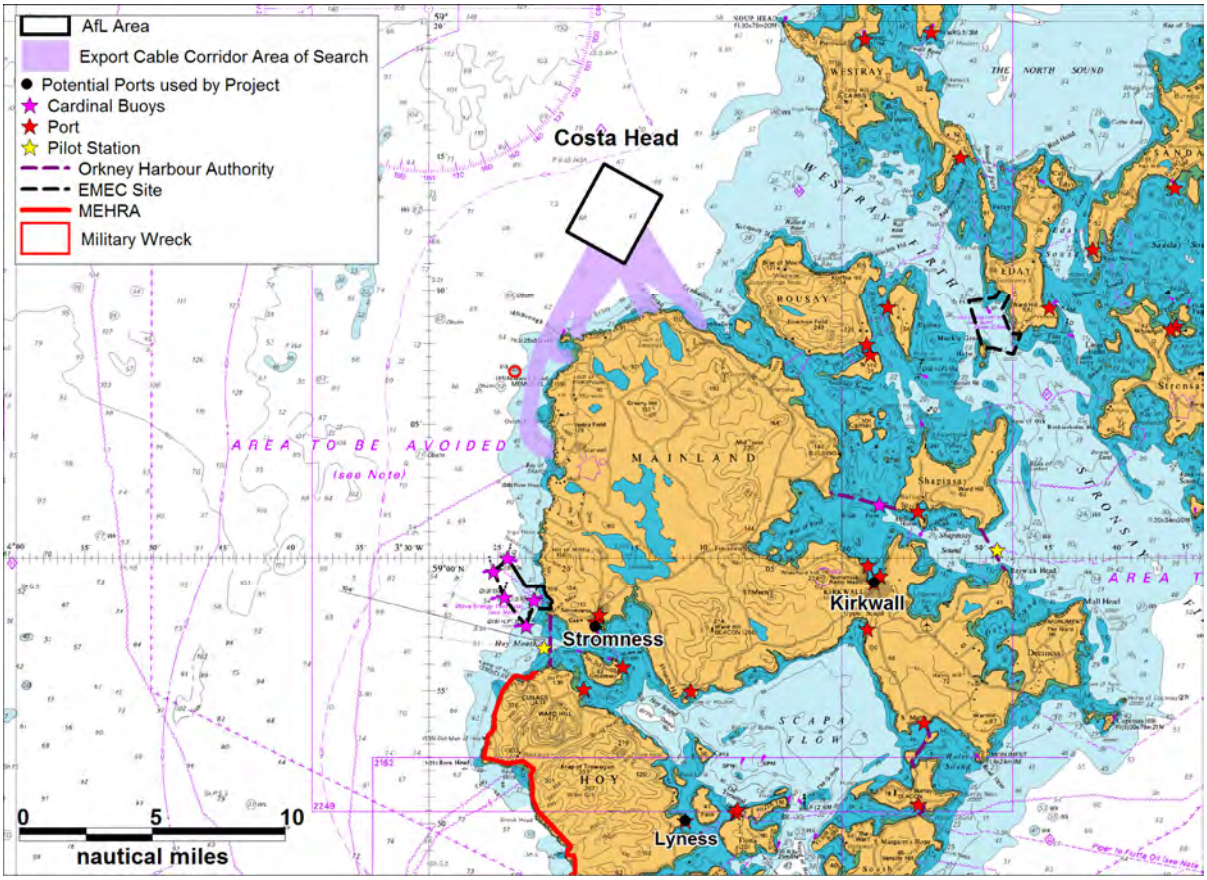


Figure 3.1 Navigational Features relative to Costa Head Wave Farm AfL Area

4. Baseline Vessel Activity Analysis

4.1 AIS Shipping Activity

4.1.1 Introduction

This section presents AIS data within 5nm of the Costa Head AfL area for two separate 28 day periods in summer and winter 2010. Separate analysis has also been carried out for an area of 5nm around the export cable corridor area of search.

A 5nm buffer was considered appropriate for the preliminary review as beyond this distance the impact of the project on shipping is likely to be minimal. (Potential cumulative impacts are discussed in Section 7.3.3.)

AIS generally covers ships above 300 gross tonnes and fishing vessels of 45m length and over. A growing proportion of smaller fishing vessels and recreational craft also carry it voluntarily.

4.1.2 Costa Head AfL AIS Review

Plots of all the tracks recorded within 5nm of the Costa Head AfL area during the summer and winter periods, colour-coded by vessel type, are presented in Figure 4.1 and Figure 4.2, respectively.

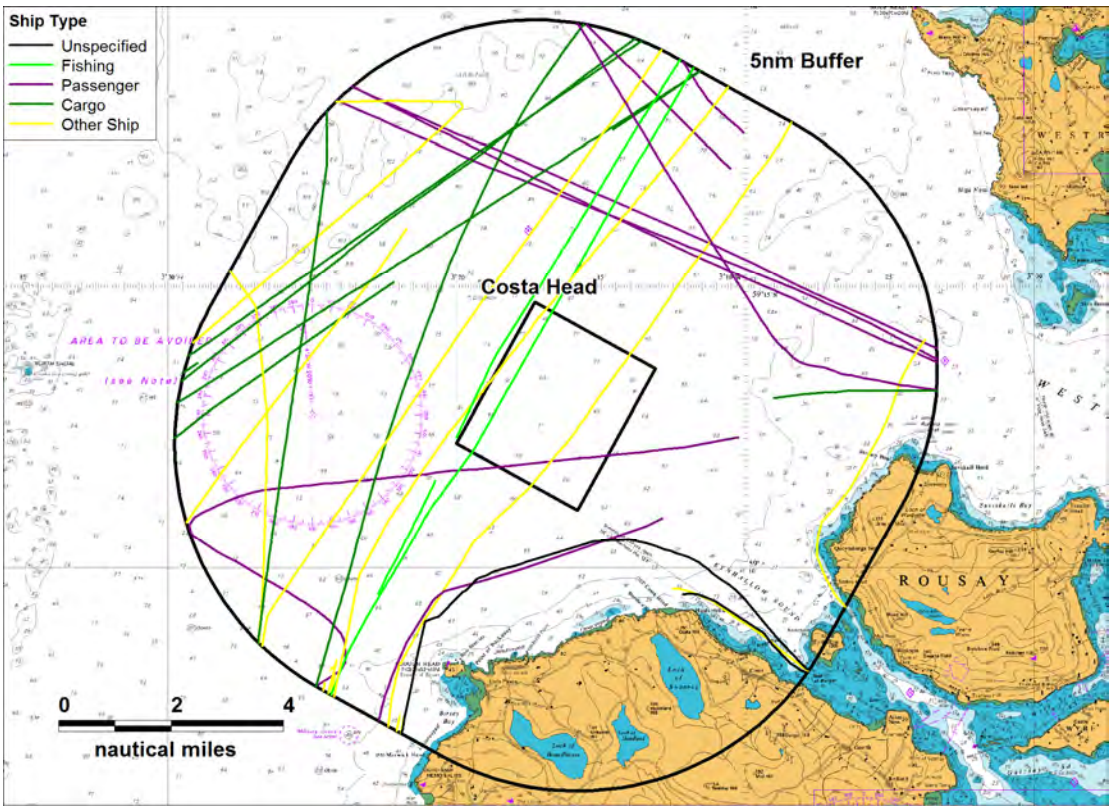


Figure 4.1 AIS Tracks by Type –28 Days in Summer 2010

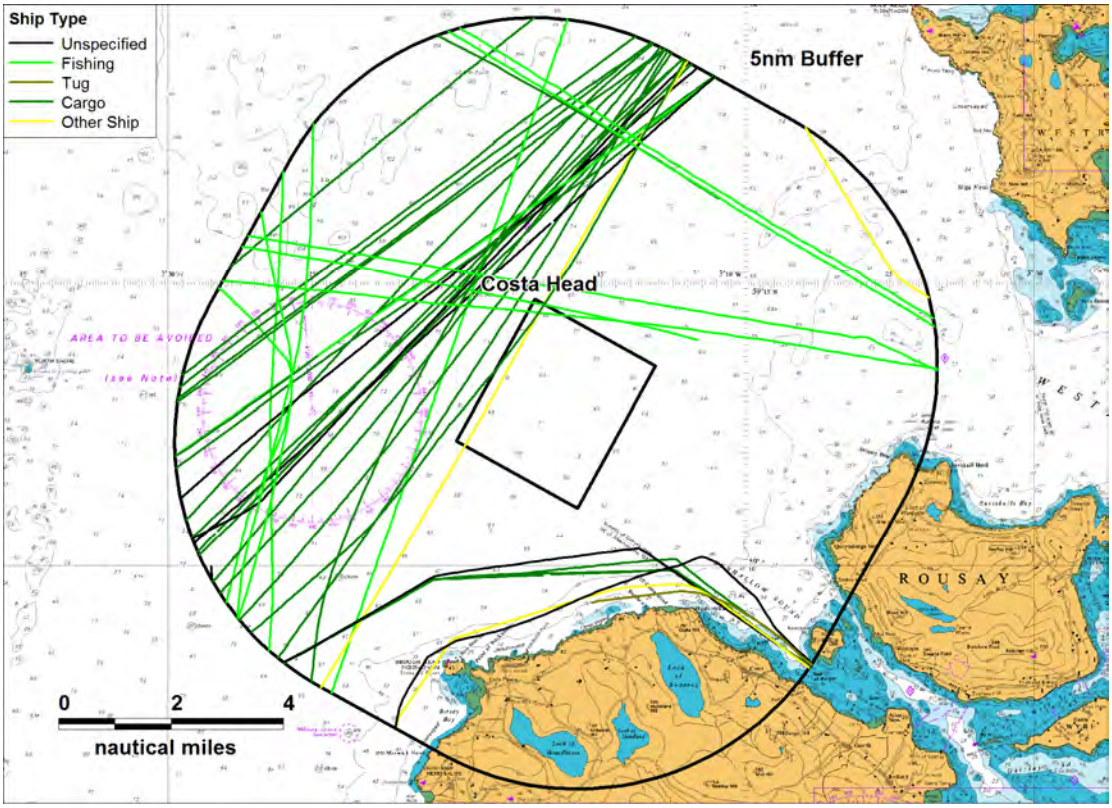


Figure 4.2 AIS Tracks by Type – 28 Days in Winter 2010

During both periods there was an average of one unique vessel per day passing within 5nm of the site, with a maximum of 4 on the busiest days. Figure 4.3 presents the ship type distribution (excluding unspecified) within 5nm of Costa Head AfL area.

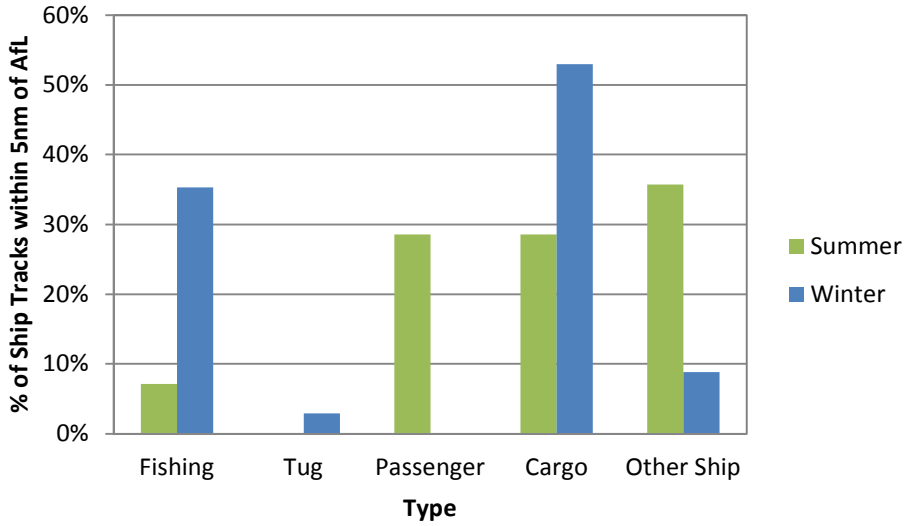


Figure 4.3 Vessel Types Identified within 5nm of Costa Head Wave Farm AfL Area

Overall, 42% of vessels identified during the combined survey period (summer and winter 2010) were cargo vessels. The majority of these transited west of the Costa Head AfL area, with one in the winter period intersecting the area en route to Onega, Russia.

Passenger vessels were recorded during the summer survey only. The majority of these were heading to/from Kirkwall. These were all cruise liners as opposed to inter-island ferries.

Other ships included a range of vessels, one of which had been carrying out work at the EMEC Billia Croo site to the south.

A number of fishing vessels were tracked to the west of the site, the majority of which were recorded during the winter period.

Plots of the tracks within 5nm of the Costa Head AfL area during summer and winter, colour coded by vessel length, are presented in Figure 4.4 and Figure 4.5.

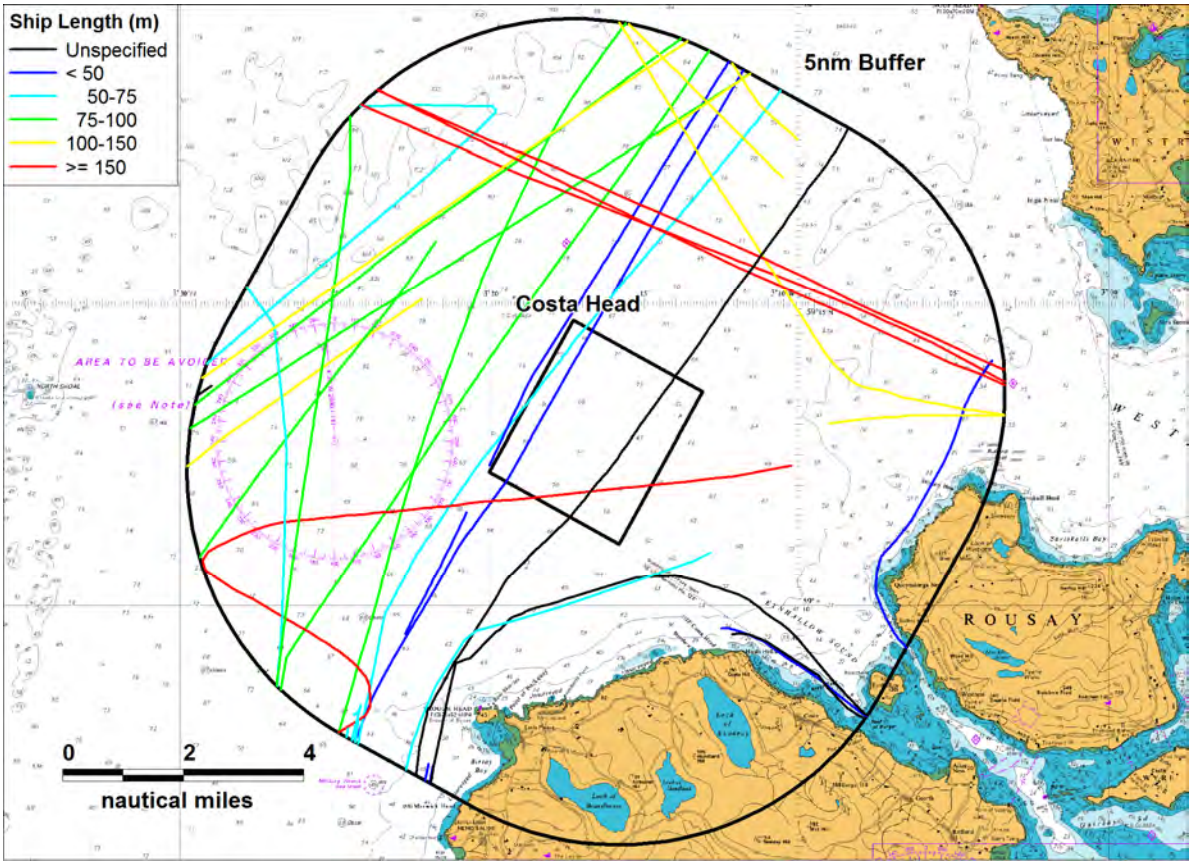


Figure 4.4 Summer 2010 AIS Tracks by Length

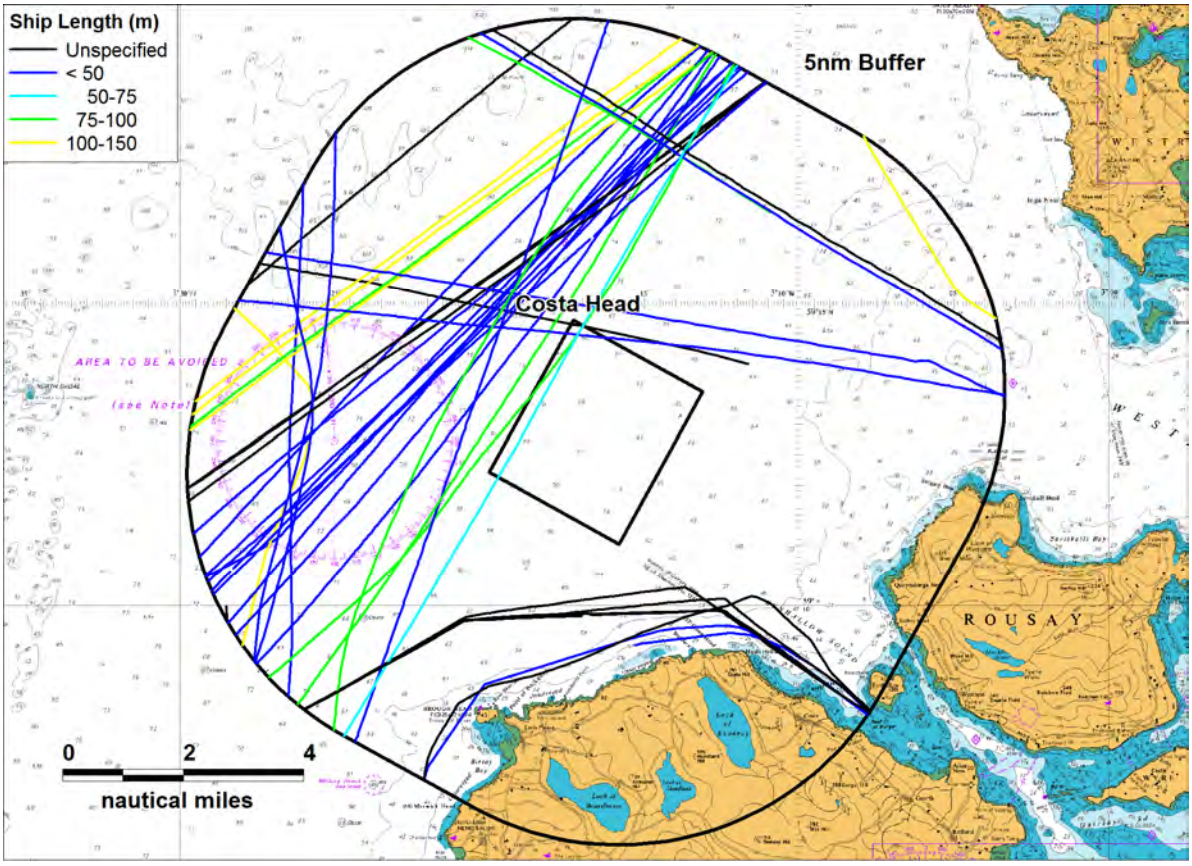


Figure 4.5 Winter 2010 AIS Tracks by Length

In the summer period, the longest vessel was the cargo ship *Romuva* at 141m, bound for Aaheim and transiting 2.5 nm to the west of the Costa Head AfL area. During winter, the longest vessel was the passenger cruise ship *Mona Lisa*, at 201m, tracked 3.5nm to the north of the Costa Head AfL area, en route to Reykjavik.

Four vessels passed through the site area during each period. Details on these vessels are presented in Table 4.1. (Where information was not broadcast on AIS, these have been researched using other data sets.)

Table 4.1 Vessels Tracked crossing Site Area

Name	Type	Length (m)	Destination
Gunilla	Sailing	61	Scalloway
Highland Eagle	Multi-Purpose Offshore	72	Aberdeen
Jammy Dodger	Pleasure Craft	13	Unspecified
Mekhanik Kottsov	Cargo	85	Onega
Rachel Jay	Fishing	26	Peterhead
Saga Pearl 2	Passenger	165	Kirkwall
Tahume	Fishing	35	Scrabster

Name	Type	Length (m)	Destination
Tugvusteinur	Fishing	33	Peterhead

4.1.3 Cable Corridor AIS Review

A total of 10 AIS tracks crossed the Export Cable Corridor Area of Search during the summer period and 9 during the winter period. All 19 tracks, colour-coded by vessel type, are presented in Figure 4.6.

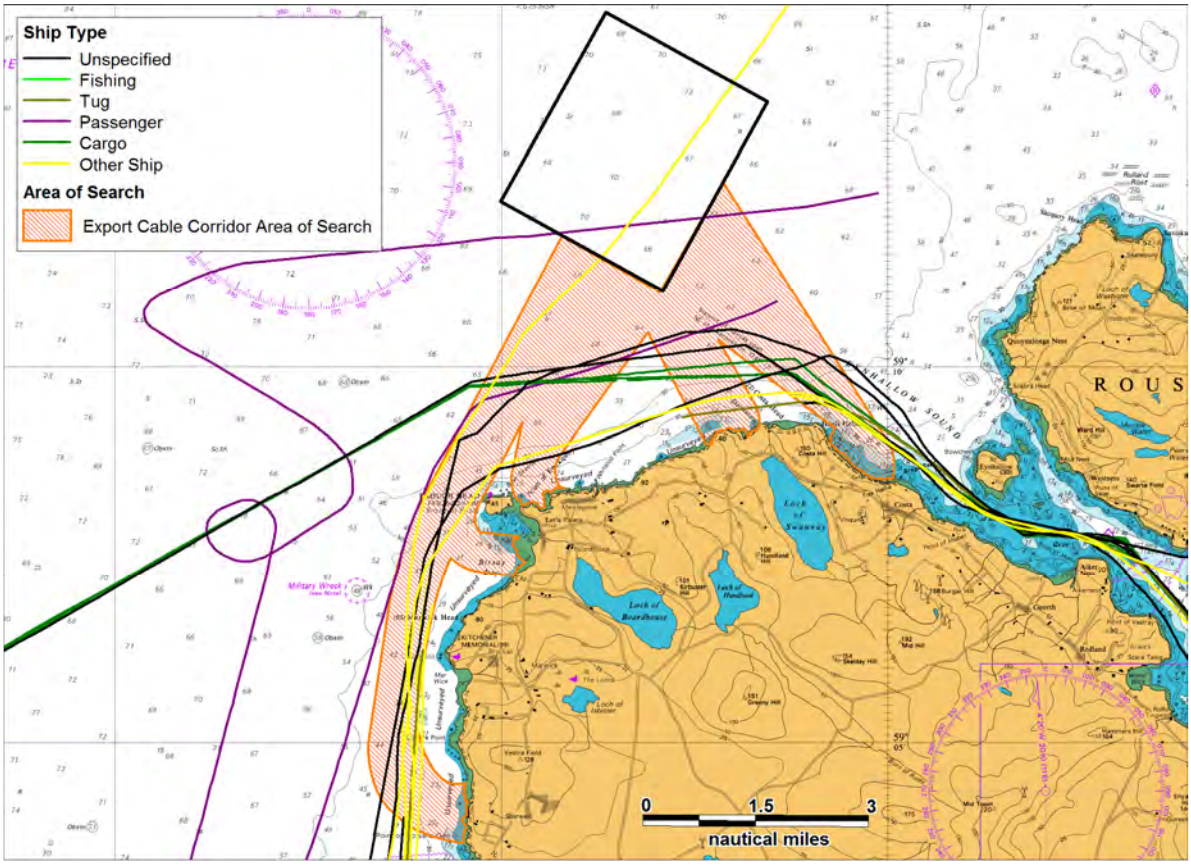


Figure 4.6 AIS Tracks by Type crossing Cable Corridor - Combined Summer and Winter 2010 (56 Days)

Ten of the 19 tracks were made by just two vessels, *Uskmoor* (commercial diving work boat) and *Norholm* (fish carrier).

4.2 Fishing Vessel Activity

The AIS data presented above included a number of fishing vessel tracks. 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).

The Costa Head AfL area is located within ICES Rectangle 47E6, Subsquare 4 (47E6/4), as shown in Figure 4.7. Data for the whole Rectangle has been analysed.

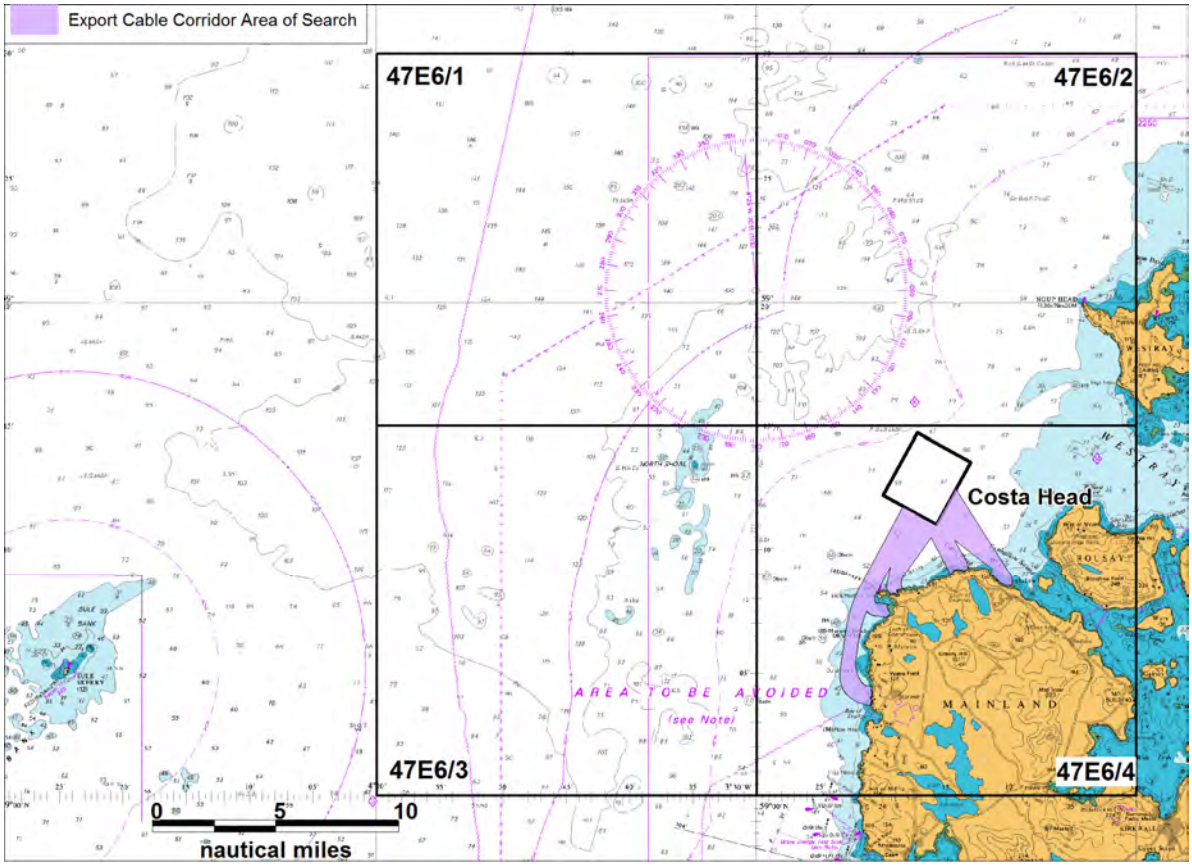


Figure 4.7 ICES Subsquares encompassing Costa Head Wave Farm

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 4.2 Average Sightings per Patrol (2006-10)

ICES Subsquare	Sightings	Patrols	Sightings per Patrol
47E6/1	782	1120	0.70
47E6/2	218	1120	0.19
47E6/3	178	1120	0.15
47E6/4	59	1120	0.05

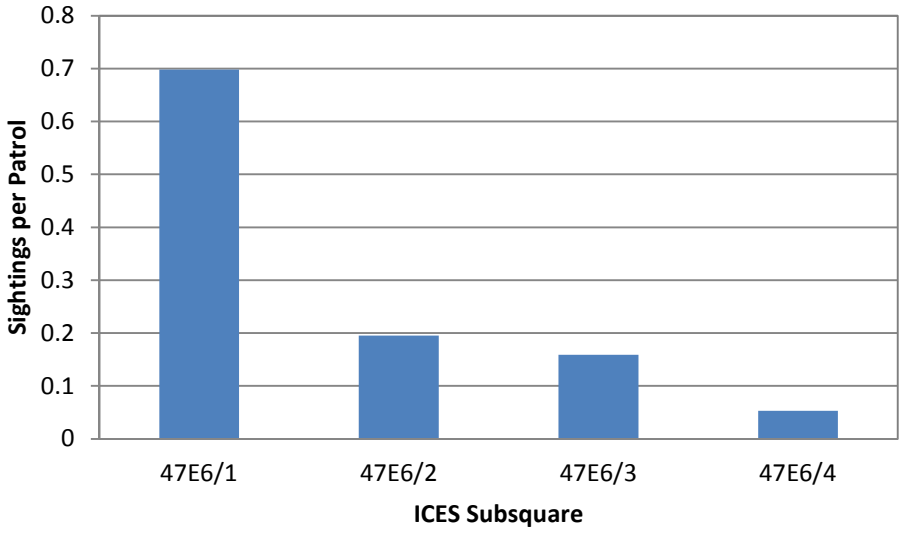


Figure 4.8 Average Fishing Vessel Sightings per Surveillance Patrol (2006–10)

Subsquare 47E6/1, the Subsquare to the northwest of Costa Head AfL area had the highest average sightings per patrol at 0.7 vessels. Subsquare 47E6/4 containing the Costa Head AfL area had the fewest sightings, although this is partly due to the fact it is roughly half on land.

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.

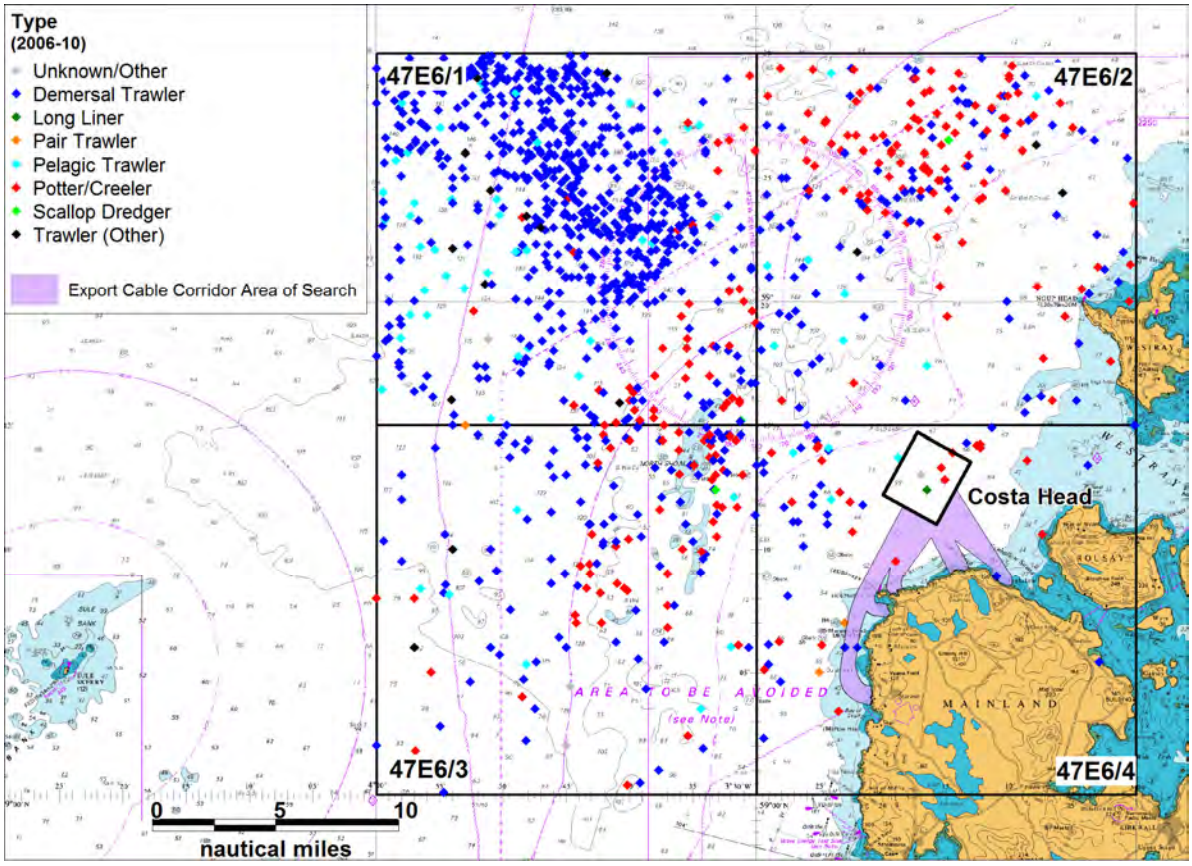


Figure 4.9 Fishing Vessel Sighting Locations

The main fishing type overall was demersal trawler (74%). The next most common type of fishing vessel was potter/creeler (18%). Within the Costa Head AfL area, five fishing vessels were sighted: 3 potter/creelers, 1 long liner and 1 unspecified vessel. Three fishing vessels were sighted within the Export Cable Corridor Area of Search; 2 demersal trawlers and 1 creeler.

In terms of vessel nationality, the vast majority of fishing vessels within Rectangle 47E6 were UK-registered (95%). Within the Costa Head AfL area, 4 of the vessels were UK registered and the long liner was of French nationality. All vessels within the Export Cable Corridor Area of Search were UK registered.

The fishing vessels colour-coded by activity when sighted are presented in Figure 4.10.

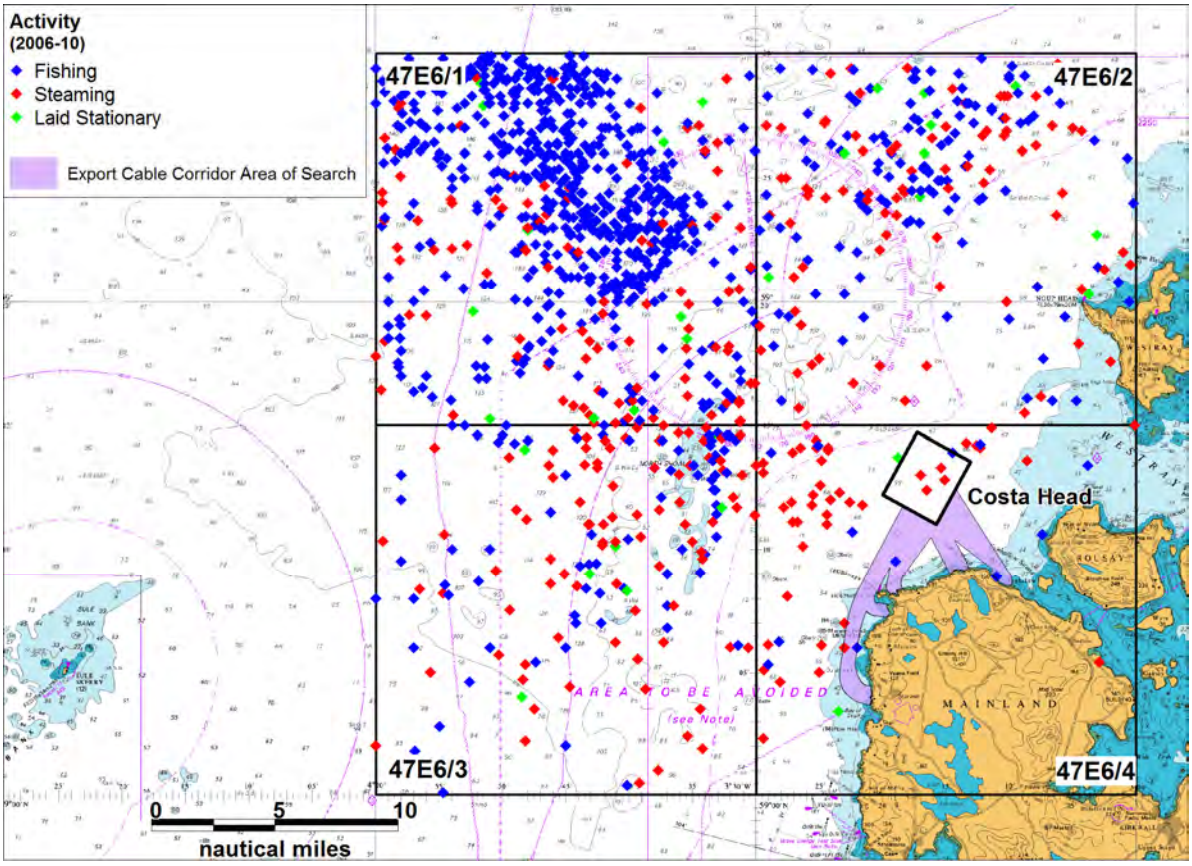


Figure 4.10 Fishing Vessel Sightings by Activity

71% of vessels sighted were fishing, i.e. gear deployed, 26% 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). Four vessels sighted within the Costa Head AfL area were steaming and one was fishing. Within the Export Cable Corridor Area of Search, 2 vessels were fishing and one was steaming on passage.

The length distribution of fishing vessels sighted in ICES Rectangle 47E6 is presented in Figure 4.11. Overall, 79% were ≥ 15m in length. Within the Costa Head AfL area and cable corridor the majority were below 15m in length.

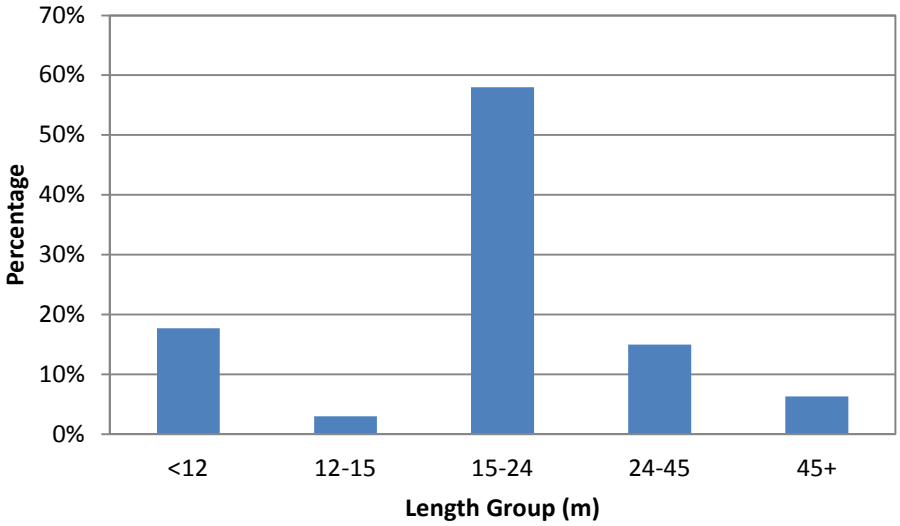


Figure 4.11 Fishing Vessel Sightings by Length Group (2006–10)

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 three-quarters 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.

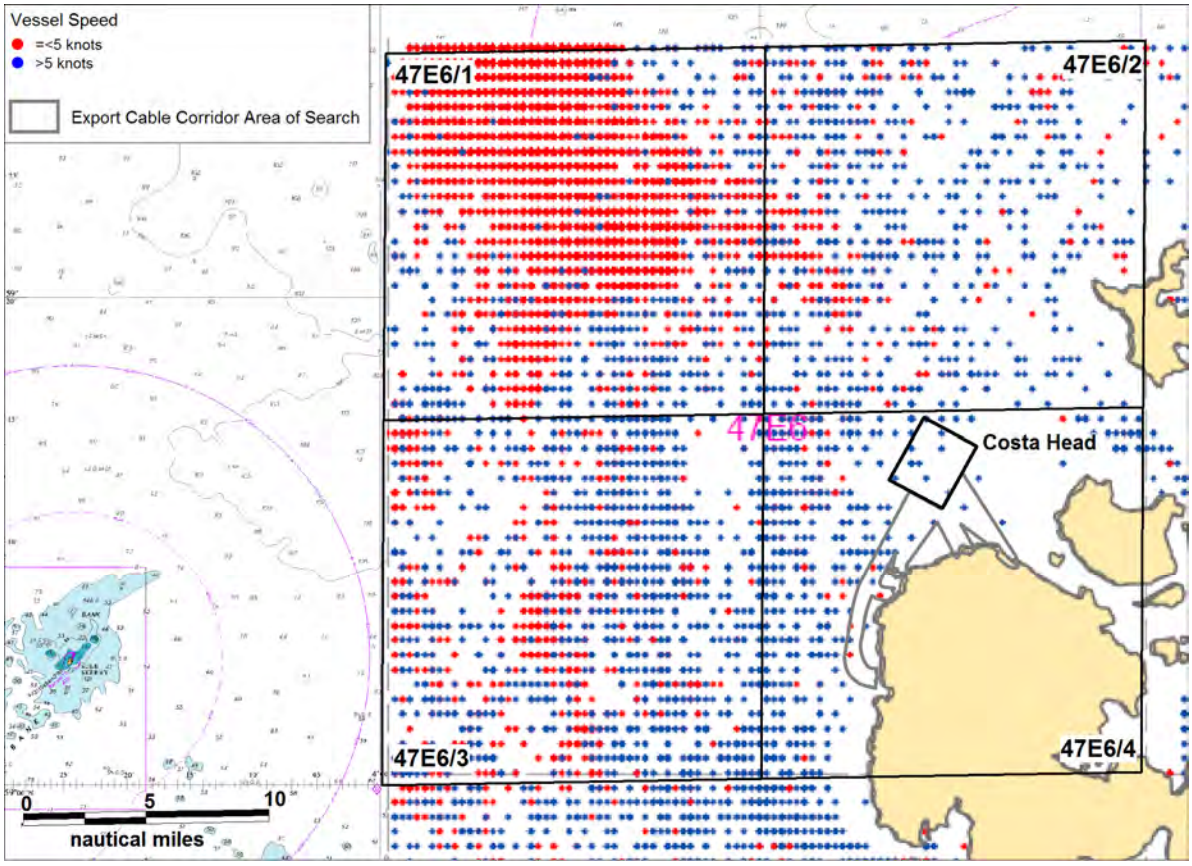


Figure 4.12 Chart of Satellite Fishing Vessel Positions by Speed (2008)

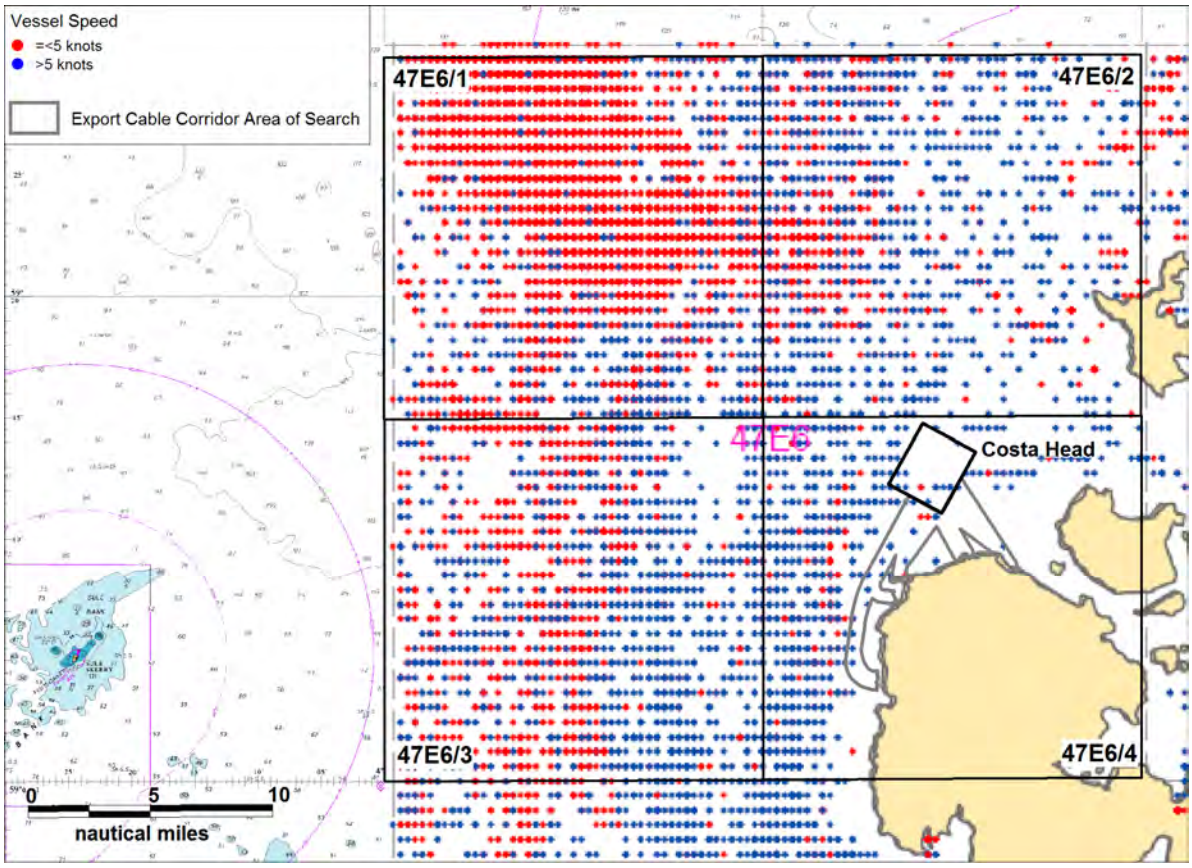


Figure 4.13 Chart of Satellite Fishing Vessel Positions by Speed (2009)

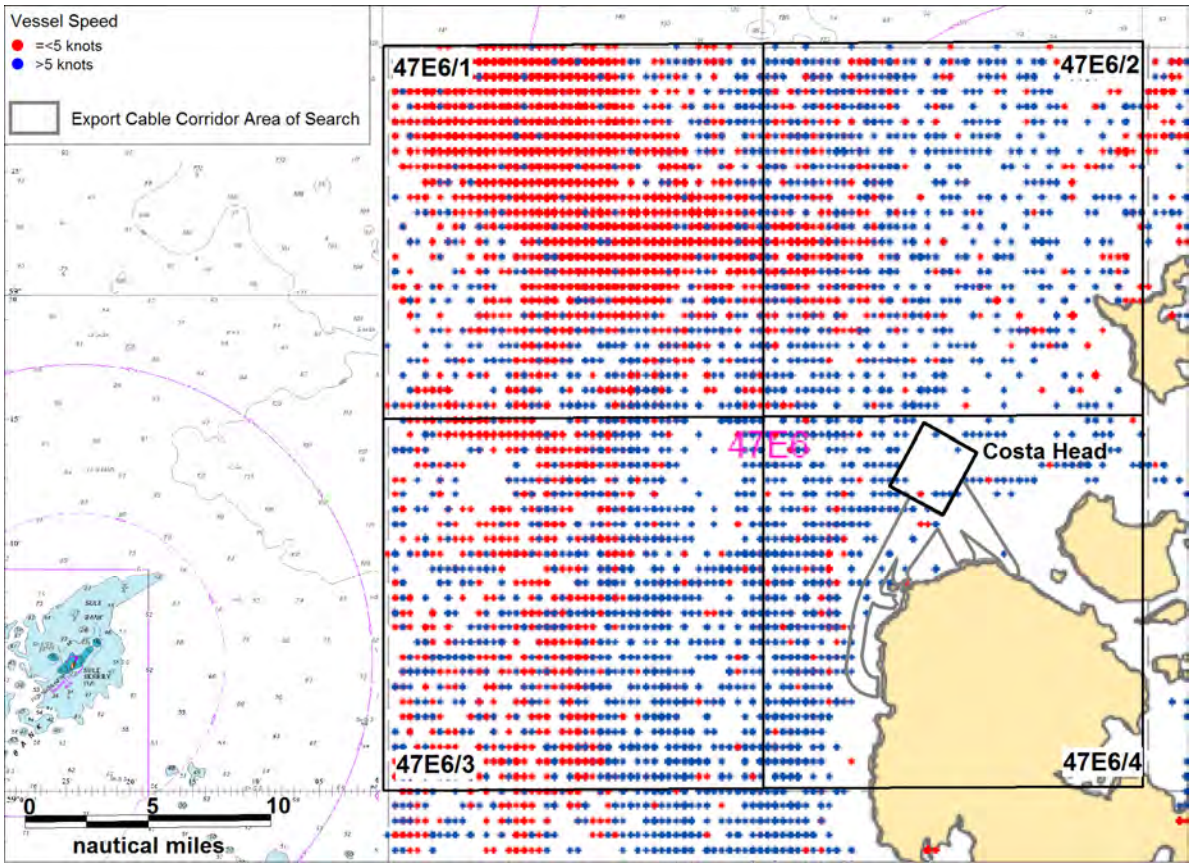


Figure 4.14 Chart of Satellite Fishing Vessel Positions by Speed (2010)

The vast majority of fishing vessel positions were to the west of the site area with only approximately 8-10 positions logged within the Costa Head AfL area per year, and 12-15 per year within the Export Cable Corridor Area of Search. In the vicinity of Costa Head, most vessels were tracked travelling at speeds over 5 knots which indicates they are likely to be steaming on passage. A small minority were logged below 5 knots which indicates they may have been fishing.

4.3 Recreational Vessel Activity

This section reviews recreational vessel activity in the vicinity of Costa Head 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. i) and updated GIS layers published in the Coastal Atlas (Ref. ii).

A summary plot of the recreational sailing activity and facilities identified in the North East Scotland Sailing Area is presented in Figure 4.15.

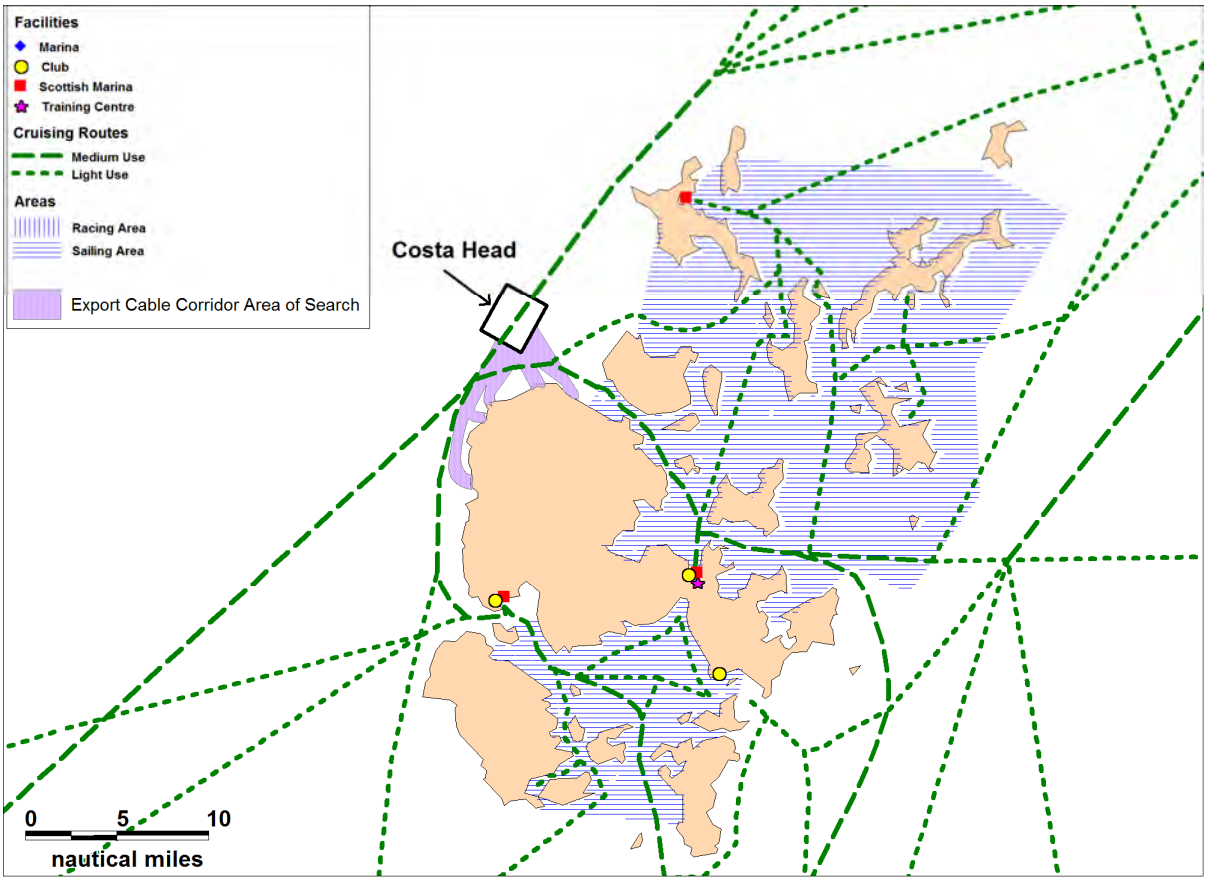


Figure 4.15 Recreational Information for North East Scotland Strategic Area

A more detailed chart of the recreational vessel activity and facilities in the vicinity of Costa Head is presented in Figure 4.16.

Based on the published data, the Costa Head AfL area and Cable Corridor lie outside of the general sailing and racing areas identified by the RYA. A medium-use[1] cruising route passes through the Costa Head AfL area, running north/south off the west coast of Mainland Orkney. This joins with a second medium-use route which passes about 1.3nm to the north west of the island, off Costa Head. These routes may be used by craft heading between various locations, such as Stromness-Westray-Shetland Islands. Both of these routes pass through the Export Cable Corridor Area of Search.

[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.

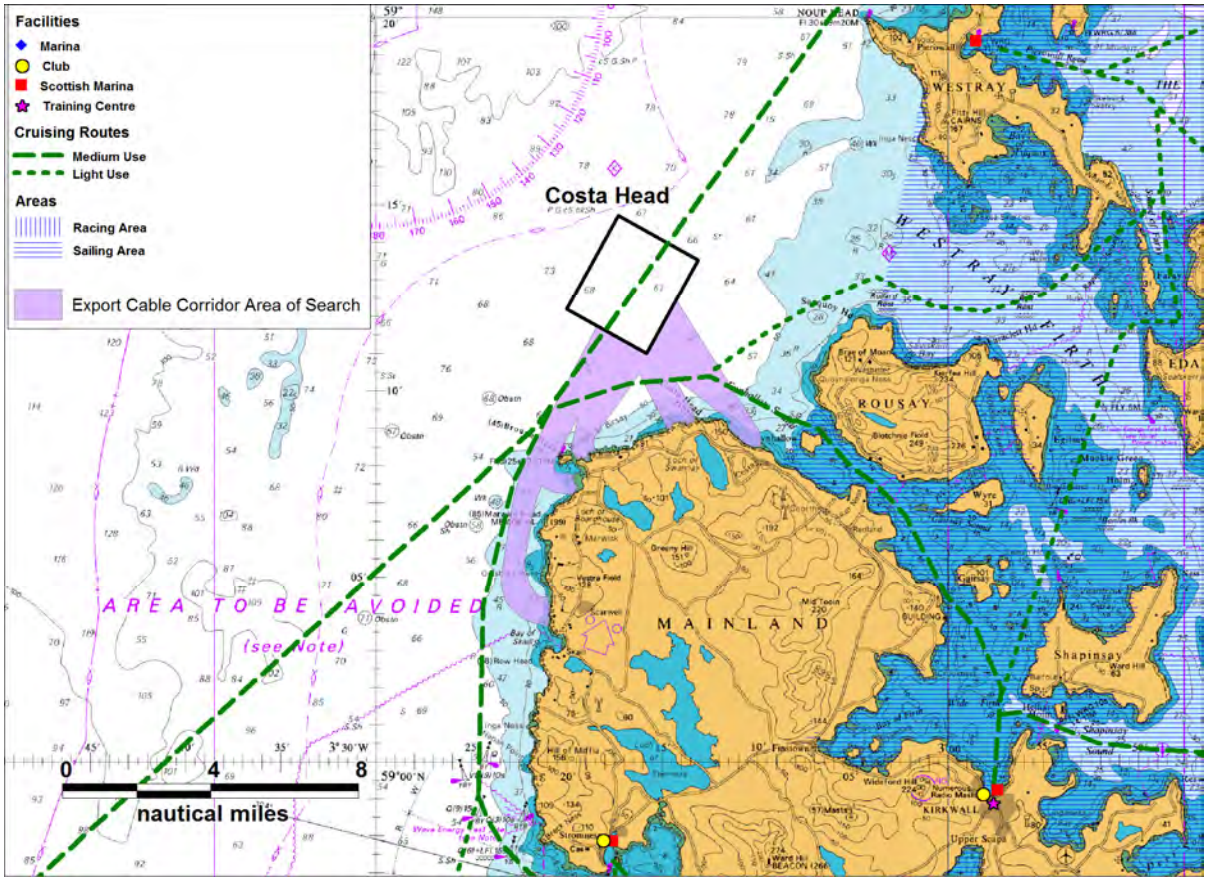


Figure 4.16 Recreational Data in the vicinity of Costa Head Wave Farm AfL Area

In terms of facilities, the nearest club (by sea) is the Kirkwall Sailing Club, approximately 16nm southeast of the Costa Head AfL area, and the closest marina and training club are also at Kirkwall.

It should be noted the routes are indicative and the RYA is updating the data as more information becomes available. For example, the preferred route through Eynhallow Sound is south of Eynhallow, not north as shown.

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.iii) which was compiled with local knowledge, includes information for recreational sailors in the vicinity of Costa Head.

The medium-use cruising route passing through Costa Head AfL area and the one to the south, indicated in Figure 4.16, are used by Clyde Cruising Club. The directions state that the principal problem with making a passage into Kirkwall from the west is the Burgar Rost in Eynhallow Sound where heavy overfalls occur on the west-going ebb tide. Kirkwall should be left on the ebb tide with sufficient time to arrive at Aiker Ness at the east end of

Eynhallow Sound during the last two hours of the ebb at neaps and not earlier than the last hour at springs.

Passage SE into Kirkwall from the NW should be made using the east-going flood tide. There are no overfalls between Eynhallow and the Orkney Mainland.

4.3.3 Orkney Marinas Sailing Guides

The Orkney Marinas website has sailing guides for Orkney waters. The publication "Going West from Westray" includes information for the sailing community within the vicinity. The routes are described below.

Westray to Stromness or Cape Wrath / Stromness to Westray

Passage time to Stromness is 4.5 hours at 8 knots. If Pierowall is departed with the first ebb in Papa Sound then the flood tide in Hoy Sound will aid passage into Stromness. Tide is low between Marwick Head and Hoy Sound and turns in Hoy Sound about 40 minutes before Kirkwall. If passage is made from Stromness to Westray two hours before low water it is possible to pick up the flood tide at Marwick Head and carry it to Pierowall.

Kirkwall to Stromness / Stromness to Kirkwall

Kirkwall to Stromness takes about 3.5 hours at 8 knots. Sailing from Stromness to Kirkwall, there is a quite a roost out of Hoy Sound on the ebb during any westerly weather. Eynhallow Sound is best approached on the flood. The deepest water is between Rousay and Eynhallow but the most straightforward channel is between Eynhallow and Mainland Orkney. The tide in Eynhallow Sound turns approximately the same time as Kirkwall so Hoy Sound is reached at the first flood.

5. Review of Historical Maritime Incidents

5.1 Introduction

This section reviews maritime incidents that have occurred in the vicinity of the Costa Head area in recent years.

The analysis is intended to provide a general indication as to whether the area of the proposed development is currently a 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 fishing 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 Costa Head AfL area between January 2001 and December 2010 are presented in Figure 5.1, colour-coded by type.

[1] MAIB aim for 97% accuracy in reporting the locations of incidents.

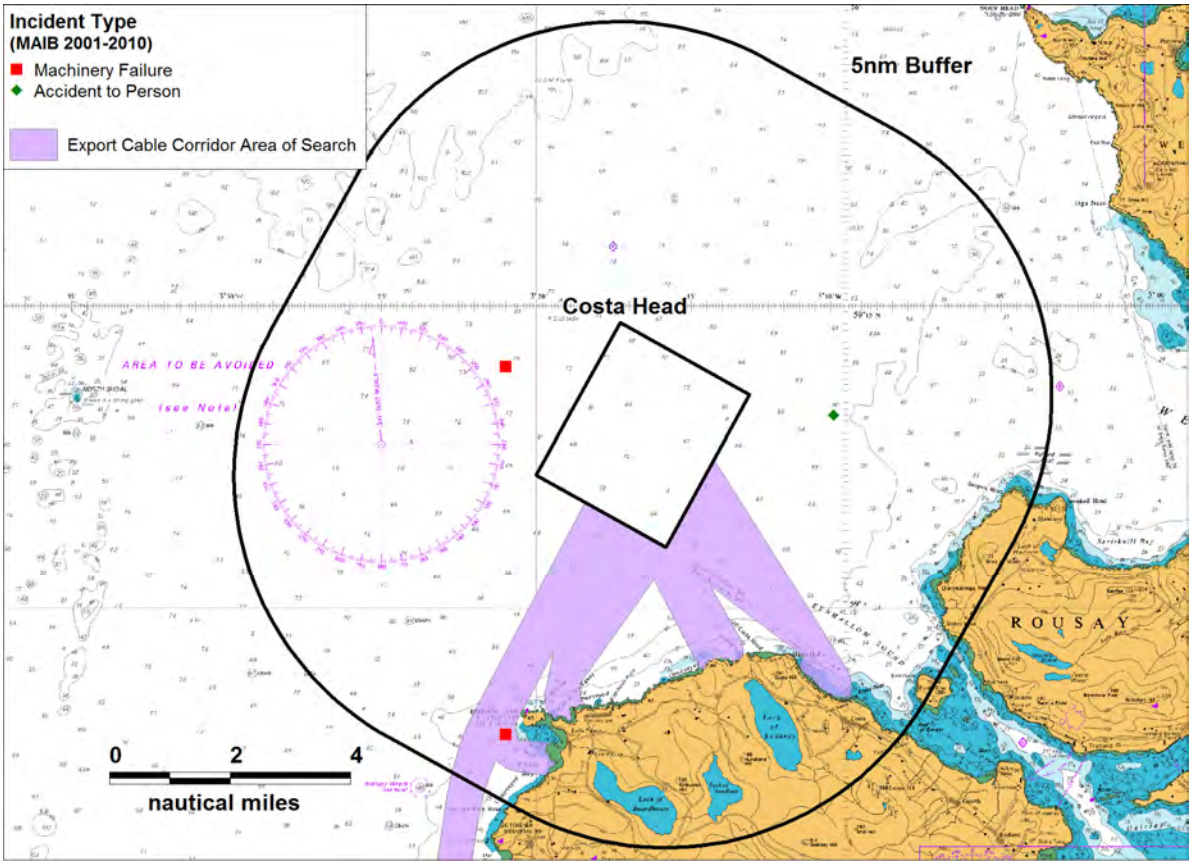


Figure 5.1 MAIB Incident Locations by Type within 5nm of Costa Head Wave Farm AfL Area

No incidents occurred within the AfL area over the 10 years. Three incidents were reported within 5nm of the AfL area. The closest occurred 1.4nm west on 26 November 2009. A French registered longline fishing vessel suffered main engine failure and had to be towed into Fraserburgh.

Brief details of the other two incidents which occurred within 5nm are listed below. Both involved UK vessels:

- On 2 May 2003 an accident to person occurred onboard a fishing vessel.
- On 5 May 2004 machinery failure occurred onboard a fishing vessel.

The May 2004 incident occurred within the cable corridor area. No other incidents were logged by MAIB within the export cable corridor area of search (including the area to the south beyond 5nm of the AfL area).

5.3 RNLI

Data on RNLI lifeboat responses within 5nm of the Costa Head AfL area in the ten-year period between 2001 and 2010 have been analysed. A total of 9 unique incidents were recorded by the RNLI (excluding hoaxes and false alarms), i.e., an average of one per year.

Two of the incidents recorded involved people being cut off from the land and were located close to shore, with 7 incidents occurring out at sea.

Figure 5.2 presents the geographical location of incidents colour-coded by casualty type.

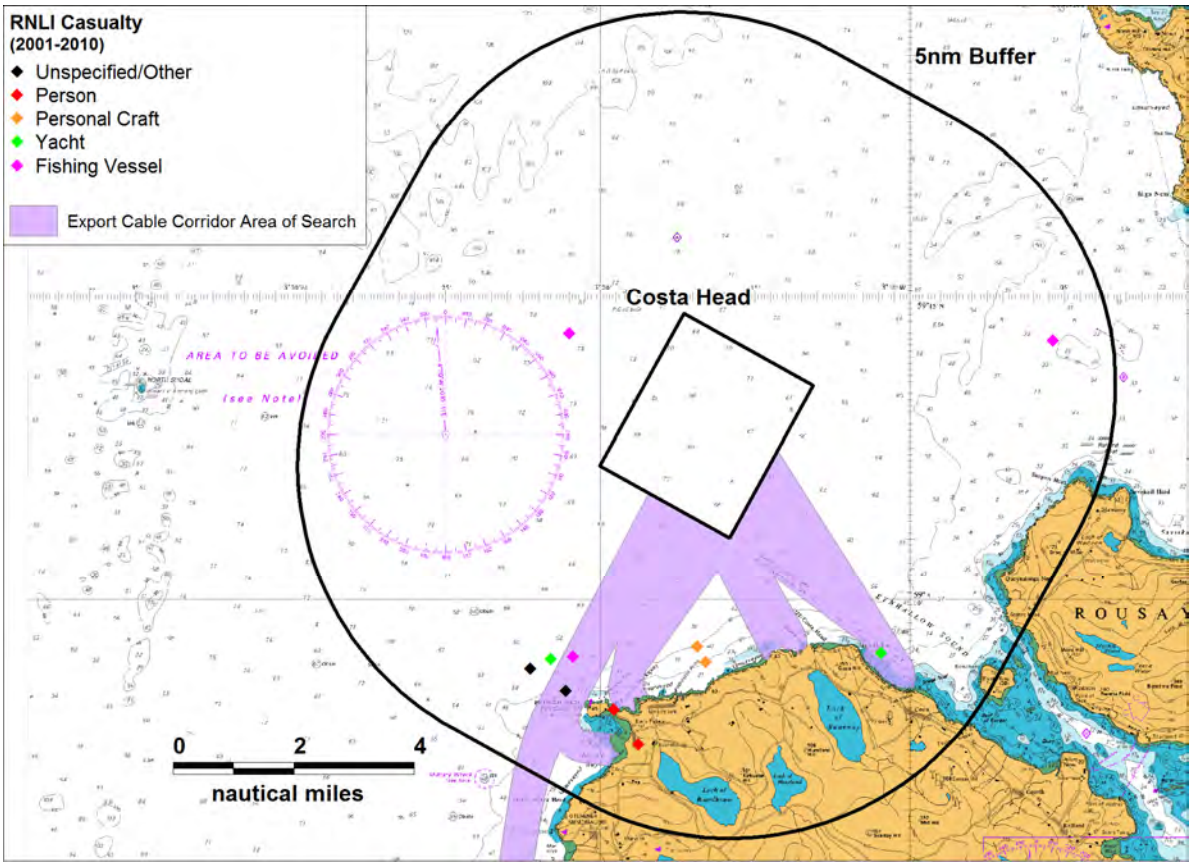


Figure 5.2 RNLI Incidents by Casualty Type within 5nm of Costa Head Wave Farm AfL Area

No incidents were recorded within the Costa Head AfL area over the 10 years analysed. The closest incident occurred 1.6nm west when a large fishing vessel suffered machinery failure on 27 November 2009. Kirkwall ALB responded. This is the same incident as recorded in the MAIB data set logged just before midnight on 26 November 2009.

55% of the incidents within 5nm of the Costa Head AfL area were responded to by Stromness RNLI and 45% by Kirkwall RNLI. The Stromness all-weather lifeboat (ALB) is currently the Severn class lifeboat *Violet, Dorothy and Kathleen*. Kirkwall ALB is currently the Severn class lifeboat *Margaret Foster*.

Within the cable corridor area, three incidents were recorded within 5nm of the AfL area (as shown in Figure 5.2 above). These were a helicopter crash, fishing vessel machinery failure and fouled propeller on yacht. A further machinery failure on a fishing vessel was logged by the RNLI in the southern part of the cable corridor area, beyond 5nm of the AfL area.

6. Stakeholder Consultation

6.1 Introduction

This section outlines the main stakeholders identified within the Costa Head AfL area and details of the consultation carried out to date.

6.2 Key Consultees

The key navigational consultees identified for the project are listed below:

- Marine Scotland Licensing Operations Team (MS-LOT)
- Maritime &Coastguard Agency (MCA)
- Department for Transport (DfT)
- Northern Lighthouse Board (NLB)
- RYA (Scotland)
- Cruising Association
- Orkney Islands Council (OIC) Marine Services
- Orkney Fisheries Association (OFA)
- Orkney Fishermen's Society (OFS)
- Marine Scotland Compliance – Fisheries Officer
- RNLI
- Orkney Dive Boat Operator's Association (ODBOA)

6.3 Summary of Consultation Meetings

Initial discussions have taken place with several of the above consultees during preparation of the PHA. Details are presented in Table 6.1.

Table 6.1 Stakeholder Comments

Stakeholder	Comments
MCA& DfT (Joint meeting on SSER sites, including Costa Head)	• Assurances needed that the converters being developed have received 3rd party verification. • 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. . If carried out from other survey vessels, this should be carried out to the appropriate standards. • UKHO input would be required on the markings of developments on charts.
MS-LOT	• List of stakeholders for the project, including navigational stakeholders, was reviewed. Noted that MS's Marine Renewable Facilitators Group

Stakeholder	Comments
	includes the MCA and NLB. Agreed that direct approach could be made where considered necessary provided MS were provided with feedback. Approach to phased developments were discussed in terms of consenting issues.
RYA (Scotland) Orkney Coastwatcher	• Heading between Stromness and Kirkwall, recreational vessels will tend to stay close in the shore and will pass south of the Costa Head AfL area. • If heading between Stromness and locations further north, such as Shetland, vessels may presently transit the area, but there is adequate room either side for vessels to avoid the Costa Head AfL area. The route taken would depend on weather. In many cases, vessels would call at Pierowall on Westray on the way, which would tend to take them south of the AfL area. • There are no significant issues with the site, provided it is adequately marked and lighted, depicted on charts and information is circulated via the appropriate methods, such as inclusion in the Clyde Cruising Club Sailing Directions. • Would like to see individual converters as far apart as possible so that vessels would have an escape route if they ended up within the array. • It was queried whether sector lights at Brough of Birsay and Noup Head could be used to help mark the site. (Subsequent consultation with NLB indicated they did not think this would be adequate. See below for initial advice received from NLB on marking and lighting.)
Northern Lighthouse Board	• NLB intend to use IALA O-139 (Ref. iv) as a basis for marking the Costa Head Wave Farm. • A cardinal buoy diamond would be the principal means to mark the area, and a 2 nautical mile range special mark light on each device in Phase I. • Further consideration would be needed for Phase II, which could involve up to 80 units. • Passive radar reflectors would be required on each device, which would also need to have suitable daymark properties. • There may be potential to use AIS to mark the site and/or individual units. • The requirements may change as understanding of the project and specific local issues develops. Also, cumulative impacts with the other planned sites off Orkney will need to be considered.
ODBOA	• Currently about 8-10 dive boats in ODBOA. Peaked at 15 a few years ago. Vessels mainly hired by tourists for diving trips, and less frequently for recreational angling. • All vessels are similar carrying 12 passengers and 2-3 crew. They have chart plotters and can set guard zones. Two vessels have AIS. • The majority of the dive boats in ODBOA spend most of their time within Scapa Flow. A few venture farther afield but the Costa Head AfL area would not pose a problem as it is far enough offshore such that it does not obstruct any regular transit routes to sites of interest.

Stakeholder	Comments
	• There are no issues with the Costa Head AfL area.
OFA and Kirkwall Fisheries Officer (OFS unable to attend)	• Larger fishing vessel data sets (AIS and VMS) were reviewed. These indicated transiting fishing vessels tended to pass clear of the Costa Head AfL area to the north and northwest. These are likely to include fishing vessels landing at Scrabster. • Smaller local vessels are not represented in this data, hence, why consultation is needed. • There are approximately 10 fishing vessels based at Tingwall and a smaller number at Westray. Most are members of OFA, and a few are with OFS. Most are small vessels (<15m) but a few are bigger and can operate out in deeper water. • There is likely to be fishing for crab and lobster in the area. Crabs are likely to be in the area during spring/summer when the females migrate towards shore from deeper water (can be >100 miles). • Costa Head AfL area is outside the bounds of winter fishing, but vessels may fish there in the summer. • Deployment of creels is weather dependent. Fishermen would not intend to leave creels in an exposed area like Costa Head in strong westerly swells due to the risk of them being damaged or lost. • There are no fish farms in the Costa Head AfL area, the nearest are several miles to the southeast in more sheltered waters. • Trawling will not be practicable given the layout and moorings, but creeling should be possible as access routes will be needed between cables for maintenance vessels. • A number of measures were suggested to reduce potential impacts, such as: minimised site footprint, no exclusion zones, minimise length of cable to landfall, bury cables, simplified moorings, fewer breakable parts, emergency response planning and habitat friendly design. • OFA promoted advance notice being given of any activities on site to allow fishermen time to plan their activities. Suggested methods of communication were discussed. • Consideration of the cumulative impact will be vital, taking a holistic approach to the effects on the fishing industry, such as displacement. • The Marine Scotland Compliance commercial fisheries study for Pentland Firth and Orkney should be released in March 2012 and will be available for use in Renewables assessment work and provide valuable data. • Local fishing vessels being given an opportunity to tender for future work at the site was strongly promoted.
OIC Marine Services (VTS and	• VTS due to be upgraded by 2012 The new radar scanner on west Mainland Orkney will be located at Black Craig where EMEC have an existing AIS and VHF repeater station. However, it will not have the ability to track targets around the coast from Marwick Head and

Stakeholder	Comments
Berthing Manager)	therefore will not provide radar coverage of the Costa Head site. The new scanner on Egilsay will cover the Westray Firth but again will not provide radar coverage of Costa Head. The new scanners should be integrated into the VTS by late autumn / early winter. • AIS coverage will be available of the Costa Head site. All EMEC vessels carry AIS as standard and this was recommended for Costa Head support vessels to ensure they can be tracked from Scapa VTS. Vessels will also need to report to Scapa VTS when crossing the reporting points in the approaches to Stromness and Kirkwall. • The site is in a lightly trafficked area. The ferry service which used to operate between Stromness and Lerwick in Shetland changed route to Kirkwall – Lerwick in the early 2000's. There are no known plans to reinstate the Stromness - Lerwick service. • Marine Services have no existing issues with the Costa Head site. However, it will be important that consideration is given to cumulative issues and the additional renewable traffic this could generate. It was noted that the location of Costa Head means that its support traffic may be passing other sites off the west coast of Mainland Orkney but not vice versa. • Ongoing port developments were discussed at Lyness, Stromness, and Kirkwall, and the possibility of these being used during the development.
RNLI (Lifeboats Operations Manager, Stromness)	• RNLI incident data was reviewed. Confirmed that no incidents have been recorded within the Costa Head AfL Area over the past 10 years. • Both Kirkwall and Stromness were seen to respond to incidents in the vicinity of the Costa Head site. The site is roughly midway between the stations. Tides and weather would be taken into account when deciding which lifeboat should respond. • Generally, the number of incidents in the area is low, and most incidents have been close to shore, which reflects maritime activity levels in the area, i.e., not a great deal of activity as far offshore as the Costa Head site. • The Stromness station has recently been upgraded with a VHF radio repeater station setup at Black Craig with the help of EMEC, which improves radio coverage off the western Orkney coastline. The lifeboat has also been fitted with AIS.

7. Preliminary Hazard Analysis

7.1 Introduction

This section provides a preliminary review of the vessel exposure and potential navigational hazards associated with the Costa Head Wave Farm based on the existing vessel activity in the area identified from the baseline data collection and the consultation feedback.

Potential mitigation measures to control the hazards are also discussed.

7.2 Vessel Exposure

From the baseline AIS data collection, a low level of traffic was observed passing through the Costa Head AfL area, averaging approximately two vessels per week. These were mainly small vessels such as fishing vessels and recreational craft.

No tankers were observed within five nautical miles of the site, which is mainly due to the area being within the IMO-adopted Area To Be Avoided (ATBA) around Orkney which applies to all vessels over 5,000 gross tonnes carrying oil or other hazardous cargoes in bulk.

The MCA have published guidance to mariners operating in the vicinity of offshore renewable energy installations (OREI) (Ref. v). The guidance notes state that, unlike wind farms, wave energy systems may not be clearly visible to the mariner, and could be semi-submerged. In the case of the AWS technology the freeboard is expected to be approximately 3m.

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. Navigate, with caution, through the array.

The choice will be influenced by a number of factors including the vessel's characteristics (type, tonnage, 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 surrounding the development. In the case of Costa Head, there is sea room both inshore and offshore of the area for vessels to avoid the site.

More in-depth consultation will be required during the Navigation Risk Assessment (NRA), with users of the area to discuss the development in more detail once device layout options and cable route(s) to shore have been better defined.

A discussion of specific hazards and how they will be addressed within the NRA is presented below for the main operational phases of the Costa Head Wave Farm development.

7.3 Hazard Review

7.3.1 Normal Operations

During normal operations, the converters will present a potential collision hazard to vessels navigating in the area. The collision risk will be assessed in the NRA using the following inputs:

- Device locations and dimensions
- Vessel activity
- Metocean data

Further data will be collected on all these inputs during the NRA process.

Any changes in vessel routeing due to the development, e.g., displacement of vessels around the site, 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. Based on the PHA work, the site is in an area that is infrequently used by vessel traffic.

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 could pose a collision hazard to passing vessels both within and beyond the site boundary. This hazard will be assessed within the NRA taking into account measures for monitoring, alerting and recovery.

Finally, the subsea cables could present a snagging hazard to fishing gear and vessel anchors. These hazards will be assessed in the NRA for the finalised cable route based on the vessel activity in the area and the planned protection measures, such as burial or mattresses.

7.3.2 Installation, Maintenance and Removal

For all vessels operating in the area there will be risks during installation, removal and maintenance, when there will be additional vessels in and around the site associated with the development, some of which may have restricted manoeuvrability. This will extend beyond the site 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 site area.

This will be assessed within the NRA based on the best available information on the likely areas of operation, number and types of vessels involved, base ports, duration of operations and weather limits.

7.3.3 Cumulative Impact

The assessment will take into account existing developments such as EMEC Billia Croo, and potential cumulative issues associated with nearby sites assessed. An illustration of currently

known developments is presented in Figure 7.1.The nearest is the Aquamarine Power Limited / SSER Brough Head Wave Site to the south.

The best available information at the time of performing the NRA will be used. Where there is uncertainty, a maximum development case will be assumed to be conservative.

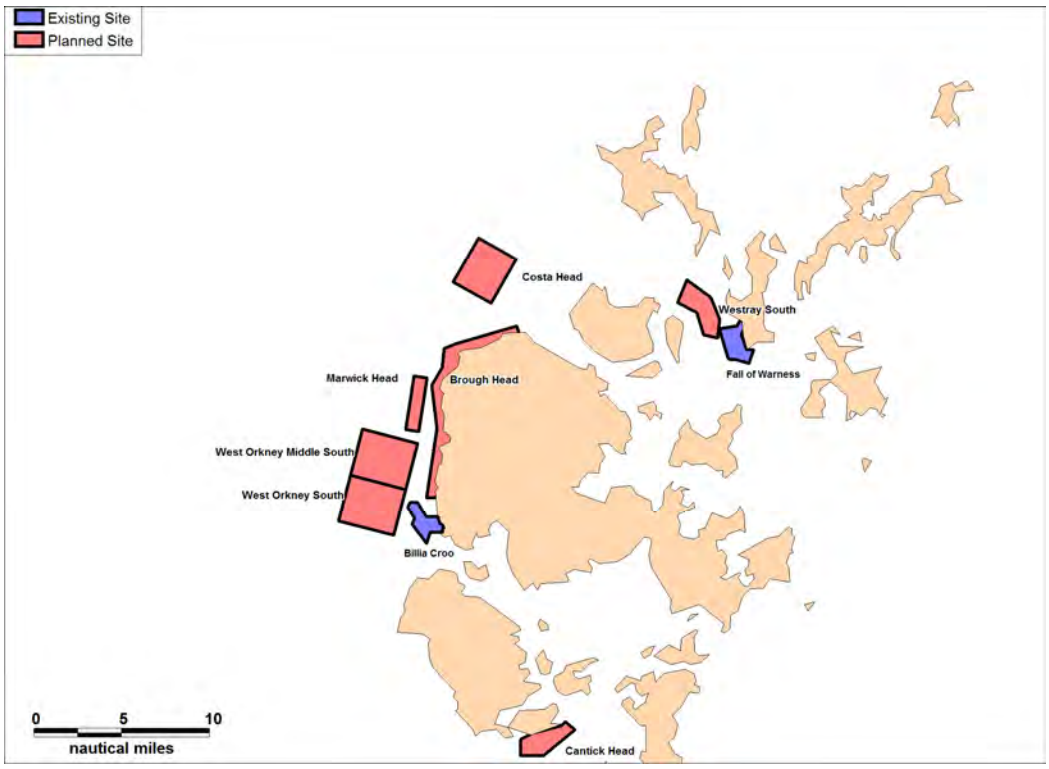


Figure 7.1 Planned Sites to be considered in the Cumulative Assessment

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).

An important measure is to ensure the final array layout is selected to minimise navigational hazards as far as practicable, i.e., taking into account wave resources, water depth and other constraints. The analysis carried out during this PHA is part of this process, which will continue based on the Scoping Opinion received and throughout the NRA.

In addition to preventive mitigation in the form of site selection, 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 NLB, UKHO and OIC Marine Services, to ensure these and other measures are implemented as effectively as possible for the Costa Head development, taking into account vessel activity.

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.

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 Navigation 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 suitable areas for deployment of converters are identified, further consultation will be carried out with the organisations listed in Section 6, as well as any other interested parties identified during the Scoping and NRA process to discuss the planned device layouts.

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 RYA, Sharing the Wind, 2004.

ii 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.

iii Clyde Cruising Club Sailing Directions and Anchorages – Part 5; N & NE Scotland and Orkney Islands; Clyde Cruising Club Publications Ltd, 2010.

iv International Association of Marine Aids to Navigation and Lighthouse Authorities, Recommendation O-139 on the Marking of Man-Made Offshore Structures, Edition 1, December 2008.

v MCA Marine Guidance Notice 372, Guidance to Mariners Operating in the Vicinity of UK OREIs, August 2008