ENVIRONMENTAL SCOPING REPORT

WESTWAVE

PILOT WAVE ENERGY DEVELOPMENT – ACHILL CO MAYO

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Contents

Executive Summary

List of Appendices

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EXECUTIVE SUMMARY

The WestWave project proposal is to develop a 5 MW wave energy project off the west coast of Ireland by 2015. The project is led by ESB Energy International Limited (ESBI) who will work with a number of wave energy technology partners in order to develop the project.

This project is a collaborative approach from ESBI and other potential utility partners to accelerate the development of the ocean energy sector in Ireland through the development of a pre-commercial wave farm array off the west coast in line with Irish Government Ocean Energy Strategy and the EU Ocean Energy Association's Roadmap. It is a 'public good' project which seeks to attract support from the EU under NER300 funding mechanism as well as support from relevant state agencies and departments in Ireland along with leading Irish and international wave energy technology developers. ESBI believes this approach will deliver the best outcome for Ireland and the EU leading to the development of commercial wave farm projects by 2020 and beyond.

The west coast of Ireland offers the best European resource in terms of wave energy potential. The potential exists to develop a significant ocean energy industry with sustainable long term employment and expertise. As part of the Ocean Energy Strategy ESBI is proposing to develop a pilot scale wave energy farm at a location on the west coast of Co Mayo. The exact location for the wave farm has not yet been identified but there are a number of options in the general area of Achill Island County Mayo which have been identified as offering potential to site the pilot wave farm.

The WEC technology suited for this project in this nearshore location is the Oyster device developed by Aquamarine Power Limited. This device operates in shallow water up to 20 m in depth and will be located close to the shore. The Oyster device has been on test in Billia Croo in Orkney and its characteristics are well understood. Data as to its environmental performance will be available to enable assessment of potential impacts and development of any required mitigation measures to be made.

The proposed development will comprise a total of six Oyster wave energy converters. These will be fixed to the rocky seabed, each using a piled foundation. The devices will be partially submerged with about 3m protruding above the sea level. The Oyster device does not produce any electricity itself but pressurises water in a high pressure pipeline to shore where electricity will be produced in the form of a hydroelectric power plant. Onshore infrastructure will include the power plant, substation and access road.

Installation of the devices will require piling of a foundation using a jackup barge and support vessels, tugs and diver support vessels and a multicat vessel. Installation of the 6 devices is expected to take about 4 months. Construction of the hydroelectric power plant and access road is expected to take about 6 months.

Preliminary ecological and archaeological assessments, in the general location, have been undertaken to assist in identifying the most appropriate final location for the project. There are no protected areas in the marine or terrestrial environment at any of the site options possible for the project but it is likely that near shore reef areas would be protected under the Habitats Directive. Within fifteen kilometres of the area, Special Protection Areas under the EU Birds Directive have also been designated as important for seal and bird breeding. Assessment under Article 6.3 of the Habitats Directive will be undertaken and a separate assessment report will be provided.

The development will require a foreshore lease from the Foreshore Licensing Unit of the Department of the Environment, Community and Local Government and planning permission from Mayo County Council.

If required a full Environmental Impact Statement in accordance with the requirements of the European Communities (Foreshore) Regulations 2009, (S.I. No. 404 0f 2009) will be prepared.

All aspects of the project will be considered including, construction phase, operational phase, decommissioning phase and potential cumulative impacts of other plans or projects in the area.

An Environmental Management Plan and Environmental Monitoring Plan will be developed in consultation with key stakeholders which will set out key management and monitoring to be undertaken to monitor impact on the environment during all project phases and provide a basis for corrective actions should these become necessary.

The project will serve to integrate policy and knowledge needs in the marine renewable energy area and will lead to the development of a robust approach and methodology for assessment of projects of this type.

This report provides the basis of the request for screening and scoping opinion.

1 INTRODUCTION

1.1 Background

1.1.1 WestWave project

The WestWave project is a collaborative approach from ESBI and other potential utility partners to accelerate the development of the ocean energy sector in Ireland through the development of a pre-commercial wave farm array off the west coast in line with Irish Government Ocean Energy Strategy[1] and the EU Ocean Energy Association's Roadmap[2]. It is a 'public good' project which seeks to attract support from the EU under NER300 funding mechanism as well as support from relevant state agencies and departments in Ireland along with leading Irish and international wave energy technology developers. ESBI believes this approach will deliver the best outcome for Ireland and the EU leading to the development of commercial wave farm projects by 2020 and beyond.

The WestWave project proposal is to develop a 5 MW wave energy project off the west coast of Ireland by 2015 to be financed by ESBI and other potential utility partners with significant financial support via EU NER300[3] funding and other sources of domestic grant funding in addition to support under the Republic of Ireland REFIT tariff for wave energy. The project is led by ESB who will work with a number of wave energy technology partners in order to develop the project. A Memorandum of Understanding (MOU) was signed between ESBI and four of the leading wave energy technology developers on 3rd November 2010. The technology developers who are party to the MOU are Aquamarine Power Limited, Pelamis Wave Power Limited, Ocean Energy Limited and Wavebob Limited. In order to extend the benefits of the project and to bring-in additional capabilities, it is envisaged that other utilities will become party to the project in due course.

The key phases of the project are:

2011: Concept Development Phase

2012–2013: Consenting and Detailed Design Phase

2014: Financial Close

2014-2015: Construction Phase

2016 on : Operational Phase

De-Commissioning Phase

1.1.2 Potential Project Locations

ESBI carried out a site selection study and identified eleven potential candidate areas. The criteria used to assess the sites included seabed conditions, wave power, marine traffic, local area considerations, required infrastructure, network conditions, environmental constraints, onshore works, port facilities and other marine users and activities. Following this process, three preferred sites were selected based upon this initial assessment and the site selection is now focused on collecting more detailed information about the three locations in order to make a final selection. The three preferred sites identified by the study are:

Site off Annagh Head, Mullet Peninsula, Co Mayo

This site is suitable for 'off-shore' technology, deep water converters with mooring depths of 50 to 100m. This site is located at the Atlantic Marine Energy Test Site (AMETS) which is being developed by Sustainable Energy Authority of Ireland (SEAI) and the Marine Institute (MI). This site is very familiar to the WestWave project as ESBI has been providing full engineering design,

[1] Ocean Energy in Ireland Report October 2005
[2] EU-Ocean Energy Association (OEA) Roadplan 2010-2050
[3] (http://www.ner300.com/)

environmental and engineering services to SEAI for AMETS over the last three years. The site is well characterised and a Foreshore Lease has been sought for this site which can accommodate small arrays of WECs. Information on this site can be found at www.seai.ie and www.marine.ie.

Site south off Achill Island, Co Mayo

This site is located to the south of Achill Island from Dooega Point to Croaghmore. This site is suitable for 'near-shore' wave energy converter technology. Sea bed surveying and wave measurements have been ongoing at this location since 2011.

Site close to Killard, Co Clare

This site is to the west of Doonbeg and close to Killard Point, Co Clare. This site is also suitable for 'near-shore' technology and sea bed surveying and wave measurements have been ongoing at this location since 2011.

1.1.3 Wave Energy Converter Technology

The four technology partners in the WestWave project have been assessed by ESBI to ensure that their wave energy converter technology is ready for the timeline required by the WestWave project. The technology assessment method, "Technology Readiness Levels" and certification approach are outlined further on the project website[4]. Technology partners have to:

- Demonstrate Ocean Operational Readiness by October 2010 such as 1:2 scale or larger WEC in an open ocean environment.
- Demonstrate Pre-Commercial Project Readiness such as full-scale, single device hardware tested and demonstrated before an investment decision is made to construct the project.

The deep water Wave Energy Converter devices (developed by Pelamis Wave Power Limited, Ocean Energy Limited and Wavebob Limited) are potentially suitable for the deep water (greater than 50m) site at Annagh Head, Co Mayo as designed. The nearshore (less than 25m) device (developed by Aquamarine Power Limited) is potentially suitable for the nearshore locations at Achill Island, Co Mayo or Killard Co Clare.

The wave energy converter (WEC) technology proposed for this project at a nearshore location is the Oyster device developed by Aquamarine Power Limited. This technology utilises wave energy in relatively shallow waters, up to 20m water depth. The Oyster itself does not generate electricity directly but pressurises water in a high pressure pipeline to drive an onshore hydroelectric power plant to produce electricity.

Aquamarine Power's first full-scale 315kW Oyster was officially launched at the European Marine Energy Centre (EMEC) in Orkney in November 2009. It tested successfully with over 6000 offshore operating hours in the open ocean environment. The first of three next generation Oyster 800 devices has now been deployed at Orkney as part of a three WEC array which will deliver up to 2.4 MW into the electricity grid. Aquamarine Power is currently performing early engineering for the latest generation Oyster 800 WEC device.

1.1.4 Overview

This Environmental Scoping Document considers the proposal to develop a nearshore project using Aquamarine Power's Oyster device at the site on the west coast of Achill in County Mayo, Ireland by 2015.

This report has been prepared by ESBI and represents the first stage of the Environmental Impact Assessment (EIA) process. It has been produced to facilitate the identification and assessment of the potential environmental impacts associated with the project.

More information can be found on the websites, www.esbi.ie and www.WestWave.ie.

[4] www.WestWave.ie

1.2 Project Objective

The principle purpose of this project is to demonstrate that a pilot wave energy project can be designed, consented, developed and operated in Ireland using innovative wave energy conversion technologies. Aside from the confidence in technology, construction and operation and maintenance, the project will also aim to lay foundations and stimulate the market in terms of consenting processes, grid access and local infrastructure required for Ireland to realise its ambitions in the Ocean Energy sector and lead to the development of commercial ocean energy projects in Ireland and the EU towards 2020.

1.3 Proposed Development Outline Description

The WestWave project proposed for Achill Island will consist of six Oyster wave energy converter devices, high and low pressure water pipelines, onshore hydroelectric plant (HEP), two drive trains and a connection to the existing grid. The WECs will be located in the sea at distances up to 1km from the coast at depths ranging up to 20m. Although a general location on Achill Island has been selected for the WestWave project a number of specific sites are under review where the project may be finally installed. The potential project locations are shown on Figure 1. They are located in the sea offshore and on land in the townland areas of:

- Ooghcorragaun West
- Ooghcorragaun East
- Claggan
- Doonaglass

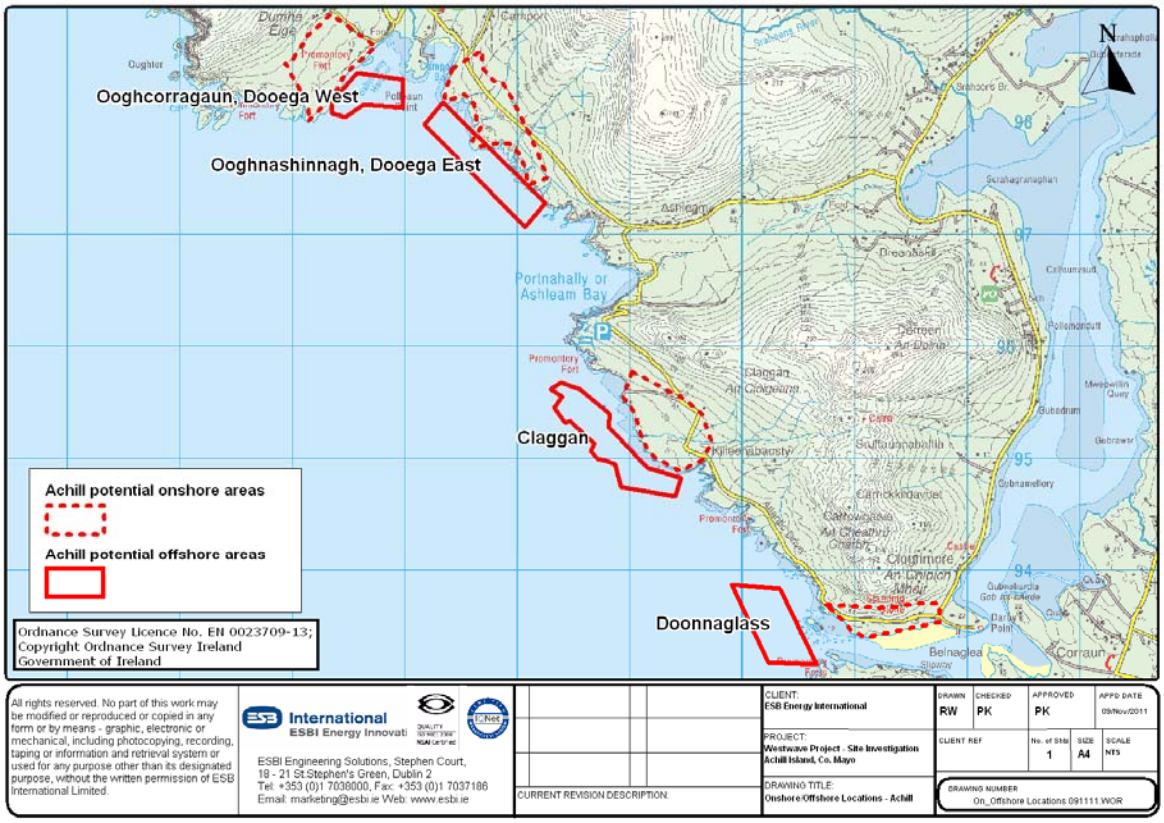


Figure 1: Potential onshore and off-shore project locations

1.4 Screening & Scoping Opinion

This joint Environmental Screening and Scoping Report relates to the following elements of the proposed development:

1. The wave energy converters near shore areas.
2. The high and low pressure water pipes and interconnecting pipes.
3. The Hydroelectric Power Plant and access road on shore associated with the near shore area.

The consents required for the onshore element of the work, which is those under the responsibility of the Distribution System Operator (ESB Networks) and separate from the substation, are being dealt with separately. These elements constitute a wooden pole, to approximately 11m in height, and overhead line conductor. They will be dealt with by the Distribution System Operator and thus are not discussed in detail within this report. In the context of this report therefore, the development is defined as the offshore WEC array area, water pipelines and hydroelectric power plant.

ESBI is seeking a formal screening opinion as to whether an Environmental Impact Assessment (EIA) will be required for the proposed development and the extent of information which should be included. This document has been produced in support of the formal request for a screening opinion from Consultees with the purpose of providing:

- a description of the proposed development;
- an initial description of the existing baseline in the project area;

- a description of any environmental constraints in the area;
- a description of the development's possible effects on the environment both positive and negative;
- a description of the approach and studies which may be required to fulfil the Environmental Impact Assessment (EIA) requirements and prepare an Environmental Impact Statement (EIS) if required; and
- other relevant information that will assist in making the scoping decision.

In addition to requesting a formal screening opinion, where it is considered by the determining authority (Department of Environment, Community and Local Government in Ireland) that an EIA is required for the proposed development, ESBI wish to seek a formal scoping opinion from the determining authority in conjunction with that decision. This document therefore also forms the basis for ESBI's request for a formal scoping opinion in the event that an EIA is considered necessary for the development. The purpose of scoping is to refine the capacity of the EIA, should it be confirmed as a requirement, and ensure that it is robust in its approach.

This report provides a description of the proposed development, outlines the potential effects that the development may have on the environment, and the methods of assessment that will be employed in assessing environmental impacts. For example field surveys for archaeology, birds, marine mammals and terrestrial ecology are planned as part of the baseline establishment. This document is for issue to the determining authorities and relevant consultees within Ireland in order to receive opinion on the project and the methods proposed.

Information used in this report is based upon an initial desk-based appraisal, using available published information, preliminary ecological, archaeological and navigation assessment of the baseline, some limited field work and initial public consultation.

1.5 EIA Legislative Requirements

The Department of the Environment, Community and Local Government

In Ireland, the foreshore is owned and administered by the State. The foreshore is defined as the seabed and resources between the Mean High Water mark and the 12 nautical mile territorial limit, the zone within which the proposed development will be constructed and operated.

The required consents for the project include a foreshore lease from the Irish government's **Department of the Environment, Community and Local Government** (DECLG) for all installations between the high water mark and the 12 nautical mile limit.

Consent and a lease will be required for the construction and operation of the proposed development under the Foreshore Acts (1933–2003), administered by the DECLG, Coastal Zone Management Division (CZMD), Foreshore Section.

If required, an EIA would be submitted under the European Communities (Foreshore) Regulations 2009 (S.I. No. 404 of 2009).

Consents are also required under the Foreshore Acts on landfall areas that are privately owned, although leases would not be necessary for any areas of privately owned foreshore.

Any dredging or dumping activities will require a separate consent regulated under the Dumping at Sea Act (1996). This act implements the requirements of the OSPAR Convention. All permit applications for the dumping of dredged spoil at sea are processes by the DECLG and CZMD.

1.6 Birds and Habitats Directive Requirement

The European Union's Habitats Directive (Council Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna), in conjunction with the Birds Directive (Council Directive 79/409/EEC on the conservation of wild birds) is the main legal tool of the European Union for nature conservation. The Habitat Directive seeks to establish "Natura 2000", a network of protected areas throughout the European Community. Member States are required to maintain or restore at 'favourable conservation status' the habitats and species of Community importance listed in Annex I and II of the Directive. The areas chosen as Special Areas of Conservation (SAC) in Ireland cover an area of approximately 13,500km2. There are 121 Special Protected Areas (SPAs) designated in Ireland.

The proposed WestWave locations are not sited within any Natura 2000 site but are located in their vicinity and as such these directives apply.

Article 6.3 of the Habitats Directive states:

'any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives'

There are no designated cSAC, pNHA or SPA in the marine environment at the location of the proposed development. However, within fifteen kilometres of the area there are a number of designated areas under the Birds and Habitats Directive (Table 1).

Table 1: Designated area within 15 km of potential WestWave locations

Site name	Site Code
Achill Head cSAC	002268
Croaghaun / Slievemore cSAC & pNHA	001955
Keel Machair / Menaun Cliffs cSAC & pNHA	001513
Bill Rocks SPA	004177
Clare Island SPA	004136
Clare Island Cliffs cSAC	002243
Corraun Plateau cSAC & pNHA	000485
Sraheens Bog NHA	002403
Bills Rocks pNHA	000469
Inishgallon pNHA	001967
Clare Island pNHA	000477

There may also be Priority 1 Habitat in the marine environment comprising of reefs in the near shore area.

Given the proximity of the WestWave site to designated areas a Natura Impact Statement (NIS) will be required to be prepared separately for the project.

1.7 Ramsar Convention on Wetlands

The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an intergovernmental treaty, which provides the framework for national action and international co-operation for the

conservation and wise use of wetlands and their resources. One of the criteria for international importance is that the site regularly (i.e. over a period of five years) holds 1% of the biogeographic population of a species or 20,000 individuals. There are no Ramsar sites in the vicinity of the proposed WestWave locations and therefore will not be an issue.

1.8 Convention on biological diversity

The Convention on Biological Diversity (CBD) was one of the three environmental recommendations to come out of the 1992 Rio de Janerio Earth Summit on Environment and Development. The CBD is pre-eminent amongst nature/biodiversity-related conventions, both in terms of its widespread support and its comprehensive scope. It represents the charter within which nature conservation and other issues relevant to the conservation and sustainable use of biodiversity must be addressed on a worldwide basis. The convention has three main objectives:

- the conservation of biological diversity;
- the sustainable use of components of biological diversity; and
- fair and equitable sharing of the benefits arising out of the utilisation of genetic resources

Due to the fact that the proposed WestWave sites are in the vicinity of Natura 2000 sites, this convention is relevant to the project.

1.9 Water Framework Directive Requirements

The European Communities (Water Policy) Regulations, 2003, (S.I. 722 of 2003) is the enabling Irish legislation of the European Communities Water Framework Directive[5].

In brief the enabling legislation provides for the protection of the status of all waters (surface and groundwater), the establishment of “river basin districts” (RBDs), co-ordination of actions by all relevant public authorities for water quality management in an RBD including cross-border RBDs, characterisation of each RBD, establishment of a Register of Protected Areas, establishment of environmental objectives and the development of programmes of measures and river basin management plans (RBMP).

A Final RBMP, covering the period 2009 to 2015, has been adopted by Mayo County Council on the 12th April 2010. The Plan is implemented jointly by the Local Authorities in the WRBD, of which Mayo County Council is one, and the lead Local Authority, with overall co-ordinating role, is Galway County Council. A full description of the river basin and its characteristics as well as the WFD objectives can be found on www.wfdireland.ie and on www.westernrbd.ie.

The Western River Basin Management Plan (2009 - 2015) establishes four core environmental objectives to be achieved generally by 2015:

- prevent deterioration of water status;
- restore good status where status is assigned as less than good by the EPA;
- reduce chemical pollution; and
- achieve water related protected areas objectives.

In addition, the Surface Waters Environmental Objectives Regulations (SI 272 of 2009) and the Groundwater Environmental Objectives Regulations (SI 9 of 2010) were made to give effect to the measures needed to achieve surface water and groundwater environmental objectives established in river basin management plans. The Regulations place a legal obligation on public authorities to aim to achieve those objectives in the context of their statutory functions.

[5] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000, establishing a framework for Community action in the field of water policy

The proposed WestWave project area comes within the Western River Basin District (WRBD) River Basin Management Plan (RBMP) management area (www.wfdireland.ie). The proposed WestWave offshore locations are within the Western Atlantic Seaboard Coastal water body (IE_WE_250_0000). As such the requirements of the river Basin Management Plan must be adhered to.

All of the potential locations for the Hydroelectric Power Plant are situated outside of any surface river water body as defined by the Environmental Protection Agency under the Water Framework Directive and are located within inter-basin water bodies as identified in the Mayo West Water Management Unit[6].

1.10 Policy requirements

1.10.1 Ocean Energy Strategy

Ireland's Ocean Energy Strategy was developed to advance Ireland's capability to deploy ocean energy technology and develop an industry sector in this field of emerging energy technology. It proposed a four phase strategy to capitalise on Ireland's marine energy resource.

Phase 1 (2005 to 2007)	This phase focuses on development by supporting product R&D and research facilities with an objective to develop and test prototype concepts and develop technical leadership in this area.
Phase 2 (2008 to 2010)	This phase supports the development of pre-commercial grid connected devices with the objective of demonstrating the potential for a cost-effective fully functional wave energy converter operating in the Irish electricity market.
Phase 3 (2011 – 2015)	This phase could provide support for a 10MW large-scale array of devices to be connected to the grid.
Phase 4 (2016 onwards)	This phase sees large-scale market deployment for ocean energy.

This phased strategy aims

- to introduce ocean energy into the renewables portfolio in Ireland; and
- to develop an Irish ocean energy industry sector.

The 2007 Government White Paper on energy policy 'Delivering a sustainable energy future for Ireland – The Energy Policy Framework 2007-2020' sets out a number of strategic goals, including a specific ocean (wave and tidal) energy target of 500 MW by 2020. This target was then restated in the 2007 Programme for Government.

WestWave is a component of Phase 3 of the Ocean Energy strategy and will contribute towards fulfilling the wave and tidal energy target of 500 MW by 2020.

1.10.2 Ocean Renewable Energy Development Plan (OREDP)

The Department of Communications, Energy & Natural Resources (DCENR), with input from the Sustainable Energy Authority of Ireland (SEAI), is in the process of developing the Offshore Renewable Energy Development Plan (OREDP), which will shape the exploitation of offshore wind and renewable energy resources in Ireland's marine territory.

[6] www/wfdireland.ie

The main aim of the OREDP is to establish scenarios for the development of offshore renewable resources in Irish waters up to 2030, and to provide a description of developing policy, which will affect the context within which they may develop.

The OREDP area covers all Irish waters from the Mean High Water Mark out to the 200m water depth contour off the west and south west coast of Ireland and the Exclusive Economic Zone (EEZ) off the north, east and south east coasts of Ireland.

A Draft Strategic Environmental Assessment (SEA) in compliance with the Planning and Development (Strategic Environmental Assessment) Regulations 2004, has been prepared under the provisions of S.I. No. 94/1997 – European Communities (Natural Habitats) Regulations, 1997 (as amended) and a draft Natura Impact Statement as the plan may affect sites designated as being of European importance (collectively, Natura 2000).

Copies of the draft OREDP, the SEA and the Natura Impact Statement for the Plan are available for download at http://www.seai.ie/Renewables/Ocean_Energy/.

1.10.3 Mayo County Development Plan 2008–2014

The current applicable Mayo County Development Plan is the 2008-2014 edition which encourages the production of energy from renewable sources under reference TI-RE 2, with a specific reference to wave and tidal among other sources (Mayo, 2008 – 2014). It recognises that natural resources are a vital element of the county's resource base and that they have not been developed to their full potential. The development of renewable resources is specifically addressed as part of its overall strategy for transport and infrastructure developments, where it aims to optimise the development of appropriate renewable energy sources that make use of the natural resources of the area concerned in an environmentally acceptable and sustainable manner.

The quality of the landscape is recognised as a key economic resource and the county has been divided into 'Landscape Protection Policy Areas'. It is also recognised that the development of the county's natural resources is necessary for economic survival and prosperity.

Landscape appraisal

In the "Landscape Appraisal of County Mayo" Achill island forms part of Area A (Area A: Achill, Clare, Inishturk and related Coastal Complex). This area is described as

"being distinct from the remainder of Mayo's coast to the north due to the steep topography and relatively uniform upland moor appearance. The overriding characteristic of this area remains the almost constantly visible coastline with Slievemore on Achill Island, at 671m in height, as a dominating feature. Dramatic vistas of steep mountain sides and sea cliffs falling to the sea are common"

Critical landscape factors are the elevated coastal vistas, steep slopes, prominent ridge lines, smooth terrain and low vegetation. The main concerns identified for natural linear features such as coastlines and ridge lines being to avoid penetration by development that will interrupt and reduce the integrity of such elements.

The coastline from Killala Bay to Killary Harbour are designated as vulnerable. The WestWave project will be located within this vulnerable area. To be considered for permission, development in the environs of these vulnerable areas must be shown not to impinge in any significant way upon its character, integrity or uniformity when viewed from the surroundings. Particular attention should be given to the preservation of the character and distinctiveness of these areas as viewed from scenic routes and the environs of archaeological and historic sites.

In addition the Local road (i.e. "The Atlantic Drive") at Dooega Head (southern part of Achill Island), from the R319 through Dooega, Cloghmore and Derreen is designated as a scenic route (Section 3.6 a Areas designated as scenic route). The WestWave Project will be located along this route. Scenic routes indicate public roads from which views and prospects of areas of natural beauty and interest can be enjoyed. The onus will be on the applicant when applying for permission to develop in the environs of a scenic route, to demonstrate that there will be no obstruction or degradation of

the views towards visually vulnerable features nor significant alterations to the appearance or character of sensitive areas.

The County Development Plan also outlines its development objectives in relation to natural heritage and under EH-NH 1 and states that 'It is an objective of the Council to protect, enhance and conserve areas designated as candidate Special Areas of Conservation, Special Protection Areas and proposed National Heritage Areas…'

1.10.4 Mayo County Council Renewable Energy Strategy 2011– 2020

Mayo County Council adopted its Renewable Energy Strategy on 9 May 2011. The Strategy sets out a path to allow County Mayo to contribute to meeting the national legally-binding renewable energy targets and clarifies the approach Mayo County Council takes to renewable energy. All major forms of renewable energy are considered in the Strategy, including ocean energy.

Mayo has potential to harness 18,500–19,500MW of renewable energy from fixed wind, floating wind and wave resources. However it is considered that less than half of this (4,900–7,900MW) can be exploited in an environmentally sensitive manner.

The area identified by Mayo County Council for wave energy potential in the strategy is reproduced in Figure 2. The WestWave potential sites are located within this area. The Strategy identifies the potential for Mayo to become a centre for research and development in ocean energy.

With respect to individual projects the Strategy states that permitting any onshore infrastructure associated with offshore wave energy developments will be determined in accordance with the principles of proper planning and sustainable development with a view to ensuring minimal adverse environmental impact. Developments must take account of the presence of and requirement to protect all Natura 2000 sites and also Local Biodiversity Areas. All proposed renewable energy development in marine waters or associated landward elements will be subject to an ecological impact assessment.

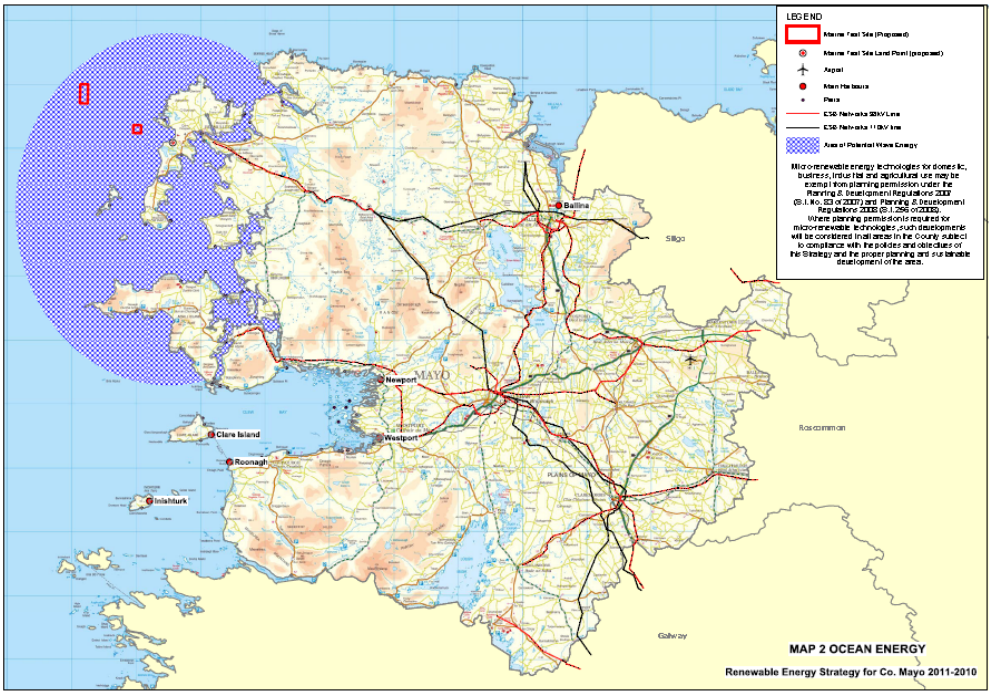


Figure 2: Mayo County Council Renewable Energy Strategy – Potential Wave Energy Map

1.10.5 County Mayo Draft Biodiversity Action Plan (2010 – 2015)

The County Mayo Draft Biodiversity Action Plan covers the period 2010 to 2015[7]. Its stated vision is:

"That Mayo becomes a place even richer in wildlife and wild places that is cherished and respected by all, and for the benefit of all."

The plan provides a framework for the conservation of biodiversity and natural heritage at a local level and is designed to ensure that national and international targets for the conservation of biodiversity can be achieved while at the same time addressing local priorities. The plan was produced as an action in the first National Biodiversity Plan published in 2002, which recognised the key role of local authorities in protecting our natural heritage. It was prepared following the guidelines produced by the Heritage Council and with regard to the National Biodiversity Plan, the County Mayo Heritage Plan 2006- 2011 and the County Mayo Development Plan 2008-2014.

The Plan identifies the main threats to nature and biodiversity in the county as being habitat destruction and fragmentation, development pressure, drainage, pollution, invasive species and climate change.

The Plan has three stated objectives as follows:

Objective 1: Increase awareness, understanding and appreciation of Mayo's biodiversity and natural heritage.

Objective 2: Collect and make accessible biodiversity/ natural heritage information

Objective 3: Promote best practice in natural heritage management and conservation

1.10.6 County Mayo Heritage Plan

The County Mayo Heritage Plan was prepared by the County Mayo Heritage Forum and covers the period 2006 – 2011[8]. The aim of the plan is to identify, raise awareness of and promote the conservation of the built, natural and cultural heritage of the county. The Heritage Plan is not a statutory plan or policy document but compliments the County Development Plan. Its three core objectives are:

Objective 1 - Promotion of Awareness and Appreciation of our Heritage

Objective 2 - Collection and Dissemination of Heritage Information

Objective 3 - Promotion of Best Practice in Heritage Management and Conservation

1.11 Other Likely Requirements

There are several other consents and licences that will be required in order to construct and operate the proposed development in Irish coastal waters. The requirements for such consents will be determined in consultation with the relevant authorities. For example planning permission for the hydroelectric plant will be required from Mayo County Council.

1.12 Document Structure

In order to accord with scoping best practice, when making a scoping request the developer is required to include:

- a plan sufficient to identify the land or site(Figure 1);
- a brief description of the nature and purpose of the development (Section 2);

[7] Draft County Mayo Biodiversity Action Plan, 2010 – 2015, Mayo County Council, 2010
[8] County Mayo Heritage Plan 2006 - 2011

- a description of the baseline (Section 3)
- a description of the development's possible effects on the environment (Section 5); and
- such other information or representations as the person making the request may wish to provide or make (Sections 4 and 7).

These requirements are addressed in this scoping report as indicated above. Section 7 describes the procedure for making comments in relation to this scoping exercise.

This report provides the basis of the request for screening and scoping opinions in Ireland.

2 PROJECT DESCRIPTION

2.1 Project location

The proposed locations under consideration for the WestWave project are located on the west coast of Achill Island in County Mayo. A final location has not yet been decided and a number of additional factors such as land availability, accessibility and resource modelling have yet to be completed before a location can be finalised.

2.2 Project description

The proposed development will comprise a total of 6 near shore Oyster wave energy converters (WECs). The Oyster device is being developer by WestWave technology partner Aquamarine Power. The devices will be fixed to the rocky seabed, each using a piled foundation. The devices will be partially submerged in operation, with about 3.5m protruding above the sea surface (relative to Mean Sea Level (MSL). There will be a minimum separation between devices of at least 25m. The exact array layout will be informed by a range of factors including technology development, hydraulic modelling, analysis of site survey, and other environmental data and will be designed to maximise the capture of wave energy resource at the particular location finally selected with the minimum footprint possible.

The wave farm will not generate any electricity in-situ. The flap of each device will pump water, via a high pressure undersea pipeline, to the onshore hydroelectric power plant. The water will be returned to the flap via a low pressure return pipeline. The pipe lines to and from the onshore installation will be directionally drilled through the bedrock. The pressurised freshwater will drive an on shore hydroelectric power plant containing a hydroelectric turbine, generator equipment, a header tank and a storage/site office area. The turbine is based on existing hydro-electric (pelton wheel) technology transforming water pumped by the device to shore. The WECs will be interlinked by a pipework connected through bridge structures on the seabed. The hydroelectric powerplant will be linked via a small substation to the existing grid on Achill island.

The project will comprise a number of components as follows:

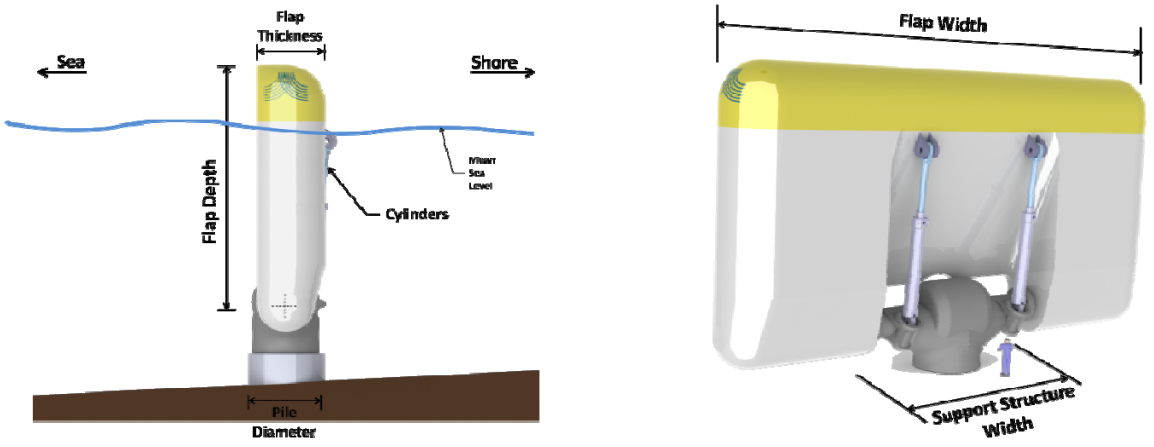
- Nearshore wave energy converter Array, consisting of 6 Oyster wave energy converters in water depths up to 20m.
- Interlinking high and low pressure pipe work on pipe bridges on the seabed between the devices.
- High pressure water pipelines from the WEC array to the onshore hydroelectric power plant.
- Low pressure water pipelines from the WEC array to the onshore hydroelectric power plant.
- Onshore hydroelectric power plant with Pelton wheel turbines incorporating a small substation.
- Access road to the hydroelectric power plant location.
- Dedicated feeder overhead power line (wooden pole) from a dedicated substation to grid substation (Construction responsibility of the distribution system operator (DSO) ESB Networks).

Each Oyster device flap will be 26m in width and approximately 12m from the top of the flap to bottom of baseframe. The expected footprint of the Oyster array will be over an area of seabed of up to 1 hectare but will be dependent on bathymetry and local variations which may influence sighting . The expected footprint of the hydroelectric powerplant and substation will be about 1 acre

and an additional area will be required for the access road which will be dependent on final site location.

2.3 Project technology

The wave energy technology suited to the proposed WestWave site at Achill is the Oyster, as developed by Aquamarine Power. Oyster consists of a simple oscillating flap, which is fitted with double acting hydraulic pistons (Figure 3). The device is mounted on the seabed in depths of 10 to 20m, such that it completely penetrates the water column. There will be a gap between the base of the flap and the seabed. Gabions or acropodes are likely to be used beneath the flap. Each passing wave activates the device; which delivers high pressure water (freshwater) via a sub-sea pipeline to the shore. Onshore, high pressure water is converted to electrical power using Pelton wheel turbines and hydro-electric generators. The flow from the turbine discharges to a header tank and returns to the device via a low pressure return pipeline.



Side View Back View

Figure 3: Labelled illustration of the Oyster WEC - Reference design of the Oyster device (Source: Aquamarine Power Limited)

Features of the Oyster device are:

- It is designed to produce clean, renewable electricity from energy captured from near shore waves.
- The hydraulic system used, is based on fresh water, recycled through a closed system.
- All electro-mechanical power generation equipment is located onshore, reducing the cost of maintenance and increasing availability. There are no marine EMF issues associated with the device.
- The high pressure water from multiple devices is connected by a manifold to a single pipeline to shore and hydro electric power conversion plant.
- The device is located in the near shore region where wave energy is more predictably directional. The water depth and wave breaking environment reduce the occurrence of extreme wave heights when compared to offshore, but without any significant reduction in the overall wave energy available (Figure 4).

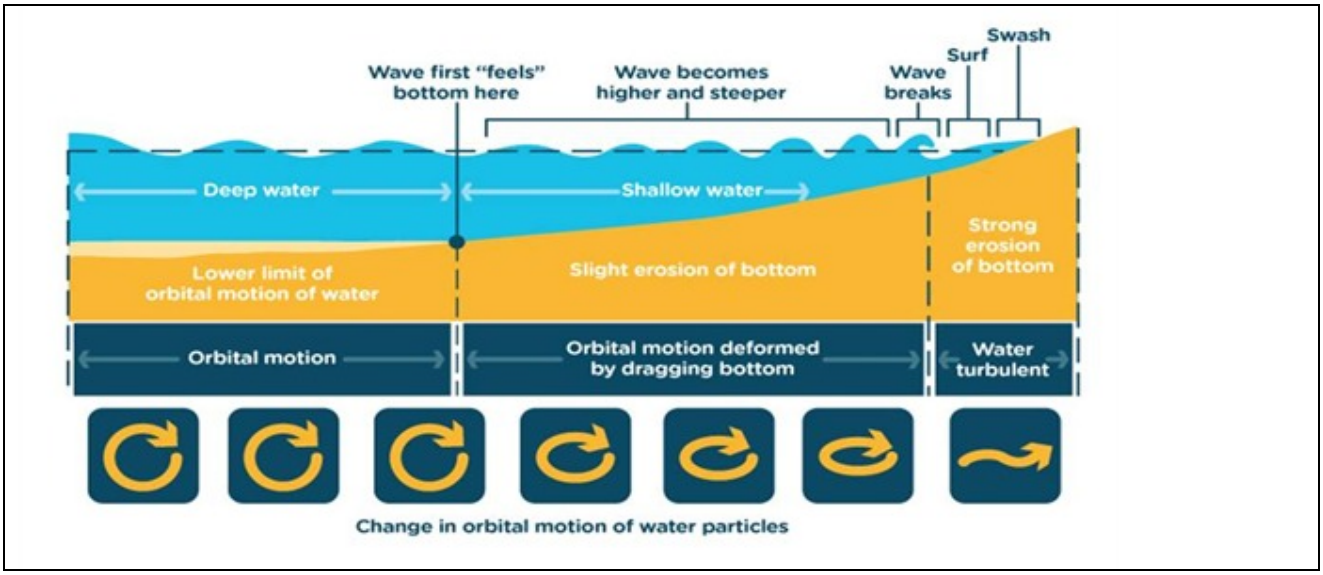


Figure 4: Change Orbital motion of water particles

2.4 Installation Methods

2.4.1 Device and Foundation Installation

Prior to installing the Oyster devices it will be necessary to prepare the seabed, this may include kelp removal, filling in gullies under the flaps, and possibly a small amount of rock removal. The most likely foundation installation method will be non-tensioned (drilled and grouted) piling using a jack-up barge.

Each device will be towed out to site from a local port. The nearest large port is Shannon-Foynes in the Shannon Estuary but other potential ports include Galway, Cork and Killybegs.

The total offshore installation duration for the installation of 6 flaps is estimated as 4 months, depending on weather. The number and types of vessels involved in the installation process will be determined following a review of similar installation activities during Oyster trials at EMEC in Orkney, as well as discussion with marine contractors and the detailed design of array components. Vessels considered likely to be involved in installation method include a Jack-up barge, 2 tugs, a dive boat and a workboat (likely to be a multicat).

2.4.2 Pipelines

The pipelines will form a closed loop water system, linking the devices to the onshore powerhouse. It is likely that the pipelines will be directionally drilled into the bedrock from shore to the offshore Oyster devices, although alternative options will be explored, including trenching or laying of the pipeline on the seabed. The pipelines will consist of high pressure pipeline (with an operating pressure of up to 120 Bar) and low pressure pipeline (with an operating pressure of up to 16 Bar)

Pipeline drilling and onshore installation works is intended during the winter months to allow offshore works to commence as soon as the weather is good enough to start. Welding and pressure testing of the pipeline will require a temporary laydown area (which will be reinstated after completion of construction works) for the length of the pipeline. Testing will involve filling the pipeline with freshwater and then pressurising.

The pipelines will be installed to within 25m of one of the Oyster foundations located in the proposed array. Once the WECs are installed pipeline spools (either rigid or flexible) will join the emerging ends of the pipelines to the devices, with the protected pipeline spools attached through protective bridge structures on the seabed.

Vessels required for pipeline installation may include a multi-cat vessel, with divers for offshore plumbing and hook-up.

2.4.3 Onshore Components

The onshore site will consist of:

- a permanent building(s) (the powerhouse), built to house the drivetrain equipment (mechanical, hydraulic and electrical equipment), and a site office/mess;
- space will be available outside the powerhouse to accommodate transformers, which will be held in casings to prevent oil spills and protect them from the atmosphere;
- substation and connection to the grid; and
- access road.

Powerhouse layout and design is yet to be finalised, however, as an indication of scale, ESBI has calculated that the approximate footprint of the site needed to accommodate the powerhouse, a vehicle turning area, parking and substation may be in the order of 1acre, for the proposed 5.4 MW development.

The exact location of onshore works will be determined during the EIA process.

2.4.4 Grid Connection

ESB Networks will be responsible for providing grid connection to the powerplant site as the distribution system operator. This will be a 20kV feeder on wooden poles similar to existing lines in the area. This element of electrical infrastructure falls outside the control of the project but is mentioned here for completeness.

2.5 Operation and Maintenance

Oyster technology is designed so that the majority of operation and maintenance can be undertaken from shore. Although the Oyster device is being designed to be compatible with diverless maintenance in the future, it is likely that divers will be required for the current technology.

2.5.1 Oyster Design Progression

Aquamarine Power Limited has followed a progressive design philosophy in the development of the Oyster technology based on the principle of ease of operation and maintenance. Where possible, the majority of components are located onshore; with the Oyster device having as few moving parts as possible. Notable milestones in the development of the technology are:

- Oyster 1 installed in the European Marine Energy Centre (EMEC) in Orkney, Scotland in 2009.
- Oyster 800 installed in EMEC in 2011.

There are detailed plans for further tests of the Oyster ahead of the WestWave project. ESBI is ensuring that the design of the Oyster device selected for the WestWave project has been proven ahead of the proposed installation on the WestWave project. Given the novel technology which is evolving a number of aspects of the design will change; with the primary focus of the design changes being:

- Ease of Installation – Whilst Oyster 1 had four piles used for installation; Oyster 800 has only two and future Oysters will be a monopile. The piling design evolution reduces the installation risks, reduces costs and reduces the footprint on the seabed floor.

- Ease of Maintenance – The Oyster design will become modular to ensure that the device is easier to maintain. The design will ultimately lead to replaceable modules for key components such as the hydraulic pumps.
- More Economic – Both the Oyster 1 and 800 were made from steel; however this adds both cost and weight to the device. Future Oysters may be made from composite materials, making the economics of an Oyster array more favourable.
- More Efficient –The shape of the flap will change, taking advantage of the change in the materials used to improve the efficiency of extracting energy from the waves.

The annual scheduled maintenance for each individual offshore device is anticipated to be about 2 weeks per year. This will be supplemented with a major overhaul every 5-6 years, including replacement of the two hydraulic modules.

2.6 Decommissioning

The wave energy array is expected to be in place for up to twenty years. At the end of this period the array will be decommissioned and the devices removed to a standard meeting industry best practice at that time.

2.7 Site selection process

The site selection process involved the assessment and consideration of the following data inputs:

- A Geographical Information System (GIS) database which highlighted the principal coastal environmentally designated zones;
- Admiralty Charts and the OSI 1:50,000 maps which showed seabed bathymetry and cliffs;
- Publically available imagery, including Google Earth, Google Streetview and the Oblique Imagery Survey Viewer on the OPW website;
- Geological information from the Marine Institute and Geological Survey of Ireland (GSI);
- Wave resource information based on details from the Wave Atlas and in-house modelling by Aquamarine Power Limited;
- Absence of designated areas (cSACs, SPA, NHA or proposed NHA);
- Feasibility of Grid Connection;
- Physical Environment;
- Site Visits in 2010 and 2011.
- Discussions with Mayo County Council.

Based on the above criteria the general location off the west coast of Achill Island from the bay at Dooega to Croaghmore was identified as being potentially suitable as a location for the WestWave project nearshore technology.

2.8 Wave resource characterisation

In November 2011 a Waverider wave monitoring buoy was deployed at the 41m water depth contour adjacent to the likely locations of the WestWave site. In addition an Acoustic Doppler Current Profiler (ADCP) was deployed simultaneously to collect wave and current data at the shallower 21m water depth location. The Waverider buoy will be deployed for a period of one year initially. The ADCP was deployed for a period of two months to collect near shore wave data.

Wave height, wave period data and current data collected will contribute to finalising the exact location for the deployment of the WECs. The data will also be used as input to a coastal process modelling required to determine the significance of any impacts on coastal processes in the area.

3 Existing Baseline

3.1 Introduction

A preliminary baseline has been developed using available information from preliminary surveys of the area, development plans, OS plans and charts, authority databases and previously referenced reports. An initial desktop assessment, limited field surveys and literature review of available background information was prepared for ESBI in October 2011. Preliminary ecological assessment reports and archaeological assessment reports were prepared in 2011[9] and 2012[10] also (see Appendix 1 and Appendix 2). Data received from the Irish Coastguard and the Marine Institute was assessed to identify any navigation issues that could arise from the proposed locations.

These provide a basis for an initial characterisation of the environment of the proposed development and for identifying potential impacts.

3.2 Seabed bathymetry

Between 12th July and 28th July 2011, INFOMAR, Ireland's seabed mapping programme conducted a set of near-shore seabed surveys on behalf of the Sustainable Energy Authority of Ireland in Killard, Co. Clare and Achill, Co. Mayo. The purpose of these surveys was to investigate the seabed properties of each area and to ascertain their suitability for the deployment of wave energy instrumentation at some point in the future. This process involved the acquisition and analysis of high resolution bathymetry, backscatter and shallow seismic data in order to build up an overview of the surface and shallow geology for each of the test sites.

Survey work was carried out on the Southwest coast of Achill Island, Co. Mayo between Dooega Headland in the north and Achillbeg Island to the south. The Survey area extends approximately 5km SW offshore from Achill and covers depths ranging from 0-55 metres LAT (lowest Astronomical Tide). The area surveyed is shown on Figure 5.

Based on the initial bathymetry and subsequent GIS analysis carried out by the Geological Survey of Ireland, examining distance from shore, water depth, slope constraints and potential landfall areas. four general sites of interest (labelled A, B, C and D) off Achill were identified as potential locations for the WestWave project (Figure 6).

[9] Preliminary Ecological Site Assessment, for the Proposed WestWave wave energy converter locations, Achill Island co. Mayo, Aquafact international Ltd. on behalf of ESBI, 2011

[10] Preliminary Cultural, Heritage Site Assessment for the proposed WestWave wave energy converter locations, Achill Island, Co. Mayo, prepared by Moore Marine Service Ltd. on behalf of ESBI, January 2012

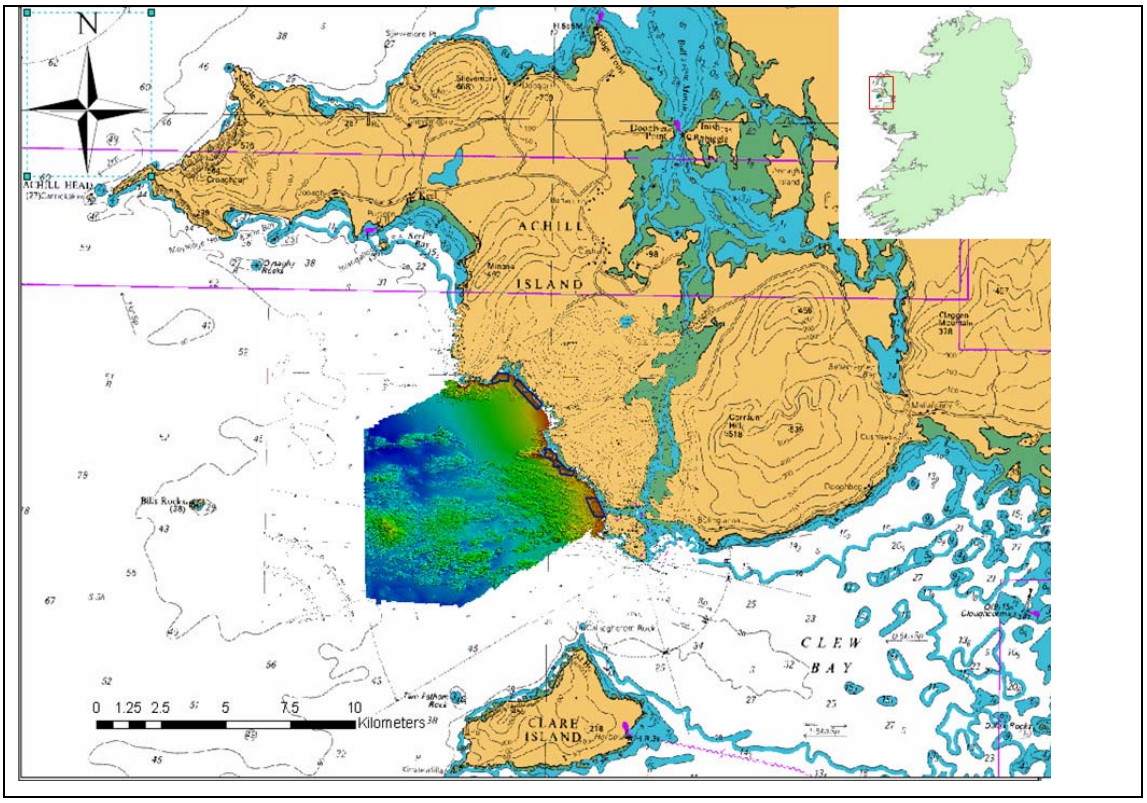


Figure 5: Area surveyed off Achill Island

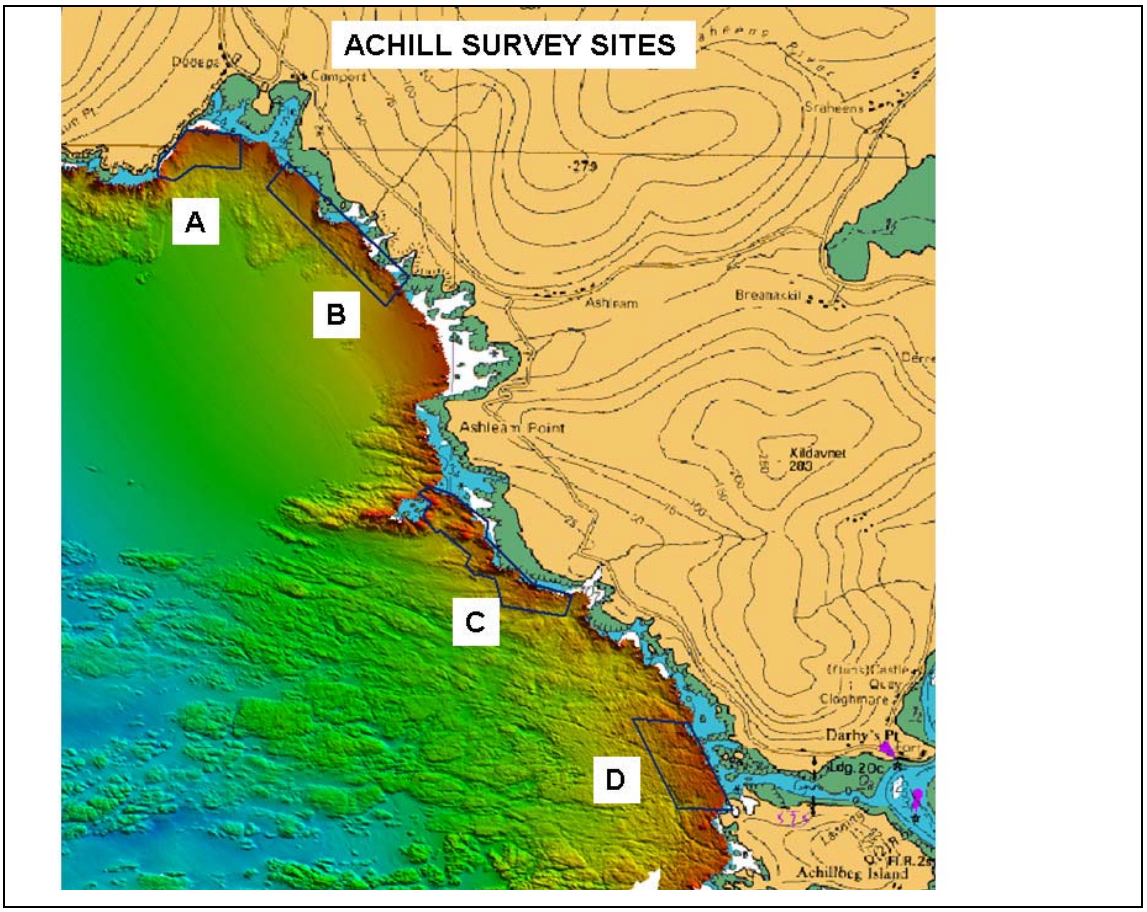


Figure 6: Potential WestWave sites surveyed

Examination of bathymetry, backscatter and shallow seismic data acquired allowed a baseline geological study of the seafloor properties of potential WestWave offshore sites “A, B C and “D” to be made as follows:

Site A - Ooghcorragaun West

The seafloor in Site “A” is composed of exposed metamorphic bedrock, overlain by a deposit of sediment interpreted to be quartz-rich sand. Shallow seismic profiles indicate this sedimentary top cover to be approximately 1 metre in thickness.

Site B - Ooghcorragaun East

The seafloor in Site “B” is also composed of exposed bedrock overlain by two areas of sedimentary top-cover, one of which is isolated in the northern section of Site “B”, while the other extends offshore further to the south of the site. This sedimentary top-cover is interpreted as sand. Examination of shallow seismic data on the periphery of Site “B” indicates a sediment thickness ranging between 0.7 and 1.5 metres over both areas, with the accumulation increasing gradually in thickness further offshore

Sites C - Claggan and Site D - Doonaglass

The seafloor in Sites “C” and “D” is interpreted as exposed bedrock with no significant sedimentary top-cover in either site, although a veneer of sediment of a few centimetres thickness would be expected to infill various crevices and fractures within the bedrock and in localised areas. Analysis of shallow seismic data supports this conclusion.

3.3 Onshore bedrock geology

A basic desk study of southern Achill’s onshore bedrock geology has been`undertaken based on the Geological Survey of Ireland’s 1:100,000 Bedrock Geology Series (The Geology of Connemara and South Mayo, Sheet 10) (Figure 7).

The rocks of southern Achill are interpreted as belonging to the Dalradian group of metamorphic rock units formed when sedimentary rocks formed on a passive margin (much like the European Atlantic coast today) were subjected to numerous phases of deformation and metamorphism relating to the closure of a major ocean. While there is speculation that some units in the area may belong to an older grouping (and are accordingly labelled dubiously Dalradian) for the purposes of this study the bedrock units can be considered to be typical of the Dalradian.

Bedrock across the area is composed of rock of high metamorphic grade. These rocks have undergone poly-phase deformation and folding on a regional scale with the formations in the study area being comprised of Schists, Pelites, Psammitic and Semi-pelitic Schists, Quartzite and Metavolcanics. The bedding planes are generally inclined with their level of dip increasing significantly across Sites “B” and “C” (to sub-vertical in places) in an area known as “The South Achill Steep Belt” The area has experienced major thrusting near the Achillbeg Fault to the south, with onshore exposures demonstrating signs of strain and sheer. These exposures are extensively faulted and fractured in places. Rock formations in this area would be generally resistant to erosion and with wave action exploiting points of weakness and faulting, especially in the schistose rocks, resulting in a jagged appearance in certain areas.

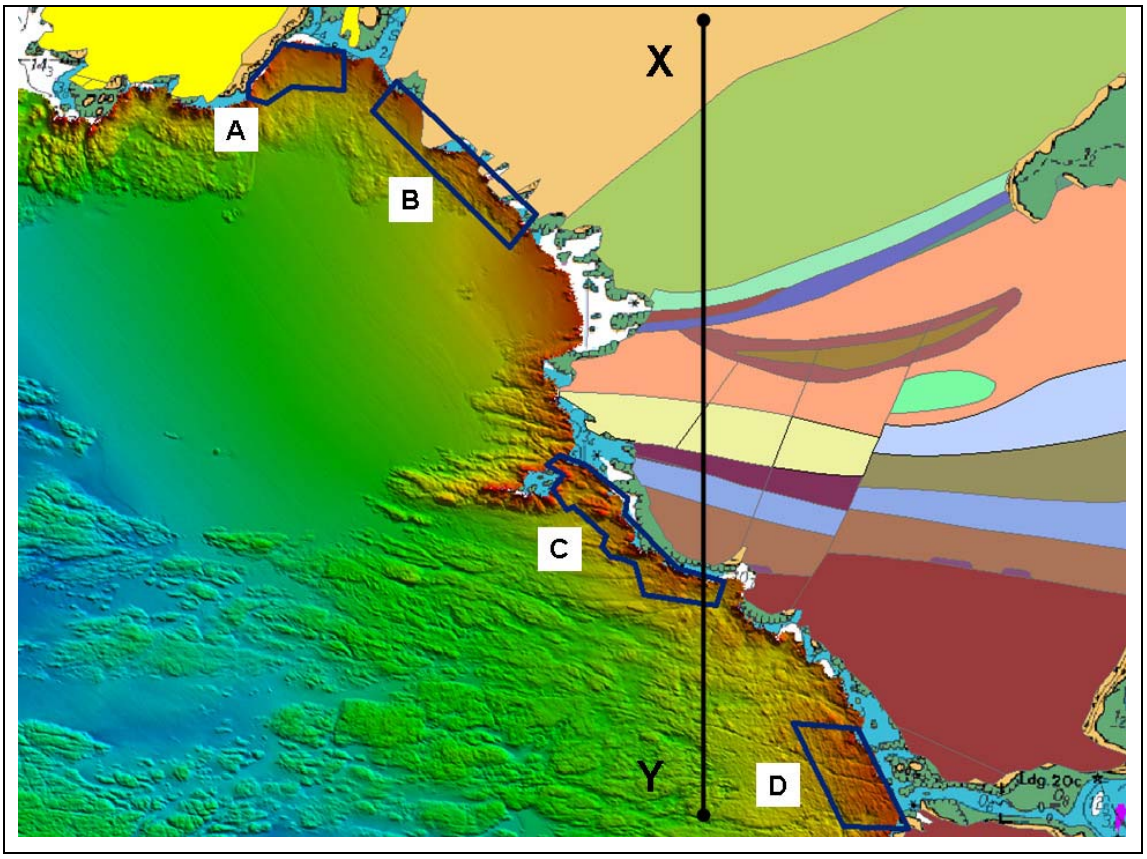


Figure 7: Onshore Bedrock Geology (1:100,000 series) with X/Y line of cross section

3.4 Oceanography

As the tidal signal along the West coast floods from south to north and vice versa on an ebbing tide, tide–induced currents will run northwards along the Achill coast on flooding tides and to the southwards on the ebb. There will be some variability in this pattern off Dooega due to the headland at this site. Wave surge and reflection will give rise to high levels of turbulence along this shore line. In terms of the characteristics of seawater in the area, full salinities i.e.35 psu will occur and temperature will vary between ca 6 – 15 ˚ C annually.

3.5 Preliminary Ecological assessment

A preliminary ecological assessment of the proposed WestWave project area was undertaken by Aquafact International Ltd who are appointed as the project ecologist. A summary of the initial baseline ecology is presented in this section.

3.5.1 Conservation Designations

It can be seen from Figure 8 below that the potential marine sites at Achill, Co. Mayo are not located within areas designated for conservation importance. Three of the potential terrestrial sites are also not located within designated sites, however one of the potential terrestrial locations (the most northerly one) does encroach on the Keel Machair / Menaun Cliffs cSAC and pNHA. Table 2 below summaries the species/habitats of conservation importance in these conservation sites (details on the pNHA sites are not available on www.npws.ie).

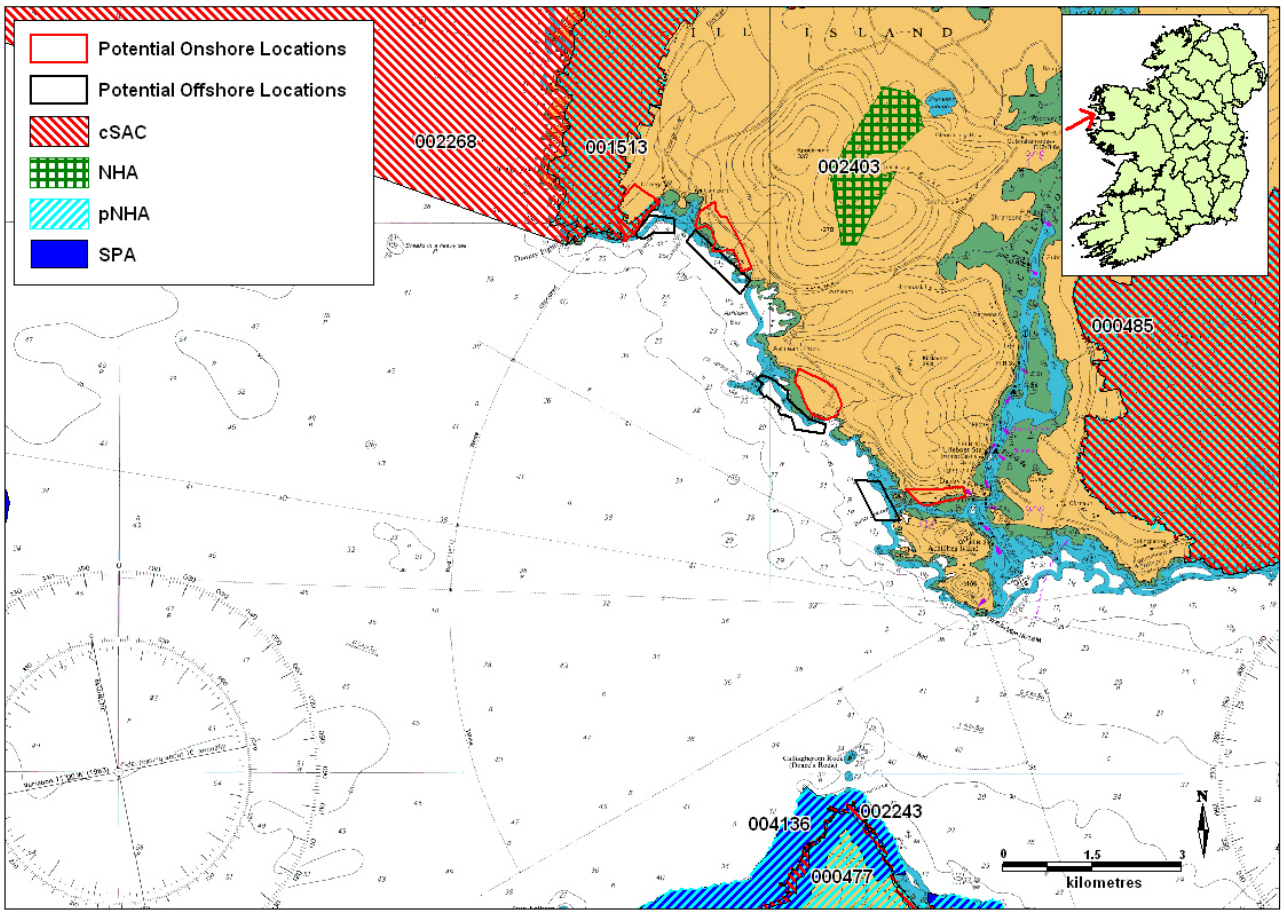


Figure 8: Potential onshore and offshore sites at Achill, Co. Mayo and all conservation sites in the vicinity.

Table 1: Species and habitats of conservation importance in the cSACs, SPA and pNHAs in the vicinity of the Achill site.

Site Name	Site Code	Annex I Habitats	Annex I Birds	Annex II Species	Non Annex I Migratory Birds
Achill Head cSAC	IE002268	- -Mudflats and sandflats not covered by seawater at low tide - Large shallow inlets and bays - Reefs	-	-	-
Croaghaun / Slievemore cSAC & pNHA	IE001955	- Vegetated sea cliffs of the Atlantic and Baltic coasts - Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) - Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto - Nanojuncetea* - Northern Atlantic wet heaths with *Erica tetralix* - European dry heaths - Alpine and Boreal heaths - Blanket bog (*active only)	- *Pyrrhocorax pyrrhocorax* (Red-billed Chough)	-	-
Keel Machair / Menaun Cliffs cSAC & pNHA	IE001513	- Perennial vegetation of stony banks - Machairs - Alpine and Boreal heaths	- *Cygnus cygnus* (Whooper swan) - *Falco peregrinus* (Peregrine falcon) - *Pyrrhocorax pyrrhocorax* (Red-	- *Petalophyllum ralfsii* (Petalwort)	- *Fulmarus glacialis* (Northern fulmar) - *Charadrius hiaticula* (Ringed Plover) - *Vanellus vanellus* (Northern lapwing) - *Actitis hypoleucos* (Common sandpiper)

Site Name	Site Code	Annex I Habitats	Annex I Birds	Annex II Species	Non Annex I Migratory Birds
			billed Chough)		
Bill Rocks SPA	IE004177	-	- *Hydrobates pelagicus* (Storm petrel)	-	- *Fratercula arctica* (Puffin) - *Rissa tridactyla* (Kittiwake) - *Phalacrocorax aristotelis* (Common shag) - *Fulmarus glacialis* (Northern fulmar)
Clare Island SPA	IE004136	-	- *Pyrrhocorax pyrrhocorax* (Red-billed Chough) - *Falco peregrinus* (Peregrine falcon)		- *Larus fuscus* (Lesser black-backed gull) - *Morus bassanus* (Northern gannet) - *Phalacrocorax carbo* (Cormorant) - *Larus canus* (Common gull) - *Rissa tridactyla* (Kittiwake) - *Uria aalge* (Common guillemot) - *Alca torda* (Razorbill) - *Fratercula arctica* (Puffin) - *Phalacrocorax aristotelis* (Common shag) - *Larus argentatus* (Herring gull)
Clare Island Cliffs cSAC		- Vegetated sea cliffs of the Atlantic and Baltic coasts - Calcareous rocky slopes with *chasmophytic* vegetation - Siliceous rocky slopes with *chasmophytic* vegetation	- *Falco peregrinus* (Peregrine falcon)		- *Fulmarus glacialis* (Northern fulmar) - *Morus bassanus* (Northern gannet) - *Rissa tridactyla* (Kittiwake) - *Uria aalge* (Common guillemot) - *Alca torda* (Razorbill)

Site Name	Site Code	Annex I Habitats	Annex I Birds	Annex II Species	Non Annex I Migratory Birds
					- *Fratercula arctica* (Puffin)
Corraun Plateau cSAC & pNHA	IE000485	- Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) - Northern Atlantic wet heaths with *Erica tetralix* - European dry heaths - Alpine and Boreal heaths - *Juniperus communis* formations on heaths or calcareous grasslands - Blanket bog (*active only)	-	-	-
Sraheens Bog NHA	IE002403	-	-	-	-
Bills Rocks pNHA	IE000469		-	-	-
Inishgallon pNHA	IE001967	-	-	-	-
Clare Island pNHA	IE000477	-	-	-	-

3.5.2 Intertidal and Marine Habitats

Intertidal habitats present include sea cliffs, sea caves, bedrock and a small area of sandy sediment near Dooega. Subtidal habitats are bed rock and kelp-dominated reef habitats with some sand at Doeoga. Figure 9 to Figure 12 show examples of the habitat types encountered along the coastline. These images are taken from the 2003 Oblique Imagery Survey and are the property of OPW, OSI and DCMNR. Typical species of such shores include *Verrucaria* in the upper splash zone, followed by littorinids in the upper shore, then a belt of the barnacles, *Chthalamus* and then a band of mussels at the lower shore. Macroalgae are uncommon on such shores but taxa such as *Porphyra* and *Corralina* can occur. Sublittoral species include the brown algae *Alaria* and *Laminaria digitata* and invertebrates such as *Holothuria forskali* and *Echinus esculentus*.

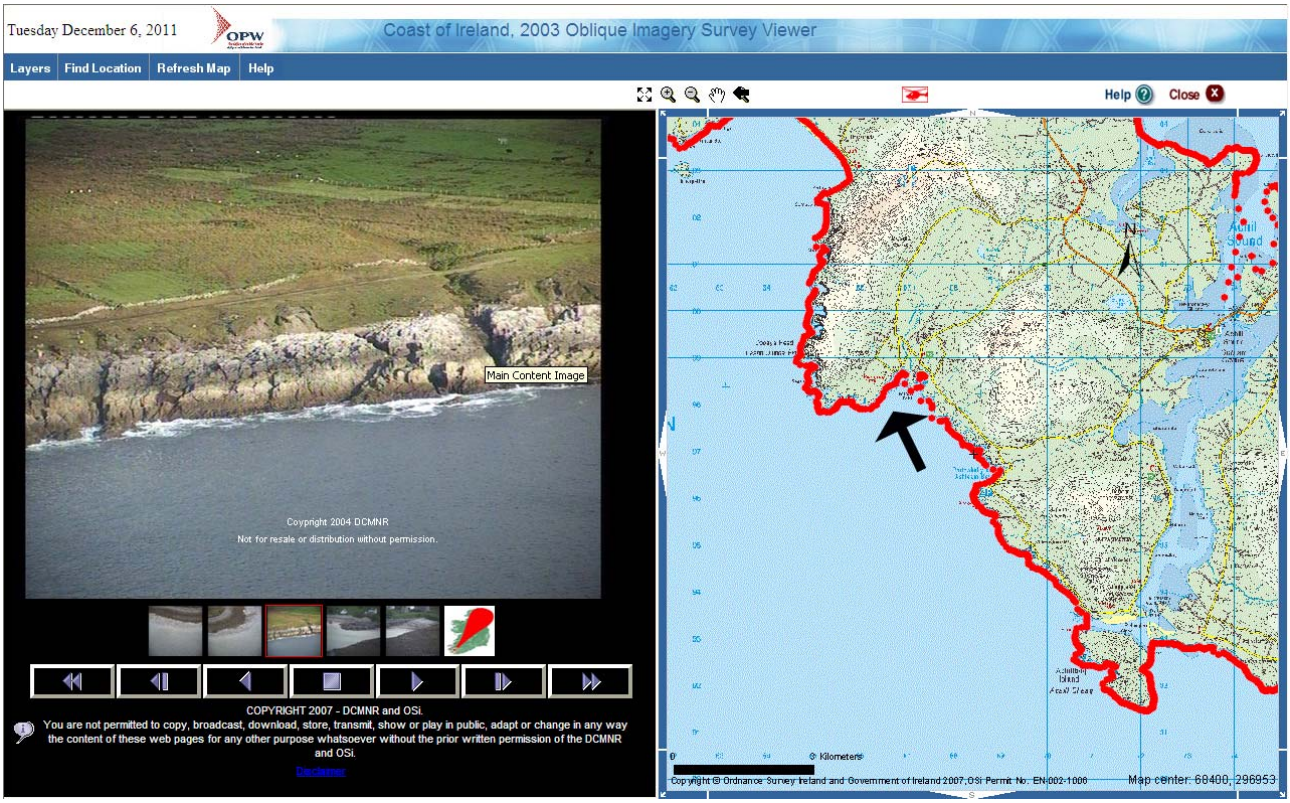


Figure 9: Aerial photograph of a section of the coastline at Achill showing cliff, poor grassland and stone wall habitats.

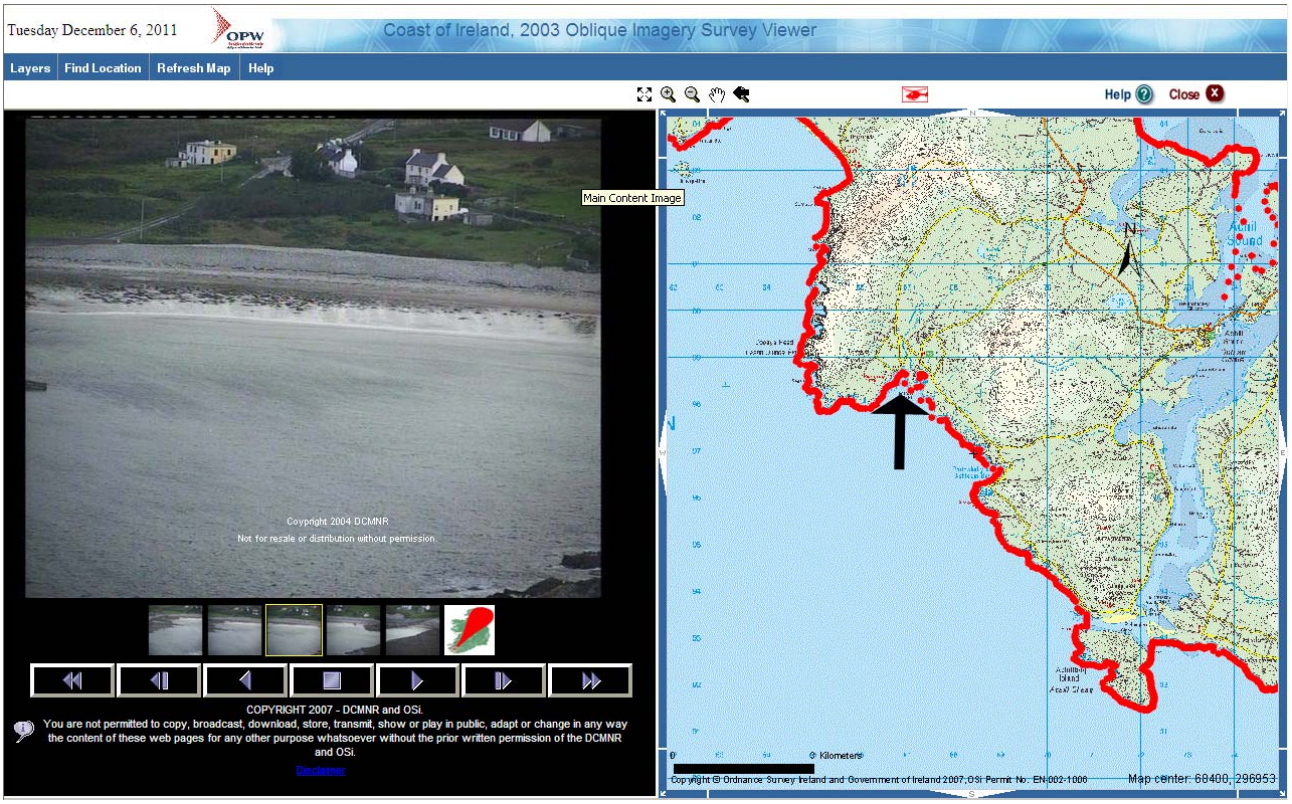


Figure 10: Aerial photograph of a section of the coastline at Achill showing cliff, poor grassland and heath habitats

Figure 11: Aerial photograph of a section of the coastline at Achill showing cliff, poor grassland and heath habitats.

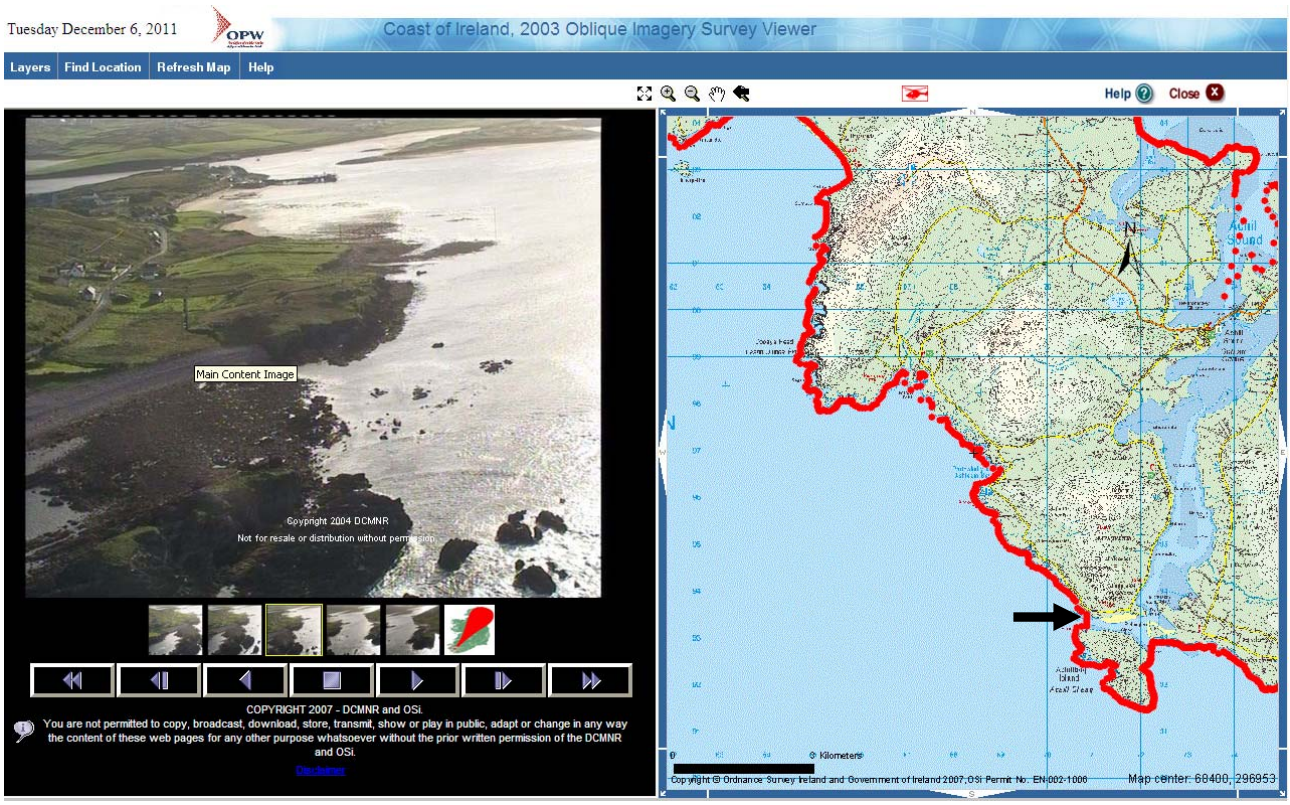


Figure 12: Aerial photograph of a section of the coastline at Achill showing exposed bed rock, stony shoreline, poor grassland and stone wall habitats.

3.5.3 Marine Mammals

All cetacean species occurring in European waters are listed as Annex IV species, requiring strict protection; prohibiting deliberate capture, killing, disturbance (particularly during breeding, rearing, and migration), and deterioration or destruction of breeding sites or resting places. Five species are further listed as Annex II species of community importance (bottlenose dolphin, harbour porpoise, grey seal, harbour seal, otter) and require the designation of Special Areas of Conservation (SACs) for their protection. In 1991 the Irish government declared all Irish waters, extending to the outer Continental shelf, a whale and dolphin sanctuary.

Data from the European Seabirds at Sea (ESAS) programme (Figure 13) show that Achill has a relatively low density of marine mammals), although this has not been corrected for sampling effort or seasonal effects. A previous analysis of IWDG (Irish Whale & Dolphin Group) data which has been corrected for sampling effort, also shows a similar result. Higher densities occur further offshore to the west of the area. Thirteen sightings of cetacean species from the immediate coastal waters around the proposed test site have been made from 1979-2003, and include common dolphins, harbour porpoise, and single records of Risso's dolphin and a sei whale.

Harbour porpoise (*Phocoena phocoena*) is the most widespread and abundant species in Ireland occurring over the continental shelf and all around the coast. It appears to be more abundant off the southwest coast and in the Irish Sea and is less abundant off the northwest but this could be due to less recording effort (Reid et al., 2003). Common dolphins (*Delphinus delphis*) are the second most frequently sighted species in Ireland are most abundant off the southwest and northwest coasts and in the Celtic Sea (Reid et al., 2003). Risso's dolphins (*Grampus griseus*) have been recorded throughout the year in Irish waters with a wide distribution. As well as being common in the Irish sea, they are regularly observed both inshore and offshore along

the south and west coasts (NPWS, 2008) with additional regular sightings inshore off the northwest and southeast coasts (Reid et al., 2003). Sei whales *(Balaenoptera borealis)* are very rarely sighted in Irish waters, tending to occur in deep water beyond the continental shelf (NPWS, 2008). The first validated sighting of sei whales in Irish waters occurred as late as September 2009 (IWDG), and only 3 strandings have been reported along Irish coasts.

The proposed site at Achill is relatively close to two harbour seal haul out sites (see Figure 8). They are located to the east of the proposed site. Some grey seal breeding and haulout locations occur 20-30km further north of the proposed test site, but are still within the normal foraging range of this species.

The impact of wave devices on marine mammals is also not well researched and understood. However, marine mammals are particularly susceptible to underwater noise associated with renewable energy device construction and operation, so using areas of known lower abundance would be preferable.

Historically, the Irish Whale and Dolphin Group (IWDG) records indicate the presence of Bottlenose dolphin, Common dolphin, Basking Shark, Killer whale, Harbour porpoise and Risso's Dolphin in the waters around Achill Island, with fewer sightings recorded in the vicinity of the proposed WestWave project location (All records are validated and available on www.iwdg.ie). There are important grey seal breeding sites on the east coast of Achill Island and on Clare Island also.

Marine mammals are particularly susceptible to underwater noise associated with renewable energy device construction and operation, so using areas of known lower abundance would be preferable.

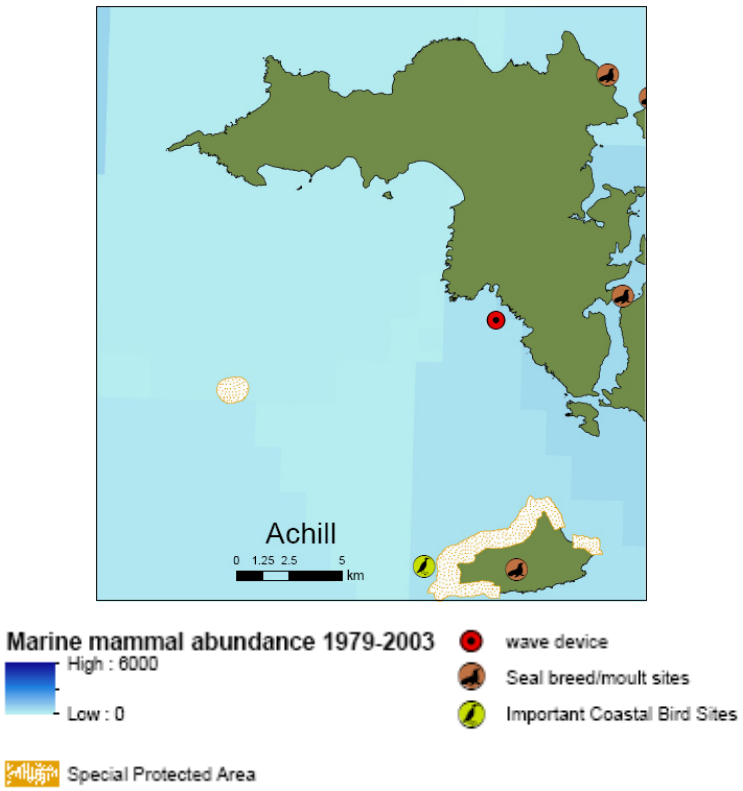


Figure 13: Marine mammal abundance data 1973-2003 and important seal and bird sites at Achill, Co. Mayo.

3.5.4 Ornithology

The proposed site at Achill is relatively close to a number of biologically important/sensitive areas including:

- designated Special Protected Area (see Figure 1); and
- important coastal bird site (see Figure 8).

The coastal sea cliffs, estuaries and offshore islands of Ireland are host to a number of nationally and internationally important bird species. At least 45 species of seabird have been recorded during at-sea surveys in Irish waters, of which 23 species regularly breed around Ireland (Pollock et al 2007, Mackey et al 2004). Of the breeding seabirds, ten species breed in internationally important numbers.

Offshore data on seabird abundance is patchy, with ESAS survey coverage generally below the desired level of coverage in both summer and winter seasons and some inshore areas of the north-west coasts unsurveyed in winter months. Therefore, trends in spatial use cannot be made for the waters off Achill. However, there are important coastal bird sites to the west and south of the proposed test site. The Duvillaun Islands support populations of great Black-backed Gull and Black Guillemot, while the Claire Island cliffs support a population of black guillemot. ESAS surveys recorded Great Black-backed Gull distribution as patchy in coastal waters, with low to moderate densities recorded off the west coast in winter, and around the north coast in summer (Pollock et al., 1997, Mackey et al., 2004). Black Guillemots are recorded as being patchily distributed in inshore waters throughout the year, but this species was probably under-estimated on surveys.

Other sea birds that are likely to occur regularly off the coast at Achill include *Rissa tridactyla* (Kittiwake), *Phalacrocorax aristotelis* (Common shag), *Phalacrocorax carbo* (Cormorant), *Fulmarus glacialis* (Northern fulmar), *Larus fuscus* (Lesser black-backed gull), *Morus bassanus* (Northern gannet, *Larus canus* (Common gull), *Uria aalge* (Common guillemot), *Alca torda* (Razorbill), *Fratercula arctica (*Puffin), *Larus argentatus* (Herring gull), Greater and Lesser Blackbacked Gull (*Larus marinus* and *Larus fuscus*) and a variety of tern species with the latter two i.e. Lesser Black-backed and terns only occurring in Summer. Other seasonal species would include shearwaters, petrels and skuas.

The area is not remote enough for the cliffs to serve as a significant location for breeding sea birds.

The marine crow, Chough (*Pyrrhocorax pyrhrocorax)* is known to occur in the area.

Due to the rocky nature of the shoreline, the intertidal area is unsuitable for most wading species. Turnstone (*Arenaria interpres*), Oystercatcher (*Haematopus ostralagus*), Purple Sandpiper (*Calidris maritima*) and Rock Pipit (*Anthus petrosus*) are likely to feed on the shoreline in suitable weather.

Terrestrial bird speciesobserved during a sitesurvey period included Robin (*Erithacus rubecula*), Wood pigeon (*Columba palumbus*), Meadow pipit (*Anthus preatensis*), Wren (*Troglodytes troglodytes*), Magpie (*Pica pica*), Jackdaw (*Corvus moneldula*), Grey Crow (*Corvus* cornix), Rook (*Corvus frugilegus*) and Bullfinch (*Pyrrhula pyrrhula*). It is considered very likely that Peregrine (*Falco peregrinus*) and Kestrel (*Falco tinnunculus*) hunt over the site. Winter and Summer visitors such as Redwing (*Turdus iliacus*), Fieldfare (*Turdus pilaris*), Swallow (*Hirundo rustica*), Martins (*Delichon* sp.), Swift (*Apus apus*), Wheatear (*Oenanthe oenanthe*) and a variety of warblers also occur at the site.

3.5.5 Terrestrial Habitats

Habitats at the four terrestrial locations can be divided into two main groupings: poor grassland at Dooega in the north (Site A) and west of Darby's Point to the south (Site D) and cut over bog/heath at the two sites south and north of Ashleam Point (Sites B and C). Small streams are also present at each location.

Besides grass species in the grassland habitat, other species noted included rush (*Juncus sp*), willow (*Salix sp*.), briar (*Rubus*), fern (*Pteridium*) and garden escapes such as Fuschia, Gunnera, Nasturtium and Crocosmium. Some hedgerow is also present within the grassland habitat and species included hawthorn (*Crategus*), nettle (*Urtica*), willow (*Salix*) and briar (*Rubus*).

Species in the heath habitat included heather (*Caluna*), ling (Erica), rush (*Juncus sp*), fern (*Pteridium*), moor grass (*Molinia*) and lichen (*Cladonia*). Stone walls were also noted within the heath habitat. This heath habitat is an Annex habitat under the Habitats Directive.

3.6 Preliminary Cultural Heritage Baseline

A preliminary Cultural heritage Report has been prepared by Moore Marine Services Limited (Appendix 2). Desktop research undertaken as part of this assessment indicated that the general area surrounding the potential project options on Achill Island has shown evidence of occupation and exploitation since Neolithic times. A large number of Registered Monuments and Places (RMP) are noted in the vicinity of the terrestrial hydroelectric power-plant options at location A, B and D, (see Figure 14) These include Promontory Forts, Hut sites, Houses, Childrens Burial Ground, Castle, Bawn and Slipway and Field systems and enclosures. The report identified that only one RMP was identified at option C (Claggan). An examination of the topographical files indicated that artefacts have been found in the study area. All relate to the terrestrial environment.

The National Inventory of Architectural Heritage (NIAH) has not yet been completed for County Mayo. In lieu of this, the County Mayo Development Plan (2008-2014) was consulted. It detailed that there were five recorded protected structures on Achill Island, None of these however are in the vicinity of any of the hydroelectric plant option areas.

Figure 14: Extract from County Mayo RMP Map MA:054a , 065 & 75

The initial cultural heritage baseline of the site options is indicated below.

3.6.1 Site A - Ooghcorragaun, Dooega West

The Record of Monument and Places has a record of one RMP site (MA:054a002), a promontory fort as being located in this area. Immediately to the west of the area are another two promontory Forts and a hut site. Aerial imagery does not record the presence of any previously undiscovered, visible archaeological features or deposits in this area. The presence of four RMP sites in the vicinity of this option indicates that this area has been the site of resource management and habitation since at least Iron Age times if not earlier. Consequently the potential for impact of archaeological material in this area is relatively high.

3.6.2 Site B - Ooghnashinnagh, Dooega East

The Record of Monument and Places has a record of four RMP sites, (MA:054a05 & 0601,02,03) located in this area. These sites comprise a childrens' burial ground, two hut sites and a habitation site. Aerial imagery does not record the presence of any previously undiscovered, visible archaeological features or deposits in this area. The presence of four RMP sites in the vicinity of this option indicates that this area has been the site of resource management, habitation and burial in antiquity. Consequently the potential for impact of archaeological material in this area is relatively high.

3.6.3 Site C - Claggan

The coastal fringe in this area is sloping and grassy with one RMP site (MA065:11) a childrens' burial ground. Aerial imagery does not record the presence of any previously undiscovered, visible archaeological features or deposits in this area. The desktop assessment indicates that that potential for the project to impact archaeology in this area is low.

3.6.4 Site D - Doonnaglass

The coastal fringe in this area is sloping and grassy with six RMP sites in the area. The site forms range from habitation sites to burials and middens thus indicating that there was a wide and varied form of habitation and resource exploitation being carried out in this area. Aerial imagery does not record the presence of any previously undiscovered, visible archaeological features or deposits. The presence of such a variety of multi-period RMP sites, their close proximity and its sheltered nature, all indicate that this is a locality of high archaeological importance where humans have been living and exploiting the natural resources of the area since prehistoric times. Consequently, the potential for impact of archaeology is high.

3.6.5 Cultural Heritage Summary

Based on the results of the assessment it would appear that the area surrounding three of the four proposed Sites (Site A, B & D) are of considerable archaeological importance. The archaeological record indicates that there has been successive occupation and exploitation of these areas from the Neolithic Period. Consequently the potential for any development to impact archaeological material, either known or unknown, would be high.

Site C has only one RMP in its vicinity and it does not appear to have had significant human exploitation. The potential for impact on archaeological material would be lower at this location.

3.6.6 Shipwreck Inventory

Archaeological assessments of the offshore test areas require a comprehensive side scan sonar and marine magnetometer survey. In the absence of this data the only information that can be gleaned as to the nature and extent of archaeological features or deposits in the offshore site locations is achieved through review of the shipwreck inventory, admiralty charts and the available multi-beam data. The data contained in the Shipwreck Inventory is not always very accurately geo-referenced, often it lists the place of loss as a very general location; i.e. 'off Achill Island' for example. Consequently review of the inventory data without the capability to cross-reference side scan data has limited effectiveness. A similar scenario is true of multi-beam data. Whilst this data is very accurate in the vertical and horizontal planes, it does not easily distinguish seabed anomalies or features, thus it is of limited use for archaeological reconnaissance purposes.

Nevertheless, the review of the existing data relating to the offshore sites does not indicate the presence of any archaeological materials or features on the subject sites.

The National Shipwreck Inventory indicates a number of vessels having possibly foundered in and around the area of Achill Island (Table 2). The locations of the loss of these vessels are general and confirmation as to whether they are in the proposed development site will only be achieved through direct site survey.

Table 2 Review of the Shipwreck Inventory GIS database has records of the loss location of the following wrecks around Achill Island:

NAME	VESSEL_TYP	DATE_OF_LO	PERIOD	PROTECTED	DMS_LAT	DMS_LONG
Unknown	Unknown	Pre-01/09/1982	Unknown	YES	053 56 10	009 55 55
Neptune	Barque	21/01/860	19th century	YES	053 56 53.44	010 03 09
Jenny	Barque	13/01/1894	19th century	YES	053 51 49.48	009 57 20.2
Successful	Fishing trawler	After 1954 or 19	Post-WWII	NO	053 56 07.47	009 55 52.78
Aghia Eiri	Merchant steamer	10/12/1940	WWII	NO	053 53 11.83	009 59 02.76

3.7 Preliminary Navigation Data

3.7.1 Preliminary AIS data

Preliminary AIS (Automatic Identification System) data has been obtained from the Irish Coastguard with respect to the site at Achill Island. It provides information on vessel movement at the site. AIS is an automated tracking system used on ships to provide information such as location, speed, course, position and identity. It is mandatory on all vessels greater than 300 tonnes or 15m in length.

Data has been provided by the Irish Coast Guard giving information from October 2009 to September 2010 for the general area.

For each quarter three plots of data were provided:

- density – density of vessel tracks;
- historical track – course over ground (COG) with vessel identifiers; and
- passage line – number and type of vessel transiting line.

The preliminary AIS data indicated that there is a well defined shipping route established between Clare Island and Achill Head (Table 3). The route is direct and there is very little deviation (Figure 15).

The periods January– March, July–September and October-December were much busier than the April – June period, which experienced less than half the traffic.

Only one vessel deviated from this route, the vessel travelled in an erratic circular motion west of Clare Island before entering Keel Bay. This occurred twice, once between Jan-Mar and again between Jul-Sept. The vessel is thought to be on a diving expedition. The vessel entered Keel bay from the Achill head side travelled north-east to the centre of Keel bay and exited by heading south by the Dooega Head side of Keel bay.

This vessel came nearest to the proposed test site but still travelled at a distance of 1.5nm from the shore.

Table 3: AIS data Vessel Summary, Achill, Co. Mayo

Period	Total North	Predominant Vessel Type	Total South	Predominant Vessel Type
Oct-Dec(09)	23	17 Cargo, 2 Fishing	21	16 Cargo, 2 Fishing
Jan-Mar(10)	18	12 Cargo, 6 Fishing	19	14 Cargo, 3 Fishing
Apr-Jun(10)	9	3 Cargo, 2 Fishing	14	8 Cargo, 2 Fishing
Jul-Sept (10)	23	13 Cargo, 5 Fishing	25	16 Cargo, 6 Fishing
Oct-Sept	**73**	**Cargo, Fishing**	**79**	**Cargo, Fishing**

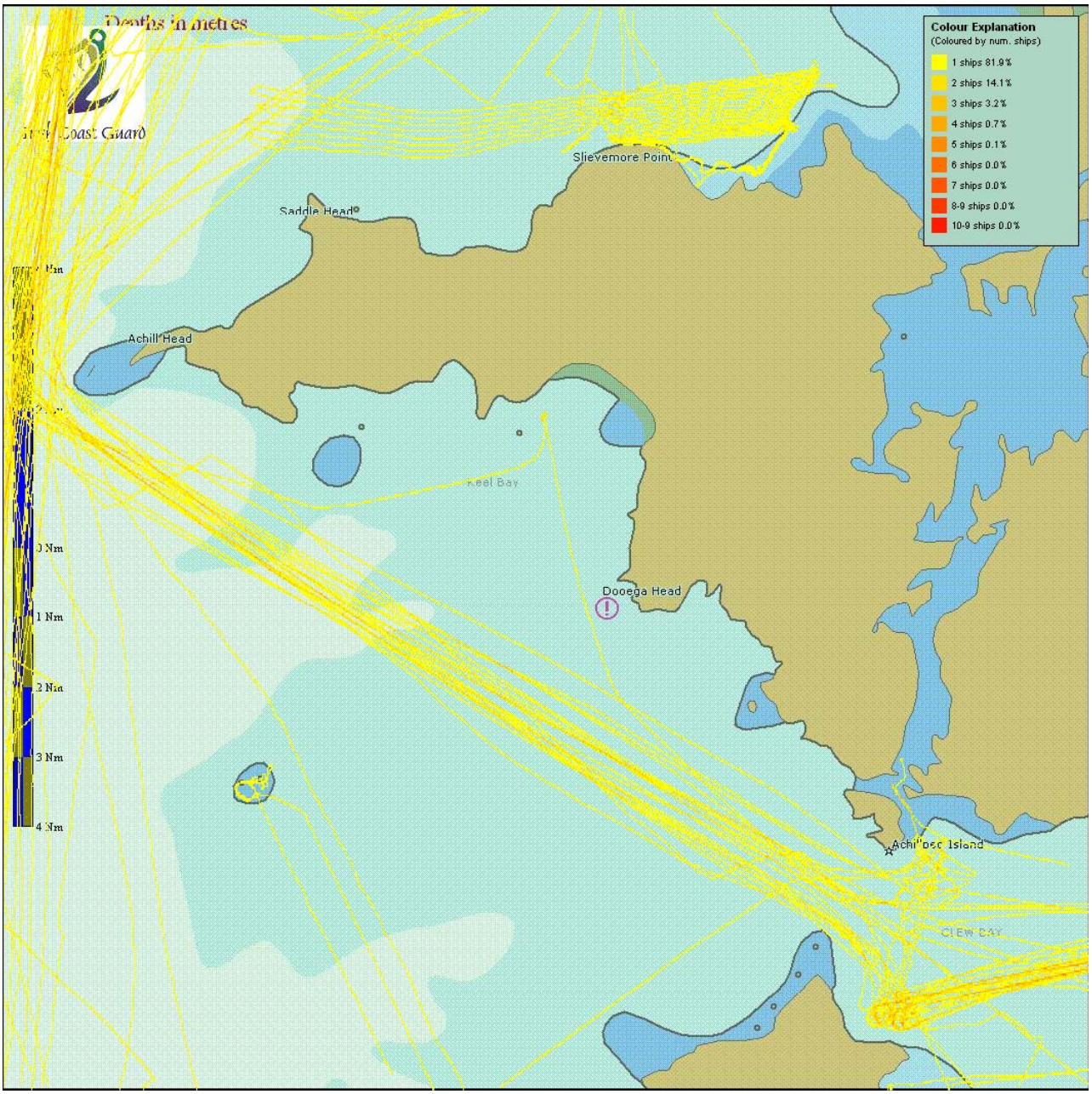


Figure 15: Achill, Co. Mayo – Vessel Density July-September 2010

3.7.2 Preliminary VMS data

The Vessel Monitoring System (VMS) is a satellite based system whereby vessels broadcast their location, heading and other summary information. It is operated by the Irish Naval Service and principally covers fishing vessels.

The Marine Institute have analysed the data for the international fishing effort from 31 Aug 2007 – 31 Aug 2010 and have provided a fishing intensity map at the areas of interest to ESBI for the WestWave project (Figure 16). The principal VMS fishing activity identified around Achill Island for vessels over 15m is gill netting with some bottom otter trawling. Bottom pair trawling and some mid water otter trawling.

It should be noted that this data only covers vessels of a given class which carry the VMS system. Other vessels will typically not be recorded. Also it is noted that the precise location of fishing areas are sensitive information, therefore the Marine Institute is only able to provide summary intensity information.

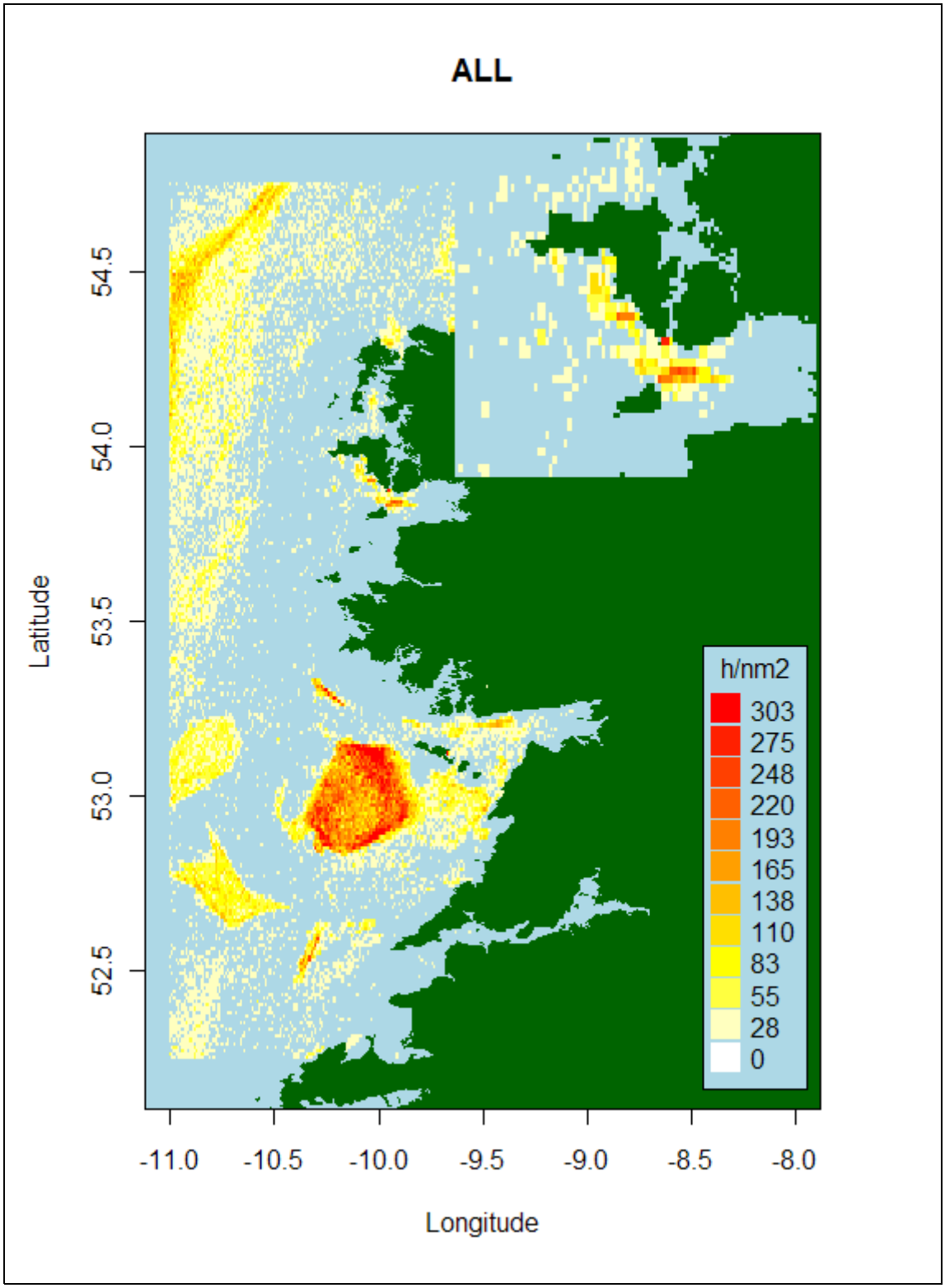


Figure 16: Fishing effort expressed as hours fished per square nautical mile for all types of fishing.

3.7.3 Potting activity

Consultation with the West Mayo Fishermens Development Co-op identified that the rocky sea bed areas along the coast of Achill Island at the proposed project locations is used for lobster potting by local fishermen.

3.8 Water Quality

The Environmental Protection Agency has made final status assessments of surface waters according to their ecological status and chemical status based on the results of the monitoring carried out to 2010. Groundwaters have been assessed based on a system that combines chemical and quantitative status.

The most up to date information on water quality status is available from the EPA Envision maps website. The detailed status of the district's individual rivers, canals, lakes, reservoirs, estuaries, coastal waters or groundwaters can be viewed using the interactive map (http://maps.epa.ie/InternetMapViewer/MapViewer.aspx); Details are also mapped and tabulated in the River Basin Management Plan and Water Management Unit action plan background documents (available at www.wfdireland.ie).

The proposed project area comes within the Western River Basin District (WRBD) River Basin Management Plan (RBMP) management area (www.wfdireland.ie). The proposed WestWave offshore project locations are within the Western Atlantic Seaboard Coastal water body (IE_WE_250_0000). The status of this water body has not yet been assigned by the EPA due to lack of comprehensive data.

Even though status has not been assigned as of yet the project should not lead to a loss of the existing status of the water body or prevent the attainment or improvement of the status of the water body where this is required. At the very least the target for the water body will be to achieve good status and ensure that all protected designated habitats are maintained.

The Dooega River (Water body code IE_WE_33-2572) enters the sea at Dooega between Site options A and B. The status of this small river is classed as poor on the basis of its biological water quality.

Sites at Claggan and Doonaglass under consideration are situated outside of any surface river water body as defined by the EPA.

The groundwater body at the locations of all the potential sites A, B, C and D (IE-WE_G_0026) has been assigned good status by the EPA.

The proposed development should not give rise to a reduction in the existing quality of the Dooega river or the groundwater body status.

3.9 Bathing waters

The new Bathing Water Directive (2006/7/EC) entered into force in March 2006. This new Directive aims to provide greater benefits in relation to improved health protection for bathers and a more pro-active approach to beach management including public involvement. The new Bathing Water Quality Regulations 2008 (SI No. 79 of 2008) transposed the 2006 Directive into Irish Law on 24 March 2008 (Source: EPA).

Dooega Beach on Achill Island is designated as a bathing area under the Bathing Water Quality Regulations 2008 (SI No. 79 of 2008). The bathing water quality in 2010 was rated as "Good water quality" at this location.

3.10 Socio economic

The proposed landfall locations are situated within the administrative area of Mayo County Council. They are located on the west coast of Achill in the District Electoral Division (DED) of Dumhá Eige (Dooega). An analysis of the DED census data from

2006 and 2011 indicates that there has been a decline in the population in the project area of -4.7 %.

The main land based activities in the area include agriculture, local fisheries and tourism.

Offshore the area is known to be utilised for lobster fishing using static fishing gear. Occasional fishing for pelagic and demersal species occurs. Vessel activity data is limited as the smaller vessels used in the area are not required to carry VMF.

3.11 Transport

Access to the potential site locations under consideration is generally good along the N59, R319 and the “Atlantic Drive” local road.

Access for marine based activities will be achieved through the major ports of Killybegs, Shannon Foynes, Belfast or possibly also Galway Port for major equipment items and major overhauls.

3.12 Air quality

There is no specific ambient air quality data available for the offshore and terrestrial environments associated with the WestWave project areas. The Air Framework Directive deals with each EU member state in terms of "Zones" and "Agglomerations". For Ireland, four zones are defined in the Air Quality Regulations (2002). The WestWave project is located in Zone D Rural Ireland. The nearest air quality monitoring station is at the EPA site in Castlebar, Co. Mayo. It records PM10, ozone concentrations and nitrogen dioxide. There is also an air quality monitoring station located at Mace Head atmospheric Research Station operated by NUI, Galway, near Carna on the west coast. It is a Global Atmospheric Watch (GAW) site and monitors ozone and gaseous mercury. Data from these sites indicates that ambient air quality is generally very good in Zone D in the general area.

The WestWave offshore and terrestrial locations are very rural in nature, with very little industry and very low population density. Traffic volumes and associated vehicle emissions are also low. This would suggest that ambient air quality is of a high standard nearshore and surrounding the landfall area.

3.13 Terrestrial Noise

Current noise levels are dominated by ocean noise, local road noise and noise resulting from the activities associated with agriculture in the area and the village of Dooega.

The nearest potentially sensitive receptors in terms of noise are private dwellings located at Dooega, at Ashleam, at Cloghmore and along the Atlantic Drive. As part of the impact assessment, all such receptors will be identified and assessed accordingly.

3.14 Marine Noise

The main sources of ambient noise in the sea are the noise of wind and wave action, biological noise from marine organisms and traffic noise from shipping. Traffic noise from shipping is usually the dominant noise component at frequencies below about 200 Hz.

The proposed sites are all located within 1km of the shore. The wave energy devices may give rise to localised noise that may impact on fauna in the area.

3.15 Commercial Fisheries (including aquaculture)

The coastal zone in much of Mayo is an important resource for coastal communities with inshore fisheries and aquaculture providing important sources of income. No detailed analysis on the fisheries in the area has been published. However, based on preliminary meetings with the local fishing community activity is dominated by potting (static gear) .

3.16 Shellfish Waters Directive

The site area is not a designated water under the Statutory Instrument, S.I. No. 268 of 2006, European Communities (Quality of Shellfish Waters) Regulations 2006 which enables the EU Shellfish Waters Directive (2006/113/EC) or as amended by the European Communities (Quality of Shellfish Waters), (Amendment) Regulations 2009 (S.I. No. 55 of 2009).

4 OVERALL APPROACH TO ASSESSMENT OF ENVIRONMENTAL IMPACTS

4.1 Overview

The assessment of environmental impacts will be conducted in accordance with best practice. The following key stages will form the basis of the assessment process:

- Consultation with statutory and non–statutory bodies and relevant stakeholders;
- Establishing a robust baseline of the existing environment on and around the site;
- Assessment of the environmental impacts and establishing their significance (primarily the assessment of residual effects once mitigation has been adopted); and
- Formulation of mitigation measures to ameliorate the potential impacts of the proposed development that cannot be avoided practically through site design.

Following established best practice, it is intended that the development will evolve in an iterative manner with the assessment process, led mainly by the consideration of constraints that exist within and around the site (environmental, technical and economic). Once the preferred design is selected, this will form the basis of the impact assessment. The four key stages of assessment are summarised below (Sections 4.2–4.6 inclusive).

4.2 Consultation

Consultations with relevant authorities, organisations and stakeholders has already commenced and will be continued throughout the assessment and site design process. The consultations will serve three main purposes:

- To establish a sufficiently robust environmental baseline of the development and its surroundings;
- To identify, early in the process, specific concerns and issues relating to the development in order that they can be discussed and appropriately accounted for in the design and assessment; and
- To ensure the appropriate involvement of the public and authorities in the assessment and design process.

With regard to the latter ESBI intends to carry out community consultation based upon the instigation of public exhibitions, meetings and circulars and would welcome comments on how the community and other stakeholders would prefer to be consulted.

A Local Community Consultation and Communications Plan have been drawn up. There has already been some preliminary consultation. A number of meetings with Mayo County Council, Doonbeg Community Group, Local marine businesses and local fishing organisations have taken place and a project website has been established, http://www.WestWave.ie/.

The main objectives of the Communication Plan are:

- To ensure that the local community at Achill is kept fully informed, in timely fashion, of plans and developments for the proposed WestWave project. It is also important to ensure that they understand that they have a say in how developments proceed, both through the statutory process and through consultation.; and
- To keep the wider Mayo community informed of developments. This includes both the general public and local statutory bodies.

4.3 Rationale and Alternatives to the Project

The rationale for the project and alternatives to the project in terms of alternative renewable energy technology options and alternative project site locations will be fully developed and described.

4.4 Baseline

The environmental baseline of the site and its surroundings will be established for each environmental aspect under consideration, (Section 3, provides a preliminary environmental baseline). This will be achieved largely through consultations with relevant authorities and organisations, a desktop review of available data and literature that generated from consultations, and detailed interpretation of specialist field surveys.

4.5 Assessment of Environmental Impacts and their Significance

Impacts can be assessed as positive, neutral or negative. Evaluation of the significant impacts is important. The significance determines the resources that should be applied in avoiding or mitigating an adverse impact or the actual value of a positive impact. Furthermore, the combined significance of the various mitigated impacts determines the overall environmental acceptability of a project.

Determining the significance of environmental impacts is one of the most contentious parts of the process, involving value judgements and personal expert interpretations about whether, and to what extent, a proposal is environmentally significant. Factors which influence the judgement include

- the character, sensitivity and current use of the environment;
- the nature, magnitude and scale of the proposal
- the likely nature, magnitude and duration of the impact;
- the resilience/sensitivity of the affected environment;
- the confidence in the predicted impacts;
- the level of public concern and knowledge of the issue; and
- the potential for mitigation;

The assessment will also take account of the different environments encountered by the project where impacts may occur. These include three main areas

- the offshore marine environment;
- the onshore intertidal environment where relevant; and

- the terrestrial location of the proposed hydroelectric plant and access road

Efforts will be made throughout the assessment to ensure that criteria and standards of significance are identified and documented and that the level of certainty of data is recorded. An explanation will be provided on the criteria that have been applied in each relevant section.

The assessment will evaluate all phases of the project including the construction phase, operational phase and decommissioning phase.

For all environmental aspects, the significance of residual impacts, i.e. those predicted once mitigation is taken account of, will form the basis of the assessment.

4.6 Development of Mitigation Measures

All measures proposed as mitigation for the development will be reported within the relevant section of the Environmental Report. The mechanism by which these measures will be carried through and implemented on site will also be made clear.

5 POTENTIAL EFFECTS and ASSESSMENT METHODOLOGY

5.1 Introduction

A description of the development's possible effects on the environment is required for the purposes of providing both a screening and scoping opinion. This section identifies these effects (referred to as 'potential effects' for the purposes of this report) and provides an outline of the assessment methodology that will be adopted in assessing the effects. The effects that could be experienced offshore and at the landfall have been listed separately where relevant. Although the methodologies described below are those typically required in the case where an EIA is required they will also be applied should an EIA not be required.

5.2 Landscape and Seascape

The proposed hydroelectric power plant will be located off the Atlantic Drive on Achill Island and the wave energy converters will be located in the sea just offshore from the power plant site. As such both the power plant and wave farm will be visible from locations along the Atlantic Drive with the potential to impact on scenic views of the area.

5.2.1 Potential Effects

Potential impact could occur from the project during construction, operation and decommissioning both with respect to the seascape, from the deployment and presence of the WECs and the landscape from the construction and physical presence of the substation and overhead grid connection. Possible impacts include:

- During the construction phase, there will be a potential short term visual impact for both the offshore and onshore elements of the project arising from the presence of construction vessels, plant and machinery etc.
- A visual impact offshore will occur as the Oyster technology will extend above the water level by about 3m depending on final design. The extent of impact will depend on the actual final location selected, array formation and any marker buoys and their location in the seascape.
- A visual impact on the landscape and visual character of the area may occur from the on-shore hydroelectric power plant and any overhead electrical connections The apex roof height of the plant is likely to be of the order of 6m with and overall footprint of the plant building likely to be circa 1000m^2.
- There will be a potential short term visual impact for both the offshore and onshore elements of the project from vessels used in decommissioning operations and works associated with decommissioning of the hydroelectric power plant.

5.2.2 Assessment Methodology

The methodology used in this assessment will be based on established best practice as described in the following guidelines:

- Environmental Protection Agency (2003), *Advice Notes on Current Practice in the preparation of EIS*

- The Landscape Institute and Institute of Environmental Management and Assessment (2002, 2nd ed.) *Guidelines for Landscape and Visual Assessment*
- Landscape Institute (2011) 'Photography and Photomontage in Landscape and Visual Impact Assessment' (Advice Note 01/11, March 2011)
- Department of Environment, Heritage & Local Government (2000) *Landscape and Landscape Assessment; Consultation Draft of Guidelines for Planning Authorities*
- Department of Trade & Industry (UK) in association with the Countryside Agency, the Countryside Council for Wales and Scottish Natural Heritage (2005) *Guidance on the Assessment of the Impact of Offshore Wind Farms; Seascape and Visual Impact Report*
- Countryside Council for Wales, Brady Shipman Martin and UCD (2001) 'Guide to Best Practice in Seascape Assessment'
- CAAS Ltd for Mayo County Council (2008) *Landscape Appraisal of County Mayo*
- Mayo County Council (2008–) *Mayo County Development Plan 2008-2014*
- Review of the preliminary and detailed design drawings of the onshore substation and the offshore wave energy converters under development, including marker buoys
- Preparation of a Zone of Theoretical Visibility map for the substation
- Assessment of available maps and local plans to identify relevant policies, designations and existing landscape characterisation within the specified study area.

A qualified landscape architect will be engaged to undertake the landscape and seascape visual impact assessment. The Initial assessment of impacts will entail a detailed study of existing national, regional and local development plans to ascertain specific landscape, visual and scenic amenity policies and landscape character assessments relating to the area including all designations.

Included in assessment will be the preparation of a Zone of Theoretical Visibility (ZTV) map to check visibility of any WECs from the vantage points in the area. Photomontages of the seascape with WECs deployed and of the substation in the landscape setting will be prepared and used to visualise the substation in the context of the surrounding landscape.

Photomontages of the proposed hydroelectric power plant and its location in the landscape and seascape montages showing the deployed wave energy converters and marker buoys will be prepared to aid in the visual impact assessment.

The significance of any reported effects will be determined by an assessment of the sensitivity/value of the land use, capacity to accommodate change and the magnitude of the effect.

5.3 Physical Environment

5.3.1 Potential Effects to Coastal Processes

Coastal processes include the wave resource and its effects on sediment transport and coastal landform. Wave action is responsible for coastal land formation, including beaches. A change in wave action, resulting from the effects of wave energy

converters, taking energy from the resource, could result in changes to landform and sediment movements in the marine environment. Wave height reduction could also occur arising from the effects of the WECs.

For the offshore works, the proposed development could give rise to the following potential effects:

- Coastal processes alteration may occur leading to changes in sediment transport resulting from modifications to tidal current flows adjacent to individual WECs devices.
- Potential alterations of sea bed bathymetry along the coast could result from changes to nearshore sedimentation, change to bedforms such as sandbars and beaches as result of tidal current alteration and tidal energy reduction through absorption by the WECs.
- Potential impacts on wave resources can also occur due to wave energy absorption, wave, refraction and diffraction. This could potentially lead to a reduction in wave resource in the area which could subsequently impact on the quality of waves available for recreational activities.
- Scouring adjacent to foundations could be a feature of installations.

Potential impacts may not be confined to the immediate area of the WECs but could also impact on wider areas of the coastline.

5.3.2 Potential Effects from Drilling Works

For the landfall works in the nearshore and intertidal environments, the proposed development could give rise to

- sediment mobilisation and chemical pollution (from spillages and from sediment if it contains contaminated material) of coastal water if not controlled appropriately; and
- physical destruction of protected habitat (dune system for example) if inappropriate construction methodology is used and strict access control is not maintained.

5.3.3 Assessment Methodology

A qualified and experienced modeller using up to date software will be engaged to undertake modelling of the coastal processes in the project area. An analysis of all available existing and newly collected data will be made to provide (where relevant) both a quantitative and qualitative assessment of the coastal processes in the project area.

The following analyses will be carried out as part of the coastal process assessment:

- wave climate analysis;
- assessment of beach profile data at Dooega; and
- sediment transport analysis .

The west coast of Achill Island is open to the Atlantic Ocean and is a high energy dynamic environment. It is therefore unlikely that the deployment of a small number of WECs will lead to any significant change in coastal processes or to noticeable loss of wave resource used for recreational purposes.

As a first step high level modelling of the natural background coastal processes will be undertaken to determine the likely significance of any potential changes due to the physical presence of WECs. If the model indicates that the scale of effect will be

indiscernible from the natural coastal processes of the area then impact will not be significant. If the high level modelling indicates that some particular areas may be impacted then more detailed modelling will be undertaken to determine the significance.

5.4 Biological Environment

Preliminary ecological assessment of the area indicates that although the potential sites are not located within any designated areas they are within 15km of such sites and therefore an assessment of the potential impacts on marine mammals, seabirds and the benthic ecology is required. Potential effects on the biological environment can occur at the locations of the WECs and along the proposed water pipe routes in the marine environment and in the wider marine environment. Potential effects can also occur at the project lay down areas and at the terrestrial location of the hydroelectric power plant and along the proposed access road. Some impact to the wider terrestrial environment could occur due to noise and other disturbance effects associated with the WECs, plant and road construction activities. The potential effects effects are discussed below.

5.4.1 Potential Effects Subtidal Benthos

The main potential effects include:

- Habitat loss: Pile installation, seabed clearance and pipe work structures interlinking the WEC devices, represent a direct loss of seabed habitat within the installation footprint. This loss will be very small in the context of the total available habitat in the area. Each device will have a footprint of approximately 130m^2, much of which will be temporary in nature with the actual pile foot print being only approximately 15m^2. Once installed the devices could act as artificial reefs and small nursery areas and this will be further explored during EIA.
- Suspended sediments: Disturbance or loss of the benthic macrofauna, due to temporary increased suspended sediment, smothering or displacement during construction could occur. Temporary increases in suspended solids and turbidity will occur during construction but given the exposed and high energy nature of the site impacts will be of very short duration and negligible in the context of the existing natural changes that occur in the area.

In such a high energy environment any alteration relative to existing conditions are likely to be negligible and therefore this will be scoped out of the EIA.

Organisms are also adapted to high energy and variable conditions on the west coast of Achill and where there is limited seabed sediment such as potential locations at Clggan and Doonnaglass for example potential for smothering will be scoped out of the EIA.

5.4.2 Assessment Methodology Subtidal Benthos

WestWave will seek advice from National Parks and Wildlife Service with respect to extent of benthic surveys required. Site specific benthic data will be acquired during dedicated benthic surveys at the final location selected for the WestWave project. The guidance document “Institute of Ecology and Environmental Management (IEEM) of Guidelines for Ecological Impact Assessment in Britain and Ireland, Marine and Coastal will be used to guide these surveys.

An initial review of the admiralty charts for the Achill sites indicates seabed substrata varying from rock to sand. Depending on depth and the substrata type in the area of

the wave energy converters and the selected pipeline routes, a number of different methodologies may be employed to carry out the subtidal assessment.

Impact assessment would draw upon this and other relevant guidance, as appropriate.

5.4.3 Potential Effects Terrestrial Habitats and Intertidal Areas

The nature of the potential risks associated with the terrestrial habitats and species will be dependant on the final selected location of the onshore infrastructure. Initial walkover assessments of the potential terrestrial habitats were undertaken in November 2011 and indicated these to be poor grassland at Dooega in the north and west of Darby's Point to the south and cut over bog/heath at the two sites south and north of Ashleam Point.

Potential impacts include :

- Habitat and Species loss: Permanent physical loss of terrestrial habitats and species in the footprint of the hydroelectric plant and access road.
- Short term disturbance of local fauna during the construction period.

Onshore infrastructure is currently estimated to require an area approximately one hectare. An access road may be required to enable access to the onshore infrastructure and may cause habitat fragmentation.

Temporary disturbance of terrestrial habitats and species in the footprint of any access routes, lay-down areas and construction compounds may occur during construction, installation, and decommissioning activities. There may be noise and light disturbance during construction, operation and maintenance and decommissioning activities.

Temporary disturbance of intertidal habitats and species in the footprint of lay-down areas and construction compounds may occur during construction and installation.

Intertidal impacts at the potential locations will be limited as it is not anticipated that there will be any major works in the intertidal areas. Directional drilling would take place back from the shore to connect the marine devices to the hydroelectric power plant. WECs themselves will be transported to the development site by sea,.

5.4.4 Assessment Methodology Terrestrial Habitats and Intertidal Areas

A Phase 1 Habitats Assessment and Habitat mapping according to Fossit (2000) will be will be conducted at the footprint of the hydroelectric plant, access road and pipeline lay down area to provide an accurate baseline against which to assess potential impacts.

The preliminary ecological survey identified two areas north and south of Ashleam as being cut overbog/heath. Heath is an annex habitat under the Habitats Directive and any potential impact will be fully evaluated should a site at these locations be selected.

5.4.5 Marine Mammals

Marine mammals frequent the area off Achill Island and hence potential for impact on these animals exist. Clare and Achill Islands are important seal breeding and haul out areas for example. The main potential negative effects on marine mammals are suggested as including the following (OSPAR 2010):

- Underwater noise generated during construction from intensive boat traffic could potentially lead to avoidance of the area by marine mammals or

damage to individuals. Most marine mammals (whales, dolphins, porpoises and pinnipeds) use sound for a variety of purposes such as communication, navigation, foraging, avoidance of predators and hazards, and to locate mates. Anthropogenic underwater noise is known to give behavioural and physiological disturbances in some marine animals (Popper et al. 2008).

- Loss of habitat from physical displacement could occur if marine mammals avoided the site during construction. This loss or habitat would likely be temporary in nature as animals would return when construction finished. The effect of the temporary loss would also be small as the habitat for marine mammals is extensive and the construction area would be very small in this context.
- Collisions of marine mammals with construction vessels could occur.
- Contamination from oil pollution or chemical leakage from construction vessels could occur as a result of accident. Although the risk of an oil spill is low vessels will be required to have a shipboard oil pollution emergency plan, emergency oil spill equipment and crews trained in its use. This will minimise the potential for any impact in the unlikely event that an oil spill occurs.

5.4.6 Assessment Methodology Marine Mammals

Site specific surveys of the selected wave farm location and general area will be conducted at the proposed WestWave project site to determine usage of the area by marine mammals. The Coastal and Marine Research Centre (CMRC) are contracted to the project to conduct surveys and assessment of marine mammals over a 12 month period to give an indication of seasonal differences in distribution and abundance. Methodologies employed for marine mammal work will include:

- Nearshore waters: All monitoring work for marine mammals in the nearshore area will follow the methodology employed for the Broadhaven marine mammal monitoring programme for comparability of datasets. Monthly land-based visual surveys of the nearshore sites will be conducted from suitable clifftop vantage points under sea conditions of Beaufort sea state ≤3 to ensure accurate identification of species. Clifftop watches will be conducted in a series of 100-minute scans throughout daylight hours with position of marine mammals determined using a theodolite, and mapped to show their distribution in relation to proposed installations.
- Offshore sea area: Seasonal boat-based visual surveys along a standard transect covering the study area will be conducted in conjunction with seabirds at sea surveys. The CMRC will provide qualified Marine Mammal Observers to record species on all visual surveys. All megafauna, including basking sharks, seals, turtles and sunfish, will be recorded. It is planned to undertake monthly surveys over a 12 month period but this will be weather dependent.
- Acoustic Monitoring: The suitability of the site will be assessed for deployment of passive acoustic monitoring. A C-POD will be supplied by CMRC and deployed to provide supplementary information to visual surveys. C-PODs will be recovered, serviced (including removing any biofouling, changing the memory card and replacing the batteries), and re-deployed approximately every three months, given an expected maximum battery life of 4 months.

The assessment of potential impacts will be made against the baseline established through the dedicated monitoring programme and will allow suitable mitigation measures to be designed if required.

5.4.7 Ornithology

There are a number of designated sites (see Table 2 above) with important Annex I bird species listed within the vicinity of the potential site locations. Little data exists on the environmental impacts of wave energy devices on avifauna. However, expert group workshops, such as the Equimar workshop (2009) and the MASTS workshop (2010), have discussed and described potential impacts as follows:

- Construction noise from vessel activity may lead to birds avoiding the area for a brief period. However, this would be a temporary disturbance and birds would return to the area following construction. The impact would likely be very low.
- During construction there would be a temporary increase in suspended solids in the water column but this would be confined to an area adjacent to the piling operation. In shallow depths used by diving birds this could give rise to some temporary loss of feeding area. This would be of short duration and given the extensive area available the impact is likely to be negligible.
- Disturbance of birds using the intertidal area and cliffs may also occur from horizontal directional drilling, power plant and access road construction. However, the area is not remote enough for the cliffs to serve as a significant location for breeding seabirds and the impact is anticipate dot be negligible.
- Above water collision with WECs may arise in cases where birds fly low over the water. Risk is likely to be greater with nocturnal and crepuscular species, with environmental conditions such as bad weather being an additional factor. However, given the small number of devices which will deployed the risk of collision will be low and the potential impact will be low also.
- There is a risk of entrapment of birds within the WEC structure but this scan be mitigated by careful design of the WEC to avoid possibilities of entrapment.
- Disturbance / displacement may arise due to noise during construction and operation of the WECs.
- Displacement may also arise due to birds avoiding areas with manmade structures and night lighting.
- Birds may need to navigate around multiple WECs but the impact is considered negligible for most devices unless they are located between breeding, foraging and/or roosting grounds.

5.4.8 Assessment Methodology Ornithology

Early consultation with National Parks and Wildlife Service (NPWS) will be undertaken to confirm sea bird data and obtain any updates to existing information. The CMRC will undertake a dedicated seabird survey at sea over a 12 month period to account for seasonal variability in distribution and abundance as follows:

- Nearshore waters: The neashore waters will be surveyed monthly following Gilbert et al (1998) from identified vantage points. The identification and location of birds using nearshore waters will be determined using theodolite stations and mapped to show their distribution in relation to proposed installations.
- Offshore sea area: CMRC will undertake seasonal boat-based seabird at sea surveys along a fixed track line within the study area. Methodology will follow the standard Joint Nature Conservation Committee (JNCC) Seabirds at Sea monitoring programme methodology described in Tasker et al (1984), and

updated by Webb & Durinck (1992). CMRC will provide qualified observers for the avian and marine megafauna components of the surveys.

The assessment of impacts will be made against the baseline data collected from specific surveys, historic and published information and mitigation measures required will be identified.

5.4.9 Appropriate Assessment

As there are a number of designated areas (see Table 2 above) within 15 km of the proposed WestWave project site locations Appropriate Assessment under Article 6.3 of the EU Habitats Directive will be made. A separate Appropriate Assessment Screening Report will be prepared and submitted together with the Foreshore Lease application.

5.5 Cultural Heritage

The preliminary cultural heritage baseline identified the west coast of Achill Island as being generally high in archaeological heritage with significant numbers of entries in the Records of Monuments and Places (RMP) in County Mayo. This is indicative of continued long term habitation and use of the area from ancient times There is therefore potential for impact on previously recorded and undiscovered cultural heritage in the area. This is particularly the case at potential site locations A, B and D where there is a higher risk of impact on unrecorded or undiscovered archaeology. Limited information relating to the marine environment exists from existing historic records and some potential exists fro impact on marine archaeology also.

5.5.1 Potential Effects

Possible impacts include:

- construction impacts upon previously recorded archaeological sites or features offshore and onshore; and
- construction impacts upon previously unrecorded archaeological sites or features offshore and onshore; and
- impacts during construction would arise from hydroelectric power plant site excavations and access road construction and horizontal directional drilling activities

There is less potential for impact in the marine environment as there are no recorded shipwrecks at the locations proposed for the project. However this can only be confirmed by onsite geo physical survey at the proposed final project location.

Potential impacts of maritime archaeological include:

- construction impacts upon previously unrecorded archaeological sites or features offshore; and
- impacts during construction can include both the potential impact of the WEC foundation installation, deployment vessel and of other construction vessels associated with the deployment and through installation of the water pipes.

5.5.2 Assessment Methodology

The assessment will be undertaken by a fully qualified and experienced archaeological consultant.

All cultural heritage site investigation works will be carried out in accordance with any licence issued by the Archaeology Unit of Department of the Environment, Heritage

and Local Government to undertake such works both in the terrestrial land marine environments

For the land based areas the study will include the following:

- Consultation with the Department of the Environment, Heritage and Local Government (DoEHLG), in particular with its Underwater Archaeology Unit (UAU);
- Record of Monuments and Places maintained by the Archaeological Survey of Ireland (ASI) on behalf of DoEHLG; a database recording all archaeological sites in Ireland known to the National Monuments Service established under Section 12 of the 1994 National Monuments (Amendment) Act;
- Record of Historic Monuments maintained by the National Monuments Service (NMS) on behalf of the DoEHLG;
- The acquisition registers and topographical files on archaeological objects held by the National Museum of Ireland (NMI);
- Historic Mapping Archive (HMA) held by Ordnance Survey Ireland (OSI); particularly the early Ordinance Survey Maps which are an unrivalled source of information for the period immediately following the Great Irish famine (1847-1850); and
- Archaeological interpretation of any geotechnical work undertaken in relation to the project, or of any geophysical, side-scan, bathymetric or diving surveys undertaken.

For the offshore areas,

- Relevant local Shipwreck Inventories and Ports and Harbour records will be examined; and
- Underwater archaeological surveys will be undertaken along the proposed water pipe routes and at the final WEC locations proposed.

The results of this work would be used to determine the exact location of any suspected wreck sites, with a view to establishing an appropriate mitigation package if required. In the marine environment identification of any cultural heritage will also be used to guide the final location of the WECs and pipe work to avoid impact.

An impact assessment will be undertaken based on comparison of the development footprint against the location and relative judged importance of the known archaeological resource.

5.6 Socio-economic

The main employment on Achill Island relate to local fisheries, agriculture and tourism. The proposed project will have some economic benefit to the area and both direct and indirect socio-economic impacts will occur form the project In general there will be short term economic benefits arising during the construction phase with some potential for longer term employment during the operational phase.

5.6.1 Potential Effects

The proposed developments may give rise to the following potential effects:

- Direct and indirect economic benefits resulting from employment and other contributions. Short term benefits will derive from temporary employment during the construction phase of the project. It is expected that during this

phase some skill transfer will occur in the area of marine works also. It is anticipated that there will be some longer term employment associated with the operation phase arising from maintenance requirements of the WECs and hydroelectric power plant.

- Disruption due to construction of the site on commercial fisheries and tourism and recreation activities (including temporary visual effects); The presence of construction vessels will disrupt local fishing activity at the selected site but this will be a very small area in comparison to the available resource.
- Operational effects upon commercial fisheries (safety zones around the WECs); Safety exclusion zones will be created around deployed WECs which would prevent commercial fishing activity at these locations. This will be necessary to avoid entanglement of fishing gear in the WEC structure or pipe work.
- The development may create a de-facto no take area which could benefit lobster fishing in the long term.

The potential impacts to fisheries will be dependent on the nature and type of fishing practices in the area and the potential mitigation opportunities. These will be considered during the assessment of impact on fisheries.

5.6.2 Assessment Methodology

For both the landfall and offshore components of the proposed development, a desk based assessment and consultation with key stakeholders will be carried out taking account of the following:

- socio-economic effects of the proposals, primarily related to any potential job creation or losses;
- proximity of the works to areas of recreational use, including public rights of way, and footpaths;
- proximity of the works to areas of interest for tourism;
- the effects of the project, both during construction and while in operation, on access to inshore and offshore fishing grounds, and recreational pursuits;
- the effects of any safety exclusion zoneboth during construction and operational phases on access to inshore and offshore fishing grounds, and recreational pursuits; and
- the experience gained from deployment of the Oyster WEC at Orkney and Lewis

Consultations will be undertaken with local fishing communities, surfers, leisure clubs and local communities coupled with a desk-based assessment. The impacts will be predicted with reference to published research where relevant, via consultations with relevant authorities and bodies, and through reference to other technical assessments relevant to the proposed development, e.g. the landscape, archaeological, navigation and biological assessments.

5.7 Transport

5.7.1 Potential Effects

The proposed development would take place at a location along the Atlantic Drive on Achill. Construction materials and equipment for the onshore works will be

transported to the selected site by road. This is the main tourist route along this part of the Island. Although the development is not expected to give rise to significant transport issues there will be short term impacts during construction and the following potential effects will be considered:

- short term construction traffic impacts upon existing traffic flows along National roads, Regional Roads, Local and unclassified roads in the local road network; and
- short term increased risk of road accidents resulting from increased traffic.

5.7.2 Assessment Methodology

A traffic and transport assessment will be carried out for the construction, operation and decommissioning phases of the proposed development by qualified and experienced assessors. Consultations will be held with the relevant local authority roads and transportation department and traffic surveys will be undertaken. The assessment will:

- identify access routes to be used to the site, particularly for abnormal loads;
- identify the increase in traffic numbers resulting from construction and operational phase;
- identify existing (baseline) traffic flows ; and
- identify potential environmental effects arising as a result of the changes to traffic flows, i.e. possible disruption or congestion, noise and air quality.

The capacity of the road network to accommodate the vehicles travelling to and from site will also be undertaken and any required modifications, e.g. road widening, will be discussed and agreed with the relevant roads and transportation departments.

5.8 Navigation

The development in the marine environment will take place in shallow water and there will be no anticipated impact on shipping routes which are located in deeper water further west (see section 3.7.1 above). Available VMS data (Section 3.7.2) indicates general fishing activity in the project area. Additionally smaller vessels (less than 15 m) typically used for lobster potting which do not have VMS but are known to use the project area (ESBI has held a consultation meeting with local fishing group).

5.8.1 Potential Effects

The potential effects that could occur include:

- Disruption of fishing vessels (trawling) using the area during the construction phase resulting from the presence of marine construction traffic. This will be very localised and is unlikely to cause significant disruption as the WECs will be located on a rocky seabed in relatively shallow water.
- Collision risk with construction vessels and other vessels using the area
- Collision risk with WECs and other vessels using the area

5.8.2 Assessment Methodology,

Offshore, effects upon vessels will be assessed, including the assessment of navigational safety issues. The assessment will:

- establish the baseline trends in navigation and use in the vicinity of the proposed cable and associated works using maritime traffic survey data and

research into the main types of vessel activity in the area, e.g. merchant, dredging, fishing and recreational vessels;

- review data relating to the location and operations of local ports, routeing measures, navigational aids, shipwrecks, other offshore infrastructure (e.g. oil and gas) and Metocean data (wind, wave, visibility and tide);
- identify the main shipping lanes that may be affected by the proposed development;
- assess potential effects upon navigation including disruption or restricted access, increased steaming times for vessels, interference with activities associated with the vessels, e.g. interference with fishing, sailing, dredging activities;
- assess potential search and rescue activities in the area; and
- undertake a collision risk assessment: and examine possible collision scenarios between different types of ships. For each scenario the probabilities of occurrence and the consequences will be assessed based on expert judgement.

The navigation risk assessment will be primarily based on:

- investigation of the existing environment;
- consultations with stakeholders, users of the area and relevant national authorities;
- Automatic Identification System (AIS) Data sourced from the Irish Coastguard;
- available VMS data; and
- consultations were carried out with all groups, organisations and agencies with a stake and/or interest in the waters off the west coast of Ireland, in particular the region off the Mayo coast.

The detailed method of assessment will be agreed with the Irish authorities prior to commencement and a semi-quantitative analysis of the traffic data in the area, based on 28 days of vessel traffic survey will be undertaken if required.

5.9 Air Quality

5.9.1 Potential Effects

Emissions of aerial pollutants will result from construction activities such as piling using jackup barges, WEC delivery and installation using tugboat and multicat vessels in the offshore works, and diesel-powered generating equipment, horizontal directional drilling equipment and construction traffic relating to the landside works. These will be localised and temporary in nature. Dust emissions during construction will also require consideration, although they are unlikely to be a significant issue for the landside works.

For the offshore works, air emissions will be distant from sensitive receptors, and are not anticipated to result in significant effects, and so will not be considered in the assessment.

The operation of the development is also considered unlikely to give rise to significant air quality impacts and so will not be assessed in detail.

The potential effects of the development on sensitive receptors are summarised below:

- Emissions from construction traffic along the local road network and on site leading to impaired air quality; and
- dust and plant emissions from the landfall works leading to impaired air quality.

5.9.2 Assessment Methodology

Construction traffic emissions will only be assessed where results from the transport and navigation assessment dictate that this is appropriate and would include if required:

- a desk top study of baseline air pollution levels for the study area;
- assessment of the potential air quality impacts of the existing road network on local air quality at specified receptors; and
- comparison of the predicted air quality impacts against air quality objective values to assess significance.

A qualitative assessment of the potential for construction plant emissions and dusts to be generated during construction will be undertaken.

5.10 Noise

5.10.1 Onshore Noise

The proposed project locations are located along the Atlantic Drive on Achill Island and are relatively remote with the nearest agglomerations of houses occurring at Dooega, Ashleam and Cloghmore. The existing terrestrial noise arises from these agglomerations, natural countryside noise, road traffic in the area and also by the background sea noise.

The main sensitive receptors with respect to the potential project locations are the dwellings located at Dooega for optional locations A and B at Ooghcorragaun, an isolated dwelling on the Atlantic Drive Road above site C (Claggan) and the dwellings at Cloghmore at optional location D (Doonnaglass).

In a similar study undertaken for the Atlantic Marine Energy Test Site background noise measurements at the Belderra area, Belmullet Co. Mayo were shown to be dominated by the ocean and wind noise .

5.10.2 Potential Effects Onshore Noise

The main source of noise associated with the project will arise primarily during the construction phase when earthmoving, transport vehicles, rock breaking and directional drilling is taking place. During the operation period there will be some noise from the hydroelectric power plant equipment and transformers and from occasional maintenance vehicles accessing the site.

Airborne noise can have an adverse impact on wildlife, human health and the perceived quality of life in a local environment, for example the tourist amenity value of the area could be reduced.

5.10.3 Assessment Methodology Onshore Noise

A qualified and experienced noise expert will be engaged to undertake a baseline noise study and subsequent noise modelling of the potential noise impact from the final selected site.

Suitable locations will be discussed and agreed with Mayo County Council prior to noise monitoring taking place.

Background noise levels of nearest sensitive receptors will be monitored. Noise propagation calculations will then be carried out, where required, using accepted acoustic calculation methodologies. For noise impacts resulting from construction operations on site, predictions will be made in accordance with relevant standards. In addition, noise source information will be sought from measured vendor data for the proposed equipment wherever possible.

Noise measurements will be taken in accordance with International Standards Organisation ISO 1996 – Acoustics – Description and Measurement of environmental noise. This standard does not set an upper limit to the windspeed in which measurements are taken, it requires the reporting of the windspeed at the time of measurement.

5.10.4 Offshore Noise

The Oyster wave energy converters will be located in shallow waters in a relatively high noise environment within 1km of the coast. It is highly likely that marine mammals and seabirds forage in this area given their presence in the wider area. No noise baseline in the marine environment currently exists.

5.10.5 Potential Effects Offshore Noise

In the marine environment many species of marine mammal use sound for detection of prey, communication and orientation. Potential disturbance could occur from any anthropogenic noise which falls within the audible range of a marine mammal and which exceeds natural background levels. This has the potential to disturb, and in extreme cases, severely injure any animal within the local area. Increase in noise levels could also mask biological acoustic cues used for hunting and social activity.

Noise from wave energy converters during operation is likely to be of low frequency and may therefore resemble underwater noise from offshore wind farms or slowly moving ship engines during operation. The potential impact from underwater noise of wave farms on marine mammals and fish during operation is likely to resemble effects from offshore wind farms, ship engines or offshore constructions. Such noise disturbance has not been shown to cause any significant harm to marine animals. In the marine environment potential impacts could occur during the construction and operational phases as follows:

- Avoidance of the area by marine mammals during the construction period mainly from piling activities.
- Avoidance of the area by marine mammals during the operational period due to the WEC noise signature.
- Avoidance of the area by marine birds during the construction period due to construction and vessel noise.
- Avoidance of the area by marine birds during the operational phase due to the WEC noise signature.

5.10.6 Assessment Methodology Offshore Noise

Noise baseline surveys will be undertaken at the selected site by a qualified and experience noise consultant. The experience and data gathered from the deployment and operation of the Oyster technology at Billia Croo in Orkney will be used in the assessment.

5.11 Water and Sediment

The proposed WestWave offshore project locations are within the Western Atlantic Seaboard Coastal water body (IE_WE_250_0000). The status of this water body has not yet been assigned by the Environmental Protection Agency due to lack of comprehensive data. However, the Atlantic Marine Energy Test Site Project is also located within this water body north of the current proposed site locations. Benthic surveys at the AMETS test site areas indicated that water quality was generally high to good based on the Infaunal Quality Index (IQI) Ecological Quality Ratio (EQR). Given the low level of man made activity in the general project site options. It is likely that water quality in the area is of good to high status.

There are no known current or historic sources of potential seabed contamination within or near to the project footprint area. The WECs will also likely be placed on rock areas with a very thin veneer of sediments which are subjected to constant change by wave action.

5.11.1 Potential Effects

Impacts on water quality are associated with:

- disturbance of seabed sediments leading to increases in suspended
- sediment concentrations or release of contaminants;
- pollution from accidental discharges; and
- drainage associated with onshore works.

Depending on the site selected some disturbance and re-suspension of seabed sediments during installation could result in increases in suspended sediment concentrations in the water column. This effect will be localised and of short duration and is not expected to result in any significant impacts on water quality. Therefore the this impact will be scoped out of the assessment.

In the unlikely event that leakage of pollutants occurs from vessels and equipment used during installation there would be potential for impact upon water quality. All vessels will be required to have an oil pollution control plan and to carry oil pollution control equipment. Crew will also be required to be trained in its use.

The Oyster technology uses bening internal fluids and hence impacts to water quality during operation will be limited should an accidental leakage occur. Some potential for impact from the use of antifoulants exists and will be addressed in the assessment.

Potential risks of water contamination form onshore construction works will be mitigated by good construction practice and design with particular attention placed on drainage control and management of materials storage areas.

5.11.2 Assessment Methodology

The assessment will be largely desk based with some additional data collection on water quality in the marine environment. Water samples will be taken coincident with the marine mammal at sea sampling. Guidance documents such as CIRIA

C584:Coastal and Marine Environmental Site Guide and the Scottish Environmental Protection Agency's (SEPA)'s Pollution Prevention Guidelines and the Irish EPA's Guidance Notes will also be reviewed with respect to potential impacts and mitigation measures

5.12 Cumulative Impacts

Cumulative impacts may arise resulting from a combination of other projects in the general area or from the project components itself. In the latter case for example scour protection and the WEC's themselves could create artificial reef structures or any exclusion zone around deployed WECs could create no take zones for fishing activity.

The location, nature, timing and extent of such other projects will be considered in assessing potential cumulative impacts particularly on marine mammals, coastal processes, fishing activities and other identified marine users. Activities which could generate cumulative impacts and which will be considered include other foreshore license applications and licensed operations in the general area.

6 ENVIRONMENTAL MANAGEMENT AND MONITORING PLAN

An Environmental Management Plan will be developed which will clearly set out key responsibilities of all stakeholders in relation to the proposed project including those of ESBI project partners and contractors engaged to deploy or construct project components. It will serve to integrate design, construction and operational activities ensuring a thorough understanding of all project aspects by all stakeholders. It will allow for ongoing review of the effectiveness of any mitigation measures proposed and will allow for the identification and implementation of any additional detailed mitigation measures that may be developed relating to specific impacts that were unforeseen and which may be identified,.

In consultation with key stakeholders, such as NPWS, a detailed Environmental Monitoring Plan will be prepared, which will set out key monitoring to be undertaken to monitor potential impact on the environment during all project phases and to provide a basis for corrective actions should these become necessary.

7 CONSULTATION RESPONSES

ESBI seeks a formal screening scoping opinion for the proposed pilot wave energy project to be located at Achill Island in Co. Mayo in order to inform any ensuing EIA. All responses should be sent directly to Paddy Kavanagh at the following address:

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Should any queries arise in relation to the contents of this report or the proposed scheme, the same contact details should be used accordingly.

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Appendix 1

Preliminary Ecological Site Assessment for the Proposed WestWave Project at Achill, Co. Mayo

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Appendix 2

Preliminary Cultural Heritage Impact Assessment of Proposed WestWave Project at Achill, Co. Mayo

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