SCOTTISHPOWER RENEWABLES

Proposed Marwick Head Wave Farm
Request for a Scoping Opinion
December 2012

This page is intentionally blank

CONTENTS

CONTENTS I

EXECUTIVE SUMMARY 1

1. INTRODUCTION 4

1.1. BACKGROUND 4

1.2. DOCUMENT PURPOSE 4

1.3. DOCUMENT STRUCTURE 5

2. POLICY & LEGISLATIVE CONTEXT 6

2.1. CLIMATE CHANGE 6

2.2. RENEWABLE ENERGY 6

2.3. PLANNING CONTEXT 7
- 2.3.1. Terrestrial Planning 7
- 2.3.2. Marine Planning 8

2.4. DEVELOPMENT CONTROL AND EIA 9
- 2.4.1. Consents and Licensing 9
- 2.4.2. EIA Regulations 10
- 2.4.3. Other Consents and Licenses 13
- 2.4.4. Legislation 14

3. DESCRIPTION OF THE DEVELOPMENT 15

3.1. SITE SELECTION 15

3.2. SITE LOCATION 15

3.3. NATURE OF THE PROPOSED WAVE FARM 18
- 3.3.1. Candidate Technology 18
- 3.3.2. Pelamis Wave Energy Converter 18
- 3.3.3. Components 18
- 3.3.4. Converter Spacing 19
- 3.3.5. Mooring 20
- 3.3.6. Installation Methodology 20
- 3.3.7. Installation Infrastructure 20
- 3.3.8. Monitoring Devices - Met masts / Wave buoys 21
- 3.3.9. Inter-Array Cabling 21
- 3.3.10. Export Cabling/Grid Connection 21

3.3.11. Operations and Maintenance Strategy 21
3.3.12. Operations and Maintenance Infrastructure 22
3.3.13. Decommissioning 23

4. ENVIRONMENTAL BASELINE & POTENTIAL EFFECTS 24

4.1. INTRODUCTION 24
4.1.1. Assessment Methodology 24
4.1.2. Cumulative and In-Combination Impacts 24

4.2. PHYSICAL ENVIRONMENT 25
4.2.1. Marine and Coastal Processes 25
4.2.2. Geology, Seabed Sediments and Sediment Transport 26
4.2.3. Water Quality and Effluent Discharges 28

4.3. BIOLOGICAL ENVIRONMENT 29
4.3.1. Benthic Ecology 29
4.3.2. Terrestrial Ecology 33
4.3.3. Ornithology 34
4.3.4. Marine Mammals 48
4.3.5. Fish and Shellfish 51

4.4. HUMAN ENVIRONMENT 54
4.4.1. Commercial Fisheries & Aquaculture 54
4.4.2. Maritime Navigation 55
4.4.3. Landscape and Seascape 57
4.4.4. Cultural Heritage 58
4.4.5. Noise 59
4.4.6. Socio Economics 60
4.4.7. Tourism and Recreation 61
4.4.8. Military Activity 63
4.4.9. Air and Climate 64
4.4.10. Other Human Activities 65
4.4.11. Summary of Main Potential Environmental Effects 65

4.5. MITIGATION 72

4.6. MONITORING 72

4.7. ENVIRONMENTAL MANAGEMENT FRAMEWORK 72

5. DRAFT OUTLINE OF THE ENVIRONMENTAL STATEMENT 73

5.1. PART 1: INTRODUCTION 73

5.2. PART 2: THE ENVIRONMENTAL IMPACT ASSESSMENT 73

6. CONSULTATION STRATEGY 75

6.1. OVERVIEW 75

6.2. PROJECT APPROACH 75

7. SCOPING QUESTIONS **77**

8. FURTHER INFORMATION **78**

APPENDICIES **79**

APPENDIX A SCOPING CONSULTEES 79

APPENDIX B DATA SOURCES 81

Executive Summary

ScottishPower Renewables (UK) Ltd (hereafter referred to as "SPR") is proposing to develop a Commercial Wave Farm (hereafter referred to as the 'Wave Farm') west of the Orkney Mainland at Marwick Head. The Wave Farm would have a capacity of 49.5MW of renewable power for export to the grid and would contribute to meeting the Scottish Government's targets of providing 100% equivalent of Scotland's electricity generation from renewable sources by 2020.

Pelamis Wave Power (PWP) and SPR are currently working together to develop the 750kW wave energy converter (see Figure 1). The wave device is a semi submerged wave device utilising the energy of the waves and is moored to the seabed.

PWP achieved grid connection and exported power to the local grid network with the full-scale, 750kW Pelamis prototype at the European Marine Energy Centre (EMEC) in August 2004. This was the world's first grid connected, open ocean demonstration of a deep-water wave energy converter.

The Pelamis device has undergone rigorous design validation in the intervening years. With more than 2,000 hours of operation, the prototype machine successfully demonstrated the Pelamis concept at full-scale, as well as generating continuous power into the grid, as expected and predicted by simulation models of experienced sea states and imposed control settings.

Figure 1: SPRs Pelamis P2 Wave Energy Converter under test in Orkney

In 2005, PWP secured the world's first commercial supply contract for wave energy converters, when a Portuguese utility placed an order for three Pelamis 750kW units to be installed off the coast of Northern Portugal. Under challenging conditions, PWP completed the installation of moorings and offshore electrical infrastructure, as well as the local final assembly and commissioning of machines before successfully exporting power to the Portuguese grid in July 2008. The company grid connected the array shortly thereafter, and

has demonstrated standard maintenance operations and activities for supporting multiple machine arrays, with minimal infrastructure requirements.

Once testing of the full-scale demonstration P2 wave energy converter and any required refinements to the design are complete it is proposed that the Wave Farm will be deployed in Orkney, subject to the required Consents and Licenses being obtained. SPR have secured exclusive rights to the development of a site to the west of the Orkney Mainland at Marwick Head. The Wave Farm would consist of 66*750kW Pelamis P2 wave energy converters within the area shown in Figure 22.

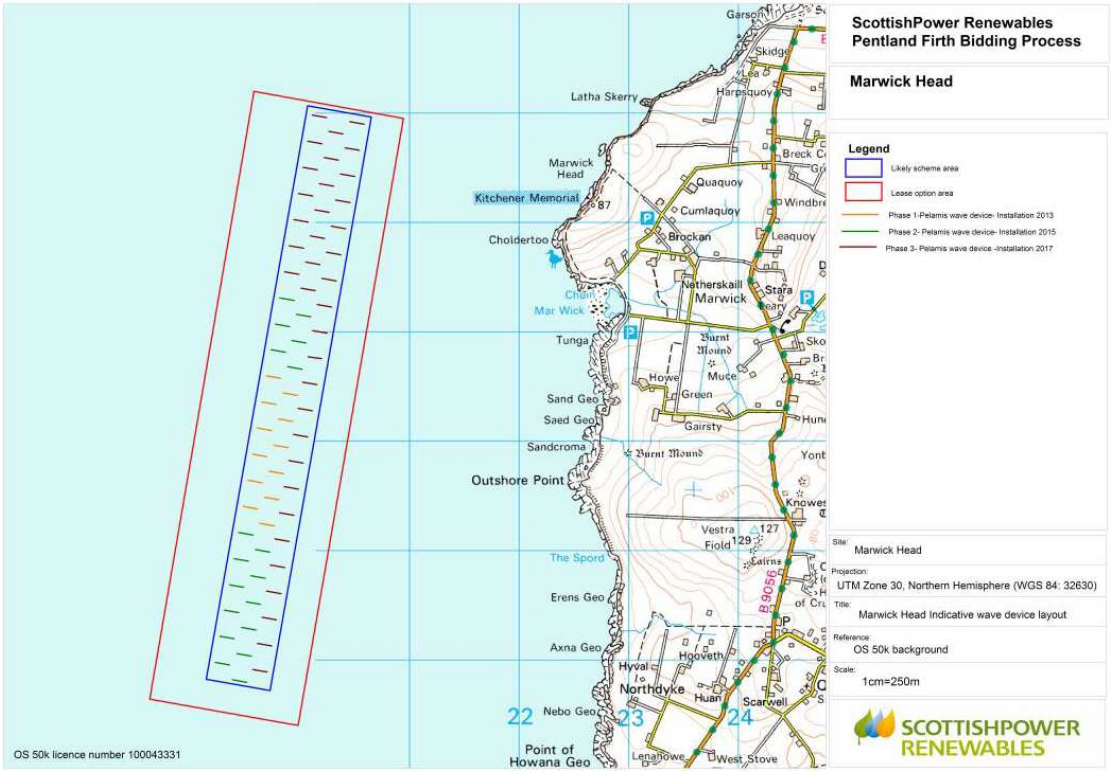


Figure 2: Marwick Head – Site Location

In addition to the wave devices, there will be associated onshore/offshore infrastructure including subsea and landfall cable, control building, substation and onshore access. The location for the onshore substation will be subject to final confirmation once local planning constraints and the locational requirements of the grid operator are ascertained. The substation site may also include the array control room. If it is possible to integrate the control room within a compound planned as part of local grid infrastructure upgrades, then this will be considered to minimise any local visual impact.

SPR will, in due course, submit a Section 36 and accompanying Environmental Statement to the Scottish Government for the development and a local planning application for the onshore elements. The development will also require a Licence under Section 21 of the Marine (Scotland) Act 2010 ("Marine licence"), from Scottish Government (Marine Scotland).

This report forms SPR's written request to the Scottish Government (Marine Scotland), under Regulation 7 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000, for its opinion as to the information to be provided in the Environmental Statement (a 'Scoping Opinion').

The Environmental Statement (ES) that will be produced for this project will support the applications for consent for offshore works, under the following legislation: Section 36 of the Electricity Act 1989; Section 21 of the Marine (Scotland) Act 2010; and a local planning application in regard to the onshore aspects of the development.

Environmental Impact Assessment (EIA) is a process that includes the identification of the potential environmental effects of a development and then seeks to avoid, reduce or offset any adverse effects through mitigation measures.

The purpose of this report is to set out the details of the proposed development, the site and the surrounding area, the potential effects of the development and the approach currently considered appropriate for the EIA to assist in the formal scoping process.

This report describes the baseline environment, and lists aspects of the environment that have the potential to be affected by the proposed development.

Although the layout and design are still developing and evolving, an understanding of the construction and operational parameters of the Wave Farm along with knowledge of the baseline environment of the site enables the possible effects of the development to be identified. The report also outlines the proposed approach and methodology to be adopted for certain studies that will require to be undertaken for the EIA.

The findings of this Scoping Report in conjunction with the Scoping Response received from Scottish Government (Marine Scotland) and other consultees will be used to inform the EIA. The list of consultees to be consulted is presented in Appendix A.

By conducting this exercise as early as possible, the overall project planning and design can take account of any alterations or measures that will act to resolve potential issues and minimise possible effects of the proposed development.

1. INTRODUCTION

1.1. BACKGROUND

1.1.1 ScottishPower Renewable Energy Limited, the parent company of ScottishPower Renewables (UK) Limited (SPR), is a wholly owned subsidiary of ScottishPower UK plc.

1.1.2 SPR is a leading UK onshore windfarm operator, managing operational windfarms in Britain with an installed capacity of >1,000MW.

1.1.3 Under the Renewables Obligation, SPR is implementing an ambitious growth programme in renewable energy, specifically wind energy.

1.1.4 SPR is also working towards becoming market leader in the emerging marine renewables sector.

1.1.5 SPR is currently involved in the development and deployment of a 750kW Pelamis P2 wave energy converter. The first Pelamis P2 purchased by SPR was initially deployed for pre-commercial testing at the Billia Croo wave facility, EMEC, in May 2012. The deployment of this device has already been given consent.

1.1.6 Knowledge gained from the installation and operation of this demonstration Pelamis P2 deployment will be used in the installation of the Marwick Head Wave Farm to the west of the Orkney Mainland.

1.1.7 It is proposed that the Wave Farm will consist of 66 Pelamis P2 wave energy converters and will be one of the first Commercial Wave Farms.

1.1.8 The Wave Farm will be 49.5MW and consent to construct and operate the Wave Farm will therefore be required under Section 36 of the Electricity Act 1989 from the Scottish Government (Marine Scotland).

1.1.9 The development of wave energy converters is at an early stage internationally and the UK is currently in a leading position, with a number of devices at various stages of development. It is therefore important to note that this is an innovative development designed to help take the marine renewables sector forward and the following points should be considered:

- The project is of strategic national importance in the UK as it will contribute to Renewable targets along with the birth of a new industry with enormous potential;
- The project will be one of the first commercial scale sites for Wave Power; and
- It is vital for projects such as this to be progressed expediently for the marine sector to move forward and for the UK to secure associated benefits.

1.2. DOCUMENT PURPOSE

1.2.1 This document forms SPRs written request to the Scottish Ministers, under Regulation 7 of the Electricity Works (Environmental Impact Assessment) (Scotland)

Regulations 2000 for their opinion as to the information to be provided in the Environmental Statement.

1.2.2 This document also informs the Scottish Ministers, that SPR intends to make an application for the following consents and licences:

- Consent under Section 36 of the Electricity Act 1989 from the Scottish Government (Marine Scotland) for the construction and operation of the Wave Farm;

- Licence under Section 21 of the Marine (Scotland) Act 2010 ("Marine licence") from Scottish Government (Marine Scotland) for the deposit any substance or object in the sea or on or under the seabed; construct, alter or improve works on or over the sea or on or under the seabed; remove substances or objects from the seabed; carry out dredging; deposit and/or use explosives; incinerate substances or objects; and

- Planning permission for the onshore elements of the project will be sought under the Town & Country Planning (Scotland) Act 1997.

1.2.3 The Environmental Statement that will be produced for this project will support the applications for consent for offshore works under the following legislation: Section 36 of the Electricity Act 1989; Section 21 of the Marine (Scotland) Act 2010; and planning permission under the Town & Country Planning (Scotland) Act 1997 for the onshore aspects. Section 20 of the Marine (Scotland) Act 2010 allows the previous FEPA and CPA licenses to be consolidated into one Marine Licence, to be administered by Marine Scotland's Licensing and Policy team.

1.2.4 The Crown Estate owns the foreshore and seabed from Low Water to 12 nautical miles (nm) and an Agreement for Lease under Section 3 of the Crown Estate Act 1961 will require to be obtained for the right of occupation for the placement of structures on, or passing cables over Crown Estate land.

1.3. DOCUMENT STRUCTURE

1.3.1 Chapter 2 identifies the legal framework, policy and Development Plan applicable to the content of this document.

1.3.2 Chapter 3 provides general information on the proposal including site selection, description of the nature and purpose of the proposed Wave Farm. A description of the potential effects on the environment is presented in Chapter 4.

1.3.3 Chapter 5 provides an outline of the proposed contents of the Environmental Statement. The approach to consultation is provided in Chapter 6 and contact details for further information are provided in Chapter 8.

2. POLICY & LEGISLATIVE CONTEXT

2.1. CLIMATE CHANGE

2.1.1 Climate change is the single most important long-term threat to the global environment, particularly to biodiversity and to birds[1]. Recent research suggests that climate change could drive between 18% and 35% of species to extinction by 2050[2].

2.1.2 The UK government, as part of its strategy to reduce greenhouse gases and tackle global warming, has placed a national obligation on all electricity suppliers to provide 10 per cent of their electricity from renewable sources by 2010 and 15% by 2015.

2.1.3 In addition, the UK Government has set a target for the supply of 15% of energy from renewable sources by 2020 and the Scottish Government has set a target for the supply of 100% of Scotland's electricity from renewable sources by 2020, recognising the extent of Scotland's important renewables resources. At the end of 2008 the amount of electricity generated in Scotland from renewable sources was around 18 per cent of the total[3].

2.2. RENEWABLE ENERGY

2.2.1 Renewable energy sources are natural energy sources such as sunlight, wind, waves and tides, which are continuously replenished. Of these, marine renewables (wave and tidal) energy has the potential to play a vital part in the future energy supply. This is recognised in the Scottish Government Marine Energy Strategy, March 2008.

2.2.2 The scale of Scotland's marine renewables potential is vast with the total wave and tidal resource in Scotland estimated at 14GW and 7.5GW respectively[4]. Within the marine industry wave and tidal prototype devices are currently being developed and tested in the field with a view to the deployment of arrays of such devices at suitable locations around the coastline of the United Kingdom. Wave and tidal offer benefits in terms of electricity generation that is free from emissions of carbon dioxide (the main 'greenhouse gas' associated with global warming) and other pollutants.

2.2.3 This Wave Farm is proposed as part of the response of SPR to targets set by UK and Scottish Governments to increase the proportion of electricity generated from renewable sources and hence reduce Scotland's contribution to climate change. In addition SPR is working towards becoming as a market leader in the emerging marine renewables sector.

2.2.4 The Scottish Government's Marine Energy Strategy (March 2008) recognises the potential that marine renewables (wave and tidal) has in future energy supply. The Strategy sets out the support mechanisms available to this growing sector of renewable energy and the next steps required in developing the Strategic Environmental

[1] Chief Scientific Adviser to the Government, Professor Sir David King, evidence to the House of Lords Select Committee on the European Union, inquiry into a "Sustainable EU Policy on Climate Change", Hansard, 10 March 2004

[2] Royal Society for the Protection of Birds, evidence to the House of Lords Select Committee on the European Union, inquiry into a "Sustainable EU Policy on Climate Change", Hansard, 3 March 2004.

[3] http://www.scotland.gov.uk/Topics/Statistics/Browse/Environment/seso/sesoSubSearch/Q/SID/205

[4] Scottish Government Marine Energy Strategy, March 2008.

Assessment for the development of wave and tidal devices around the Scottish coastline. The Strategy underwrites the Scottish Government's commitment to maintaining Scotland's position at the forefront of the marine energy industry.

2.3. PLANNING CONTEXT

2.3.1. Terrestrial Planning

2.3.1.1 A request to the Local Authority will be made under Section 57 of the Town & Country Planning (Scotland) Act covering the onshore elements of the development.

2.3.1.2 Depending on the precise location of the site consideration will also be made to the Conservation (Natural Habitats &c) Regulations 1994 (as amended) with regards to the potential requirement for an Appropriate Assessment, and Environmental Protected Species licences (see Section 2.4.1). However, given that there is limited room for manoeuvre within the Crown Estate lease area and the proximity of the various conservation designations (and features likely to be impacted); it is highly unlikely that changes to site location will remove the need for an Appropriate Assessment.

National Regulations

2.3.1.3 Scottish Ministers are responsible for the National Planning Framework for Scotland (NPF) which sits at the top of the policy hierarchy and is the long term strategy for the development of Scotland.

2.3.1.4 The first NPF (NPF 1) was produced in 2004 and provides a non-statutory spatial planning framework for Scotland for the period to 2025. It identifies key drivers of change in the environment and economy of Scotland and defines strategic infrastructure requirements to provide a basis for future planning.

2.3.1.5 Several provisions of the NPF are of relevance to the current proposals: for example, the need for sustainable development, and the need to promote and deliver the Scottish Government's renewable energy targets and aspirations. The framework also recognises the economic benefits that developing Scotland renewable energy potential could bring.

2.3.1.6 The second NPF (NPF 2) was published in 2009 and provides an important vehicle for the national debate about the sort of place we want Scotland to be. It will guide and provide a vision for Scotland's spatial development up to 2030, setting out strategic development priorities to support the Scottish Government's central purpose - promoting sustainable economic growth.

2.3.1.7 The introduction of NPF 2 is a big step towards securing the future of the renewable energy industry in Scotland; the Government clearly states its commitment to realising the power generating potential of all renewable sources of energy. NPF 2 recognises that longer term potential is likely to lie with new technologies such as wave and tidal power, biomass and offshore wind.

2.3.1.8 Scottish Planning Policy (SPP) is the statement of the Scottish Government's policy on nationally important land use planning matters. It was published in February 2010 as a result of the commitment to proportionate and practical planning policies. The SPP

replaces a series of planning guidance documents, providing a shorter, clearer and more focused statement of national planning policy.

2.3.1.9 The SPP is a statement of Scottish Government policy on land use planning and contains the following:

- Scottish Government's view of the purpose of planning;
- Core principles for the operation of the system and the objectives for key parts of the system;
- Statutory guidance on sustainable development and planning under Section 3E of the Planning etc. (Scotland) Act 2006;
- Concise subject planning policies, including the implications for development planning and development management; and
- Scottish Government's expectations of the intended outcomes of the planning system.

2.3.1.10 The SPP contains 'subject policies', one of which relates to renewable energy. The following extracts are taken from this subject policy:

2.3.1.11 '*Planning authorities should support the development of a diverse range of renewable energy technologies, guide development to appropriate locations and provide clarity on the issues that will be taken into account when specific proposals are assessed. Development plans should support all scales of development associated with the generation of energy and heat from renewable sources, ensuring that an area's renewable energy potential is realised and optimised in a way that takes account of relevant economic, social, environmental and transport issues and maximises benefits.*'

2.3.1.12 'Off-shore renewable energy generation presents significant opportunities to contribute to the achievement of Government targets. Although the planning system does not regulate off-shore development, it is essential that development plans take into account the infrastructure and grid connection needs of the off-shore renewable energy generation industry. Development plans should identify appropriate locations for facilities linked to the manufacture, installation, operation and maintenance of off-shore wind farms and wave and tidal devices.'

Regional Regulations

2.3.1.13 The Local Development Plan (LDP) for an area comprises both the approved structure and the adopted local plan.

2.3.1.14 The Planning etc (Scotland) Act 2006 requires Orkney Islands Council to replace the existing Structure Plan and Local Plan with a single LDP. The LDP will set out the long-term vision for future development and land use across Orkney.

2.3.2. Marine Planning

2.3.2.1 Marine spatial planning is recognised as the mechanism for achieving a more integrated, simplified and sustainable approach to the management of marine sectors and activities and increased protection of the natural marine and coastal environment. The Marine (Scotland) Act 2010 sets out provisions for marine planning in Scottish waters.

2.3.2.2 Marine planning in Scotland will be based on a 3-tier system:

- Scotland (National) Level Planning;
- Regional Level Planning; and
- International Level Planning.

2.3.2.3 Renewable energy developments would be incorporated as part of the regional level planning.

2.3.2.4 The requirements under The Energy Act 2004 for offshore installations to prepare decommissioning plans will also be considered.

Scotland (National) Plans

2.3.2.5 Nationally there will be a single Scottish National Marine Plan. The plan will be prepared by Marine Scotland and will set national economic, social and marine ecosystem objectives alongside objectives relating to the mitigation of, and adaptation to, climate change. The plan may set out specific spatial requirements for particular types of activity or development where these are of national significance.

Regional Plans

2.3.2.6 These will be prepared for Scottish Marine Regions to take forward policies and priorities defined in the National Marine Plan. Regions will be defined by Marine Scotland and managed by a Marine Planning Partnership which will comprise someone nominated by the Scottish Ministers as well as one or more public authorities and/or stakeholders. The Partnerships will prepare a regional plan for their area, which is likely to include a vision for the marine area covered by the plan, management policies for specific sectors, and a framework for decision making in relation to development consents.

2.4. DEVELOPMENT CONTROL AND EIA

2.4.1. Consents and Licensing

Electricity Act 1989

2.4.1.1 Under Section 36 of the Electricity Act 1989 ('the Act'), consent is required from the Scottish Ministers for the construction, extension and operation of a wave power generating station with a capacity greater than 1.0MW.

2.4.1.2 On granting consent under Section 36, the Scottish Ministers can also decide that planning permission be deemed to be granted, if requested to do so.

2.4.1.3 The capacity of the proposed Wave Farm will be 49.5MW. Consent for the Wave Farm will therefore be required under Section 36 of the Electricity Act.

Marine Licence

2.4.1.4 The Wave Farm and selected cable route will require a licence under Section 21 of the Marine (Scotland) Act 2010 ("Marine licence") from Scottish Government (Marine Scotland).

Onshore Planning

2.4.1.5 The onshore aspects of the Wave Farm will require planning permission under the Town & Country Planning (Scotland) Act 1997.

EPS

2.4.1.6 Under the Conservation (Natural Habitats, & c.) Regulations 1994, as amended by The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007 and The Conservation of Habitats and Species Regulations 2010 it is an offence to disturb or to recklessly capture or kill European protected species (EPS), including all cetaceans. A license to damage or disturb EPS can be applied for from Scottish Ministers; however, in granting such a license Scottish Ministers must make arrangements for monitoring the incidental capture and killing of EPS, as well as make arrangements for the carrying out of such research or the taking of such conservation measures as are necessary for ensuring that such incidental capture and killing does not have a significant negative impact on the species considered.

SEA and AA

2.4.1.7 A Strategic Environmental Assessment (SEA), which covered the Pentland Firth and Orkney Waters (PFOW) area, was carried out in 2007[5]. This highlighted all of the possible effects relating to marine renewable energy projects as well as providing baseline data for the area.

2.4.1.8 An Appropriate Assessment (AA) has been undertaken by The Crown Estate for the leasing round in general, which incorporated the Marwick Head Wave Farm site but was not specific to this site. Consequently, a site specific AA will also have to be undertaken by Marine Scotland in due course, based on information provided by SPR.

Scoping Question: Have all regulatory requirements that the project should be taking into account been identified?

2.4.2. EIA Regulations

2.4.2.1 The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 ('the EIA Regulations') implement Council Directive 85/337/EEC as amended by Council Directive 97/11/EC on the assessment of the effects of certain public and private projects on the environment, insofar as it relates to applications for consent to construct, extend or operate a power station or install or keep installed overhead electricity lines under Sections 36 and 37 of the Act. Guidance on the Regulations is contained in a Guidance Note (the 'Guidance Note').

2.4.2.2 Under the Regulations, Section 36 development that is considered likely to have significant effects on the environment must be subject to EIA and an Environmental Statement (ES) submitted with the Section 36 application.

[5] Note: This SEA is due to be updated in 2013.

2.4.2.3 Schedule 1 of the Regulations lists those developments for which EIA is mandatory, whilst Schedule 2 describes projects for which the need for EIA is judged by the Scottish Ministers on a case-by-case basis through a screening process. Schedule 3 describes the criteria to be used by the Scottish Ministers to determine if a development is 'EIA development'.

2.4.2.4 Where EIA is required, environmental information must be provided by the developer in an Environmental Statement. Schedule 4 specifies the information that must or may be provided in such a Statement.

2.4.2.5 The Regulations prohibit the Scottish Ministers from granting consent for an EIA development without taking into account an Environmental Statement, together with any associated environmental information.

2.4.2.6 The proposed Wave Farm is a Schedule 2 development: *"(1) a generating station, the construction of which (or the operation of which) will require a section 36 consent but which is not Schedule 1 development."* If therefore it is likely to have significant environmental effects because of factors such as its nature, size or location, it is 'EIA development', and a formal EIA is required. SPR independently proposed that the Wave Farm should be subject to EIA.

Obtaining a Scoping Opinion (Regulation 7)

2.4.2.7 Under Regulation 7, the developer of an EIA development may ask the Scottish Ministers, before submitting an application for a Section 36 consent under the Act, to state in writing their opinion as to the information to be provided in the Environmental Statement (i.e. to provide a 'Scoping Opinion').

2.4.2.8 The Guidance Note (Guidance on The Electricity Works (Environmental Impact Assessment)(Scotland) Regulations 2000) states that this provision allows the developer to be clear about what the Scottish Ministers consider the main effects of the development are likely to be and therefore the topics on which the Environmental Statement should focus.

2.4.2.9 The request for a Scoping Opinion must be in writing and should include basic information on the proposed development as set out below:

(a) a plan sufficient to identify the site which is the subject of the proposed development;

(b) a brief description of the nature and purpose of the proposed development and its possible effects on the environment; and

(c) such further information or representations as the person making the request may wish to provide or make.

2.4.2.10 This information is presented in the following sections. The Guidance Note states that the developer should also submit a draft outline of the Environmental Statement, giving an indication of what they consider to be the main issues, to provide a focus for the Scottish Ministers' considerations.

2.4.2.11 Once they have all the information they require, the Scottish Ministers are required to consult and obtain the views of the Consultative Bodies (the Planning Authorities of the area in which the development is planned, Scottish Natural Heritage (SNH) and the Scottish Environment Protection Agency (SEPA), the developer and other organisations (as they see fit).

2.4.2.12 When the Scottish Ministers issue a Scoping Opinion, they must state what information should be included in the Environmental Statement, giving their reasons why. The Regulations also require the Scottish Ministers to make available to the public, via the Planning Authorities, their Scoping Opinion.

2.4.2.13 The findings of this Scoping Report in conjunction with the Scoping Opinion received from Scottish Government and other consultees will be used to inform the EIA. The list of consultees to be consulted is presented in Appendix A.

2.4.2.14 Other relevant Environmental Impact Assessment legislation are as follows:

- Marine Works (Environmental Impact Assessment) Regulations 2007; and
- Environmental Impact Assessment (Scotland) Regulations 1999.

2.4.2.15 The requirements of the above will be met within the EIA process adopted for the Wave Farm.

Provision of Information by Consultative Bodies (Regulation 8)

2.4.2.16 Under the Environmental Information (Scotland) Regulations 2005, public bodies must make environmental information available to any person who requests it. These Regulations are pertinent where a developer is preparing an Environmental Statement for an EIA development.

2.4.2.17 Regulation 8 of the EIA Regulations provides for the developer to acquire from public bodies any environmental information which they hold which will assist in the preparation of the Environmental Statement.

2.4.2.18 When the developer notifies the Scottish Ministers, under Regulation 8, that he intends to provide an Environmental Statement with the application, the Scottish Ministers will notify the Consultative Bodies and other relevant environmental organisations and ask them to make the information available. The developer will be told who these organisations are, together with their addresses.

The Environmental Impact Assessment Process

2.4.2.19 Environmental Impact Assessment (EIA) is a process which includes the identification of the potential environmental effects of a development and then seeks to avoid, reduce or offset any adverse effects through 'mitigation measures'. EIA follows a series of stages:

- Site selection and project initiation;
- Screening – is an EIA required?
- Pre-application discussions;

- **Scoping – consultation on proposed scope and methodology[6];**
- Environmental baseline studies – establish what is there;
- Assessment of effects – determine the potential effects;
- Mitigation – modify proposals to incorporate mitigation measures and re-assess residual effects;
- Preparation of Environmental Statement;
- Submission of Section 36 Application with Environmental Statement;
- Consideration of application and environmental information by Scottish Ministers and consultees;
- Decision to refuse or grant consent (with or without conditions); and
- Implementation and monitoring.

2.4.2.20 In reality the EIA process is both iterative and cyclic, and runs in tandem with project design. As potential effects are identified, the design of the project, e.g. the layout of the Wave Farm will be adjusted and mitigation measures proposed. Consultation, a vital component of the EIA process, continues throughout each stage and contributes both to the identification of potential effects and mitigation measures.

2.4.2.21 The EIA process therefore provides the opportunity to develop projects, for which the environmental effects have effectively been removed or minimised. In many cases significant effects on for example ecology, birds, mammals and noise can be prevented through sensitive design and selection. Others, for example the effects of construction, can be effectively managed through the adoption of best practice.

2.4.2.22 At this early scoping stage however it is important to identify all the *'potential'* effects so that a rigorous assessment process, with input from independent experts, is followed based on sound objective evidence. The *potential* effects of the proposed Wave Farm are then stated on which the Environmental Statement should focus. Those effects that are considered to be non-significant issues, and that are therefore scoped out of the Environmental Statement, are also stated.

2.4.3. Other Consents and Licenses

2.4.3.1 A request to the Local Authority will be made under Section 57 of the Town & Country Planning (Scotland) Act covering the onshore elements of the development.

2.4.3.2 Determining bodies for these consents and licences have been included in the Consultee List (Appendix A) to ensure that they are aware of the proposals at the earliest stage and their requirements for environmental information are incorporated into the Scoping Opinion and Environmental Statement as appropriate.

2.4.3.3 Depending on the precise location of the site, consideration will also be made to the Conservation (Natural Habitats &C.) Regulations 1994, as amended, with regards to the

[6] The stage ScottishPower Renewables is currently at with the Wave Farm.

potential requirement for an Appropriate Assessment and Environmental Protected Species licences.

2.4.4. Legislation

2.4.4.1 The Marine and Coastal Access Act 2009 aims to put in place a better system for delivering sustainable development of the marine and coastal environment and address both the use and protection of the marine resources. It proposes to deliver an integrated system for planning, consents, nature conservation, coastal and estuary management, fisheries management and enforcement, with some marine functions to be reserved for the UK Government whilst others are devolved to regional administrations. A key aspect of the Marine and Coastal Access Act is the introduction of a network of Marine Conservation Zones.

2.4.4.2 The key issues covered in the UK Marine Act are:

- The creation of the Marine Management Organisation (MMO);
- Planning in the marine area;
- Licensing activities in the marine area;
- Marine nature conservation;
- Managing marine fisheries;
- Reform of inland and migratory fisheries;
- Modernisation and streamlining of enforcement powers; and
- Administrative penalties scheme for domestic fisheries offences.

2.4.4.3 To address devolved matters the Scottish Government introduced the Marine (Scotland) Act 2010. The Scottish Marine Act sets out a strategic approach to managing Scotland's seas and includes:

- Greater local control over marine and coastal areas;
- A simpler regulatory system for the marine environment;
- Creation of a Scottish marine management organisation – Marine Scotland;
- More action on marine nature conservation; and
- A strategic national approach.

3. DESCRIPTION OF THE DEVELOPMENT

3.1. SITE SELECTION

3.1.1 SPR bidding process for the lease of Crown Estate sites in the Pentland Firth and Orkney Waters (PFOW). The purpose of this leasing round was to accelerate the development of commercial wave and tidal arrays in the PFOW strategic area. SPR were successful in their bid to develop the Marwick Head wave site on the north-west coast of Orkney, and have been awarded exclusive development rights for a wave farm with a capacity of 50MW.

3.1.2 The initial site-selection process took due consideration of all technical, environmental, social, economic and political constraints, including factors such as shipping, MoD operations, ecology, bathymetry, seabed conditions, fishing, wave and tidal resource, grid issues, support infrastructure and accessibility. An overall assessment of the site was established against these criteria.

3.1.3 We have also had valuable input from various consultations. This has confirmed that the site does not have any "showstopper" environmental issues (based on available information). However, the site is close to the Marwick Head Special Protection Area which will require full consideration via a Habitat Regulations Appraisal and subsequently an Appropriate Assessment. However, the feedback from this report will form the basis of the Environmental Impact Assessment process and Habitat Regulations Appraisal and may highlight issues that have not been identified during the production of this report.

3.1.4 These factors have led to our selection of Marwick Head as an optimum site for development.

3.2. SITE LOCATION

3.2.1 The Orkney Islands are located off the north coast of Scotland. The proposed location for the Wave Farm is shown in Figure 2.

3.2.2 The area under consideration is Marwick Head, in the waters to the north west of the Orkney Mainland. There are ferry services from Scrabster to Stromness and Gills Bay to St. Margarets Hope.

3.2.3 Marwick is the nearest village to the proposed site and is accessed by land via the B9056/A967.

3.2.4 At present the precise location for the Pelamis wave energy converters within the Marwick Head site are yet to be determined and will be the subject of a review of technical (such as separation distances between each device), environmental and stakeholder considerations as the Environmental Assessment progresses. Depth and benthic conditions are all suitable for deployment of a Wave Farm within the proposed area.

3.2.5 In addition to the wave energy converters there will also be a requirement for an export power cable route from the Wave Farm as well as onshore infrastructure components such as a grid connection point, control building and substation. The

preferred and secondary search areas for both the cable corridors and the onshore infrastructure are shown in Figure 3. The preferred landfall locations have been selected with regards the SPA and the potential location for the interconnector cable substation location. Most of the preferred cable landfall locations are in relatively close proximity to the offshore development which helps to reduce offshore cable routeing costs and risks. The longer the cable run is from the offshore development site then the higher the costs and risks become. As part of their involvement in the Pentland Firth Developers Forum, and inclusion into discussions with SHETL and their search for appropriate infrastructure sites, SPR will aim to tie in their plans with other potential developments in the area. The EIA will consider (if details are available) the planned infrastructure sites being proposed by other developers and how SPR may coordinate with these developers to reduce any impact on the local area. This particularly relates to the West Orkney Middle South, West Orkney South, Brough Head and Costa Head developments and their associated landfall locations.

3.2.6 In 2009, Highlands and Islands Enterprise (HIE) published a grid options study to assist the development of the Pentland Firth and Orkney Waters. This study indicates where potential future local grid reinforcements could be made, while the recent conclusions report from the Electricity Network Strategy Group discusses the potential new wider transmission infrastructure developments. According to both studies there is potential future build of transmission assets into the east of the region (near Duncansby Head) via an HVDC link to the Moray coast, with potential timeframes of between 2015 and 2020. This is considered to be the likely preferred grid connection option for the project.

3.2.7 The final, most appropriate design will be guided by the findings of the environmental assessment together with feedback from consultation and responses to this Scoping Report.

3.2.8 The Crown Estate owns the foreshore and seabed from Low Water to 12 nautical miles (nm).

3.2.9 The site has been selected to avoid International and National designations. The potential area of interest is outwith any existing nature conservation designations, although is in close proximity to Marwick Head SPA (see Figure 3). However consideration would be given to designations in the vicinity of the area of interest as required under Regulation 48 of The Conservation (Natural Habitats, & c.) Regulations 1994. Marine, coastal and terrestrial designations are described in Chapter 4.

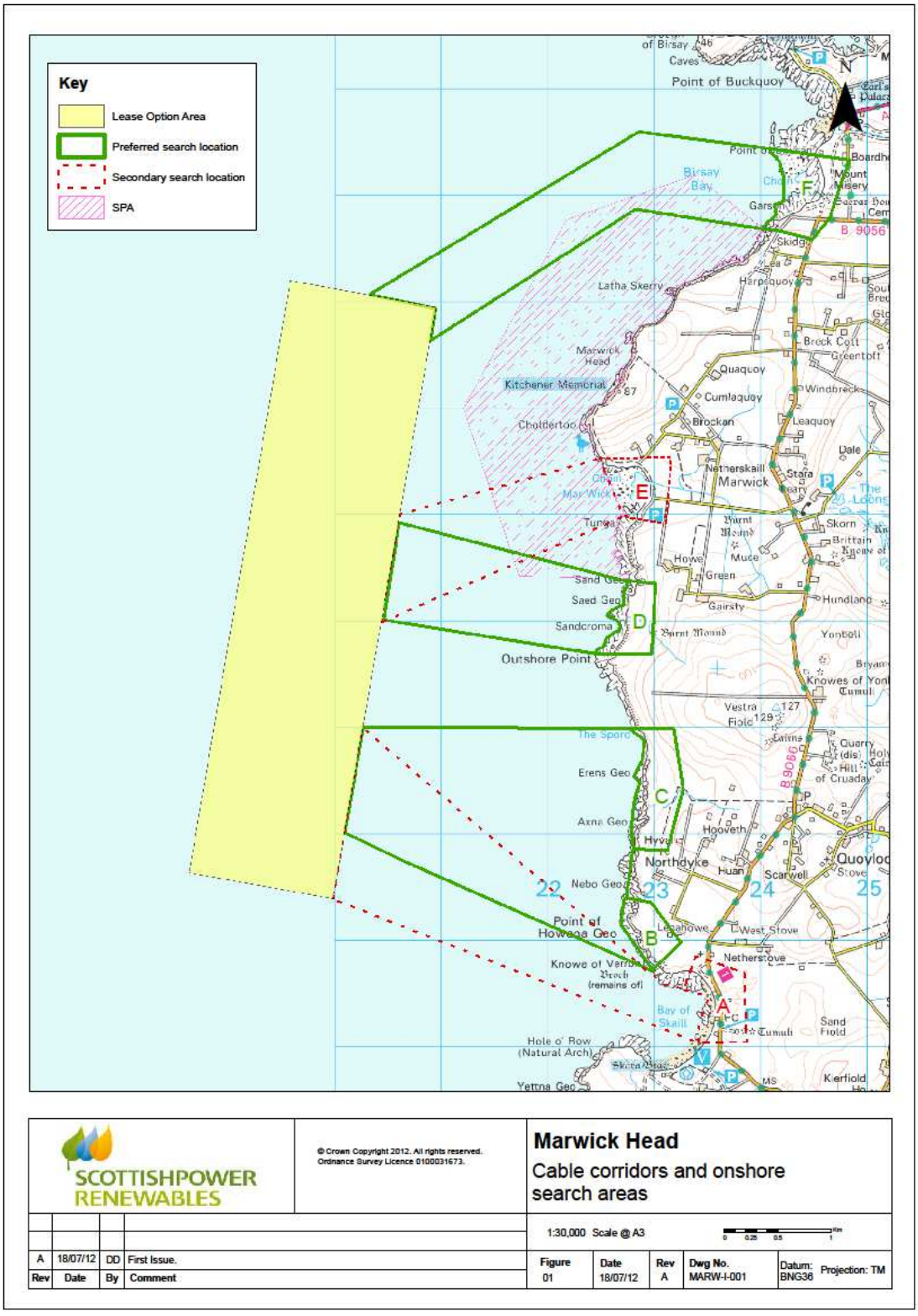


Figure 3: Map Showing Potential Cable Corridors and Onshore Areas of Search

3.3. NATURE OF THE PROPOSED WAVE FARM

3.3.1. Candidate Technology

3.3.1.1 The proposed Wave Farm would generate renewable electricity from wave power.

3.3.1.2 Pelamis has developed their next generation wave energy converter (the P2), a 750kW device, one of which SPR has currently deployed at the European Marine Energy Centre (EMEC) on Orkney. The development work related to the P2 device builds on the development work undertaken for the Pelamis P1 device, which was also deployed at EMEC in 2004.

3.3.1.3 The technology invented by Pelamis has received international attention, and it is regarded as one of the leading technologies in its field. The device has been extensively tested at commercial scale (750kW) at EMEC and a site off Portugal and has delivered electricity to the grid during its operational period.

3.3.1.4 During this period extensive performance data was collected to determine the output based on the wave regime. This data was used to refine the design, which has resulted in the production of the P2 device.

3.3.1.5 The installation and subsequent removal of the device on many occasions has allowed for the refining of this phase of operations.

3.3.1.6 The testing has also served to prove the operation of the various subsystems associated with the power capture and conversion of kinetic to electrical energy.

3.3.2. Pelamis Wave Energy Converter

3.3.2.1 The device is a semi- submerged wave device, articulated structure composed of cylindrical sections linked by hinged joints. The wave induced motion of these joints is resisted by hydraulic motors via smoothing accumulators. The hydraulic motors drive electrical generators to produce electricity. Power from all the joints is fed down a single umbilical cable to a junction on the seabed. Several devices can be connected together and linked to the shore through a single seabed cable.

3.3.3. Components

3.3.3.1 Based on previous experience the Wave Farm is likely to comprise of the following key components:

- 66 wave energy converters each consisting of a semi-submerged articulated structure composed of cylindrical sections linked by hinged joints. The converters are linked to the shore through either a single or multiple seabed cable(s);
- Landfall cabling for power transmission and control system;
- Onshore control building, external substation compound containing transformer and switch gear equipment;
- Grid connection from onshore control building to a local connection point (at a location to be determined); and
- Local access to the onshore control building.

3.3.3.2 There will also be associated infrastructure with the above components such as utility cabling and temporary on shore construction facilities. It is also likely that a number of current monitoring devices will be deployed throughout the operational life of the Wave Farm. The data provided by these monitoring devices will be essential to advance the understanding of the performance and interaction of wave energy converters with the resource.

3.3.3.3 As stated above there will also be a requirement for onshore infrastructure. The location of such infrastructure will depend upon the precise location of the wave energy converters and will be developed as the design progresses. SPR considers it important to gather the initial views of consultees before finalising the layout, so that initial views, in particular natural heritage constraints, can be taken into account at the earliest possible stage. There will also be a subsea and landfall cable route connecting the Wave Farm to the onshore infrastructure.

3.3.3.4 An assessment of the environmental effects of both the onshore and offshore components of the Wave Farm will be prepared and reported within the Environmental Statement (ES).

3.3.3.5 Careful consideration will be given to the design and layout of the Wave Farm as the EIA progresses. Although the site boundary is currently fixed in location and extent, as this was part of the leasing round which was run by The Crown Estate, the layout of the array will be able to be varied to take into consideration environmental constraints. Therefore, the most appropriate layout of the array will be guided by the findings of the environmental assessment together with feedback from consultation and consideration of technical requirements.

3.3.3.6 The distance of the location of the converters offshore will depend on local seabed conditions, water depth (with a requirement for the device to be located in at least 50m water depth) and grid connection requirements.

3.3.4. Converter Spacing

3.3.4.1 The final layout and numbers of devices would be based on the results of the geophysical and resource surveys and the resultant modelling work that will be undertaken. The depth and the width of the site would vary accordingly based on the optimised site design.

3.3.4.2 The level of data gathered from previous projects on the optimal spacing of wave energy converters is limited; however, SPR is working closely with E.ON at the EMEC testing facility to see how these devices interact when in proximity to one another. It is also known that areas inshore of the converters will experience slightly reduced wave energy levels. This may mean that the layout of the array will be altered when more data is gathered (e.g. from the testing multiple devices at EMEC). Additionally, the effects of inter array influences on machine performance will be investigated through the deployment of the first phase of the Marwick Head project (12 wave energy converters and 9MW). As a result of these data gathering processes it may be possible to pack arrays more efficiently than predicted using the data that is currently available.

3.3.4.3 At present the Marwick Head site is assumed to take up an approximate footprint of 7.78km^2.

3.3.5. Mooring

3.3.5.1 Bathymetric and geophysical surveys will be undertaken in the coming months to assess the seabed conditions at the site. Multibeam echosounder/swathe will be utilised to produce a topographical map of the seabed surface over the survey area. Additionally, the area will also be investigated using sub-bottom profiling equipment. Other tests will also be undertaken to assess the soil properties that are encountered at the site.

3.3.5.2 The proposed method of mooring is through the use of embedment anchors, which are connected to the devices via mooring wire and steel chains. There is a limited mooring spread, therefore, negligible disturbance to the seabed during the installation and operational phases of the project. This system is currently in operation at EMEC and has shown no significant impacts upon the seabed.

3.3.6. Installation Methodology

3.3.6.1 The initial 750kW machine was installed at EMEC using the following technique:

- Mooring installation (including embedment anchors set to the appropriate depth) carried out by an anchor handling tug (AHT);
- Wave energy converters towed to site by appropriate tugs; and
- The mooring and electrical connections are made in one remote winching operation, and the rear yaw restraint line is connected before installation vessels are disconnected.

3.3.6.2 The above installation method will be adapted through the knowledge gained during the operations at EMEC. A variety of installation and removal techniques are currently being investigated, such as the reduction in the number of vessels required for operations.

3.3.7. Installation Infrastructure

3.3.7.1 Land access for construction vehicles for the on shore/coastal components will be subject to survey and will be selected to minimise potential effects on the local area and transport infrastructure.

3.3.7.2 For road access to the Marwick Head site grid infrastructure, proposed access is via the B9056/A967.

3.3.7.3 Depending on the final infrastructure locations some upgrading of existing roads may be required and/or a new local road to the control building/substation compound maybe required.

3.3.7.4 The wave energy converters themselves will be delivered by sea. The pier at Lyness has been used in the past for the berthing of the Pelamis devices and is currently undergoing an upgrade programme funded by the Orkney Islands Council. Where the

installation may impact natural heritage features through disturbance, such impacts will be mitigated through careful timing of works.

3.3.8. Monitoring Devices - Met masts / Wave buoys

3.3.8.1 Between 2013 and 2014, SPR will be undertaking surveying and modelling work of the Marwick Head site. The use of ADCP current measuring devices and wave buoys will commence during a Work Package scheduled for 2013, in which it is anticipated that up to two years of continuous wind and wave data will be recorded. The exact technology to be used is still under review, but will consist of an on shore met station near the site and/or a wave buoy on location.

3.3.9. Inter-Array Cabling

3.3.9.1 Each device will be interconnected with other devices on the Wave Farm via an umbilical. The final layout of devices and therefore cables will largely depend on the site sea bed conditions, bathymetry and the results of the modelling work which will be undertaken after the resource assessment work has been completed. However, the layout will be designed to minimise the cable lengths while maximising the level of redundancy. The techniques adopted for the laying of the subsea and landfall cable will depend on the local conditions and will either be buried or protected, as appropriate.

3.3.9.2 The onsite control building/substation will need to be large enough to hold a transformer, switchgear, power electronics, control and communications equipment and auxiliary supplies.

3.3.9.3 In 2009, Highlands and Islands Enterprise (HIE) published a grid options study to assist the development of the Pentland Firth and Orkney waters. This study indicates where potential future local grid reinforcements could be made, while a conclusions report from the Electricity Network Strategy Group discusses the potential new wider transmission infrastructure developments. According to both studies there is potential future build of transmission assets into the region.

3.3.10. Export Cabling/Grid Connection

3.3.10.1 The diameter of the subsea cable is likely to be approximately 100mm. The array will most likely have 1 or 2 subsea cables laid from the devices to the cable landfall point onshore.

3.3.11. Operations and Maintenance Strategy

3.3.11.1 The device can be controlled remotely via the supervisory control and data acquisition (SCADA) connections and control system. These are used to monitor and control the wave energy converter and operate the onshore electrical equipment to allow grid connection. They also communicate with the various operating systems and condition monitoring systems to provide status reports and alarms on a wide variety of performance indicators such as generator temperature, voltage, and water ingress amongst others. Under normal operating conditions the device can be operated automatically and doesn't require constant supervision to optimise output and carry out

start up and shut down operations. However, it is possible to manually intervene with the device using the control systems.

3.3.11.2 The system operates autonomously and scheduled maintenance of the wave energy converter is currently anticipated to occur approximately every 5 years. However, the maintenance period for the device will be reviewed. If the 5-year intervention period is realised then this will constitute 1-2 interventions per month each lasting approximately 1 day in duration (including transit time to the site). However, during the initial stages of the array it is likely that approximately 1 intervention per week at the site will be required.

3.3.11.3 Maintenance of the wave energy converter will be carried out by removing the Pelamis device from its moorings (an operation that can take as little as 2-hours) and towing it into a safe harbour. Here it will be maintained and any faults addressed in a clean environment prior to being re-installed.

3.3.11.4 Maintenance and intervention requirements outwith the 5 year intervention period will be minimal and be of similar duration to that stated in Paragraphs 3.3.11.2 and 3.3.11.3. ROV and possibly diver inspections will be carried out to visually inspect the condition of the wave energy converter, mooring chains, umbilical, anchor points and cabling to shore.

3.3.11.5 In compliance with established North Sea standards cathodic protection will be applied to all subsea equipment. Methods for preventing marine growth will take the form of antifouling paint.

3.3.11.6 The device will contain oils for lubrication, anti fouling agents and hydraulic fluids. Only recognised marine standard materials and substances will be used in the device.

3.3.12. Operations and Maintenance Infrastructure

Operations and Maintenance Base

3.3.12.1 For the purpose of routine maintenance activities it will be required to move the machine from its operational site to a berth at a service / operational base. This berth will require power and allow safe access and egress for inspection and maintenance of the machine. The routine servicing will require some plant such as portable generators, air compressors and hydraulic power packs to be located on the quayside alongside the machine.

3.3.12.2 Cranes will be required for the replacement of larger components, it is anticipated that all lifts required would be less than 200 tonnes.

3.3.12.3 The harbour used will also need to have the ability for cargo barges accepting trailer load outs to moor stern to the quay. The water depth would need to be at least 8m to handle larger construction vessel / anchor handlers.

3.3.12.4 Storage and workshop facilities will be required for maintenance activities to be carried out, this would need to be large enough to hold approximately 4 Pelamis power units and spares and have an overhead gantry crane.

Weather Monitoring Devices

3.3.13. Decommissioning

3.3.12.5 Decommissioning is virtually a reversal of the installation process. Decommissioning will take place in three phases:

- Disconnect and removal to port of the wave energy converter;
- Removal of subsea cables, mooring line and chains; and
- Complete removal of embedded anchors.

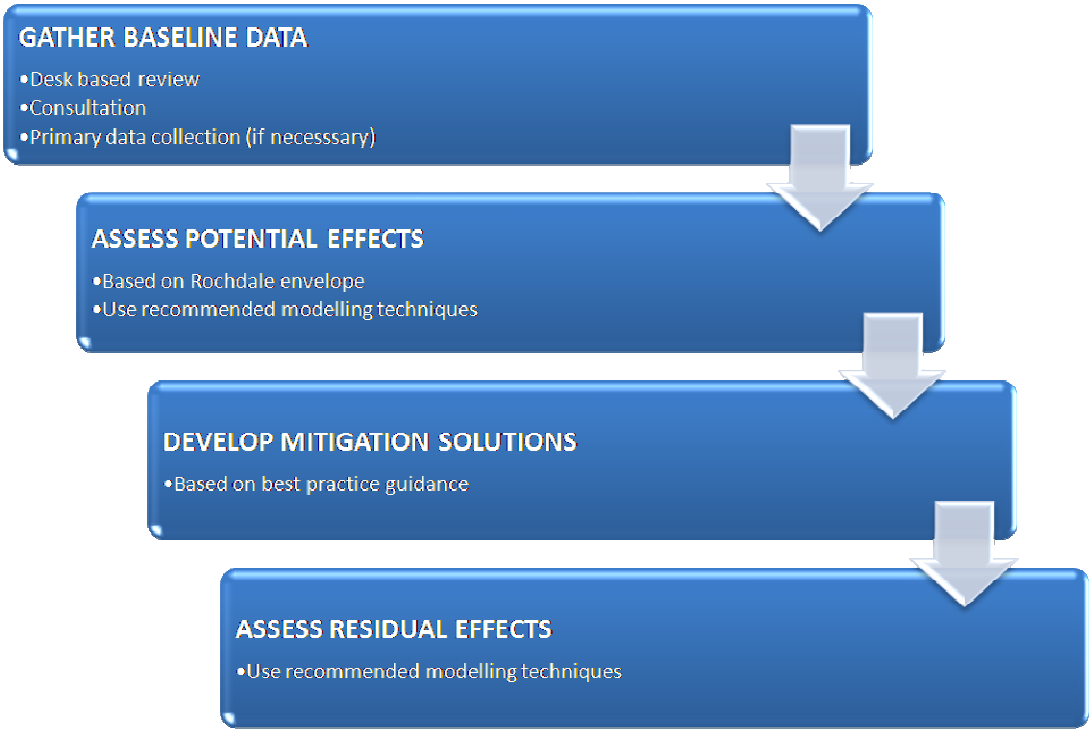
3.3.12.6 "As-left" ROV surveys will be undertaken and any debris removal operations would be carried out as required.

4. ENVIRONMENTAL BASELINE & POTENTIAL EFFECTS

4.1. INTRODUCTION

4.1.1. Assessment Methodology

4.1.1.1 Each of the subtopics in this chapter will use the same broad environmental assessment methodology structure. This is illustrated in the figure below.



4.1.2. Cumulative and In-Combination Impacts

4.1.1.2 This part of the assessment will take into account all plans and projects which may act in combination to increase the magnitude of certain impacts upon the local environment. The appropriate spatial scale will be based upon the biology of the species or habitat being impacted.

Scoping Question: Do the requirements outlined for assessment of effects look appropriate and complete?

Scoping Question: Are there any other key sources of environmental information that should be consulted?

4.2. PHYSICAL ENVIRONMENT

4.2.1. Marine and Coastal Processes

Baseline Conditions

Bathymetry

4.2.1.1 Surveys of the proposed site are to be carried out during 2013 to give an accurate indication of the water depths within the development area. The only known depths so far for this site are those taken from Admiralty charts, which state that the site is in excess of 50m (chart datum) in depth.

Hydrography

4.2.1.2 The northern Scottish coastline experiences a tidal rise and fall of approximately 1.7m (from Jones, 1975 in Bennett and Covey, 1998).

4.2.1.3 The wave regime at Marwick Head is energetic and relatively well understood, based on the measurements and analysis that have been carried out at the EMEC test site to the south.

EIA Methodology

TABLE 4.1 Primary Data Collection Methodology

Information requirement	Field method	Key regulators/public bodies
PHYSICAL ENVIRONMENT		
Marine and Coastal Processes		
Baseline bathymetric and oceanographic data	A full geophysical survey will be undertaken at the Marwick Head site. This will include: ▪ Multibeam swath bathymetry; ▪ Sidescan sonar; ▪ Ground truthing of bathymetric/sonar data with boreholes and grab samples, where required; ▪ Optical Backscatter to determine suspended sediment concentrations; ▪ Seismic profiling; ▪ ADCP measurements (principally seabed mounted); ▪ Drop-down video tow; and ▪ ROV survey. Information on bathymetric and oceanographic data from this survey will be extracted.	Marine Scotland Scottish Environment Protection Agency (SEPA) Scottish Natural Heritage (SNH) Orkney Islands Council (Marine Services)
Cetacean risk assessment	This work will determine whether an EPS licence is needed and what mitigation is required. It is likely that an MMO will require to be present during 'noisy' elements of the work.	

Potential Project Effects (Marine)

4.2.1.4 Wave energy extraction effects of the Marwick Head Wave Farm may occur across three spatial scales. The magnitude of the effect will reduce significantly as the spatial scale becomes larger.

- Device scale – localised to the immediate vicinity of a single device;
- Near-field scale – on the scale of the lease area – the effects of the devices acting in combination;
- Far-field – the effects of the wave farm extending beyond the lease area.

4.2.1.5 No significant effects on seabed bathymetry are expected to result from installation or operation of the site. However, the navigation of other sea users will be affected. However, the site has been selected due to the lack of a shipping route and the low numbers of vessels utilising this area. Whilst operational the array will be appropriately marked as well as possessing a radar signature so that it can be identified and avoided by other sea users in the area.

4.2.1.6 Alteration of the wave regime may occur. However, the Scottish Marine Renewables Strategic Environmental Assessment reports that wave farms are likely to affect a zone 20km around the device or device array. This is conservative, and it is likely that effects will be felt over a smaller area (Faber Maunsell and Metoc, 2007).

4.2.1.7 Alteration of sediment transport may result; however, floating devices, such as Pelamis, are considered to pose the least effects on the physical environment (Faber Maunsell and Metoc, 2007). In water that is deep (50m in the instance of the Marwick Head site) relative to the wavelength, there is not thought to be an effect of the surface equipment on the sea bed (Faber Maunsell and Metoc, 2007).

Potential Project Effects (Terrestrial)

4.2.1.8 Given the high energy environment of the site there is not thought to be any effect of the development on the local terrestrial environment.

Potential Cumulative Effects

4.2.1.9 Cumulative effects are only likely to occur at the scale of the development (the cumulative effect of multiple devices) and at the scale of multiple arrays in the area (the far-field level). There are other wave farms proposed for development on the west coast of the Orkney Mainland and these could potentially act in combination with the Marwick Head site. However, the sites are well separated and the area is an extremely high energy one.

4.2.2. Geology, Seabed Sediments and Sediment Transport

Baseline Conditions

Seabed geology and sediments

4.2.2.1 British Geological Survey (BGS) data covering the west of the Orkney Mainland, and the area of the proposed development site, shows that the seabed is primarily composed of sandy gravel (Barne *et al.,* 1997).

4.2.2.2 Additional surveys of the proposed development site will be undertaken in order that the seabed composition can be confirmed.

Coastal geomorphology

4.2.2.3 Orkney's cliffs are formed from the Devonian Old Red Sandstone Group. This was laid down some 370 million years ago when northern Caithness and Orkney were part of a vast freshwater lake, known as Lake Orcadia (Caithness BAP, 2003).

4.2.2.4 Most of the coastal environment of the west Orkney Mainland consists of high cliffs (Orkney possesses 6% of the UK's cliff resource), which have near vertical faces (Barne *et al.,* 1997). Some bays, including shingle bays, are present near to the proposed site; including Marwick Bay and Birsay Bay. There are also many geos and caves along this coastline.

4.2.2.5 The Marwick Head Site of Special Scientific Interest (SSSI) has been designated for its seabird colonies, which rely in part on the sandstone cliffs of the area for their nesting locations.

EIA Methodology

TABLE 4.2 Primary Data Collection Methodology		
Information requirement	Field method	Key regulators/public bodies
PHYSICAL ENVIRONMENT		
Geology, Seabed Sediments and Sediment Transport		
Existing data (desk based)	Collation and review of any previous records or data relating to the presence of protected sites of geomorphological interest	Marine Scotland Scottish Natural Heritage (SNH)
Seabed sediments data	A full geophysical survey will be undertaken on the Marwick Head site. See details of this survey in Table 4.1.	Marine Scotland (MS) Scottish Environment Protection Agency (SEPA) Scottish Natural Heritage (SNH) Orkney Islands Council (OIC)

Potential Project Effects (Marine)

4.2.2.6 Alteration of sediment transport may result from modifications to the wave regime. However, given that the Pelamis technology is floating and in a deep water environment (50m+), then the effects on seabed interactions are likely to be negligible in nature.

4.2.2.7 The environmental effects of cabling/trenching and embedment anchors on sediments or water quality will have to be fully considered. Impacts from scour protection or additional material needed to protect cables will also require consideration. A full cabling study will be undertaken as part of the project development process, which will assess all potential cabling options and the environmental implications of each.

Potential Project Effects (Terrestrial)

4.2.2.8 There is not thought to be any effect of the development on the local terrestrial geological environment.

Potential Cumulative Effects

4.2.2.9 Cumulative effects are only likely to occur at the scale of the development (the cumulative effect of multiple devices) and at the scale of multiple arrays in the area (the far-field level). There are other wave farms proposed for development off of the wesy coast of Orkney (both inshore and offshore) and these could potentially act in combination with the Marwick Head site. However, the sites are some distance apart and the area is an extremely high energy one.

4.2.3. Water Quality and Effluent Discharges

Baseline Conditions

Marine & Coastal Waters/Freshwater

4.2.3.1 Improvements in the water quality of coastal areas off of the north of Caithness have been made over the period 2000-2006 (SEPA, 2006). 99% of coastal waters in Scotland have been classified as being excellent or good (grade A or B) (from SEPA, 2006 in Faber Maunsell and Metoc, 2007).

4.2.3.2 Between 2000 and 2006 the Orkney Islands have shown a fall in the length of coastline designated as Class C, with a reciprocal increase in Class B coastal areas (SEPA, 2006).

4.2.3.3 There are several SEPA WFD river and loch monitoring points in the vicinity of the proposed site; however, these are inland freshwater systems and the proposed development site will not affect them. There are no SEPA WFD monitoring points related to groundwater sources within the vicinity of the proposed site. The nearest marine coastal monitoring point is Stromness Harbour.

4.2.3.4 There are no designated shellfish growing waters or aquaculture sites of any kind in the vicinity of the proposed site, and there are no designated bathing waters classified by SEPA in the Orkney archipelago; the closest to the proposed site being on the northern Caithness coast (SEPA, 2009).

Effluent Discharges

4.2.3.5 In 2000 Kirkwall Bay was classified as Class C due to sewage inputs, oil spills and discharges from vessels; however, this had improved to Class B in 2001. This improvement was principally related to the new Kirkwall STW being completed. More coastline within Kirkwall Bay has also been improving due to reduced frequency of oil spills / vessel discharges (SEPA, 2006).

4.2.3.6 In 2000 Weydale Bay was classified as Class C due to discharges from Weydale sewage pumping station. This improved to Class B in 2001 with a further improvement to Class A in 2003 (SEPA, 2006).

4.2.3.7 2.0km of Class C coast is in Stromness Harbour, due to unsatisfactory CSO discharges, oil spills, and discharges from vessels. This classification has remained for the same reasons through to 2006 (SEPA, 2006).

Data sources

Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA.

SEPA (2006). Scotland's Water Environment Review 2000-2006.

SEPA (2009). Scottish Bathing Waters 2009.

EIA Methodology

TABLE 4.3 Primary Data Collection Methodology		
Information requirement	Field method	Key regulators/public bodies
PHYSICAL ENVIRONMENT		
Water Quality and Effluent Discharges		
Existing data (desk based)	Collation and review of any previous records or data relating to the water quality of the area in the vicinity of the proposed site and other water designations present.	Marine Scotland (MS) Scottish Environment Protection Agency (SEPA)

Potential Project Effects

4.2.3.8 The potential effects of the proposed project to the local water quality are thought to be nil; however, there may be accidental events which may include spillages of oils and/or lubricants. These are likely to be small in quantity and are likely to have only a very localised effect on the marine environment as they will be dispersed rapidly given the high energy nature of the site.

Potential Cumulative Effects

4.2.3.9 Cumulative effects are possible given the number of devices proposed for the array; however, a failure in more than one device resulting in a leakage event is highly unlikely. Other potential cumulative effects may come from the shipping traffic which utilise the area, and any possible leaks/spillages arising from them.

4.2.3.10 The other proposed array sites are relativelty close to the Marwick Head site. However, given the energetic nature of the this part of the Atlantic coastline it is thought highly unlikely that even if there were a leakage at any other site that it would act in combination with the proposed Marwick Head site.

4.3. BIOLOGICAL ENVIRONMENT

4.3.1. Benthic Ecology

Baseline Conditions

4.3.1.1 Orkney lies on a biogeographical boundary between the generally richer marine life of western Britain and the less diverse marine life of the North Sea region (Barne *et al.*, 1996).

4.3.1.2 Moore (2010) describes data gathered from recent Marine Scotland surveys of the benthos to the west of the Orkney Mainland. The video runs carried out at this location showed the area to be:

*'From southwest of Outshore Point to Marwick Head three sites display a seabed substrate of stepped bedrock platforms. The horizontal faces are mostly of bare appearance apart from encrustations of Pomatoceros spp., orange bryozoans and pink coralline algae (**CR.MCR.EcCr.FaAlCr.Pom**). Some dense stands of Flustra foliacea occur on sediment-influenced rock (**CR.MCR.EcCr.FaAlCr.Flu**). Scattered*

Alcyonium digitatum occurs on upward-facing rock surfaces but becomes much richer on the vertical faces of the steps and in the more uneven rocky areas, where it could be interpreted as representing localised patches of the biotope, ***CR.MCR.EcCr.FaAlCr.Alc****.*

*From Marwick Head to Eynhallow Sound the four sites examined display a mix of sediment and reef habitats. The shallowest site (30 - 32 m) close to the mouth of Eynhallow Sound possibly experiences elevated currents. The substrate of stepped bedrock supports a community similar to that of the stepped bedrock south of Marwick Point, except that much of it is covered by dense Ophiocomina nigra (****CR.MCR.EcCr.FaAlCr.Bri****). At the other sites the rock is mostly broken into boulders, sometimes with cobbles and pebbles, on a bed of coarse sand or gravel, with some extensive areas of coarse sand. The rock supports faunal crusts of Pomatoceros spp. and bryozoans, with dense Caryophyllia smithii (****CR.MCR.EcCr.FaAlCr.Car****) or Flustra foliacea (****CR.MCR.EcCr.FaAlCr.Flu****) depending upon the degree of sediment influence. The coarse sediment, formed into 1m long waves at one site, exhibits an impoverished epibiota and little evidence of infauna apart from the presence of bivalve siphons similar to those described above (****SS.SCS.CCS****).'*

Designations and Protection

4.3.1.3 There are no benthic ecology designations in the vicinity of the proposed Marwick Head site; however, it is noted that Annex I habitats are likely to exist (e.g. reef habitat) as well as Priority Marine Features (PMF's).

4.3.1.4 However, a preliminary Marine Scotland survey identified three species within the wider area as being of conservation importance. These were *Nucella lapillus*, *Ammodytes marinus* and *Echinus esculentus*. *N. lapillus* and *E. esculentus* are common throughout the coastal zones of the UK. *A. marinus* is an important species in relation to seabird populations as well as established fisheries. Moore (2010) states that evidence for habitat preference by this species in Shetland suggests that muost of the sedimentary sites off of the west coast of Orkney and west of Stroma will be potential habitat for this species and that '*renewable energy schemes may need to take account of the potential for adversely impacting sandeel habitat*'. More broadly, survey methods will aim to determine whether any Scottish PMFs (http://www.snh.gov.uk/protecting-scotlands-nature/safeguarding-biodiversity/priority-marine-features/) are present that might influence micro-siting of the anchors, cables and/or the devices.

4.3.1.5 Four biotopes with measures of conservation importance were found during the Moore (2010) survey; however, the actual proposed site location was not surveyed and only two of these biotopes were recorded in the vicinity of the proposed development location. These biotopes were **SS.SCS.CCS** and **SS.SSa.CFiSa**. These are both a UK Biodiversity Action Plan Priority Habitat and Scottish Biodiversity List Habitat (Moore, 2010).

Data sources

Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody, J.P., Davidson, N.C. and A.L. Buck, eds. (1996). Coasts and seas of the United Kingdom. Region 2 Orkney. Peterborough, Joint Nature Conservation Committee. (Coastal Directories Series).

Thorpe, K., Dalkin, M., Fortune, F., & Nichols, D.M., (1999), Sector 2. Orkney: area summaries, 122 pages. ISBN 1 86107 475 1

Moore, C.G. (2009). Preliminary assessment of the conservation importance of benthic epifaunal species and habitats of the Pentland Firth and Orkney Islands in relation to the development of renewable energy schemes. Scottish Natural Heritage Commissioned Report No. 319.

Moore, C.G. (2010). Preliminary assessment of the conservation importance of benthic species and habitats off the west coast of Orkney and in the Pentland Firth in relation to the development of renewable energy schemes. Scottish Natural Heritage Commissioned Report No. 352.JNCC Coastal Directory for Region 3 North-east Scotland: Cape Wrath to St. Cyrus.

EIA Methodology

TABLE 4.4 Primary Data Collection Methodology

Information requirement	Field method	Key regulators/public bodies
BIOLOGICAL ENVIRONMENT		
Benthic Ecology		
Existing data (desk based)	Collation and review of any previous records or data relating to the benthic ecology of the area in the vicinity of the proposed site and other conservation designations present.	Marine Scotland Scottish Natural Heritage (SNH)
Baseline marine ecological data	**Field survey** Multibeam swath bathymetry/Acoustic Ground Determination System data from the Geophysical survey of the Marwick Head site will give preliminary information on the seabed profile and the presence of any notable features (e.g. areas of reef). . This will be used to inform a benthic campaign comprising grab samples in areas of softer sediments (or areas which are thought to comprise sensitive habitats), and drop-down/towed cameras (taking stills or video footage) in areas of harder sediment and/or those likely to be utilised for development. Towed camera work is unlikely to yield significant identification results of the biotopes present; however, will be useful for ground truthing and in conjunction with the grab sampling regime. The spatial extent of any grab sampling, initial video and or drop-down camera campaigns will be determined by the geophysical survey results after expert analysis and in conjunction with the technology developer and the EIA consultant. Once determined approval would be sought from Marine Scotland and SNH. The methodology agreed upon will give appropriate detail and extent of the proposed deployment area, any agreed buffer zone (likely to be	Marine Scotland Scottish Natural Heritage (SNH)

TABLE 4.4 Primary Data Collection Methodology		
Information requirement	Field method	Key regulators/public bodies
	small given the perceived localised effects of wave energy converter deployments) and the selected cable route to shore. If utilised, video surveys will cover the likely deployment area of the converters, an agreed buffer and any control sites and also the selected cable route(s). A drop-down campaign (instead of or in addition to) the video surveys will follow a grid pattern, with more intensive drops being undertaken in areas of notified features. Video and/or stills camera work, in conjunction with the grab sampling regime, will allow for the broad determination of the development site with regards the biotopes present and allow for the production in GIS of a biotope map for the area. As part of this process any PMF's will also be identified. Biotopes and/or PMF's of particular importance can then be targeted with additional video, drop-down stills camera work or grab sampling where appropriate in order to determine their extent. This will be particularly important when it comes to the micro-siting of the converters and the cables. The beam trawling, grab samples and video work may also be carried out on control sites outwith the Marwick Head development site, if this is determined to be necessary after consultation with MS and SNH. Phase I Habitat Surveys will also be undertaken in appropriate intertidal areas likely to be affected by any cable landfall operations. These will follow best practice techniques used in current SCM assessments.	

Potential Project Effects

4.3.1.6 The potential effects of the proposed project on the benthic ecology of the area are thought not to be significant in nature. There will be direct loss of habitat due to the presence of the devices anchoring and mooring system; however, some of these structures will also act as hard substrata on which organisms may colonise. There may also be small levels of re-suspension of sediments in the area of the embedded anchors during installation. The levels of sediment present will be determined during surveys.

Potential Cumulative Effects

4.3.1.7 Cumulative effects are possible given the number of devices proposed for the array; however, the total area of seabed loss will be negligible in the context of the area off the west coast of the Orkney Mainland.

4.3.1.8 There are other proposed array sites off of the west coast of the Orkney Mainland; however, even when taken into account they are not expected to lead to a significant loss of benthic habitat.

4.3.2. Terrestrial Ecology

Baseline Conditions

4.3.2.1 The Orkney islands are primarily low with gentle relief. There is a general lack of trees and woodland cover. The islands support large areas of productive pastures and some arable farming (Land Use Consultants, 1998)

4.3.2.2 Approximately 60% of the total land area of Orkney is farmland, comprising improved grassland (c .60%), rough grassland (c .35%) and arable crops (c .5%) (Land Use Consultants, 1998). The remainder of the land area is mostly moorland, but also includes development areas, coastal areas and lowland nature reserves.

4.3.2.3 The rearing of livestock is the mainstay of the agricultural economy. There are approximately 30,000 beef cattle in Orkney. Sheep are also an important resource (Land Use Consultants, 1998).

4.3.2.4 The uniform crop structure, where crops are produced on Orkney, provides for low species diversity; however, spring planted crops are an essential dietary component of the various over-wintering birds that visit the islands on their migratory route south (Land Use Consultants, 1998).

4.3.2.5 Improved or rough grassland with maritime heath is a feature of the cliff-top habitat in the vicinity of Marwick Head (Land Use Consultants, 1998).

Designations and Protection

4.3.2.6 The Marwick Head SSSI is designated for its avifauna and not its terrestrial habitats. However the maritime cliff vegetation includes plant species such as Thrift, Spring Squill and Kidney Vetch (SNHi website).

Data sources

Fowler, S.L., Everett, S.J. and Scott Wilson Resource Consultants (1997). Chapter 8 Land use, infrastructure and coastal defence. *In:* Coasts and seas of the United Kingdom. Region 2 Orkney ed. by Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody, J.P., Davidson, N.C., and A.L. Buck 145-154. Peterborough, Joint Nature Conservation Committee. (Coastal Directories Series).

Land Use Consultants (1998). Orkney landscape character assessment. Scottish Natural Heritage Review No. 100.

SNHi website – accessed November 2010.

EIA Methodology

TABLE 4.5 Primary Data Collection Methodology		
Information requirement	Field method	Key regulators/public bodies
BIOLOGICAL ENVIRONMENT		
Terrestrial Ecology		
Existing data (desk based)	Collation and review of any previous records or data relating to the terrestrial ecology of the area in the vicinity of the proposed site and other conservation designations present.	Scottish Natural Heritage (SNH)
Baseline ecological data	Initial Phase 1 Habitat Survey in order to identify principal communities and habitats across site of any proposed onshore works. Survey findings used to identify the requirement for any further detailed surveys. These may include a National Vegetation Classification survey, and/or species specific surveys.	Scottish Natural Heritage (SNH)

Potential Project Effects

4.3.2.7 The potential effects of the proposed project to the terrestrial ecology of the area are thought not to be significant in nature. There will be direct loss of habitat due to the presence of the substation; however, the location for this will be carried out in a sensitive manner so as not to significantly affect any designated sites or areas of conservation importance.

Potential Cumulative Effects

4.3.2.8 There will likely be cumulative effects resulting in multiple arrays siting their onshore infrastructure in the coastal areas of the West of Orkney. This will depend upon the proposed locations for other projects onshore infrastructure and their proximity to those involved in the Marwick Head project and will be fully assessed as part of the EIA process.

4.3.3. Ornithology

Baseline Conditions

4.3.3.1 The Old Red Sandstone cliffs in the area support a variety of seabird fauna and breeding birds will be present throughout much of the year and especially from March to August. They are home to a number of nesting species including, northern fulmars (*Fulmarus glacialis*), black-legged kittiwakes (*Rissa tridactyla*), razorbills (*Alca torda*) and common guillemots (*Uria aalge*).

4.3.3.2 The non-cliff sections of the coast are likely to have a strandline composed of detached and decaying seaweeds. This acts as a particularly important habitat for wintering wading birds such as turnstones (*Arenaria interpres*) and purple sandpipers (*Calidris maritima*) which feed on invertebrates in the decaying vegetable matter. Other wintering waders, such as redshanks (*Tringa totanus*) and curlews (*Numenius arquata*) feed in intertidal habitats and on pasture land close to the coast.

4.3.3.3 Orkney coastal waters are important feeding grounds for breeding seabirds, and in winter support coastal populations of diving seabirds (e.g. Great Northern Divers, Slavonian Grebes, Black-throated Divers, Long-tailed Ducks and Red-breasted Mergansers). Inland lochs support species of ducks and divers, some of which (e.g. Red-breasted Merganser) utilise the coastal areas.

4.3.3.4 The extensive shoreline of the Orkney archipelago supports a vast array of wading birds, some in nationally important numbers. These include species such as the Curlew (which is the most numerous of the species present), Turnstone and Purple Sandpiper. Mudflats and sandy shores (none in the vicinity of the proposed development) support species such as Bar-tailed Godwits and Sanderlings.

4.3.3.5 Spring planted crops are beneficial to certain species of overwintering birds, primarily due to the stubble that remains after the crop has been combined. A major feature of the Orkney over-wintering avifauna is the presence of large numbers of geese such as greylag, pink-footed, barnacle and Greenland white-fronted geese.

4.3.3.6 Receptor bird species at risk of being affected by wave energy development in this area include seabirds, and especially those species that are notified features of SPAs. Species at greatest risk are likely to be those seabirds that are nervous of structures, either as breeding species or as wintering populations, and that are limited to use of habitat in the coastal zone in which wave energy devices will mostly be deployed. Among seabirds, Furness and Wade (2012) identified no Scottish seabird populations as being at high or very high vulnerability to wave energy devices, and three species as having populations at moderate vulnerability to wave energy devices (red-throated diver, black-throated diver, great northern diver). A further 19 species were considered to be at low vulnerability (in descending order of vulnerability scores these were razorbill, common scoter, common guillemot, black guillemot, Slavonian grebe, European shag, Atlantic puffin, little tern, greater scaup, velvet scoter, Arctic tern, common goldeneye, northern gannet, roseate tern, common eider, common tern, Sandwich tern, great cormorant, Manx shearwater). A further 16 species were classed as having populations at very low vulnerability (in descending order of scores, black-legged kittiwake, long-tailed duck, great skua, great crested grebe, Arctic skua, little auk, northern fulmar, great black-backed gull, sooty shearwater, white-tailed eagle, European storm-petrel, common gull, Leach's storm-petrel, lesser black-backed gull, black-headed gull, herring gull). Scores of species' population vulnerability from that report are tabled below for reference. Coastal birds, such as shorebirds, birds of prey and scavengers, may be at low risk of being affected by disturbance and these include red-breasted merganser, turnstone, purple sandpiper, curlew, redshank, white-tailed eagle, peregrine. Effects on terrestrial birds are likely to be negligible, providing siting of onshore structures takes account of local habitats. Receptor bird species identified are thus: common eider, long-tailed duck, common scoter, common goldeneye, red-throated diver, black-throated diver, great northern diver, Slavonian grebe, northern fulmar, Manx shearwater, sooty shearwater, European storm-petrel, Leach's storm-petrel, northern gannet, great cormorant, European shag, Arctic skua, great skua, black-headed gull, common gull, lesser black-backed gull, herring gull, great black-backed gull, black-legged kittiwake, common tern, Arctic tern, Sandwich tern, common guillemot, razorbill, black guillemot, little auk, Atlantic puffin, red-breasted merganser, turnstone, purple sandpiper, curlew, redshank, white-tailed eagle, peregrine, although impacts on many of these species are likely to be negligible at the population level. This assessment requires knowledge of environmental impacts of an array of devices of this type and that is

uncertain. However, a recent review for SNH has used available knowledge of seabird ecology and behaviour to provide the best available assessment of the vulnerability of seabird species' populations to wave energy devices (Furness and Wade, 2012) and that work will be used as a foundation for the EIA and AA.

Table 4.6. Species vulnerability index for wave energy device impacts on seabird populations in Scotland (ranked by species score). Data from Furness and Wade (2012)

Species	Score	Descriptor on 5-score scale
Red-throated diver	288	3: moderate vulnerability
Black-throated diver	288	3: moderate vulnerability
Great northern diver	270	3: moderate vulnerability
Razorbill	192	2: low vulnerability
Common scoter	180	2: low vulnerability
Common guillemot	176	2: low vulnerability
Black guillemot	169	2: low vulnerability
Slavonian grebe	169	2: low vulnerability
Shag	165	2: low vulnerability
Atlantic puffin	160	2: low vulnerability
Little tern	156	2: low vulnerability
Greater scaup	154	2: low vulnerability
Velvet scoter	154	2: low vulnerability
Arctic tern	153	2: low vulnerability
Common goldeneye	144	2: low vulnerability
Northern gannet	136	2: low vulnerability
Roseate tern	135	2: low vulnerability
Common eider	130	2: low vulnerability
Common tern	126	2: low vulnerability
Sandwich tern	125	2: low vulnerability
Great cormorant	110	2: low vulnerability
Manx shearwater	102	2: low vulnerability
Black-legged kittiwake	98	1: very low vulnerability
Long-tailed duck	96	1: very low vulnerability
Great skua	96	1: very low vulnerability
Great-crested grebe	91	1: very low vulnerability
Arctic skua	84	1: very low vulnerability
Little auk	81	1: very low vulnerability
Northern fulmar	80	1: very low vulnerability
Great black-backed gull	75	1: very low vulnerability
Sooty shearwater	72	1: very low vulnerability
White-tailed eagle	72	1: very low vulnerability
European storm-petrel	68	1: very low vulnerability
Common gull	65	1: very low vulnerability
Lesser black-backed gull	64	1: very low vulnerability
Leach's storm-petrel	64	1: very low vulnerability
Black-headed gull	60	1: very low vulnerability
Herring gull	48	1: very low vulnerability

Designations and Protection

4.3.3.7 There are several designations in the vicinity of the proposed project, which are detailed in the tables below.

Special Protection Areas (SPAs)		
Site	**Description and Qualifying Feature**	**Comment**
Marwick Head Northern Isles	The Marwick Head Special Protection Area is a 2km 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 1km into the marine environment to include the seabed, water column and surface. Qualifying species: Marwick Head regularly supports populations of common guillemot (*Uria aalge*). Additionally, Marwick Head also regularly supports 75,000 seabirds including nationally important populations of the following species: black-legged kittiwake (*Rissa tridactyla*) and common guillemot (*U. aalge*).	The Marwick Head SPA is situated directly adjacent to the proposed development location.
Rousay	The Rousay SPA consists of sea cliffs and areas of maritime heath and grassland in the northwest and northeast of the island. The boundary of the Special Protection Area overlaps with the boundary of the Rousay SSSI (see below), and the seaward extension extends approximately 2 km into the marine environment to include the seabed, water column and surface. Qualifying species: The Rousay SPA regularly supports about 30,000 seabirds including nationally important populations of Arctic tern (*Sterna paradisaea*), Arctic skua (*Stercorarius parasiticus*), black-legged kittiwake (*Rissa tridactyla*), common guillemot (*Uria aalge*) and Northern fulmar (*Fulmarus glacialis*).	The Rousay SPA is situated 10km to the NE of the proposed development location.
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. There are several small oligotrophic lochs on the site.	The closest of the four areas of the Orkney Mainland Moors SPA is situated 8km to the east of the proposed development location.

Special Protection Areas (SPAs)		
Site	**Description and Qualifying Feature**	**Comment**
	Qualifying species: Orkney Mainland Moors SPA regularly supports populations of European importance including the hen harrier (*Circus cyaneus*), red-throated diver (*Gavia stellata*), and short-eared owl (*Asio flammeus*). Only the red-throated diver is likely to utilise coastal waters, therefore, may come into contact with the proposed development.	
West Westray	West Westray SPA is an 8km 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 into the marine environment to include the seabed, water column and surface. Qualifying species: West Westray qualifying species include Arctic tern (*Sterna paradisaea*), common guillemot (*Uria aalge*), razorbill (*Alca torda*), black-legged kittiwake (*Rissa tridactyla*), Arctic skua (*Stercorarius parasiticus*) and Northern fulmar (*Fulmarus glacialis*).	The West Westray SPA is situated >20km to the NE of the proposed development location.
Calf of Eday	Calf of Eday SPA is a small maritime island to the north of Eday in Orkney. Calf of Eday has a rocky shoreline with cliffs to the north and the west. The island is covered by maritime heath and grassland. The boundary of the SPA encompasses the boundary of the Calf of Eday SSSI (see below), and the seaward extension extends approximately 2 km into the marine environment to include the seabed, water column and surface. Qualifying species: Calf of Eday qualifying species include the great cormorant (*Phalacrocorax carbo carbo*), great black-backed gull (*Larus marinus*), common guillemot (*Uria aalge*), Northern fulmar (*Fulmarus glacialis*) and black-legged	The Calf of Eday SPA is situated >20km to the ENE of the proposed development location.

Special Protection Areas (SPAs)		
Site	**Description and Qualifying Feature**	**Comment**
	kittiwake (*Rissa tridactyla*).	
Hoy	Hoy SPA covers the northern and western two-thirds of Hoy island, which is formed of Old Red Sandstone and contains Orkney's highest hills, and adjacent coastal waters. The SPA supports an extremely diverse mixture of mire, heath and alpine vegetation and Britain's most northerly native woodland. These upland areas and the high sea cliffs at the coast support an important assemblage of moorland breeding birds and breeding seabirds. The seaward extension extends approximately 2 km into the marine environment to include the seabed, water column and surface. Qualifying species include red-throated diver (*Gavia stellata*), peregrine (*Falco peregrines*), great skua (*Stercorarius skua*), Atlantic puffin (*Fratercula arctica*), black-legged kittiwake (*Rissa tridactyla*), Arctic skua (*Stercorarius parasiticus*), Northern fulmar (*Fulmarus glacialis*), great black-backed gull (*Larus marinus*) and common guillemot (*Uria aalge*).	The Hoy SPA is situated 20km NW from the proposed development location.

Note: These are the principal SPAs in the area. Others (most notably the more distant coastal SPAs – e.g. those in Caithness) will be considered during the EIA process, if appropriate. Data from the SNHi SiteLink web pages.

4.3.3.8 Connectivity between seabird populations of these SPAs and the AOS can be estimated based on known maximum foraging ranges of breeding seabirds (Table 4.7).

Table 4.7. Maximum foraging ranges of breeding seabirds which have the potential to use the proposed development area.

Species	Mean foraging range (km)	Maximum foraging range (km)	Reference
Red-throated diver	11 4.5	50 9	Langston 2010 Thaxter *et al.* 2012
Northern fulmar	69 48	664 580	Langston 2010 Thaxter *et al.* 2012
Great cormorant	10 8 5.2	50 50 35	Forrester *et al.* 2007 Langston 2010 Thaxter *et al.* 2012
Shag	7 . 7 . 5.9	17 17 20 12.7 17	Wanless *et al.* 1991 Pearson 1968 Langston 2010 Wanless *et al.* 1998 Thaxter *et al.* 2012
Arctic skua	28	100	Langston 2010

Table 4.7. Maximum foraging ranges of breeding seabirds which have the potential to use the proposed development area.			
Species	**Mean foraging range (km)**	**Maximum foraging range (km)**	**Reference**
	6.4	75	Thaxter *et al.* 2012
Great skua	36	100	Langston 2010
	.	13 or 219	Thaxter *et al.* 2012
Herring gull	<40	.	Ratcliffe *et al.* 2000 in Langston 2010
	10.5	92	Thaxter *et al.* 2012
Great black-backed gull	<40	.	Ratcliffe *et al.* 2000 in Langston 2010
Black-legged kittiwake	.	55	Pearson 1968
	.	40-60	Suryan *et al.* 2000
	.	73	Daunt *et al.* 2002
	<5km, 1991	.	Hamer *et al.* 1993
	>40km, 1990	.	Hamer *et al.* 1993
	25	200	Langston 2010
	26	59	Kotzerka *et al.* 2010
	25	120	Thaxter *et al.* 2012
Arctic tern	.	20	Pearson 1968
	12	21	Langston 2010
	7.1	30	Thaxter *et al.* 2012
	.	29	Perrow *et al.* 2011
Sandwich tern	.	25	Pearson 1968
	15	70	Langston 2010
	11.5	54	Thaxter *et al.* 2012
	.	54	Perrow *et al.* 2011
Common tern	.	22	Pearson 1968
	9	37	Langston 2010
	4.5	30	Thaxter *et al.* 2012
	.	9	Perrow *et al.* 2011
Common guillemot	6-8	100	Bradstreet and Brown 1985
	24	200	*Langston 2010*
	38	135	*Thaxter et al. 2012*
Razorbill	10	51	*Langston 2010*
	.	35	Benvenuti *et al.* 2001
	24	95	Thaxter *et al.* 2012
Black guillemot	0-4	7	Bradstreet and Brown 1985
	5	55	Langston 2010
Atlantic puffin	.	140	Pearson 1968
	3-5	100	Bradstreet and Brown 1985
	30	200	Langston 2010
	4	200	Thaxter *et al.* 2012

4.3.3.9 Given the very large foraging ranges of some seabirds, such as northern fulmars which may forage as much as 600km from the nest while breeding, and common

guillemots which may forage up to 200km from their nest while breeding (Table 4.7), many seabird SPAs around the British Isles will have some connectivity with the AOS. However, for those at considerable distances such connectivity will be trivial because the area increases with the square of distance so, all else being equal, seabird density will tend to fall with the square of distance from the breeding site. There will be a need in the Environmental Assessment to consider which of these sites fall close enough to the AOS to require assessment. This is likely to include all seabird SPAs in Orkney, Caithness and Sutherland, but in the extreme case (northern fulmar) would include all SPAs in Scotland for which northern fulmar is a notified feature. This is likely also to be informed by assessment of the hazard that wave energy devices represent to different seabird species. Clearly that hazard will be negligible for many seabirds but may be significant for a few species such as divers. Furness and Wade (2012) identified the vulnerability of the Scottish northern fulmar population to wave energy devices as 'very low vulnerability' so consideration of connectivity of northern fulmar SPAs to the AOS should focus on the closest sites which are likely to be responsible for most of the northern fulmar abundance in the AOS. In contrast, species identified by Furness and Wade (2012) as 'moderate vulnerability' (great northern diver, red-throated diver, black-throated diver) require connectivity to be considered over the full range of their breeding season foraging (in the case of red-throated divers) and in relation to their migration routes and winter distributions (in the case of all three species).

Sites of Special Scientific Interest (SSSIs)		
Site	**Description and Qualifying Feature**	**Comment**
Marwick Head	Marwick Head SSSI is on the west coast of the Orkney Mainland between Bay of Skaill and the Brough of Birsay. The geology of this site features sandstone cliffs which provide excellent nesting locations for many sea bird species. The site accommodates one of the three largest seabird colonies in Orkney. The breeding Guillemot (*Uria aalge*) and Kittiwake (*Rissa tridactyla*) are of national importance with 4% and 2% respectively of the British and Irish breeding populations present. Other species of national importance in the area include: Fulmar (*Fulmarus glacialis*), Razorbill (*Alca torda*), Puffin (*Fratercula artica*), Shag (*Phalacrocorax aristotelis*), Jackdaw (*Corvus monedula*) and Herring Gull (*Larus argentatus*).	Adjacent to the proposed site
Loch of Isbister and the Loons	This SSSI is a wetland site of both botanical and ornithological interest. The site supports a very diverse breeding and wintering wildfowl population, and is nationally important for breeding Pintail (*Anas*	The Loch of Isbister and the Loons SSSI is situated 8km to the east of the proposed development site

Sites of Special Scientific Interest (SSSIs)		
Site	**Description and Qualifying Feature**	**Comment**
	acuta), Wigeon (*Anas penelope*), Mallard (*Anas platyrhnchos*), Teal (*Anas crecca*), Tufted Duck (*Aythya fuligula*), Red Breasted Merganser (*Mergus serrator*), Shoveler (*Anas clypeata*) and Shelduck (*Tadorna tadorna*).	
Rousay	This SSSI hosts Arctic tern and Arctic skua on the west-facing slopes of Faraclett and Quendal-Brings. The seacliffs from Rough of Scabra to Saviskaill Head host over 29,000 individual seabirds including: 10,000 guillemots, 9,000 kittiwakes, fulmar, razorbills, puffins, shags, great skuas, black guillemots, and five species of gull. The moorland supports a diverse breeding bird assemblage, including: red-throated diver, wigeon, teal, common sandpiper, hen harrier, merlin, red grouse, golden plover, dunlin, snipe, curlew, great skua, Arctic skua, short-eared owl, stonechat, wheatear, raven and twite. Red-breasted mergansers may also breed and peregrines breed occasionally.	The Rousay SSSI is situated 10km to the NE of the proposed development location.
West Mainland Moorlands	Ornithologically the West Mainland Moorlands SSSI is famous for their birds of prey. The area contains approximately 19 hen harrier (*Circus cyaneus*) nest sites. A minimum of 14 pairs of short-eared owl (*Asio flammeus*) bred between 1996 and 2000. The hill lochans support approximately 18 pairs of red-throated divers (*Gavia stellata*). The moorlands also supports breeding populations of kestrels (*Falco tinnunculus*), merlin (*Falco columbarius*), Arctic skuas (*Stercorarius parasiticus*), great skua (*Stercorarius skua*), golden plover, whimbrel, wigeon, lapwing, dunlin, snipe , curlew, stonechat, wheatear and raven.	The West Mainland Moors SSSI is situated approximately 10km to the east of the proposed development site
Lochs of Harray and Stenness	Both lochs are of importance for a variety of wintering wildfowl including nationally significant populations of Pochard (*Aythya farina*), Tufted Duck (*Aythya fuligula*) and Scaup (*Aythya marila*) on Loch of Harray and Goldeneye (*Bucephala clangula*) on Loch of Stenness.	The Lochs of Harray and Stenness SSSI is situated approximately 10km to the south east of the proposed development site
Hoy	The Hoy SSSI is the most important area in Orkney for great skua and supports an internationally important breeding	The Hoy SSSI is situated 20km NW from the proposed development

Sites of Special Scientific Interest (SSSIs)		
Site	**Description and Qualifying Feature**	**Comment**
	population. Additionally the site is nationally important for Arctic skua and for red-throated diver. The site also supports an internationally important assemblage of breeding seabirds with around 120,000 individuals present comprising 14 different species, including nationally important populations of fulmar, great black-backed gull and guillemot.	location
Doomy and Whitemaw Hill	Doomy and Whitemaw Hill are two areas of typical dwarf-shrub heath and blanket bog within the central part of the island of Eday. The site supports breeding whimbrel and Arctic skua.	The Doomy and Whitemaw Hill SSSI is situated 30km NE from the proposed development location
Calf of Eday	The Calf of Eday SSSI supports a nationally and internationally important breeding colony of cormorants contributing to 3% of the British population.	The Calf of Eday SSSI is situated >30km NE from the proposed development location
North Hill	This SSSI is of considerable ornithological importance, regularly supporting about 5,000 pairs of Arctic Terns. In addition there is also an important Arctic Skua colony. The surrounding cliffs support colonies of Kittiwakes and Guillemots.	-
West Westray	West Westray SSSI supports a nationally and internationally important colony of breeding seabirds. Further inland the nationally important maritime cliff habitat provides breeding sites for nationally and internationally significant colonies of Arctic skua and Arctic tern. The guillemot and kittiwake colonies make up a significant proportion of the British population, 3.8% and 3.3% respectively. Razorbill has suffered a decline in population in recent years and currently contributes towards 0.5% of the British population. Large numbers of puffin, fulmar and shag also occur contributing towards this nationally important breeding seabird colony. Arctic skua can be found inland and the site harbours 1.8% of the British population. Arctic terns also use the heath for nesting although numbers have fluctuated in recent years.	The West Westray SSSI is situated >20km to the NE of the proposed development location.
East Sanday Coast	East Sanday Coast SSSI is the most important stretch of shore in Orkney for wintering waders, such as Purple sandpiper (*Calidris*	The East Sanday Coast SSSI is situated >30km to the NE of the proposed

Sites of Special Scientific Interest (SSSIs)		
Site	**Description and Qualifying Feature**	**Comment**
	maritima) and turnstone (*Arenaria interpres*). Additionally, ringed plover (*Charadrius hiaticula*), sanderling (*Calidris alba*) and bar-tailed godwit (*Limosa lapponica*) are also present. The site has additional importance in spring, when Sanday becomes a staging post for turnstone migrating north to their breeding grounds, and also supports a diverse assemblage of other shorebirds, including dunlin (*Calidris alpine*), curlew (*Numenius arquata*), redshank (*Tringa tetanus*) and oystercatcher (*Haematopus ostralegus*).	development location.
Stromness Heaths and Coasts	The Stromness Heaths and Coasts SSSI is important for its coastal geomorphology and maritime grassland. Although both are important for ornithological interests the site is not designated for ornithological features.	The Stromness Heaths and Coasts SSSI is situated 10km to the south of the proposed development location.

Note: These are the principal SSSIs in the area. Others (most notably those further inland and more distant coastal SSSIs) will be considered during the EIA process, if appropriate. Data from the SNHi SiteLink web pages.

RAMSAR		
Site	**Description and Qualifying Feature**	**Comment**
East Sanday Coast	East Sanday Coast Ramsar site is a 40km stretch of coast on the island of Sanday in Orkney. The coastline consists of rocky and sandy sections and is notable for the presence of sand dune and machair habitats, which are rare outside of the Hebrides as well as extensive intertidal flats and saltmarsh. The site is further characterised by a series of tombolos, bars, spits and shingle ridges. The Ramsar site consists of parts of Northwall and Central Sanday SSSIs and the entire East Sanday Coast SSSI (see above). East Sanday Coast Ramsar supports, in winter, internationally important populations of purple sandpiper (*Calidris maritima*) and turnstone (*Arenaria interpres*). Non-qualifying interest: As well as its importance for purple sandpiper and turnstone, the site is also of interest for its overall assemblage of wintering waders, which include ringed plover (*Charadrius hiaticula*), golden plover (*Pluvialis apricaria*), lapwing (*Vanellus vanellus*), knot (*Calidris canutus*), sanderling (*Calidris alba*), dunlin	The East Sanday Coast SSSI is situated >30km to the NE of the proposed development location.

RAMSAR		
Site	**Description and Qualifying Feature**	**Comment**
	(*Calidris alpina*), snipe (*Gallinago gallinago*), bar-tailed godwit (*Limosa lapponica*), curlew (*Numenius arquata*) and redshank (*Tringa totanus*).	

Note: Data from the SNHi SiteLink web pages.

4.3.3.10 The Joint Nature Conservation Committee (JNCC) working with SNH, is currently undertaking a review of SPA designated sites and boundaries for existing seabird colonies. This includes the seaward extension of SPAs for seabird breeding colonies. It is understood that plans exist for SPAs for auks to be extended by 1km seawards, colonies for fulmars to be extended by 2km seawards and for colonies with petrels to be extended by 4km. Decisions regarding terns and shags have yet to be made. It seems likely therefore that the Marwick Head SPA would be extended seawards by 1 or 2km into the marine environment to include the seabed, water column and surface (SNH Sitelink).

4.3.3.11 The JNCC is currently making recommendations to SNH that Scapa Flow be put forward as a candidate SPA. Scapa Flow meets SPA criteria both in winter and summer. In winter, two species, Great Northern Diver and Slavonian Grebe, are present in Scapa Flow in internationally important concentrations while a further 11 species are present in nationally important numbers. In summer, observational work has shown that Scapa Flow is the most important feeding area for the Red-throated Divers that nest within the Hoy SPA. It will be necessary to assess whether birds from Scapa Flow SPA use the planned development area.

Data sources

Benvenuti, S., L. Dall'antionia, P. Lyngs. (2001). Foraging behaviour and time allocation of chick-rearing razorbills (*Alca torda*) at Graesholmen, central Baltic Sea. Ibis 143, 402-412.

Bradstreet, M.S.W., Brown, R.G.B. (1985). Feeding ecology of the Atlantic alcidae. Chapter 6 in Nettleship, D.N. and Birkhead, T.R. The Atlantic Alcidae. Academic Press, London.

Daunt, F., Benvenuti, S., Harris, M.P., Dall'Antonia, L., Elston, D.A., Wanless, S. (2002). Foraging strategies of the black-legged kittiwake *Rissa tridactyla* at a North Sea colony: evidence for a maximum foraging range. Marine Ecology Progress Series 245, 239-247.

Forrester, R.W., Andrews, I.J., McInerny, C.J., Murray, R.D., McGowan, R.Y., Zonfrillo, B., Betts, M.W., Jardine, D.C., Grundy, D.S. (2007). The Birds of Scotland. Scottish Ornithologists' Club, Aberlady.

Furness, R.W. and Wade, H. (2012). Vulnerability of Scottish seabird populations to tidal turbines and wave energy devices. Report to Scottish Natural Heritage.

Hamer, K.H., Monaghan, P., Uttley, J.D., Walton, P., Burns, M.D. (1993). The influence of food supply on the breeding ecology of Kittiwakes *Rissa tridactyla* in Shetland. Ibis 135, 255–263.

Kotzerka, J., Garthe, S., Hatch, S.A. (2010). GPS tracking devices reveal foraging strategies of Black-legged Kittiwakes. Journal of Ornithology 151, 459-467.

Langston, R.H.W. (2010). Offshore Wind Farms and Birds: Round 3 zones, extensions to Round 1 and Round 2 sites and Scottish Territorial Waters. RSPB Research Report 39. RSPB, Sandy.

NBN (2010). National Biodiversity Network website accessed December 2010.

Pearson, T.H. (1968). The feeding biology of sea-bird species breeding on the Farne Islands, Northumberland. Journal of Animal Ecology 37, 521-552.

Perrow, M.R., Skeate, E.R., Gilroy, J.J. (2011). Visual tracking from a rigid-hulled inflatable boat to determine foraging movements of breeding terns. Journal of Field Ornithology 82, 68-79.

Ratcliffe, N., Catry, P., Hamer, K.C., Klomp, N.I., Furness, R.W. (2002). The effect of age and year on the survival of breeding adult great skuas *Catharacta skua* in Shetland. Ibis 144, 384-392.

Suryan, R.M., Irons, D.B., Benson, J. (2000). Prey switching and variable foraging strategies of black-legged kittiwakes and the effect on reproductive success. Condor 102, 374–384.

SNHi (2010). Website accessed August 2010.

Thaxter, C. B., Lascelles, B., Sugar, K., Cook, A. S. C. P., Roos, S., Bolton, M., Langston, R. H. W., Burton, N. H. K. (2012). Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. Biological Conservation, in press.

Wanless, S., Harris, M.P., Morris, J.A. (1991). Foraging range and feeding locations of shags *Phalacrocorax aristotelis* during chick rearing. Ibis 133, 30-36.

Wanless, S., Grémillet, D., Harris, M.P. (1998). Foraging activity and performance of shags *Phalacrocorax aristotelis* in relation to environmental characteristics. Journal of Avian Biology 29, 49-54.

EIA Methodology

TABLE 4.8 Primary Data Collection Methodology

Information requirement	Field method	Key regulators/public bodies
BIOLOGICAL ENVIRONMENT		
Ornithology		
Existing data (desk based)	Collation and review of any previous records or data relating to the ornithological ecology of the area in the vicinity of the proposed site and other conservation designations present. APEM data collection has been ongoing under contract to MS. This data will be analysed by SPR and its consultants who will decide its applicability to the environmental assessment of the development site.	Scottish Natural Heritage (SNH) Royal Society for the Protection of Birds (RSPB) Marine Scotland

TABLE 4.8 Primary Data Collection Methodology		
Information requirement	Field method	Key regulators/public bodies
Baseline presence and use of area by resident birds in proximity to site and migratory birds on passage through site	**Terrestrial survey** A dedicated survey, including breeding birds, will cover the area of all possible proposed cable landfall and substation locations. **Boat survey** Dedicated monthly boat survey (for 1-2 years) using methodology recommended in Camphuysen *et al.* (2004). Surveys to be conducted in transect pattern by boat based visual observers. Survey covering wave array lease boundary area and an appropriate buffer zone. Survey methodologies have been agreed with SNH and MS and can be made available on request. SPR will endeavour to work with adjacent developers to share data on impacts to inform cumulative assessments.	Scottish Natural Heritage (SNH) Royal Society for the Protection of Birds (RSPB) Marine Scotland

Potential Project Effects

4.3.3.12 The potential effects of the proposed project to the ornithological ecology of the area are thought to be small, based on the recent SNH review of hazards to seabird populations of tidal and wave energy devices in Scotland (Furness and Wade, 2012) and other recent reviews (ICES. 2010; ABP Marine Environmental Research, 2011; Langton *et al.*, 2011; Witt *et al.*, 2012). There will be direct loss of habitat due to the presence of the substation; however, the location for this will be carried out in a sensitive manner so as not to significantly affect any designated sites or areas of conservation importance. The main concern will be potential effects on populations of seabirds, resulting from collision mortality, displacement from habitat, or alteration of habitat. Boat survey data will be used to assess the numbers of seabirds of each species using the area and hence potentially affected by the development. There may be a possibility to use data from ongoing digital aerial surveys being conducted by APEM Ltd. on behalf of Marine Scotland. However, at this stage it is unclear whether such data provide reliable estimates of seabird density at an appropriate spatial scale for use in EIA or AA, and issues of calibration between aerial surveys and boat based surveys remain to be resolved.

4.3.3.13 Other effects to be considered during the environmental impact assessment are the potential uses of the proposed project area by seabirds from specific SPAs, based on observed flight-lines, information available from tracking seabirds from breeding sites (such as from the FAME project and from work on Hoy SPA by Environmental Research Institute, Thurso), and knowledge of foraging ranges of the key species. This will allow an assessment to be made on the potential for disturbance to seabirds and collision risk to diving seabirds. Additionally, any risks posed by the presence of installation vessels at the site will be considered.

Potential Cumulative Effects

4.3.3.14 As there are several designated sites in the vicinity of the proposed development and there are also other proposed developments along the west coast of the Orkney Mainland then there is the potential possibility for cumulative effects. This

potential will be fully assessed during the EIA process, following recommended best practice methodologies currently being developed by The Crown Estate for developments in the Pentland Firth Orkney Waters (PFOW) area.

4.3.4. Marine Mammals

Baseline conditions

4.3.4.1 Grey (*Halichoerus grypus*) and harbour seals (*Phoca vitulina*) occur all year round in the coastal waters of the Orkney Islands. Seals often return to shore to haul out on rocks or beaches between feeding trips at sea. Such trips can last up to two to three weeks. Seals also come ashore during the breeding season to give birth, and at other times to moult their fur (Faber Maunsell and Metoc, 2007).

4.3.4.2 The Northern Isles (Shetland and Orkney) contain the largest proportion of both grey and common seals in Scotland (Faber Maunsell and Metoc, 2007). Both species are widespread and present in relatively large numbers throughout the Orkney archipelago (Faber Maunsell and Metoc, 2007). The western coast of the Orkney Mainland has a limited number of seal haulout locations and breeding areas. Harbour seal haul-outs (Sea Mammal Research Unit, 2002) and grey seals (Duck, 1997) on the west of the Orkney Mainland are primarily located at Birsay (although there are no grey seal pupping sites thought to be located along this coast). Seal haul-out sites are principally concentrated on the Scapa Flow islands of Switha, Cava, Flotta as well as on northern Hoy (Duck, 1997). Amongst the northern islands of the archipelago seals were abundant on Stronsay, Sanday, Westray, part of North Ronaldsay and on the east side of Mainland (Duck, 1997). Telemetry studies show that the Pentland Firth and Orkney waters are stopping off places for grey seals, as well as a route for animals moving between feeding areas. These patterns are brought up to date in SNH's publication 'Seal movements in the Pentland Firth and Orkney'. The ES will need to take into account the local seal management unit and the current state of populations of grey and harbour seals (the UK harbour seal population status is currently classified as 'unfavourable').

4.3.4.3 Over twenty species of whales, dolphins and porpoise can be seen around the Scottish coastline, including common dolphins (*Delphinus delphis*), minke whales (*Balaenoptera acutorostrata*), killer whales (*Orcinus orca*) and bottlenose dolphin (*Tursiops truncatus*) (of which the Scottish population is the most northerly in the world) (Faber Mansell and Metoc, 2007). Harbour porpoise (*Phocoena phocoena*) are also present throughout the year and Risso's dolphin (*Grampus griseus*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), long-finned pilot whale (*Globicephala melas*),minke whales (*B. acutorostrata*), striped dolphins (*Stenella coeruleoalba*) and white-beaked dolphins (*Lagenorhynchus albirostris*) have all been recorded from the west Orkney Mainland coastline in the vicinity of the proposed development location (NBN, 2010). Most or all of these species are likely to occur within the Pentland Firth. Records of marine mammal species in this area have recently been summarised in an SNH report '*Abundance and behaviour of cetaceans and basking sharks in the Pentland Firth and Orkney waters*' published in 2011 (Evans *et al.*, 2011). This report provides a valuable summary of marine mammal distribution and ecology in the area, but also has severe limitations, as observations were mainly opportunistic and so are heavily biased to specific locations and times of year. This makes it very difficult to assess the spatial use of the area by particular species and makes assessment of numbers and seasonality difficult. Evans *et al.* (2011) report 6635 records of cetaceans since 1980, of which about half (3332) were harbour porpoises. Minke whales (800), killer whales (474), white-

beaked dolphins (416), Risso's dolphins (361) and unidentified dolphins (448) form the bulk of the other half of the records. No other species represented more than 3% of records although there were around 100 records of each of bottlenose dolphin, short-beaked common dolphin, Atlantic white-sided dolphin and long-finned pilot whale. Harbour porpoise are present throughout the year, but most of the dolphins and whales have been seen predominantly in summer. It is unclear whether this represents seasonal movements of these animals or simply a lack of observers present in winter and more difficult sea conditions obscuring presence of mammals. The report suggests that Scapa Flow and adjacent areas in south Orkney, Gills Bay, Dunnet Bay, and Strathy Bay may be favoured areas for cetaceans, but concludes that '*the uneven distribution of effort limits clear interpretation of distribution patterns*' (Evans *et al.*, 2011). Detailed and scientifically well-designed observations of cetaceans (A. Robbins, unpublished report to SNH and EMEC, 2011) have been made at the EMEC test site at Billia Croo, and these could be used to inform on the extent to which different marine mammals use such an area of high wave energy.

Designations and Protection

4.3.4.4 There are no designated sites for marine mammals within the area of interest; however, there are several protected sites within the Orkney archipelago and elsewhere. The individual animals from these sites may utilise the West Orkney Mainland coastline. Given the protection afforded marine mammals and the number of haulout and breeding sites in the vicinity of the proposed development location these species and their behavioural patterns will be fully assessed within the EIA. At this early stage, the SACs at Sanday, Faray and Holm of Faray, Moray Firth, North Rona, Dornoch Firth, Isle of May and North Northumberland Coast will be scoped in on the basis of the potential foraging range of the species concerned. The ES will review published telemetry data to assess proportions of seals belonging to each SAC that may be in the development area.

Data sources

ABP Marine Environmental Research 2011. Modelling and mapping the relative encounter/collision risk for mobile marine species (birds and mammals) with tidal stream energy devices in Welsh waters. Report R.1681a, to Countryside Council for Wales.

Duck, C.D. (1997). Chapter 5.14 Seals. In: Coasts and seas of the United Kingdom. Region 2: Orkney, ed. by J.H. Barne, C.F. Robson, S.S. Kaznowska, J.P. Doody, N.C. Davidson and A.L.Buck, 116-119. Peterborough, Joint Nature Conservation Committee (Coastal Directories Series).

Evans, P.G.H. (1997). Chapter 5.15 Whales, dolphins and porpoises. In: Coasts and seas of the United Kingdom. Region 2: Orkney, ed. by J.H. Barne, C.F. Robson, S.S. Kaznowska, J.P. Doody, N.C. Davidson and A.L.Buck, 120-123. Peterborough, Joint Nature Conservation Committee (Coastal Directories Series).

Evans, P.G.H., Baines, M.E., Coppock, J. 2011. Abundance and behaviour of cetaceans and basking sharks in the Pentland Firth and Orkney Waters. Report by Hebog Environmental Ltd & Sea Watch Foundation. Scottish Natural Heritage Commissioned Report No. 419.

Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA.

Furness, R.W. and Wade, H. (2012). Vulnerability of Scottish seabird populations to tidal turbines and wave energy devices. Report to Scottish Natural Heritage.

ICES (2010). Environmental interactions of wave and tidal energy generation devices. Special request Advice June 2010, Section 1.5.5.7, ICES Advice 2010 Book 1. Pages 184-194. ICES, Copenhagen.

Langton, R., Davies, I.M., Scott, B.E. 2011. Seabird conservation and tidal stream and wave power generation: information needs for predicting and managing potential impacts. Marine Policy 35, 623-630.

NBN Gateway (2010). Website accessed December 2010.

SNHi (2010). Website accessed August 2010.

Witt, M. J., Sheehan, E. V., Bearhop, S., Broderick, A. C., Conley, D. C., Cotterell, S. P., Crow, E., Grecian, W. J., Halsband, C., Hodgson, D. J., Hosegood, P., Inger, R., Miller, P. I., Sims, D. W., Thompson, R. C., Vanstaen, K., Votier, S. C., Attrill, M. J., Godley, B. J. 2012. Assessing wave energy effects on biodiversity: the Wave Hub experience. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences 370, 502-529.

EIA Methodology

TABLE 4.9 Primary Data Collection Methodology

Information requirement	Field method	Key regulators/public bodies
BIOLOGICAL ENVIRONMENT		
Marine Mammals		
Existing data (desk based)	Collation and review of any previous records or data relating to the marine mammal ecology of the area in the vicinity of the proposed site. APEM data collection has been ongoing under contract to MS. This data will be analysed by SPR and its consultants who will decide its applicability to the environmental assessment of the development site.	Scottish Natural Heritage (SNH) Sea Mammal Research Unit (SMRU) Marine Scotland
Baseline distribution of marine mammals: Temporal and spatial distribution of marine mammals within the site Habitat utilisation of marine mammals within the site	**Boat and VP survey** Monthly boat based surveys by Marine Mammal Observers conducting visual observations in transects. Boat surveys (for 1-2 years of data) will be integrated with the ornithological methodology. Surveys to be conducted in transect pattern by boat based visual observers. Survey covering wave farm lease boundary area and an appropriate buffer zone (agreed with SNH). Survey methodologies have been agreed with SNH and MS and can be made available on request. SPR will endeavour to work with adjacent developers to share data on impacts to inform cumulative assessments. **Other Field Surveys** Noise monitoring.	Marine Scotland Scottish Natural Heritage (SNH) Sea Mammal Research Unit (SMRU)

Potential Project Effects

4.3.4.5 The potential effects of the proposed project to the marine mammal ecology of the area are thought to primarily consist of the effects of noise and the potential collision/barrier effects of the proposed array. The potential uses of the proposed project area by marine mammals will be assessed as part of the EIA process. This will allow an assessment to be made on the potential risks posed by the presence of the array as well as the installation vessels at the site.

4.3.4.6 The potential for the following impacts should be considered by the EIA:

- Collision.
- Entrapment.
- Disturbance as a result of noise, light, vibration.
- Pollution from routine and accidental discharges.
- Interruption of known migratory routes.
- Physical intrusion/obstruction and/or barrier to movement.
- Electric and electromagnetic field effects.
- Disruption to feeding, nursing, socialising and mating.
- Displacement from preferred breeding sites and feeding areas (could be through deterrence or attraction caused by devices).
- Loss and/or creation of haul out areas.
- Death/injury due to collisions, entanglement or extreme noise during construction.
- Finally, cumulative effects of the above and other projects will be considered.

4.3.4.7 Mitigation may be required to reduce impacts on marine mammals to an acceptable level. Various mitigation options include, but are not limited to:

- Avoid sensitive sites /species.
- Avoid siting devices in particularly sensitive areas e.g. migration routes, feeding, breeding areas, haul out sites.
- Avoid installation during sensitive seasons.
- Minimise use of high noise emission activities such as piling or percussive drilling.
- Increase device visibility.
- Use of protective netting or grids.
- Use of observation (for example marine mammal observers (MMO)) and warning systems (e.g. passive acoustic monitoring (PAM) or active sonar) with feedback to control activity.
- Implementation of relevant SNH/JNCC or other guidance.
- Implement 'soft start' for piling and, where possible, other noisy activities.

Potential Cumulative Effects

4.3.4.8 As there are several other proposed developments along the West of Orkney Mainland then there is the potential possibility for cumulative effects. This potential will be fully assessed during the EIA process.

4.3.5. Fish and Shellfish

Baseline Conditions

Teleosts, Bivalves and Crustaceans

4.3.5.1 A variety of finfish and shellfish are present in and around the proposed development area at Marwick Head. These include spawning and nursery areas for finfish and important areas for some shellfish species. The table below outlines the importance of the area for certain species.

Finfish and Shellfish Resource	
Species	**Proposed development site use**
Herring (*Clupea harengus*)	Spawning area
Sprat (*Sprattus sprattus*)	Spawning area
Saithe (*Pollachius virens*)	Nursery area
Sandeel (*Ammodytes marinus*)	Spawning and nursery area
Lemon sole (*Microstomus kitt*)	Spawning and nursery area
King Scallop (*Pecten maximus*)	Present in proposed development area
Queen Scallop (*Aequipecten opercularis*)	Present in proposed development area
Lobster (*Homarus gammarus*)	Present in proposed development area
Edible crab (*Cancer pagurus*)	Present in proposed development area
Razorshell (*Ensis* sp.)	Present in proposed development area

4.3.5.2 Anadromous species (Atlantic salmon and sea trout) are not fished commercially in the area, but are known to be present along the west coast of the Orkney Mainland (NBN, 2010). These will be assessed for their known migratory patterns in the area.

Elasmobranchs

4.3.5.3 Basking sharks (*Cetorhinus maximus*) are listed as 'vulnerable' on the IUCN red list, though they are seen only occasionally in the Pentland Firth and Orkney waters. There are no records for this species for the Orkney archipelago within the NBN records (NBN, 2010); however, they are known to be present within the Orkney archipelago. Evans *et al.* (2011) report 345 records of basking sharks (involving 385 individuals) from North Scotland and Orkney reported since 1980. These were widely scattered throughout the region, with no particular concentration, and have occurred in most months of the year, though mostly between July and September. Since basking sharks filter feed plankton they are expected to occur particularly in areas with frontal systems that aggregate plankton, so the rather diffuse distribution pattern shown by the 345 records plotted by Evans *et al.* (2011) (Figure 15 in their report) is unexpected and suggests either that these animals were passing through the area rather than aggregating on food patches, or that suitable aggregations of plankton are spatially unpredictable in this region.

Designations and Protection

4.3.5.4 There are no designated sites for fish or shellfish within the area of interest; however, the River Thurso (on the north Caithness coast) is a Special Area of Conservation (SAC) for Atlantic salmon (*Salmo salar*).

Data Sources

Evans, P.G.H., Baines, M.E., Coppock, J. (2011). Abundance and behaviour of cetaceans and basking sharks in the Pentland Firth and Orkney Waters. Report by Hebog Environmental Ltd & Sea Watch Foundation. Scottish Natural Heritage Commissioned Report No. 419.

Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA.

NBN (2010). Website accessed December 2010.

SNHi (2010). Website accessed December 2010.

EIA Methodology

TABLE 4.10 Primary Data Collection Methodology		
Information requirement	Field method	Key regulators/public bodies
BIOLOGICAL ENVIRONMENT		
Fish and Shellfish		
Existing data (desk based)	Collation and review of any previous records or data relating to the marine and freshwater fisheries resource of the area in the vicinity of the proposed site.	Scottish Natural Heritage (SNH) Marine Scotland (MS)
Baseline marine ecological data	**Field survey** Assessment of multibeam swath bathymetry/Acoustic Ground Determination System data from the Geophysical survey of the proposed development area site will give preliminary information on the seabed profile. This will be used to inform the benthic environment, which, once known, will give an indication as to the species likely to be present in the area. This will be backed up by a drop-down/towed camera (taking stills or video footage) to identify some of the habitats and species present. Beam trawling and grab sampling may also be carried out in support of the camera surveys if deemed to be appropriate.	Scottish Natural Heritage (SNH) Marine Scotland (MS)

Potential Project Effects

4.3.5.5 The potential effects of the proposed project to the fish and shellfish ecology of the area are thought to primarily consist of the effects of habitat removal, noise and the potential collision/barrier effects of the proposed array. The potential presence of fish and shellfish within the proposed project area will be assessed as part of the EIA process. This will allow an assessment to be made on the potential risks posed by the presence of the array as well as the effects of the installation program.

Potential Cumulative Effects

4.3.5.6 As there are several other proposed developments along the west Orkney Mainland coastline then there is the potential possibility for cumulative effects. This potential will be fully assessed during the EIA process.

4.4. HUMAN ENVIRONMENT

4.4.1. Commercial Fisheries & Aquaculture

Baseline Conditions

4.4.1.1 Most commercial fishing in the area is inshore creel fishing for edible crab (*Cancer pagurus*), velvet crabs (*Necora puber*), and lobster (*Homarus gammarus*). There are known to be local fishermen who utilise the shoreline adjacent to the proposed project and may be affected by the proposals. There are no known areas for aquaculture (finfish or shellfish) in the vicinity of Marwick Head.

4.4.1.2 There is no known pelagic or demersal commercial fishing within the area of the proposed development site; however, the area is known as a transit route for fishing vessels heading towards other grounds.

4.4.1.3 Stromness, Tingwall and Kirkwall are the main ports in the vicinity of Marwick Head for commercial fishing and sea-angling. Fishing in the area employs relatively few people, although the industry is currently experiencing a healthy level of activity.

4.4.1.4 Although, as mentioned above, commercial fishing in the immediate area of the proposed site is restricted to inshore creel fishing for edible crab (*C. pagurus*), velvet crab (*N. puber*), and lobster (*H. gammarus*); common skate (*Dipturus batis*), cod (*Gadus morhua*), herring (*Clupea harengus*), mackerel (*Scomber scombrus*), plaice (*Pleuronectes platessa*), saithe (*Pollachius virens*), sole (*Microstomus kitt*), whiting (*Merlangius merlangus*), monkfish (*Lophius piscatorius*) and ling (*Molva molva*) are also caught in inshore waters around Orkney.

Data sources

DEFRA (2008). The United Kingdom fishing vessel list.

Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA. Environmental Report Section C SEA Assessment: Chapter C7 Fish and Shellfish.

Seafish (2008). Economic survey of the UK fishing fleet 2006.

NBN (2010). Website accessed December 2010.EIA Methodology

EIA Methodology

TABLE 4.11 Primary Data Collection Methodology		
Information requirement	Field method	Key regulators/public bodies
HUMAN ENVIRONMENT		
Commercial Fisheries		
Existing data (desk based)	Collation and review of any previous records or data relating to fishing activities (commercial and otherwise) in the area of the proposed development.	Marine Scotland
Baseline activity, location, species and commercial value	Consultation with commercial and recreational fishermen, fishing organisations and fishery management organizations. Consultations will be facilitated by a Fisheries Industry Representative.	Marine Scotland

Potential Project Effects

4.4.1.5 The potential effects of the proposed project to the fish and shellfish fisheries in the area are thought to primarily consist of the effects of limiting fishing activity in an area off the west coast of the Orkney Mainland. The potential presence of fisheries and fishing vessels within the proposed project area will be assessed as part of the EIA process to determine the significance of this impact. This will allow an assessment to be made on the potential risks to fishermen posed by the presence of the array as well as the effects of the installation program.

Potential Cumulative Effects

4.4.1.6 As there are several other proposed developments along the west coast of the Orkney Mainland then there is the potential possibility for cumulative effects to impact upon the local fishing sector. This potential will be fully assessed during the EIA process.

4.4.2. Maritime Navigation

Baseline Conditions

4.4.2.1 Very high vessel traffic densities occur in areas around Orkney, particularly the areas of Scapa Flow, the Stronsay Firth and around Kirkwall. High vessel traffic densities also occur in the inter-island channels in Orkney. There are also considerable movements of tanker and supply vessels associated with the oil trade in Orkney is a known port of call for tanker vessel traffic. Tankers call at the Talisman operated Flotta Oil Terminal in Scapa Flow and Scapa Flow is also utilised for ship to ship transfers of oil (Faber Mansell and Metoc, 2007). However, areas of low vessel density occur in coastal areas west of the Orkney (Faber Mansell and Metoc, 2007), where the proposed site is located. To avoid the risk of pollution, vessels of more than 5000 gross registered tonnes carrying oil or other hazardous cargoes in bulk are advised to avoid the area to the west coast of the Orkney Mainland, within which the proposed array is located (Faber Mansell and Metoc, 2007).

4.4.2.2 There are no known scheduled ferry routes that pass in the vicinity of the proposed location. However, there may well be large passenger cruise ships that utilise the west coast of the Orkney Mainland.

4.4.2.3 The proposed development is adjacent to a light RYA cruising route (Faber Maunsell and Metoc, 2007). Further to the west of the proposed location there is also a medium cruising route (Faber Maunsell and Metoc, 2007).

Data sources

Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA.

RYA (2008). UK coastal atlas of recreational boating, second edition.

Admiralty Charts

RADAR survey data

Automatic Identification System (AIS) data

EIA Methodology

TABLE 4.12 Primary Data Collection Methodology		
Information requirement	Field method	Key regulators/public bodies
HUMAN ENVIRONMENT		
Maritime Navigation		
Baseline vessel traffic information	**Navigational Traffic Survey** Methods for this survey will be agreed with the MCA, and will include gathering of Automatic Identification System (AIS) and radar data for vessels transiting the site and adjacent area. Data will be gathered in order to identify vessel routes, types, and transit times.	Maritime and Coastguard Agency (MCA) Northern Lighthouse Board (NLB)
Navigational risk presented by a wave farm	**Navigational Safety Risk Assessment** Any assessment would be carried out in close consultation with the MCA, and in order to fulfil requirements under MGN 371. A Preliminary Hazard Analysis will be undertaken, and a scope will be agreed for a full Navigational Safety Risk Assessment (NSRA), if deemed necessary by the MCA. Any full NSRA would include assessment of baseline risks of collision, followed by analysis of collision risk presented by the construction/ operation/ decommissioning of the wave farm. This would include collision risk due to the physical presence of the array and any associated installation/ maintenance vessels. There would also be consideration of cumulative effects (with other marine renewable projects) and in combination effects (with other developments/activities).	Maritime and Coastguard Agency (MCA) Northern Lighthouse Board (NLB)

Potential Project Effects

4.4.2.4 The potential effects of the proposed project to maritime navigation are primarily related to the presence of proposed Pelamis devices at the proposed project site. Additionally, project vessels will be present during all phases of the project, with the greatest intensity during the construction and decommissioning phases. However, maintenance vessels will also be present during the operational phase.

Potential Cumulative Effects

4.4.2.5 As there are several other proposed developments along the west coast of the Orkney Mainland then there is the potential possibility for cumulative effects to affect the risk to navigation. This potential will be fully assessed during the EIA process.

4.4.3. Landscape and Seascape

Baseline Conditions

4.4.3.1 Orkney is particularly agricultural in nature with approximately 60% of the total land area being farmed. This comprises improved grassland (c .60%), rough grassland (c .35%), and arable crops (c .5%) (Land Use Consultants, 1998). The remainder of the land area is mostly moorland. The principal forms of agriculture are livestock and dairy cattle, primarily for the production of Orkney beef and dairy products (Land Use Consultants, 1998). A significant number of sheep are also reared for the production of lamb and wool (Land Use Consultants, 1998). Crops are also grown to a lesser extent, including seed potatoes, barley, oats, kale and oil seed rape (Land Use Consultants, 1998).

4.4.3.2 The West Orkney Mainland comprises the most extensive land area in Orkney, and is the area within which Marwick Head is situated. The topography varies from wide loch basins to moorland hills. There are three primary Character Areas in the vicinity of the proposed site – these are listed below.

4.4.3.3 **Coastal hills and heath** - The landcover type within this character area is that of improved or rough grassland with maritime heath in the areas most exposed to the sea (Land Use Consultants, 1998). This landscape is scarcely populated, with a few farmsteads present.

4.4.3.4 **Cliff Landscape** - This landscape type is found predominantly along the Atlantic western coasts of the study area, therefore of particular importance to the location of the proposed development, with some of the cliff tops being over 200m. The main features of this landscape are formed by marine erosion, creating cliffs, stacks , caves and arches (Land Use Consultants, 1998). This makes spectacular scenery, for example at Marwick Head. Generally, the cliff tops are of rough grass extending right to the cliff edge, with some montane and peatland vegetation (Land Use Consultants, 1998).

4.4.3.5 **Coastal Basins** - The Coastal Basins landscape type is particularly relevant when considering the possibility of cable landfall locations in Marwick Bay. This landscape is settled and typically contains large estate farms with characteristic farmstead buildings (Land Use Consultants, 1998). Views out to sea and access to beaches are an attractive aspect of these landscapes (Land Use Consultants, 1998).

4.4.3.6 Additionally, a scenic area to the south of the site has been in existence since 1980. This is the Hoy and West Mainland National Scenic Area (NSA). The special qualities of this designated site include:

- A palimpsest of geology, topography, archaeology and land use;
- An archaeological landscape of World Heritage Status;
- The spectacular 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.

Data sources

Land Use Consultants (1998). Orkney landscape character assessment. Scottish Natural Heritage Review No. 100.

SNHi (2010). Website accessed December 2010.

EIA Methodology

TABLE 4.13 Primary Data Collection Methodology		
Information requirement	Field method	Key regulators/public bodies
HUMAN ENVIRONMENT		
Landscape and Seascape		
Change to landscape/ seascape character from the proposed wave farm development	Field surveys not thought necessary. Sufficient information to assess impacts is thought to exist.	Scottish Natural Heritage (SNH) Orkney Islands Council (OIC)

Potential Project Effects

4.4.3.7 The potential effects of the proposed project to the landscape character and seascape of the west Orkney Mainland are primarily related to the presence of the offshore Pelamis devices and onshore works (e.g. a substation). Additionally, any vessels at the proposed project site (during all phases of the project) will have to be considered.

Potential Cumulative Effects

4.4.3.8 As there are several other proposed developments along the west of the Orkney Mainland then there is the potential possibility for cumulative effects to affect the landscape/seascape character of the area. This potential will be fully assessed during the EIA process.

4.4.4. Cultural Heritage

Baseline Conditions

4.4.4.1 The archaeological features of the West Orkney Mainland are extremely significant in their nature and extent. There are sites for chambered cairns, standing stones, stone circles, and settlement (such as Skara Brae, the Neolithic village, Maes Howe chambered cairn, the Ring of Brodgar stone circle and the standing Stones of Stenness) (Land Use Consultants, 1998). More recent cultural heritage features include the Earl's Palace at Birsay on the north western tip of Mainland, to the north of the proposed development. At Marwick Head, directly adjacent to the proposed development location, is the Kitchener Memorial, from which there will be views across the site.

4.4.4.2 Records show that numerous wrecks have occurred in the area, including the H.M.S. Hampshire, which is a designated war grave. However, it is unclear as to the extent of what may remain on the seabed in such a highly exposed area.

Data sources

Land Use Consultants (1998). Orkney landscape character assessment. Scottish Natural Heritage Review No. 100.

Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA.

Historic Environment Guidance for the Offshore Renewable Energy Sector (Wessex Archaeology Ltd for COWRIE, 2007)

EIA Methodology

TABLE 4.14 Primary Data Collection Methodology		
Information requirement	Field method	Key regulators/public bodies
HUMAN ENVIRONMENT		
Cultural Heritage		
Baseline information on marine and terrestrial archaeology in the region of the Ness of Duncansby site	Data from benthic and geophysical surveys of the proposed Marwick Head site will be subject to archaeological assessment. Additionally, surveys will be carried out along any proposed cable routes (marine and onshore) as well as at proposed substation locations. If required, further detail may be collected on specific archaeological sites of interest, should these be discovered within the Marwick Head project envelope.	Historic Scotland The Ministry of Defence (MoD) The Receiver of Wreck (The Maritime and Coastguard Agency) Orkney Islands Council (OIC)

Potential Project Effects

4.4.4.3 The potential effects of the proposed project to the cultural heritage assets of the area are primarily related to the presence of the devices, cabling and onshore facilities. All of these infrastructure components will be present during all phases of the project and they will be sited sensitively after taking the cultural heritage assets into account.

Potential Cumulative Effects

4.4.4.4 As there are several other proposed developments along the west coast of the Orkney Mainland then there is the potential possibility for cumulative effects to affect local cultural heritage assets. This potential will be fully assessed during the EIA process.

4.4.5. Noise

Baseline Conditions

4.4.5.1 Anthropogenic noise levels in the area of the proposed development are likely to be low due to the lack of industrialisation, however farm machinery, traffic and marine vessel movements are intermittent noise sources.

4.4.5.2 Ambient underwater noise levels at the proposed site are not known at present and will vary depending on weather conditions.

Data sources

Scottish Executive (1999). Planning Advice Note (PAN 56). Planning and Noise.

Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA.

Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA; Chapter 9: Marine Mammals.

Atlas of Cetacean Distribution in north-west European Waters – JNCC

EIA Methodology

TABLE 4.15 Primary Data Collection Methodology		
Information requirement	Field method	Key regulators/public bodies
HUMAN ENVIRONMENT		
Noise[7]		
Noise generated form vessel and road traffic related to the wave farm	Onshore field surveys not thought necessary. Sufficient information to assess impacts is thought to exist. Underwater noise assessments may be undertaken to assess the background ambient noise at the proposed wave development site. This will be compared with operational data of devices deployed elsewhere (e.g. at the EMEC Billia Croo test facility).	Orkney Islands Council (OIC) Sea Mammal Research Unit (SMRU) Scottish Natural Heritage (SNH)

Potential Project Effects

4.4.5.3 The potential effects of the proposed project to onshore and underwater noise are primarily related to installation noise (vessels and activities), the presence of the wave energy converters during their operational phase and onshore noise levels being affected by construction traffic as well as from the presence of additional maritime vessels to the local area. Vessels will be present during all phases of the project, with the greatest intensity during the construction and decommissioning phases. However, maintenance vessels will also be present during the operational phase. The wave energy converters themselves, along with their mooring systems, will create a certain level of noise, which will be assessed in the EIA and related to local ambient noise levels. Any addition to the onshore noise levels in the area will be assessed against the receptors present.

Potential Cumulative Effects

4.4.5.4 As there are several other proposed developments along the west coast of the Orkney Mainland area then there is the potential possibility for cumulative effects to affect underwater and onshore noise in the area. This potential will be fully assessed during the EIA process.

4.4.6. Socio Economics

Baseline Conditions

4.4.6.1 The Orkney Islands are relatively sparsely populated with the two main centres of population being Kirkwall and Stromness, which are both situated on Mainland. This is the main island in the archipelago and constitutes 75% of the population of the islands. Kirkwall, with a population of approximately 8,700, is located on the eastern part of the Orkney Mainland, approximately 25km east of the proposed site. Stromness is on the west coast of the Orkney Mainland, approximately 15km south of the proposed site, and has a population of around 2,200. Between these two main population centres there

[7] Relates to effects on humans, and not on other marine and ecological receptors

are many smaller communities. The overall population of the Orkney Islands in 2010 was approximately 19,590.

4.4.6.2 Although the retail and public services are significant employers on Orkney (employing approximately 17.5% and 33% respectively) the traditional sectors of the economy (such as beef, cheese, whisky, beer, fish and other seafood) also contribute significantly to the employment sector. Additionally recent growth has been seen in other sectors including tourism (8.7% of employment on Orkney) (Kirkwall has been nominated the UK's best cruise ship destination), food and beverage manufacture, jewellery, knitwear, and other crafts. The construction sector and other major industries (e.g. the Flotta oil terminal) also contrivute to the economy.

Data sources

Scottish Government (2007). Economic Strategy.

Scottish Government (2005). Going for Green Growth; a Green Jobs Strategy for Scotland.

EIA Methodology

TABLE 4.16 Primary Data Collection Methodology		
Information requirement	Field method	Key regulators/public bodies
HUMAN ENVIRONMENT		
Socio-Economics		
Baseline information on socio-economic environment in the region of the proposed wave farm	Field surveys not thought necessary. Sufficient information to assess impacts thought to exist.	Orkney Islands Council (OIC) Highlands and Islands Enterprise (HIE) Scottish Enterprise

Potential Project Effects

4.4.6.3 The potential effects of the proposed project on the socio-economics of the area would likely be generally positive in nature. The project will attract capital investment to the area and lead to the creation of jobs. Job creation will occur primarily during the construction/ installation and maintenance phases of the project. There is currently a local project officer based in Orkney employed to assist with the development of the project.

Potential Cumulative Effects

4.4.6.4 As there are several other proposed developments along the west coast of the Orkney Mainland then there is the potential possibility for cumulative effects to occur in relation to inward investment to Orkney and job creation. This potential will be fully assessed during the EIA process.

4.4.7. Tourism and Recreation

Baseline Conditions

4.4.7.1 Some 127,200 people are estimated to have visited Orkney in 2004 (excluding cruise liner passengers). This is close to the target of 128,000 per annum outlined in the 2000-2005 Orkney Tourism Strategy and is a 15.6% increase on the 110,000 numbers that

visited Orkney in 2000. Therefore, the tourism numbers visiting Orkney are healthy and increasing, providing a boost to the local economy.

4.4.7.2 Recreational activities in the immediate area of the proposed development include windsurfing, surfing, fishing (including sea angling), kayaking, birdwatching, diving, cycling and walking. There are also numerous galleries and sites of interest to visit (e.g. Kitcheners Memorial).

4.4.7.3 Directly to the east of the proposed site, a coastal path runs down the west coast of the Orkney Mainland from Black Craig in the south to Whitaloo Point in the north, with views out across the Atlantic.

4.4.7.4 Inland from the proposed site is Marwick Bay, overlooked by the Kitchener Memorial. Although there are no visitor figures for this site, a few kilometres to the south are two out of the five most visited sites on Orkney. These are Skara Brae (with 69,361 visitors in 2009) and Skaill House (with 49,975 visitors in 2009).

Data sources

Scottish Government (2007). Economic Strategy.

RYA (2008). UK coastal atlas of recreational boating, second edition.

Tourist figures
http://www.visitscotland.org/pdf/orkney_tourism_strategy.pdf

VisitScotland tourism facts and figures for Orkney
http://www.visitscotland.org/pdf/vs_northern.pdf

Orkney Core Paths Plan
http://www.orkney.gov.uk/nqcontent.cfm?a_id=12919

Humphreys, R. and Reid, D. (2002). The Rough Guide to Scotland 5th edition. Rough Guides Ltd.

EIA Methodology

TABLE 4.17 Primary Data Collection Methodology

Information requirement	Field method	Key regulators/public bodies
HUMAN ENVIRONMENT		
Tourism and Recreation		
Baseline information on tourism and recreation activities in the area	Field surveys not thought necessary. Sufficient information to assess impacts thought to exist.	Orkney Islands Council (OIC) Highlands and Islands Enterprise (HIE) Scottish Enterprise VisitScotland

Potential Project Effects

4.4.7.5 The potential effects of the proposed project on the socio-economics of the area would likely be generally positive in nature. The project will attract capital investment to the area and lead to the creation of jobs. Job creation will occur primarily during the

construction/ installation and maintenance phases of the project. There is currently a local project officer based in Orkney employed to assist with the development of the project. Additionally, in the short to medium term the project is likely to attract a lot of media attention, which will advertise the area to the wider world. This in turn may well lead to an increase in visitor numbers and, indirectly, increased job creation.

Potential Cumulative Effects

4.4.7.6 As there are several other proposed developments along the west coast of the Orkney Mainland then there is the potential possibility for cumulative effects to occur in relation to inward investment to Orkney and job creation. This potential will be fully assessed during the EIA process.

4.4.8. Military Activity

Baseline Conditions

4.4.8.1 The proposed Marwick Head site is not located within a military practice and exercise area; however, there is an area adjacent to the south. The MOD is currently undertaking a review of its practice and exercise areas under byelaw; however no information is yet available on the location of proposed new byelawed sites (Faber Mansell and Metoc, 2007).

4.4.8.2 Faber Maunsell and Metoc, 2007 identify the proposed site as being within the WW2 Northern Mine Barrage area and thus there is a possibility that munitions may be present on the seabed in the proposed development area. An assessment of the proposed site will be made to identify if there is any possibility of munitions to be located within the lease area.

Data sources

Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA.

MOD Practice and Exercise area (PEXA) charts.

EIA Methodology

TABLE 4.18 Primary Data Collection Methodology

Information requirement	Field method	Key regulators/public bodies
HUMAN ENVIRONMENT		
Military Activity		
Baseline information on military activity in the region of the Ness of Duncansby site	Field surveys not thought necessary. Sufficient information to assess impacts thought to exist.	Ministry of Defence (MOD)

Potential Project Effects

4.4.8.3 The potential effects of the proposed project on the military activity of the area would occur through all phases of the proposed project; however, they are not thought likely to be of any significance, given that the proposed site is not within a practice and exercise area (PEXA). Close consultation with the Ministry of Defence (MOD) will be undertaken to ensure that this remains the case.

Potential Cumulative Effects

4.4.8.4 As there are several other proposed developments along the west coast of the Orkney Mainland, some of which are within the PEXA, then there is the potential possibility for cumulative effects to occur in relation to the effects on military activity. This potential will be fully assessed during the EIA process.

4.4.9. Air and Climate

Baseline Conditions

4.4.9.1 Due to the rural nature of Orkney the air quality in the region is generally excellent. Air pollution in the area of the Marwick Head currently comes from low levels of road traffic, farming vehicles and marine vessels transiting along the west coast of the Orkney Mainland, as well as those vessels that work the area (e.g. inshore fishing vessels).

4.4.9.2 Airborne dust sources are primarily from road traffic as well as some agricultural soil erosion.

Data sources

National Atmospheric Emissions Inventory

EIA Methodology

TABLE 4.19 Primary Data Collection Methodology

Information requirement	Field method	Key regulators/public bodies
HUMAN ENVIRONMENT		
Air and Climate		
Baseline air quality pollutant levels	Field surveys not thought necessary. Sufficient information to assess impacts thought to exist.	Orkney Islands Council (OIC) Scottish Environment Protection Agency (SEPA) Scottish Government Traffic Scotland

Potential Project Effects

4.4.9.3 The potential effects of the proposed project on the air quality of the area would occur through all phases of the proposed project; however, the construction phase will likely have the greatest potential for impact. These will come in the form of emissions from road traffic associated with the onshore elements of the project and the marine vessels associated with device installation.

Potential Cumulative Effects

4.4.9.4 As there are several other proposed developments along the west coast of the Orkney Mainland then there is the potential possibility for cumulative effects to occur in relation to the effects on air quality; however, activities are unlikely to occur at the same time. This potential will be fully assessed during the EIA process.

4.4.10. Other Human Activities

Baseline Conditions

4.4.10.1 As the marine renewables sector grows in the Pentland Firth and Orkney Waters area so there are plans to develop the local infrastructure. This will primarily take the form of harbour improvements, such as those currently under way at Lyness and Stromness. Such improvements will have the potential to impact on the wider area in a similar fashion as the proposed project (e.g. increased vessel and road traffic movements).

4.4.10.2 There are no known areas of aggregate extraction in the area.

EIA Methodology

TABLE 4.20 Primary Data Collection Methodology

Information requirement	Field method	Key regulators/public bodies
HUMAN ENVIRONMENT		
Other Human Activities		
Baseline water quality and local contaminant status	Field surveys not thought necessary. Sufficient information to assess impacts thought to exist.	The Crown Estate Scottish Environment Protection Agency (SEPA) Maritime and Coastguard Agency (MCA) Orkney Islands Council (OIC)

Potential Project Effects

4.4.10.3 The potential effects of the proposed project on other human activities of the area would occur through all phases of the proposed project; however, they are not thought likely to be of any significance as the timings of any such activities are unlikely to overlap. Close consultation with those groups in Table 4.20 will be undertaken to ensure that this remains the case.

Potential Cumulative Effects

4.4.10.4 At present there are no known activities that are likely to overlap with the works involved in the proposed Marwick Head project development. However, the potential for any cumulative impacts to occur will be fully assessed during the EIA process.

4.4.11. Summary of Main Potential Environmental Effects

4.4.11.1 An initial qualitative assessment of all potential effects has been based on the information presently available on the project and the baseline environmental description presented above. Table 4.22 summarises the main potential effects associated with the proposed Marwick Head wave farm development. As potential effects will vary between each phase of the project, effects have been split into the following categories, (this follows the same approach as set out in the Scottish Government Scottish Marine Renewables SEA scoping document):

- Construction and installation;
- Operation;
- Maintenance; and

- Decommissioning.

4.4.11.2 Effects have been considered as set out in Table 4.21. Note that for some of the potential effects, effect significance is unknown at this stage (highlighted orange) and will require further data collection and analysis. Depending on the further data analysis and assessment during the EIA process these effects may be identified as potentially significant, or conversely, effects may be identified as unlikely to be significant and will then be scoped out of the EIA.

TABLE 4.21 CONSIDERATION OF EFFECTS	
✓	Potentially significant effect requiring detailed investigation in the EIA
✓	Effect significance unknown at this stage until further data collated and assessed
✓	Effect unlikely to be significant (and therefore scoped out of EIA)
×	No effect (and therefore scoped out of EIA)

4.4.11.3 The main potential effects of the proposed wave farm on the environment are summarised in Table 4.22. Table 4.22 also includes details of the issues that are considered not to be significant in nature and which are proposed to be "scoped out" of the Environmental Impact Assessment. Consultees are invited to consider these non-significant issues and advise whether they agree with the view that these issues need not be addressed within the Environmental Impact Assessment.

Scoping Question: Have the most likely and significant effects been identified through this analysis? Are there any others that should be considered for inclusion in the full assessment process and if so why?

TABLE 4.22 MAIN POTENTIAL EFFECTS OF THE PROPOSED SITE

Potential Effect	Construction & Installation	Operation	Maintenance	De-commissioning
PHYSICAL ENVIRONMENT				
Marine and Coastal Processes				
Changes to wave climate	×	✓	×	×
Changes to tidal flows	×	✓	×	×
Geology, Seabed Sediments and Sediment Transport				
Increase in suspended sediment	✓	✓	×	✓
Changes to seabed morphology	✓	✓	×	×
Changes to sediment processes	✓	✓	✓	✓
Changes to coastal processes	×	✓	×	×
Disturbance of contaminated sediments	✓	✓	✓	✓

TABLE 4.22 MAIN POTENTIAL EFFECTS OF THE PROPOSED SITE				
Potential Effect	Construction & Installation	Operation	Maintenance	De-commissioning
Water Quality and Effluent Discharges				
Release of contaminants into marine environment	✓	×	✓	✓
Accidental release of contaminants into marine environment	✓	✓	✓	✓
Disturbance of existing contaminants in marine environment	✓	✓	✓	✓
Creation of obstacle to munitions likely to migrate	✓	✓	✓	×
Disturbance of seabed sediments	✓	✓	✓	✓
Accidental release of pollutants into freshwater	✓	✓	✓	✓
Disturbance of existing contaminants in the terrestrial environment	✓	×	✓	✓
BIOLOGICAL ENVIRONMENT				
Benthic Ecology				
Substratum loss	✓	×	×	✓
Smothering	✓	✓	×	✓
Increased turbidity	✓	✓	✓	✓
Decrease in flow velocities	×	✓	×	×
Decrease in wave exposure in adjacent coastal zone	✓	✓	×	×
Devices act as invasives stepping stone	×	✓	×	×
Accidental release of contaminants	✓	✓	✓	✓
Terrestrial Ecology				
Permanent physical loss of important terrestrial habitats and species	✓	✓	✓	×
Temporary disturbance of important terrestrial habitats and species	✓	✓	✓	✓
Siltation of water courses and secondary effects on freshwater bodies	✓	×	×	✓

TABLE 4.22 MAIN POTENTIAL EFFECTS OF THE PROPOSED SITE				
Potential Effect	Construction & Installation	Operation	Maintenance	De-commissioning
Accidental release of contaminants	✓	✓	✓	✓
Marine Mammals				
Noise disturbance	✓	✓	??	✓
Collision risk (vessels and underwater structures)	✓	✓	✓	✓
Barrier effects	✓	✓	✓	✓
Accidental release of contaminants	✓	✓	✓	✓
Entanglement in cable catenary's and mooring lines	×	✓	×	×
Entrapment between device sections	×	✓	×	×
Loss of potential important habitats	✓	✓	✓	✓
Electromagnetic effects	✓	✓	✓	✓
Cumulative effects	✓	✓	✓	✓
Ornithology				
Collision risk with vessels	✓	✓	✓	✓
Collision risk with devices and underwater infrastructure	✓	✓	×	✓
Disturbance by noise and human activity related to the wave farm	✓	✓	✓	✓
Loss of potential foraging and/or breeding/nesting habitats	✓	✓	✓	✓
Disturbance by noise and human activity related to the onshore supporting works	✓	✓	✓	✓
Barrier effects, indirect effects and disturbance due to operations and maintenance	✓	✓	✓	✓
Entrapment in parts of the device	×	✓	×	×
Accidental release of contaminants	✓	✓	✓	✓
Cumulative effects	✓	✓	✓	✓

TABLE 4.22 MAIN POTENTIAL EFFECTS OF THE PROPOSED SITE				
Potential Effect	Construction & Installation	Operation	Maintenance	De-commissioning
Fish and Shellfish				
Noise and vibration disturbance	✓	✓	✓	✓
Loss of habitat in footprint	×	✓	×	✓
Effects of electromagnetic fields	×	✓	×	×
Collision risk	×	✓	×	×
Increase in habitat heterogeneity (e.g. fish aggregating device, artificial reef)	×	✓	×	✓
Suspended sediments	✓	✓	✓	✓
Disturbance to spawning and nursery grounds	✓	✓	✓	✓
Disturbance to migratory fish routes (e.g. Atlantic salmon)	✓	✓	✓	✓
Entrapment in parts of the device	×	✓	×	×
Plankton				
Alteration of plankton productivity through alteration of coastal processes	×	✓	×	×
HUMAN ENVIRONMENT				
Commercial Fisheries				
Altered access to fishing grounds	✓	✓	✓	✓
Increased conflict over diminished grounds	✓	✓	✓	✓
Displacement of, or reduction in, fish and shellfish resource	✓	✓	✓	✓
Loss or damage to fishing gear	✓	✓	✓	✓
Maritime Navigation				
Temporary disturbance to regular shipping traffic	✓	×	×	✓
Permanent displacement of regular shipping traffic	×	✓	×	×
Increased navigational risk and collision risk	✓	✓	✓	✓
Increased navigational risk if	✓	✓	✓	✓

TABLE 4.22 MAIN POTENTIAL EFFECTS OF THE PROPOSED SITE				
Potential Effect	Construction & Installation	Operation	Maintenance	De-commissioning
device breaks free from moorings or when under tow				
Landscape and Seascape				
Effect on landscape	✓	✓	✓	✓
Effect on seascape	✓	✓	✓	✓
Effect on visual amenity	✓	✓	✓	✓
Effect on submerged landscapes	✓	✓	✓	✓
Cultural Heritage				
Disturbance and destruction of known and unknown archaeological submarine sites (incl. wrecks)	✓	✓	×	✓
Disturbance and destruction of known and unknown archaeological terrestrial sites	✓	×	×	✓
Influence to cultural heritage setting	✓	✓	×	✓
Noise[8]				
Noise generated from vessels and devices related to the wave farm	✓	✓	✓	✓
Noise generated from heavy plant associated with the onshore infrastructure	✓	×	✓	✓
Noise generated from the onshore infrastructure	×	✓	×	×
Socio-Economics				
Employment opportunities related to onshore facilities	✓	✓	✓	✓

[8] Relates to effects on humans, and not on other marine and ecological receptors

TABLE 4.22 MAIN POTENTIAL EFFECTS OF THE PROPOSED SITE				
Potential Effect	Construction & Installation	Operation	Maintenance	De-commissioning
Increased demand for local private services/goods	✓	✓	✓	✓
Increased demand for local public services/goods	✓	✓	✓	✓
Nuisance impacts e.g. noise, lighting, dust, etc.	✓	✓	✓	✓
Interference with planned infrastructure improvements in the local area	✓	✓	×	✓
Tourism and Recreation				
Disturbance to recreational activity	✓	✓	✓	✓
Visual impacts which deter tourism	✓	✓	✓	✓
Opportunities for local tourism	×	✓	×	×
Military Activity				
Temporary disruption to military exercises	✓	✓	✓	✓
Long-term obstruction to military exercises	×	✓	✓	×
Effects of array on military sonar	×	✓	×	×
Disturbance of unexploded ordinance	✓	×	×	✓
Air and Climate				
Dust emissions	✓	×	×	✓
Gas emissions (e.g. CO_2)	✓	×	✓	✓
Avoidance of air quality pollutant emissions	✓	✓	✓	✓
Avoidance of greenhouse gas emissions	✓	✓	✓	✓
Infrastructure				
Temporary disruption to local traffic/access	✓	✓	✓	✓
Direct damage to subsea power/telecommunications cables	✓	×	×	✓
Other Human Activities				
Temporary disruption to transiting of marine disposal vessels	×	×	×	×

TABLE 4.22 MAIN POTENTIAL EFFECTS OF THE PROPOSED SITE				
Potential Effect	Construction & Installation	Operation	Maintenance	De-commissioning
Permanent displacement of routes for marine disposal vessels	×	×	×	×

4.5. MITIGATION

4.5.1.1 The most effective mitigation of the effects of the wave farm will be achieved through an evolution of the most sensitive layout of individual wave energy converters within the designated lease area through an optimisation process and the selection of the most appropriate cable route to shore. Timing of construction and decommissioning will need to take account of the potential disturbance to birds and marine mammals. It is likely that some or potentially all elements of construction will need to be timed outwith the seabird breeding season to avoid disturbance having an adverse effect on the qualifying features of the local SPAs. This would likely mean construction / installation between August and March.

4.5.1.2 In continuing the iterative development of the wave farm, SPR and their environmental consultants will combine careful site design with comprehensive mitigation measures to avoid, reduce or offset the significant environmental effects. These effects will be identified through the detailed EIA process and will assist in the tiering of appropriate mitigation measures.

4.6. MONITORING

4.6.1.1 Where elements of uncertainty remain regarding predicted effects (as part of the full EIA exercise) a monitoring programme and period of review maybe required.

4.6.1.2 Any requirements for monitoring programmes will be discussed with the relevant regulatory authority and committed to as part of the Environmental Statement. It would be expected that monitoring commitments would become subsequent consent conditions.

4.7. ENVIRONMENTAL MANAGEMENT FRAMEWORK

4.7.1.1 It is acknowledged that the prevention or control of effects depends not only on the implementation of mitigation and monitoring measures, but also good design and continual iteration between all studies. These will include engineering design, construction and operation activities and technical criteria. Constant review of development proposals will be an important element, and will be the precursor to successful consent and development.

5. DRAFT OUTLINE OF THE ENVIRONMENTAL STATEMENT

5.0.1.1 It is proposed at this stage that the Environmental Statement will comprise a single A3 document combining text and graphics. A separate A4 Non-Technical Summary of the information contained in the Environmental Statement will also be provided. Detailed specialist reports will be available as a separate Technical Appendix if considered appropriate. Electronic Copies/PDFs of NTS will be made available on the project website and/or on DVDs.

5.0.1.2 It is proposed the text of the Environmental Statement will be divided into 2 parts, as described below.

5.1. PART 1: INTRODUCTION

5.1.1.1 Part 1 will comprise six chapters, as follows:

5.1.1.2 Chapter 1 will provide an introduction to renewable energy development and wave power in particular. It will give a short overview of the wave resource in Scotland and the Pentland Firth and Orkney Waters area, and the potential benefits of the wave farm in terms of reduced emissions.

5.1.1.3 Chapter 2 will include an overview of the impact assessment methodology used by the team, including scoping and consultation and the identification of key environmental effects. This section will conclude by providing an overview of the Environmental Statement structure.

5.1.1.4 Chapter 3 will provide the reader with an overview of all additional consultations (e.g. community consultation, landowner consultation, commercial fisheries consultation, etc.) undertaken by SPR throughout the EIA process.

5.1.1.5 Chapter 4 will describe the wave farm site selection process. It will describe the main alternatives studied and the main reasons for the choice of this site, taking into account the environmental effects. It will describe the way in which mitigation of environmental effects has been considered during site design, layout and the EIA process.

5.1.1.6 Chapter 5 will provide details of the site and a description of the proposed wave farm. This will include details of the size, layout and design of the wave farm and associated onshore/offshore infrastructure. This chapter will also outline the construction, installation, operational, maintenance and decommissioning requirements of the project.

5.1.1.7 Chapter 6 will present an overview of the relevant statutory planning guidance and Development Plan policies which apply to the wave afrm on the proposed site.

5.2. PART 2: THE ENVIRONMENTAL IMPACT ASSESSMENT

5.2.1.1 Part 2 will report the results of the EIA to date, and will contain a number of chapters reporting the findings of the impact assessment on each of the topics, which have been identified for inclusion in the EIA process during this scoping exercise. It is considered that the Chapters will include:

- Ecology (Benthic, Terrestrial and Marine mammals);
- Ornithology;
- Coastal Processes and Morphology;
- Fish and Shellfish;
- Commercial Fisheries;
- Maritime Navigation;
- Landscape and Seascape;
- Noise (underwater and onshore);
- Socio-economics;
- Cultural Heritage; and
- Other issues (such as military activities, munitions and contamination, water quality and onshore transport and traffic).

5.2.1.2 Each of these 'assessment chapters' will be prepared by the relevant expert environmental consultant(s). SPR experts in marine energy development, construction and operation, and additional specialist input would be utilised during the EIA, as required.

5.2.1.3 The assessment chapters will be structured using the same format, where practicable. Each chapter will begin with an Introduction followed by a description of the method of assessment for the particular topic under discussion. This will include an outline of relevant consultations undertaken, documentation studied and the means of defining the Study Area for that topic. Should there be any difficulties (technical deficiencies or lack of know-how) encountered in compiling the required information, this will be noted.

5.2.1.4 The existing baseline conditions for the topic will then be described. An assessment will then be made of the nature, magnitude, duration and significance of the likely effects of the construction, installation, operation, and maintenance and decommissioning of the proposed wave farm on the topic. Mitigation measures that have been committed to will be taken into account in the assessment. These mitigation measures would be used to avoid, reduce and remedy the effect, where practical. An assessment will be made of the significance of the likely residual effect, following mitigation.

5.2.1.5 Part 2 would be concluded by a chapter summarising the EIA findings.

6. CONSULTATION STRATEGY

6.1. OVERVIEW

6.1.1.1 It is understood and acknowledged that a well considered and implemented Consultation Strategy initiated at the start of the EIA process is a vital tool in the successful development of a project. The primary aim of any such strategy should be to inform, engage and resolve.

6.1.1.2 By conducting the exercise as early as possible, the overall project planning and design can take account of any alterations or measures that will act to resolve potential issues and minimise possible effects of the proposed development.

6.1.1.3 The need for effective public participation is identified throughout relevant legislation and planning guidance.

6.1.1.4 The Public Participation Directive (PPD) (Directive 2003/35/EC) was issued by the European Commission in order to provide members of the public with opportunities to participate on the consenting and ongoing regulation of certain categories of activities within Member States. Such opportunities are provided through access to information, justice, and through consultation on certain key documents.

6.1.1.5 The Directive makes specific changes to the way in which EIA is undertaken, and the EIA Directive14 has been amended to incorporate these requirements.

6.1.1.6 PAN81 was released by the Scottish Executive in 2007 to provide guidance to local authorities and developers when engaging communities through the planning process.

6.1.1.7 The implementation of the new Planning (etc) Scotland Act 2006 will result in large changes to the planning system in Scotland. One of the main drivers for these changes is the recognised need for greater public involvement and consultation in the planning system.

6.1.1.8 The new Act will require applicants to undertake pre-consultation with local communities before submission of a planning application.

6.1.1.9 Whilst not yet applicable, the wave farm will be developed in cognisance of the new planning Act in relation to community consultation and with due regard for PAN81: Community Engagement.

6.2. PROJECT APPROACH

6.2.1.1 The consultation strategy proposed for the project will consist of open engagement with stakeholders via:

- Communication (the dissemination of project information); and
- Consultation (opportunity for stakeholders' views to be reported, discussed and considered).

6.2.1.2 Communication will be facilitated by various approaches including this Scoping Report and may include Public Information Days and Leaflets.

6.2.1.3 The Consultation exercise provides an opportunity for organisations to raise concerns or issues with regard to the proposed development that they would like to see addressed as part of the EIA. They can also provide local and specialised information or advice to assist the compilation of the Environmental Statement. Any such advice in conjunction with the feedback on concerns will help to define the approach and scope for the assessments undertaken during the EIA.

6.2.1.4 SPR has held initial meetings with officials at Joint Nature Conservation Committee, Marine & Coastguard Agency, Chamber of Shipping, The Crown Estate, Ministry of Defence, Scottish Natural Heritage, Royal Society for the Protection of Birds and Scottish Government as part of the site selection exercise.

6.2.1.5 Non-statutory bodies and individuals will not automatically be consulted by the determining authority. However, these bodies and individuals may also possess local knowledge and information useful in compiling the Environmental Statement.

6.2.1.6 Through this scoping exercise and a consultation process undertaken by SPR and topic specialists we are inviting input from non-statutory consultees and individuals to inform the development of the wave farm. The scope of works detailed in the above Chapters is therefore not exhaustive and will be subject to further consideration by SPR, the project team and consultees.

6.2.1.7 The list of consultees to be consulted during the Scoping Exercise is presented in Appendix A.

Scoping Question: Does the list of proposal consultees reflect the range of stakeholders that should be considered as consultees for this project?

7. SCOPING QUESTIONS

7.0.1.1 A list of the scoping questions is covered throughout this document, and for ease is also provided below. When providing comment and feedback it will be very helpful if these questions are considered.

Have all regulatory requirements that the project should be taking into account been identified?

Do the requirements outlined for assessment of effects look appropriate and complete?

Are there any other key sources of environmental information that should be consulted?

Have the most likely and significant effects been identified through this analysis? Are there any others that should be considered for inclusion in the full assessment process and if so why?

Does the list of proposal consultees reflect the range of stakeholders that should be considered as consultees for this project?

8. FURTHER INFORMATION

8.0.1.1 The scope of works detailed in the above sections is not exhaustive and will be subject to further consideration by SPR, the project team and consultees.

8.0.1.2 SPR invites consultees to comment on this scoping document, provide comment on the methodologies proposed, and identify any concerns that they consider have not been addressed in this document and provide details of any relevant environmental information that would inform the assessment. This information will then be considered to influence the scope and approach to the EIA.

8.0.1.3 SPR is now seeking consultees' views on the proposed wave farm in order to incorporate these into the EIA process. All responses should be addressed to:

Douglas Watson
Marine Development Officer
ScottishPower Renewables
2nd Floor North
New Building
Cathcart Business Park
Spean Street
Glasgow
G44 4BE

Tel: +44 (0) 141 614 0491

Or e-mail response to:

Douglas.Watson2@scottishpower.com

8.0.1.4 If you wish to discuss matters in this report in more detail, please do not hesitate to contact SPR on the above number prior to responding to the scoping exercise.

APPENDICIES

APPENDIX A SCOPING CONSULTEES

Organisation *Organisations who are issued the scoping report via the Scottish Government. The scoping report is sent directly to all other organisations by ScottishPower Renewables.	
General	
Association of Salmon Fisheries Boards	Orkney Islands Council: Transport
British Telecommunications	Orkney Marinas
British Marine Aggregate Producers Association(BMAPA)	Orkney Renewables Energy Forum (OREF)
Department for Business Enterprise and Regulatory Reform (BERR)	Orkney Sailing Club
Caithness Salmon Fishery Board	Orkney Trout Fishing Association (OTFA)
Civil Aviation Authority (CAA)*	Royal National Lifeboat Institution (RNLI)
Chamber of Shipping*	Royal Society for the Protection of Birds (Scotland) (RSPB)*
Defence Estates (MOD)*	Royal Yachting Association (RYA)
Forestry Commission*	Scottish and Southern Energy
Highland Council*	Scottish Canoe Association
Highlands and Islands Enterprise (HIE)	Scottish Coastal Forum
Historic Scotland*	Scottish Creelers and Divers
JNCC	Scottish Environment Protection Agency (SEPA)*
Marine and Coastguard Agency*	Scottish Federation of Sea Anglers
Marine Conservation Society	Scottish Fishermens Federation (SFF)*
Marine Scotland (re: S36, S34, FEPA)*	Scottish Fisheries Committee
Marine Scotland: Compliance*	Scottish Natural Heritage (SNH)*
Maritime and Coastguard Agency (MCA)	Scottish Pelagic Fishermen's Association
NATS*	Scottish Surfing Federation
Northern Lighthouse Board (NLB)*	Scottish Water
Northlink Ferries	Scottish White Fish Producers Association
Orkney Cetacean Recorder	Scottish Wildlife Trust*
Orkney Creel Fishermen's Association	Scotways
Orkney Dive Boat Operators Association (ODBOA)	Sea Fish Industry Authority
Orkney Ferries	Sea Mammal Research Unit (SMRU)
Orkney Fishermen's Association	Scottish Government* (Energy Consents; Air Climate Division, Environmental Division-Freshwater Team, Environment Group, Trunk Roads Networks and Ports and Harbours)
Orkney Fishermen's Society	Transco
Orkney Fishfarm Association	The Crown Estate (TCE)*
Orkney Islands Council: Archaeology	The Health and Safety Executive*
Orkney Islands Council: Marine Services	The Royal Yachting Association*
Orkney Islands Council: Planning	
Orkney Local Councillors	
Councillor Alistair Gordon	Councillor Jimmy Moar

Organisation *Organisations who are issued the scoping report via the Scottish Government. The scoping report is sent directly to all other organisations by ScottishPower Renewables.	
General	
Councillor Rob Crichton	Councillor Eoin Scott
Councillor Ian Johnstone	
Community Councils	
Birsay Community Council	Harray and Sandwick Community Council

APPENDIX B DATA SOURCES

TABLE B1 Data Sources		
Databases/Tools/Statistics	Publications	Consultees
PHYSICAL ENVIRONMENT		
Geology, Seabed Sediments, Sediment Transport and Coastal Processes		
▪ DTI. (2004). Atlas of UK Marine Renewable Energy Resources. Produced by ABPmer, the Met Office, Garrard Hassan, Proudman Oceanographic Laboratory. ▪ UK National Tidal Gauge Network (owned and funded by the Environment Agency, kept online by the Proudman Oceanographic Laboratory) ▪ WaveClimate Accessed at: http://www.waveclimate.com ▪ Mapping European Seabed Habitats (MESH) webGIS ▪ SeaZone	▪ British Geological Society (1996). Chapter 2 Geology and physical environment. *In: Coasts and seas of the United Kingdom.* Region 3 North-east Scotland: Cape Wrath to St. Cyrus, ed. by J.H. Barne, C.F. Robinson, S.S. Kaznowska, J.P. Doody and N.C. Davidson, 19-40. Peterborough, Joint Nature Conservation Committee (Coastal Directories Series). ▪ Appropriate Admiralty charts. ▪ Orkney Admiralty Tidal Stream Atlas	▪ Marine Scotland (MS) ▪ Scottish Environment Protection Agency (SEPA) ▪ Scottish Natural Heritage (SNH) ▪ Highland Council ▪ British Geological Society (BGS) ▪ UK Hydrographic Office (UKHO) ▪ Categorisation of waters - Maritime and Coastguard Agency (MCA)
Water Quality and Effluent Discharges		
▪ Hydrogeology map for Scotland – BGS ▪ SEPA website	▪ Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA. ▪ SEPA (2006). Scotland's Water Environment Review – Coastal Water Quality 2000-2006. ▪ SEPA (2009). Scottish Bathing Waters 2009. ▪ Scotland's WFD aquatic monitoring strategy (SEPA, 2007).	▪ Scottish Environment Protection Agency (SEPA) ▪ Orkney Islands Council (OIC)
BIOLOGICAL ENVIRONMENT		
Benthic Ecology		
▪ JNCC coastal and sub littoral surveys ▪ Mapping European Seabed Habitats (MESH) database ▪ SNHi website	▪ Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody, J.P., Davidson, N.C. and Buck, A.L. eds. (1997). Coasts and seas of the United Kingdom. Region 2 Orkney. Peterborough, Joint Nature Conservation Committee. (Coastal Directories Series). ▪ Thorpe, K., Dalkin, M., Fortune, F., & Nichols, D.M., (1999), Sector 2. Orkney: area summaries, 122 pages. ISBN 1 86107 475 1 ▪ Moore, C.G. (2009). Preliminary assessment of the conservation importance of benthic epifaunal species and habitats of the Pentland Firth and	▪ Marine Scotland (MS) ▪ Scottish Natural Heritage (SNH)

TABLE B1 Data Sources		
Databases/Tools/Statistics	Publications	Consultees
	Orkney Islands in relation to the development of renewable energy schemes. Scottish Natural Heritage Commissioned Report No. 319. ▪ Moore, C.G. (2010). Preliminary assessment of the conservation importance of benthic species and habitats off the west coast of Orkney and in the Pentland Firth in relation to the development of renewable energy schemes. Scottish Natural Heritage Commissioned Report No. 352.JNCC Coastal Directory for Region 3 North-east Scotland: Cape Wrath to St. Cyrus.	
Terrestrial Ecology		
▪ SNHi	▪ Fowler, S.L., Everett, S.J. and Scott Wilson Resource Consultants (1997). Chapter 8 Land use, infrastructure and coastal defence. In: Coasts and seas of the United Kingdom. Region 2 Orkney ed. by Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody, J.P., Davidson, N.C. and Buck, A.L. 145-154. Peterborough, Joint Nature Conservation Committee. (Coastal Directories Series). ▪ Land Use Consultants (1998). Orkney landscape character assessment. Scottish Natural Heritage Review No. 100. ▪ SNHi website – accessed November 2010.	▪ Scottish Natural Heritage (SNH)
Ornithology		
▪ SNHi ▪ JNCC ▪ NBN Gateway ▪ Commissioned surveys ▪ Local Biological Records	▪ Benvenuti, S., L. Dall'antionia, P. Lyngs. (2001). Foraging behaviour and time allocation of chick-rearing razorbills (Alca torda) at Graesholmen, central Baltic Sea. Ibis 143, 402-412. ▪ Bradstreet, M.S.W., Brown, R.G.B. (1985). Feeding ecology of the Atlantic alcidae. Chapter 6 in Nettleship, D.N. and Birkhead, T.R. The Atlantic Alcidae. Academic Press, London. ▪ Daunt, F., Benvenuti, S., Harris, M.P., Dall'Antonia, L., Elston, D.A., Wanless, S. (2002). Foraging strategies of the black-legged kittiwake Rissa tridactyla at a North Sea colony: evidence for a maximum foraging range. Marine Ecology Progress Series 245, 239-247. ▪ Forrester, R.W., Andrews, I.J., McInerny, C.J., Murray, R.D., McGowan, R.Y.,	▪ Royal Society for the Protection of Birds (RSPB) ▪ Scottish Natural Heritage (SNH) ▪ Marine Scotland (MS)

TABLE B1 Data Sources		
Databases/Tools/Statistics	Publications	Consultees
	Zonfrillo, B., Betts, M.W., Jardine, D.C., Grundy, D.S. (2007). The Birds of Scotland. Scottish Ornithologists' Club, Aberlady. ▪ Furness, R.W. and Wade, H. (2012). Vulnerability of Scottish seabird populations to tidal turbines and wave energy devices. Report to Scottish Natural Heritage. ▪ Hamer, K.H., Monaghan, P., Uttley, J.D., Walton, P., Burns, M.D. (1993). The influence of food supply on the breeding ecology of Kittiwakes Rissa tridactyla in Shetland. Ibis 135, 255–263. ▪ Kotzerka, J., Garthe, S., Hatch, S.A. (2010). GPS tracking devices reveal foraging strategies of Black-legged Kittiwakes. Journal of Ornithology 151, 459-467. ▪ Langston, R.H.W. (2010). Offshore Wind Farms and Birds: Round 3 zones, extensions to Round 1 and Round 2 sites and Scottish Territorial Waters. RSPB Research Report 39. RSPB, Sandy. ▪ NBN (2010). National Biodiversity Network website accessed December 2010. ▪ Pearson, T.H. (1968). The feeding biology of sea-bird species breeding on the Farne Islands, Northumberland. Journal of Animal Ecology 37, 521-552. ▪ Perrow, M.R., Skeate, E.R., Gilroy, J.J. (2011). Visual tracking from a rigid-hulled inflatable boat to determine foraging movements of breeding terns. Journal of Field Ornithology 82, 68-79. ▪ Ratcliffe, N., Catry, P., Hamer, K.C., Klomp, N.I., Furness, R.W. (2002). The effect of age and year on the survival of breeding adult great skuas Catharacta skua in Shetland. Ibis 144, 384-392. ▪ Suryan, R.M., Irons, D.B., Benson, J. (2000). Prey switching and variable foraging strategies of black-legged kittiwakes and the effect on reproductive success. Condor 102, 374–384. ▪ SNHi (2010). Website accessed August 2010. ▪ Thaxter, C. B., Lascelles, B., Sugar, K., Cook, A. S. C. P., Roos, S., Bolton, M., Langston, R. H. W., Burton, N. H. K. (2012).	

TABLE B1 Data Sources		
Databases/Tools/Statistics	Publications	Consultees
	Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas. Biological Conservation, in press. ▪ Wanless, S., Harris, M.P., Morris, J.A. (1991). Foraging range and feeding locations of shags Phalacrocorax aristotelis during chick rearing. Ibis 133, 30-36. ▪ Wanless, S., Grémillet, D., Harris, M.P. (1998). Foraging activity and performance of shags Phalacrocorax aristotelis in relation to environmental characteristics. Journal of Avian Biology 29, 49-54.Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA.	
Marine Mammals		
▪ SNHi ▪ NBN Gateway ▪ Commissioned surveys ▪ SMRU survey records ▪ Local Biological Records	▪ ABP Marine Environmental Research 2011. Modelling and mapping the relative encounter/collision risk for mobile marine species (birds and mammals) with tidal stream energy devices in Welsh waters. Report R.1681a, to Countryside Council for Wales. ▪ Duck, C.D. (1997). Chapter 5.14 Seals. In: Coasts and seas of the United Kingdom. Region 2: Orkney, ed. by J.H. Barne, C.F. Robson, S.S. Kaznowska, J.P. Doody, N.C. Davidson and A.L.Buck, 116-119. Peterborough, Joint Nature Conservation Committee (Coastal Directories Series). ▪ Evans, P.G.H. (1997). Chapter 5.15 Whales, dolphins and porpoises. In: Coasts and seas of the United Kingdom. Region 2: Orkney, ed. by J.H. Barne, C.F. Robson, S.S. Kaznowska, J.P. Doody, N.C. Davidson and A.L.Buck, 120-123. Peterborough, Joint Nature Conservation Committee (Coastal Directories Series). ▪ Evans, P.G.H., Baines, M.E., Coppock, J. 2011. Abundance and behaviour of cetaceans and basking sharks in the Pentland Firth and Orkney Waters. Report by Hebog Environmental Ltd & Sea Watch Foundation. Scottish Natural Heritage Commissioned Report No. 419. ▪ Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA. ▪ Furness, R.W. and Wade, H. (2012).	▪ Scottish Natural Heritage (SNH) ▪ Sea Mammal Research Unit (SMRU) ▪ Marine Scotland (MS)

TABLE B1 Data Sources		
Databases/Tools/Statistics	Publications	Consultees
	Vulnerability of Scottish seabird populations to tidal turbines and wave energy devices. Report to Scottish Natural Heritage. ▪ ICES (2010). Environmental interactions of wave and tidal energy generation devices. Special request Advice June 2010, Section 1.5.5.7, ICES Advice 2010 Book 1. Pages 184-194. ICES, Copenhagen. ▪ Langton, R., Davies, I.M., Scott, B.E. 2011. Seabird conservation and tidal stream and wave power generation: information needs for predicting and managing potential impacts. Marine Policy 35, 623-630. ▪ NBN Gateway (2010). Website accessed December 2010. ▪ SNHi (2010). Website accessed August 2010. ▪ Witt, M. J., Sheehan, E. V., Bearhop, S., Broderick, A. C., Conley, D. C., Cotterell, S. P., Crow, E., Grecian, W. J., Halsband, C., Hodgson, D. J., Hosegood, P., Inger, R., Miller, P. I., Sims, D. W., Thompson, R. C., Vanstaen, K., Votier, S. C., Attrill, M. J., Godley, B. J. 2012. Assessing wave energy effects on biodiversity: the Wave Hub experience. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences 370, 502-529.	
Fish and Shellfish		
▪ SNHi ▪ NBN Gateway ▪ MarLin ▪ CEFAS	▪ Evans, P.G.H., Baines, M.E., Coppock, J. (2011). Abundance and behaviour of cetaceans and basking sharks in the Pentland Firth and Orkney Waters. Report by Hebog Environmental Ltd & Sea Watch Foundation. Scottish Natural Heritage Commissioned Report No. 419. ▪ Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA. ▪ NBN (2010). Website accessed December 2010. ▪ SNHi (2010). Website accessed December 2010.	▪ Scottish Natural Heritage (SNH) ▪ Marine Scotland (MS)
HUMAN ENVIRONMENT		
Commercial Fisheries and Aquaculture		

TABLE B1 Data Sources		
Databases/Tools/Statistics	Publications	Consultees
▪ CEFAS ▪ DEFRA	▪ DEFRA (2008). The United Kingdom fishing vessel list. ▪ Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA. Environmental Report Section C SEA Assessment: Chapter C7 Fish and Shellfish. ▪ Seafish (2008). Economic survey of the UK fishing fleet 2006. ▪ NBN (2010). Website accessed December 2010.	▪ Marine Scotland (MS) ▪ Scottish Environment Protection Agency (SEPA) ▪ Scottish Fishermen's Federation
Maritime Navigation		
▪ Maritime and Coastguard Agency (MCA) ▪ Northern Lighthouse Board (NLB)	▪ Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA. ▪ RYA (2008). UK coastal atlas of recreational boating, second edition. ▪ Admiralty Charts ▪ RADAR survey data ▪ Automatic Identification System (AIS) data	▪ Maritime and Coastguard Agency (MCA) ▪ Northern Lighthouse Board (NLB) ▪ Marine Scotland (MS)
Landscape and Seascape		
▪ SNHi	▪ Land Use Consultants (1998). Orkney landscape character assessment. Scottish Natural Heritage Review No. 100. ▪ SNHi (2010). Website accessed December 2010.	▪ Scottish Natural Heritage (SNH)
Cultural Heritage		
▪ The Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS) ▪ Hydrographer of the Navy (Admiralty Charts) ▪ Lloyds Wreck register	▪ Land Use Consultants (1998). Orkney landscape character assessment. Scottish Natural Heritage Review No. 100. ▪ Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA. ▪ Historic Environment Guidance for the Offshore Renewable Energy Sector (Wessex Archaeology Ltd for COWRIE, 2007)	▪ Historic Scotland (HS)
Noise		
▪ SNH ▪ SMRU ▪ JNCC ▪ COWRIE	▪ Scottish Executive (1999). Planning Advice Note (PAN 56). Planning and Noise. ▪ Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA. ▪ Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA; Chapter 9: Marine Mammals. ▪ Atlas of Cetacean Distribution in north-west European Waters – JNCC	▪ Scottish Natural Heritage (SNH) ▪ Marine Scotland (MS) ▪ Sea Mammal Research Unit (SMRU)
Socio-economics		
▪ VisitScotland Research ▪ Office for National Statistics – Official labour market statistics.	▪ Scottish Government (2007). Economic Strategy. ▪ Scottish Government (2005). Going for Green Growth; a Green Jobs Strategy for	▪ Scottish Government ▪ Highlands and Islands Enterprise (HIE)

TABLE B1 Data Sources		
Databases/Tools/Statistics	Publications	Consultees
▪ HIE	Scotland.	
Tourism and Recreation		
▪ VisitScotland Research ▪ Office for National Statistics – Official labour market statistics. ▪ Highlands and Islands Enterprise	▪ Scottish Government (2007). Economic Strategy. ▪ RYA (2008). UK coastal atlas of recreational boating, second edition. Tourist figures ▪ http://www.visitscotland.org/pdf/orkney_tourism_strategy.pdf VisitScotland tourism facts and figures for Orkney ▪ http://www.visitscotland.org/pdf/vs_northern.pdf Orkney Core Paths Plan ▪ http://www.orkney.gov.uk/nqcontent.cfm?a_id=12919 ▪ Humphreys, R. and Reid, D. (2002). The Rough Guide to Scotland 5th edition. Rough Guides Ltd.	▪ Scottish Government ▪ Highlands and Islands Enterprise (HIE)
Military Activity		
▪ MoD	▪ Faber Maunsell and Metoc (2007). Scottish Marine Renewables SEA. ▪ MOD Practice and Exercise area (PEXA) charts	▪ MoD
Air and Climate		
▪ Meteorological Office ▪ National Atmospheric Emissions Inventory	▪ National Atmospheric Emissions Inventory	▪ Orkney Islands Council (OIC) ▪ Scottish Environment Protection Agency (SEPA) ▪ Scottish Government ▪ Traffic Scotland
Other Human Activities		
		▪ The Crown Estate ▪ Scottish Environment Protection Agency (SEPA) ▪ Maritime and Coastguard Agency (MCA) ▪ Orkney Islands Council