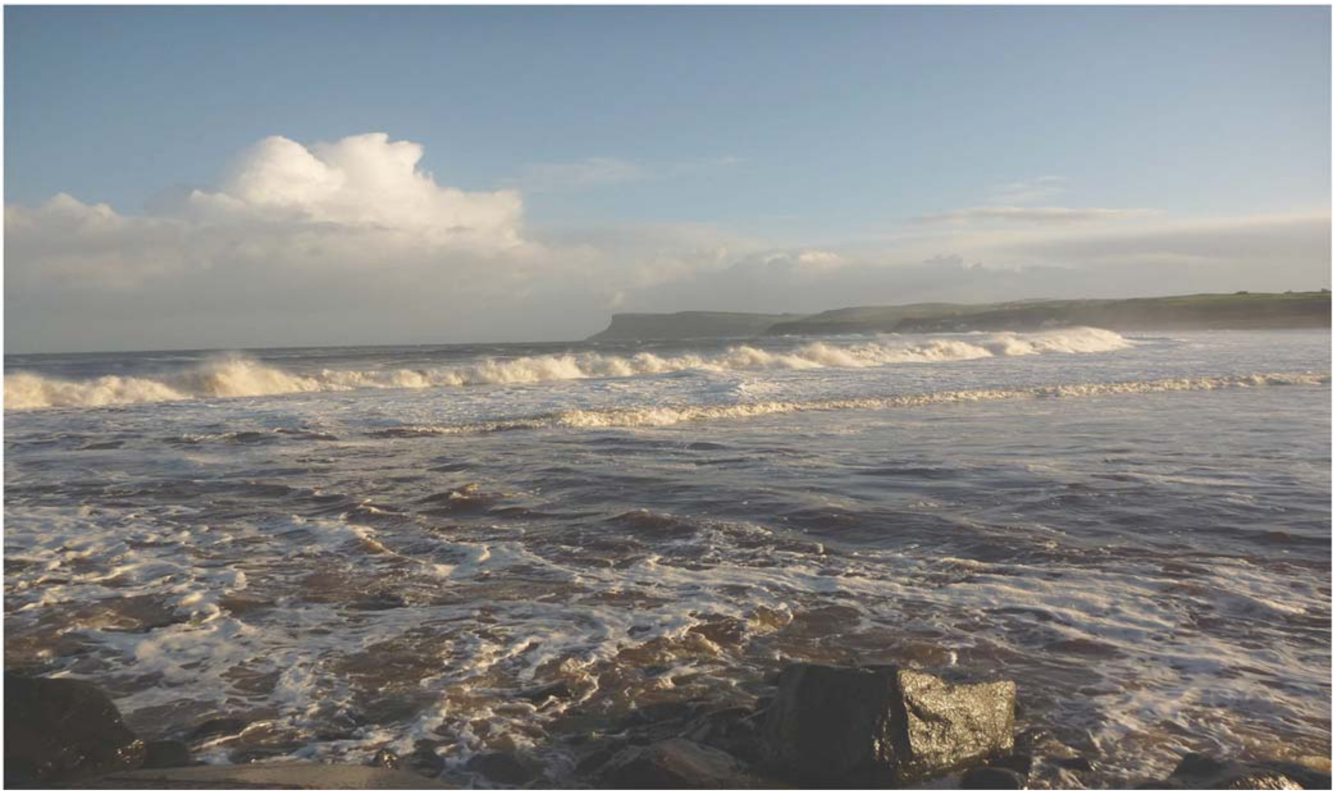
Fair Head Tidal Energy Park
- Consent Application -



Volume 1

Non-Technical Summary

Contents

Acronyms:

Term	Definition
AA	Appropriate Assessment
AFBI	Agri-food and Biosciences Institute
AfL	Agreement for Lease
AHH	Andritz Hammerfest Hydro
ALARP	As Low As Reasonably Practicable
ARL	Atlantis Resources Ltd
CCGBC	Causeway Coast and Glens Borough Council
CIA	Cumulative impact assessment
CIL	Commissioners of Irish Lights
DAERA	Department for Agriculture, Environment and Rural Affairs
DBE	DEME Blue Energy
DETI	Department of Enterprise, Trade and Investment
DfE	Department for the Economy
DoE MD	Department of Environment, Marine Division
DPME	DP Marine Energy
EIA	Environmental Impact Assessment
EMEC	European Marine Energy Centre
EPR	Ethylene propylene rubber
ES	Environmental Statement
ESAS	European Seabirds at Sea
EU	European Union
FHTEP	Fair Head Tidal Energy Park
FLO	Fisheries Liaison Officer

Term	Definition
FTE	Full Time Equivalent
GHG	Greenhouse gases
GVA	Gross Value Added
HRA	Habitat Regulations Appraisal
km	Kilometre
kv	Kilovolt
LCAs	Landscape Character Assessment
LAT	Lowest Astronomical Tide
LSE	Likely Significant effect
m	Metre
m/s	Metre per second
MCA	Maritime and Coastguard Agency
MCT	Marine Current Turbines
MHWS	Mean high water springs
MPA	Marine Protected Areas
MU	Management Unit
MW	MegaWatt
NIEA	Northern Ireland Environment Agency
NRA	Navigational Risk Assessment
NRP	Natural Research (Projects) Limited
O&M	Operation and Maintenance
ORESAP	Offshore Renewable Energy Strategic Action Plan
pMCZ	Proposed Marine Conservation Zones
PMF	Priority Marine Feature

Term	Definition
RSPB	Royal Society for the Protection of Birds
SAC	Special Area of Conservation
SCAs	Seascape Character Areas
SPA	Special Protection Areas
TCE	The Crown Estate
TECs	Tidal energy convertors
TVL	Tidal Ventures Limited
UNFCCC	United Nations Framework Convention on Climate Change
XLPE	Cross-linked polyethylene

1 Introduction

This Environmental Statement (ES) has been prepared by DP Marine Energy Ireland Ltd (DPME), on behalf of Fair Head Tidal Energy Park Ltd (FHTEP) which is a special purpose vehicle formed by partners DPME and Bluepower NV.

The ES is submitted in support of an application for consent for the 100 MW FHTEP Project a proposed tidal energy development, covering an area of approximately 4.2km^2, less than 1km off the North Antrim Coast in Northern Ireland (the "Project"). The scope of the application is all the offshore components up to the mean high water springs including the tidal turbines with their support structures and foundations, electrical hubs and all cabling works.

Excluded from the application are all onshore works above mean high water springs including onshore cabling works, new substation and connection into the existing Northern Ireland electricity network. These will be subject to a separate application.

This Non-Technical Summary (NTS) provides an overview of the Project, including a description of what FHTEP propose to build and information on the surveys and studies undertaken to inform the Environmental Impact Assessment (EIA) process. It outlines the key findings of the impact assessment, proposed mitigation measures to reduce or remove any impacts, together with plans for monitoring in order check any mitigated impacts are in line with those expected.

1.1 The Development & Tidal Energy

There is broad consensus amongst the scientific community that human activities continue to influence global climate change, resulting in increased instances of extreme weather events, rising sea levels, greater seasonal variations, floods and droughts. Such events are predicted to continue unless action is taken to address the high levels of greenhouse gases (GHG) emitted into the atmosphere. Marine renewables (wave and tidal) energy has the potential to play a vital part in the future energy supply. Wave and tidal offers benefits in terms of electricity generation that is free from emissions of carbon dioxide (the main GHG associated with global warming) and other pollutants.

At a global level, under the United Nations Framework Convention on Climate Change (UNFCCC) the Paris Agreement, which came into force on 4th November 2016, brings, for the first time, all nations into a common cause to undertake ambitious efforts to combat climate change. The Agreement's central aim is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius.

At a UK level, the Climate Change Act 2008, which extends to Northern Ireland, established a legislative framework for the UK to reduce its greenhouse gas emissions by 80% compared to 1990 levels by 2050.

In response to growing concerns on climate change related impacts, the European Union (EU) implemented a new Directive 2009/28/EC "On the Promotion of the Use of Energy from Renewable Sources". Under this, for the UK, 15% of all energy must be provided from renewable sources by 2020.

The Strategic Energy Framework for Northern Ireland (2010) and associated Offshore Renewable Energy Strategic Action Plan (ORESAP) (2012-2020) placed a national obligation on all electricity suppliers to provide 40% of their electricity from renewable sources by 2020. An aim of the ORESAP is that 300MW is generated from tidal resources in Northern Ireland by 2020.

The proposed tidal energy array at Fair Head together with similar renewable energy projects will contribute to achieving these targets. There are many similarities between tidal and wind energy technologies. However, importantly, the predictability of tidal energy can complement the intermittency (and unpredictability) of wind to help ensure the continuing reliability of UK electricity supplies, in addition to supplying a clean source of renewable energy.

This Project would be one of the first large scale commercial tidal arrays in the world, with the potential to create jobs and develop skills for both the local and wider Northern Ireland economy.

1.2 The Project Proposers

This application is submitted on behalf of FHTEP, a joint venture company established for the Project by DP Marine Energy Ltd and Bluepower NV. Background information about the two companies is given below.

1.2.1 DP Marine Energy Ltd (DPME)

DPME is one of a group of companies headquartered in Cork operating under the DP Energy name. DP Energy is a renewable energy and sustainable development specialist business which has been pioneering renewable energy projects for over 20 years, operating in sites across the world. In addition to its tidal interests it also has projects in wind, solar and energy storage.

To date, DP Energy has delivered 262MW of built projects, and consented a further 530MW. In addition the Group also has a pipeline of over 1000MW of renewable energy sites under development around the world, including an interest in 330MW of tidal energy projects.

1.2.2 Bluepower NV

Bluepower NV is a company established by DEME Blue Energy and Nuhma, both Belgian companies.

The dredging, environmental and marine engineering group DEME is an international market leader for complex marine engineering works with roots going back over 150 years. DEME has operated for many years in the offshore wind energy sector and has taken an active role in the development and construction of more than 3.7 GW of built wind projects in Europe.

In regard to tidal energy, DEME has gained direct installation experience as part of the installation team for the SeaGen device, the first commercial scale tidal turbine at Strangford Lough in Northern Ireland. DEME is now taking an active role in the installation of Phase 1A of the MeyGen tidal energy project, Scotland.

Nuhma works on behalf of the Limburg municipalities on sustainability, energy, and innovation through targeted investments.

1.3 Consenting Authorities

In October 2012 FHTEP entered into an Agreement for Lease (AfL) for the Project with the seabed owner, The Crown Estate (TCE). As this time the consenting authority for a Marine Licence was the Department of Environment, Marine Division (DoE MD) and consenting authority for Article 39 of the Offshore Electricity Development (Environmental Impact Assessment) Regulations (Northern Ireland) 2008 ('the EIA Regulations') was the Department of Enterprise, Trade and Investment (DETI). Several of the early steps in the process were administered by these departments including the provision of the Scoping Opinion in 2015 following the submission of a Scoping Report on which the fundamental EIA guidance for the site was defined.

The DoE MD became the Department of Agriculture Environment and Rural Affairs (DAERA) and DETI became the Department for Economy (DfE) with effect from 9th May 2016 and are referred to in the ES in line with that date, that is DoE MD before 9th May 2016 and DAERA afterwards.

1.4 Consultation

1.4.1 Statutory and Non-Statutory Consultation Meetings

Following the announcement that FHTEP were awarded an AfL, FHTEP contacted a number of statutory and non-statutory consultees at various times spanning a period from December 2012 to November 2016 to introduce and provide an update on the Project.

Regular steering group meetings (minimum of 2 per year) were held with DoE MD/DAERA and DETI/DfE and separate Project update meetings with The Crown Estate.

Specific consultation meetings for the following EIA topics were conducted:

- birds and mammals;
- commercial fishing;
- navigation workshops; and
- socio-economic.

A summary of these consultation activities and points raised are discussed in detail in each of the relevant impact assessment chapters.

1.4.2 Fair Head Tidal Project Website

A website (www.fairheadtidal.com) for the Project was launched in June 2014 including a Project, Environment and Development sections. Contact details for any general, Project or media queries are also made available on the website.

The display boards presented at the open days are also available for download on the website. The ES will also be available for download.

1.4.3 Public Information Events and Communication

Since the inception of the Project FHTEP have consulted locally with Moyle District Council and more recently the Causeway Coast and Glens Borough Council (CCGBC), local residents, local fishermen, councillors and politicians. Activities associated with the consultation process (generally listed chronologically) have included:

- monthly visits to undertake surveys: June 2013 to 2015;
- request for Scoping Opinion: December 2013;
- notification of intent to deploy ADCP devices: March 2014;
- letters to local stakeholders, councillor's and politicians: May 2014 and July 2016;
- notification of open days displays (newspapers): May 2014 and July 2016;
- dedicated Fair Head Tidal website: June 2014;
- sponsorship of local Rathlin Sound Maritime Festival: 20104;
- presentation to Causeway Coast and Glens Borough Council: Aug 2016; and
- meetings with various Politicians: Aug 2016.

1.4.4 Public Response and Sensitivities

The onshore infrastructure is not part of this application and works are ongoing on the onshore element of the Project.

Questions were asked of the potential visibility of turbines from the surrounding area. In response, a series of photomontages were on display during the open days in August 2016 for local review, details of which can be found in Chapter 14: Seascape and Landscape Visual Impact Assessment.

Potential issues on the fishing industry are separately dealt with in Chapter 12: Commercial Fisheries.

1.4.5 Post Submission Consultation

Following submission of the Marine Licence Application, notice of the application will be advertised in local newspapers in the Antrim area. A statutory public consultation period of 42 days will remain open to allow written representations on the Project to be made.

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

In addition, FHTEP will continue its communications with local marine users, the local community and wider public to keep them informed of the Project progress and key milestones.

1.5 Site Selection and Alternative

1.5.1 Site Selection Criteria

The selection of the Fair Head site has considered the following criteria:

- available resource;
- availability of seabed;
- technical and environmental constraints;
- social considerations;
- suitability for installation, maintenance and operation; and
- grid connection feasibility.

1.5.2 Technology Selection Criteria

The selection of suitable tidal technologies for the Fair Head site has considered the following criteria:

- sustainable, renewable form of electricity generation;
- technology maturity;
- suitability for the Fair Head site;
- commercial viability; and
- health & safety.

1.5.2.1 Fair Head Technology Selection

The preferred concept for the Fair Head site is an open rotor turbine. There are a wide range of systems for mounting open rotor turbines in the sea, ranging from fixed structures on the seabed to buoyant designs, which may be mid-water or fully floating on the surface.

Although most operational experience to date has been with fixed, seabed mounted structures, significant progress has been made more recently with floating devices.

Floating concepts potentially offer a number of benefits over fixed structures on the seabed including lower installation costs (through the use of smaller vessels/tugs), ease of access and the use of less material (eg. steel) relative to the amount of energy they generate. These factors potentially make them a more commercially viable proposition and able to compete with other, more mature, forms of renewable energy generation technologies. However, pending the outcome of further ‘real sea’ testing and operational hours, they have been excluded from the design envelope for the Fair Head project. Details on the proposed tidal turbine technology for the Project, including associated infrastructure, for which consent is being sought, is presented in sections 2.4 to 2.6 below.

2 Project Details

2.1 General

The proposed development comprises of the following:

- 100MW of Tidal Energy Convertors (TECs) or turbines which convert tidal energy to electrical energy;
- structures & foundations for securely holding the TECs in position;
- electrical hubs which will either be subsea or surface piercing for housing electrical collection and conversion equipment;
- intra-array cables to take the electrical energy from the TECs to the electrical hubs; and
- export cable(s) to shore to take the electrical energy collected at the hubs to the proposed landfall sites.

2.2 Project Location

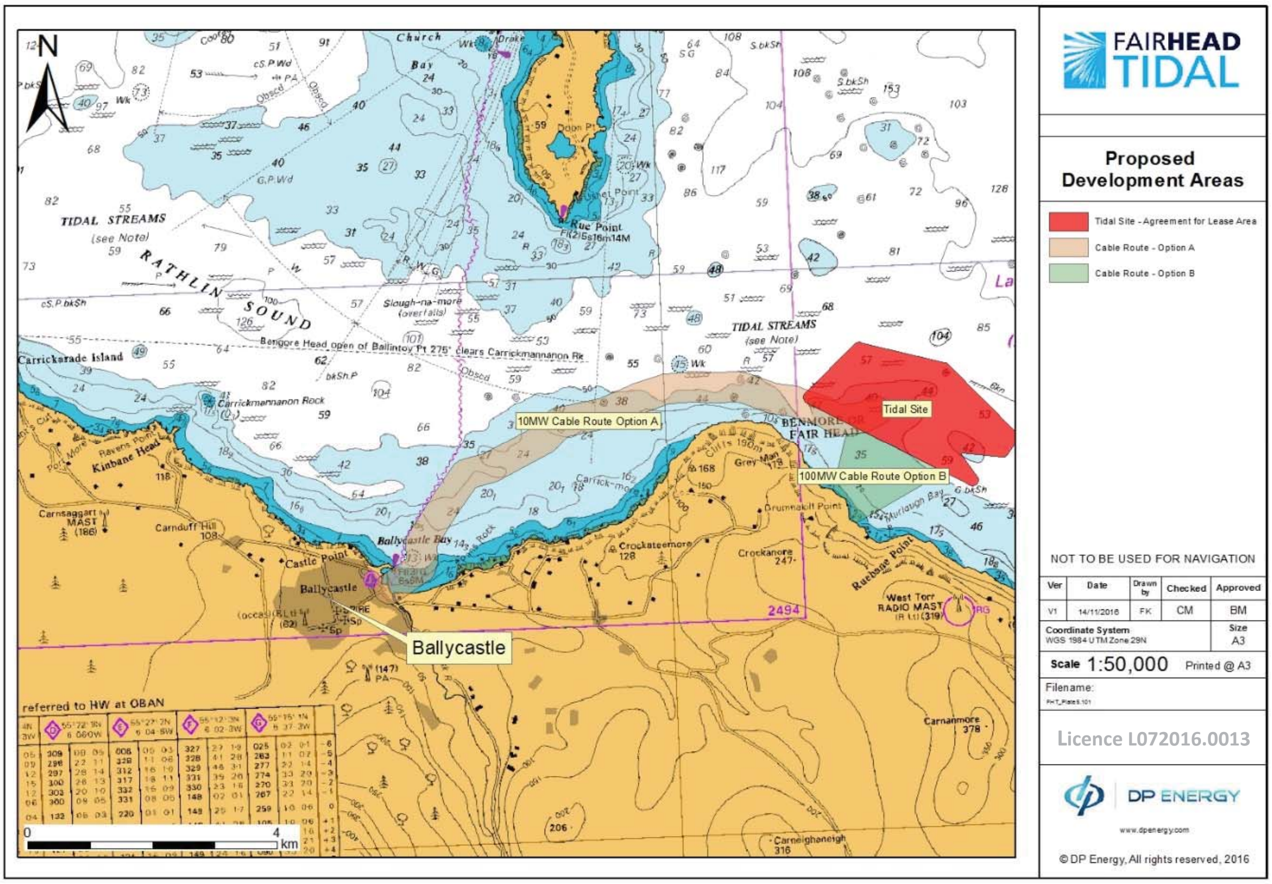
The AfL provides FHTEP with exclusive rights to seek consent for a tidal project on the site and, subject to securing the required consents for the installation and operation of the project from the regulatory authorities, take a long term lease over the seabed.

The AfL area is circa 4.2km^2 and is centred on latitude 55.230° and longitude -6.104°. It lies approximately 750m from the nearest point of its perimeter to landfall and is illustrated in Plate 1.1: .

In addition to the AfL area, the Project includes two potential marine export cable corridors, one to Murlough Bay and one to Ballycastle, for getting the power generated ashore, from where it will connect into the Northern Ireland electricity network.

The marine environment around Fair Head is noted for its strong tidal currents with the North Channel being at its narrowest between the Antrim Coast and the Mull of Kintyre. This constriction results in accelerated flows, compared with the open ocean environment, as tidal forces cause large volumes of water to be exchanged between the Irish Sea and Atlantic Ocean. This acceleration is further enhanced in shallower coastal areas, through channels such as Rathlin Sound and around headlands such as Fair Head.

Plate 1.1: Agreement for Lease (AfL) area (red) and cable route corridors (brown & green)



2.3 Design Envelope

Although tidal energy generation is not new, the technology intended for large scale extraction of energy from tidal streams and conversion to electricity is. There are a wide variety of designs under development including the TECs themselves and their support structures and foundations. A number of full scale devices have been deployed at test centres including the European Marine Energy Centre (EMEC) in Orkney and operational experience is being fed back into the design process. In order to accommodate this evolution of the technology a design envelope approach has been adopted for this consent application. This is to allow learning in four key development areas tobe captured in the time between consenting application and final decisions on the project design which could be a number of years away: technical, environmental, health & safety and commercial.

This approach is not dissimilar to an offshore wind farm development which would typically apply for consent for a design envelope defined by maximum rotor diameter, tip height and different foundation options etc., whilst excluding items that do not impact on the EIA such as turbine internal components (eg. generator, gearbox etc.). At this stage, the design envelope for a tidal project will be broader in scope than for a wind farm development as the latter is a more mature technology.

It would be impracticable to define an extremely wide design envelope which could accommodate all of the potential tidal energy options and their range of impacts within an

EIA. However, enough flexibility needs to be built into the EIA process to enable a sufficient range of devices and technologies to be considered for selection at the time of deployment.

In order to maintain flexibility, the key elements are selected and considered on a realistic “worst case” basis, each being appraised in relation to the various potential impacts and the required reasonable practicable remedial actions, if necessary.

As such, the key objective of the Project design envelope is to assess the potentially greatest environmental impact in each specific area whether visual, navigational, ecological etc. To this end a detailed list of characteristics was compiled and a comparative assessment of “likely greatest effect” was undertaken.

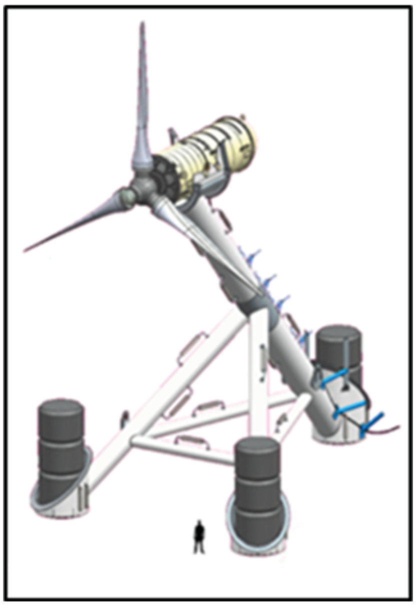
2.4 Tidal Turbines, Structures & Foundations

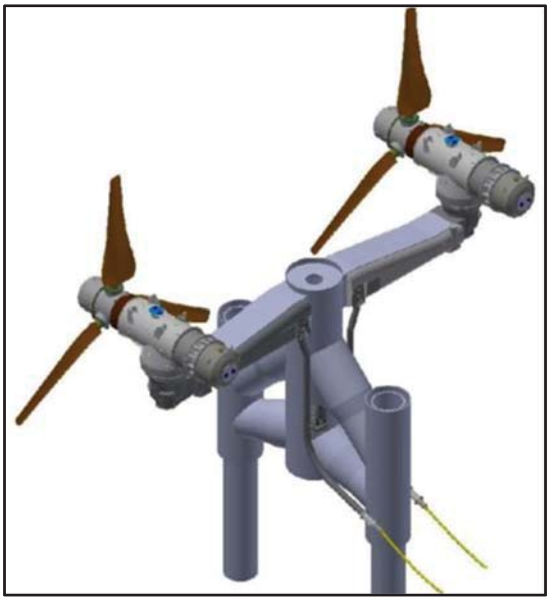
For the purposes of the EIA three different models of TEC have been evaluated in detail in order to provide a reference design envelope, as follows:

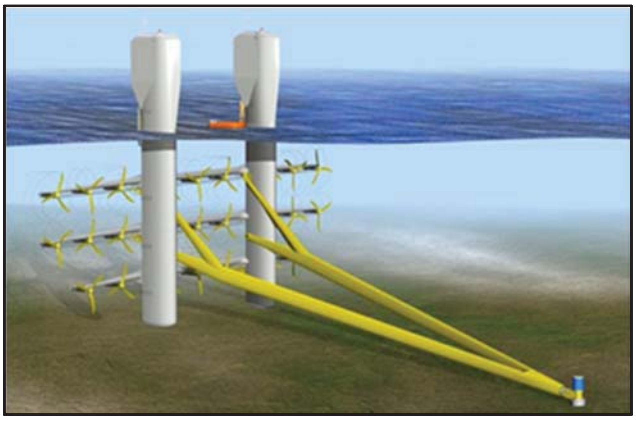
- Andritz Hammerfest Hydro (AHH) - 1.25MW TEC, developed from their European Marine Energy Centre (EMEC) commercial prototype. This comprises of a single rotor turbine with a diameter of 26m, mounted on a gravity based tripod type structure. The turbine rotates around the structure using an active yaw system to face into the tidal flow;
- Atlantis Resources Ltd (ARL) – Seagen 20U, a two x 1.5MW machine, developed from the Marine Current Turbines (MCT) Strangford Lough commercial prototype. This comprises of two single rotor turbines, each with a rotor diameter of 20m, mounted on a twin-monopile type structure which is fixed into the seabed; and
- Schottel Hydro - SIT III – 55kW TEC. In total 36 of these turbines are mounted on three cross arms on a twin-spar buoy structure to give a total output of some 2MW. The structure is free to rotate around a central pivot point on the seabed to align with the tidal flow. This pivot point may be mounted on either a gravity base or attached to a monopole fixed into the seabed.

These three devices differ in important aspects including rotor diameter and speed, configuration on their support structure and the support structure itself together with foundation design. They are illustrated in Plate 1.2: .

Plate 1.2: Andritz, Atlantis and Schottel TECs and support structure







2.5 Other Infrastructure

2.5.1 Electrical Hubs

Electrical designs and equipment are evolving for tidal arrays, and there are advantages and disadvantages with each of the options, which will be further evaluated prior to making a final decision for construction. The electrical hub would either be submerged or surface piercing, or possibly a combination of the two. It is likely that the electrical hub(s) will either be integrated into the same structure used to support TECs or mounted on its own standalone structure. It would be used to house electrical and control equipment, acting as a collection point for the cables from a number of TECs.

2.5.2 Intra-array and Export Cables

The choice of TEC, support structure and in particular whether a surface penetrating or entirely subsea approach is taken has a significant impact on the feasibility of cable configuration and connection options. For a technology with surface access (e.g. Schottel) the use of wet-mates may be eliminated entirely. For an entirely subsea layout the use of wet-mate connectors, with the associated subsea intervention/operations using specialist equipment, is expected to be significant. It is likely, however, that a combination of concepts may be employed, with for example dry surface piercing electrical hubs for energy collection and export to shore, with wet-mate "stab" connections between TECs and support structures to optimise maintenance operations.

Double armoured cable is foreseen to be used as it provides greater protection from possible damage and its weight aids stability, in a tidal environment, on the seabed. Double armoured cable typically consists of an inner armoured layer with steel wires of approximately 5mm in diameter surrounding the conductors, which would then be overlaid with a second layer of armouring with steel wires of approximately 7mm in diameter (Plate 1.3:). The cable insulation would be either cross-linked polyethylene (XLPE) or ethylene propylene rubber (EPR). The cable may also include auxiliary power cores and fibre optic links.

Plate 1.3: 3 core double armoured subsea cable

2.6 Array Configuration

Due to limited tidal array deployments to date there remains a degree of uncertainty in array design which will remain until more experience is obtained from commercial developments. Final array design would be undertaken post-consent and informed by a range of factors relating to health and safety, engineering criteria, environmental constraints, legislative requirements and economics.

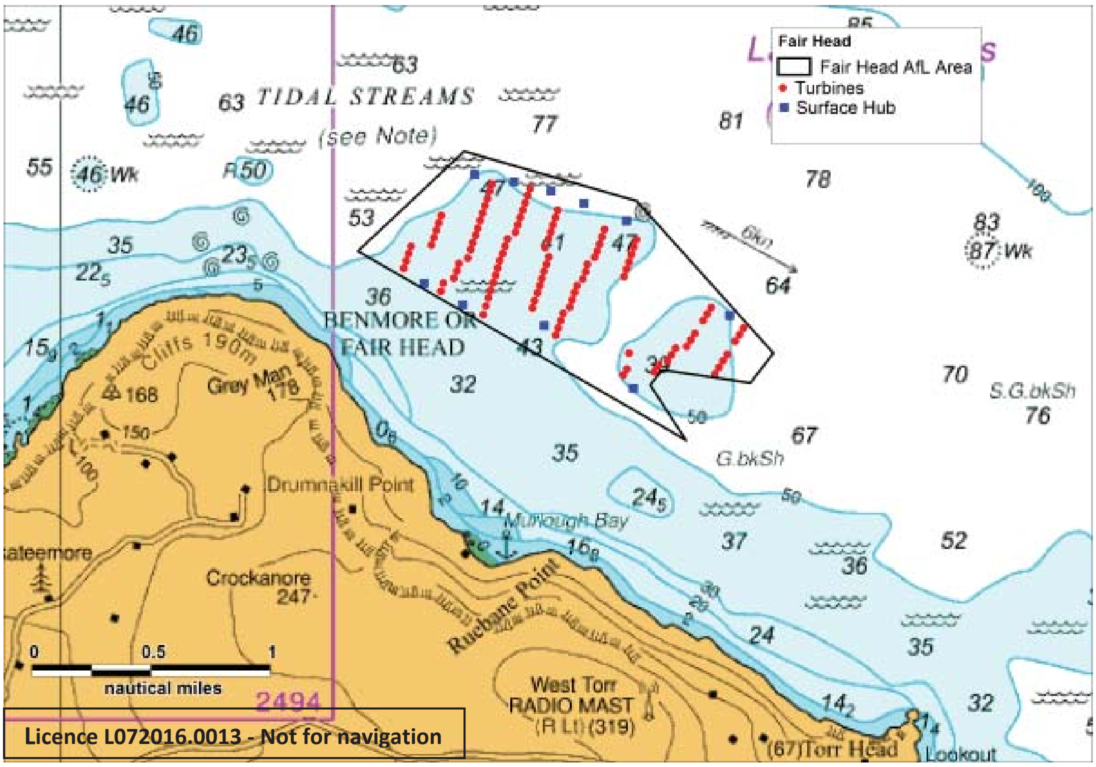
The approach taken within the array designs outlined in Table 1.1 emphasises the need for flexibility and thus specifying an array envelope that encompasses the likely greatest effect.

Table 1.1: Array configuration design envelope

Design Option	ARL -3MW Streamtec	1.25MW Andritz	1MW Andritz	2MW Schottel Triton	Surface piercing electrical hub	Subsea electrical hub
1a	34				10	
1b	34					10
2	30			5		10
3a	2	76			10	
3b	2	76				10
4	2	68		5		10
5a		80			10	
5b		80				10
6		72		5		10
7a			100		10	
7b			100			10
8			90	5		10

The indicative layout used for Option 7a is presented in Plate 1.4: . It is stressed that this layout is indicative only in terms of the project design envelope and the final layout could be a different mixture of subsea and/or surface devices.

Plate 1.4: Indicative Turbine Array Layout



3 Environmental Impact Assessment

The main focus of the EIA is to assess the potentially significant impacts of the Project on the environment. This requires input from a number of specialists with expertise in each of the environmental disciplines covered as part of the EIA in order to develop a detailed understanding of the baseline environment, establish the importance and sensitivity of that environment and evaluate the significance of any potential impacts.

Cumulative impacts are considered throughout the EIA process and have been considered for all phases of the Project. Consultation with DAERA has confirmed a list of other projects which, together with this Project, may result in potential cumulative impacts.

Results from the assessment of impacts on specific EIA topics and explanations on how conclusions were reached are summarised below in sections 3.1 to 3.12.

Information included in the EIA is also informed by results from the Project Navigational Risk Assessment (NRA) (Appendix 15.1 and summarised in Chapter 15 Shipping and Navigation). Potential effects of the offshore Project on sites of European conservation importance (Natura sites) have also been assessed through a Habitat Regulations Appraisal (HRA). The NRA & HRA, although subject to different legislative requirements form an integral part of the overall EIA process. A description of the approach to the HRA and collection of information to inform the Appropriate Assessment (AA) is also included in the HRA report (Appendix 4.2).

3.1 Physical Environment

Sediment transport along this region of coast is dominated by tidal processes. The side scan sonar data over a large proportion of the Project has been interpreted to be gravel with boulders. The sediment in these regions shows characteristics marked as gravel with cobbles.

The hydrodynamic modelling carried out by FHT allows the impacts of the array on current speed and direction to be quantified, and based on a review of regional sediment transport processes along this section of coast, the scale and impact footprint of this change is not significant enough to interrupt existing natural processes.

Water levels will not be affected by the development, apart from the immediate area of each turbine (and jack-up if used during installation).

Previous research on the effects of the turbines on waves indicates that the area of non-negligible change will be very localised (less than 100m from each device) and changes at the adjacent coasts will be below the uncertainty limits of measurement and modelling.

Suspended sediment due to cable trenching and pile installation will be dispersed rapidly over a wide area.

There are no predicted cumulative impacts with other existing or proposed developments.

3.2 Benthic

FHTEP and historic survey data sampled an appropriate range of potential subtidal habitats on the development site (including cable corridors). The results showed a mosaic of bedrock and stony reef habitats, typical of high energy environments where sand scour has a profound influence on biological assemblages. Sedimentary areas included coarse sands and gravels, mixed with cobbles; these areas were more limited than the bedrock and stony reef habitats. Some of the sedimentary areas showed larger scale bedforms (ripples), which are mobile and harbour a sparse faunal component. Within Ballycastle Bay, pockets of muddy gravels have also been identified, which harbour a greater faunal component.

The habitats identified and classified into biotopes harbour a number of Priority Marine Feature (PMF) species, but none of these fall into the Proposed Marine Conservation Zones (pMCZ) species list, and instead are considered to be adequately represented within existing Marine Protected Areas (MPAs).

In terms of habitats, two potential component (sub-scale) habitats of pMCZ habitats were identified in the region: brittlestar beds on coarse sands and cobbles, and circalittoral sand and gravel communities. These were most extensive within Ballycastle Bay, but are also widely recorded throughout Northern Ireland's inshore waters, with substantial areas of such habitats already protected through existing MPAs.

Bedrock and stony reef constituted the majority of the development area, which are EC Habitats Directive Annex I habitats, but are excluded from the pMCZ habitats list as these are high energy environment examples of reef which are not included.

All impacts have been assessed as not significant. These include potential effects during installation: the direct loss of benthic species and habitat; smothering from drill cuttings, displaced sediment and impacts from suspended sediment dispersion and deposition; and potential effects during operation: habitat change due to introduction of new structures; impacts to benthic species from cable electromagnetic fields and thermal radiation (heating of surrounding sediment and interstitial water).

3.3 Intertidal Ecology

A desk based review of available literature was carried out, detailing the ecology of the region around the proposed landfalls. The review of the existing information and data was used to develop an appropriate survey strategy for site specific characterisation for the two potential cable landfall sites, and to place the subsequent results in a regional context.

Site specific surveys, that included an intertidal biotope survey, were undertaken in September 2014. Intertidal habitat surveys were conducted to map biotopes approximately 500m either side of the proposed landfall. Following analysis of the data collected through baseline surveys at Ballycastle Bay, 18 intertidal biotopes were identified.

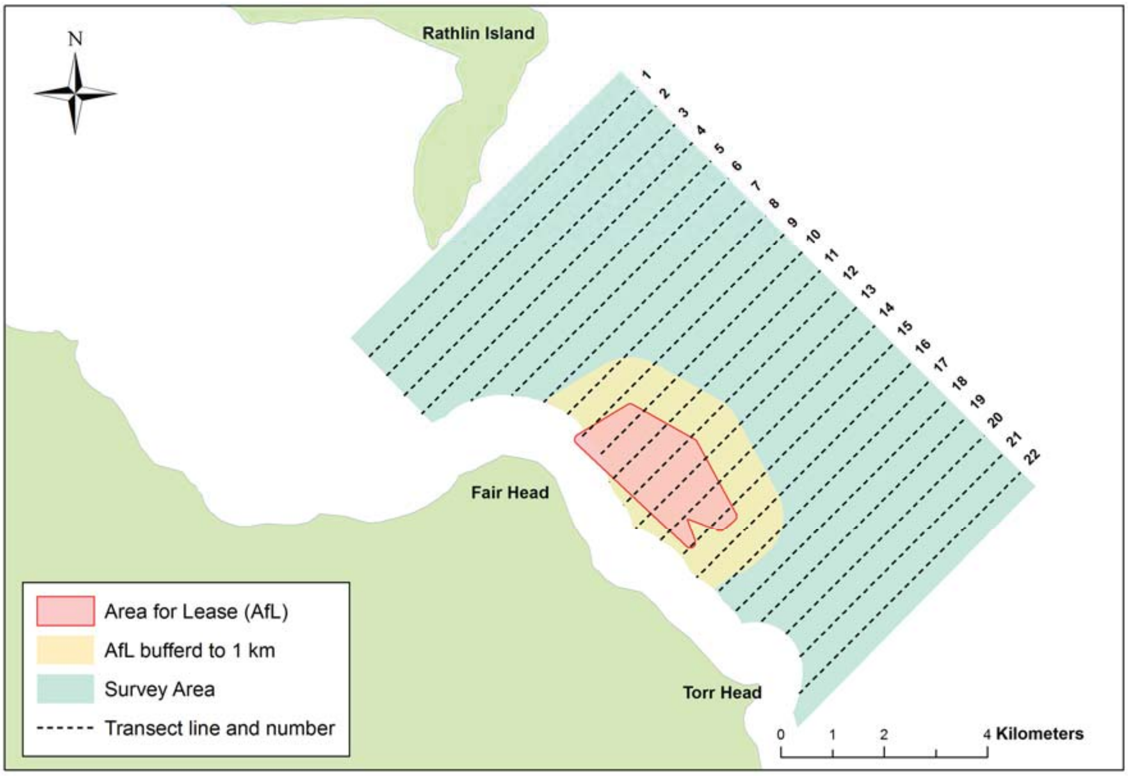
The potential construction and operational impacts on intertidal sediment communities and intertidal rocky communities, for both landfall options, were assessed as not significant.

3.4 Birds

The ornithology of the Project survey area (Plate 1.7) was characterised by undertaking a two-year programme of commissioned boat-based surveys following European Seabirds at Sea (ESAS) protocols. The surveys were conducted by Agri-Food and Biosciences Institute (AFBI) and Natural Research (Projects) Limited (NRP) between July 2013 and June 2015 and the methodology was discussed and agreed prior to commencement with the Northern Ireland Environment Agency (NIEA).

The ESAS surveys were complemented by shore-based vantage point watches of auk species conducted from Fair Head during the breeding season to provide additional information on diving behaviour.

Plate 1.5: Project Survey Area and transect layout



The results and analysis of the survey data concluded that five seabird receptors merited categorisation as medium priority for EIA and as such were subject to a detailed assessment of the impacts potentially arising from the Project. All other receptors were rated as low priority for EIA. The five medium priority receptors are the regional breeding populations of shag, common guillemot, razorbill, black guillemot and puffin.

The potential impacts of disturbance, displacement, direct habitat change, indirect changes to habitats and prey, collision risk and accidental contamination are examined in detail for all medium priority receptors. Although, collision risk is considered for all medium priority receptors, collision modelling was not required for shag and black guillemot because neither of these species is anticipated to be subject to a collision risk from the Project (Appendix 9.2). In each case, for the phases of the Project applicable, the potential impacts are shown to be of negligible magnitude. In all cases it is judged that these impacts would give rise to impacts of negligible significance under the terms of the EIA Regulations.

The potential for disturbance and accidental contamination to impact on receptors are minimised through a range of embedded mitigation and good practice vessel management measures.

Two receptors (breeding common guillemot and razorbill) merit examination of the potential for the Project to contribute, together with other development in the region, to a cumulative impact. In all cases it is judged that these impacts would give rise to cumulative impacts of low significance under the terms of the EIA Regulations.

The potential for the Project to affect the integrity of Special Protection Areas is examined in the Project's HRA report (Appendix 4.2). It is concluded that the Project in isolation and in combination with other marine projects in the region would not compromise the conservation importance for any SPA. It follows that the Project would not prevent the integrity of any SPA being maintained.

3.5 Marine Mammals and Basking Shark

The proposed FHTEP turbine array is predicted to have negligible or minor effects on marine mammals and basking sharks. The 24 month survey found that harbour porpoise was the principal species observed at the Project site, and suggested that harbour porpoise presence varied little between years. Grey seal, harbour seal, killer whales, and basking sharks were also positively identified within the area around the Project during the visual surveys. In addition, observations of common dolphin, bottlenose dolphin and at least one unidentified large whale were made while transiting to and from the survey, while minke whale was confirmed during additional shore-based vantage point seabird monitoring. Absolute density estimates from survey work using distance sampling methods could only be produced for harbour porpoise, generating an overall estimate of 0.251 porpoises per km^2. Results from the C-POD deployment supported the findings from the visual survey that harbour porpoise frequently used the proposed site and revealed that porpoise detections were more frequent at night and during autumn/winter months. In addition, detection probability was greatest during times when fast tidal flows could be expected. The baseline surveys were supplemented by other existing information, which supported the conclusion that harbour porpoises are the marine mammal species most frequently encountered at the Project site. Therefore, although other marine mammals relevant to the Project site (e.g. bottlenose dolphin, minke whale, grey seal and harbour seal) have been examined within this assessment of potential impacts of the Project, harbour porpoise have received particular attention.

Potential impacts on marine mammals associated with the construction, installation, operation, maintenance and decommissioning of the Project were assessed. The key impacts are identified as noise emissions during installation and operation, risk of injury to small marine mammals through collision with construction and maintenance vessels, and through potential for animals to collide with operating turbines.

During the construction, operation and decommissioning of the Project an increase in vessel traffic can be expected. This will lead to an increase in potential for interaction between marine mammals and the hulls of moving vessels and ducted propellers used for dynamic positioning. Relative to typical shipping levels in the area, the increase in vessel traffic will be moderate. New evidence concerning the source of 'corkscrew injuries' on seal species now suggests that these injuries are the cause of seal predation events, and not caused by the ducted propellers of vessels. However, until more data can be collected on the source of such injuries, appropriate mitigation should be considered to reduce the potential for vessel strikes and injuries from propellers.

Noise generated from vessel traffic, drilling activities and during the operation of turbines has the potential to disturb or cause injury to marine mammals. Pin-pile drilling activities are the only noise identified that could potentially cause impacts among high-frequency cetaceans (i.e. harbour porpoise) at very close ranges (<20m). During the operation phase the sound field produced by the array could be detectable from as far as ~8km from the centre of the Project site. This is equivalent to an area of approximately 134km^2. Within this area, it was estimated that a possible 0.2% of the harbour porpoise population from the West Scotland Management Unit (MU), 0.6% of the harbour seal population and 2% of the grey seal population from the Northern Ireland MU would be impacted by noise produced by activities associated with Project.

Encounter rate modelling undertaken revealed a large degree of variation across technology and siting options being considered for this Project, with associated variations in the relative collision risk to marine mammals, most notably harbour porpoise. Assuming an avoidance rate of 98%, the estimated encounter rates for the 'worst-case' tidal array scenario (Option 8) was unlikely to result in a >1% reduction in harbour porpoise, grey seal and harbour seal populations. Appropriate avoidance rates for marine mammal species are currently unknown and the evidence for high avoidance rates is based largely on a qualitative assessment supported by a small number of behavioural observations in addition to anecdotal evidence. Furthermore, the consequences of collisions are also unknown. Therefore, there is a requirement to work with regulators and stakeholders to update this assessment as new information becomes available on avoidance behaviour of marine mammals to this type of development.

After an initial review in the Project's HRA report (Appendix 4.2) four SACs were selected for further investigation. Both the South-East Islay Skerries SAC (harbour seal) and The Maidens SAC (grey seal) were considered to have low impact (connectivity in HRA terms) with the Project site. Therefore, it cannot be reasonably predicted that the Project would undermine the conservation importance of the qualifying interests identified within the SACs.

The proximity of the Skerries and Causeway SAC and the Inner Hebrides and the Minches cSAC, both designated for harbour porpoise, means that connectivity must be assumed. For understanding impacts on the qualifying species (i.e. harbour porpoise), the impacts of the project on the wider population was made assuming a large degree of mobility in SAC populations. The environmental footprint of the Project is geographically distant from the boundaries of the SAC supporting habitats. Furthermore, no significant effects on the prey items are predicted to result as a consequence of the Project. Therefore, no direct effects resulting from the Project were identified which would impact either the population or supporting habitats within both designated sites.

3.6 Fish Ecology

The main focus of the fish ecology assessment was to consider impacts on important fish habitats, such as key spawning or nursery grounds which are essential for sustaining fish populations and potential impacts on individual fish species and their contribution to local biodiversity and wider food webs. The assessment considered impacts on the following fish groups:

- pelagic species;
- demersal species;
- elasmobranch fish species; and
- diadromous fish species.

The potential impacts assessed, during construction and operation, included: smothering, habitat loss, noise impact, collision risk, habitat modification, electromagnetic fields (EMF), barrier to movements and accidental contamination. No significant impacts were identified with respect to impacts on natural fish.

In the Project's HRA report (Appendix 4.2) the North Channel was identified as a migration route for Atlantic salmon from SACs located to the south of the Project area (west and south coast of UK and east and south east Ireland). Although there is a large number of SACs located to the south of the AfL area, based on the results from the assessment, it was concluded that the Project will not have any effects on SACs where Atlantic salmon is a qualifying interest.

3.7 Commercial Fisheries

The impacts of the Project on commercial fisheries were assessed. To quantify spatial and temporal variation, commercial fisheries are described both at the local level and at the wider regional level in order to provide context to the baseline and impact assessment.

Data was obtained from a range of sources to inform the commercial fisheries baseline, including consultations with local fishermen. However, due to concerns amongst fishermen with sharing potentially sensitive data on commercially important fishing grounds in the public domain, specific information on effort levels and landings from within the Fair Head AfL Area remains limited.

For the purpose of informing the impact assessment, it has therefore been necessary to characterise commercial fishing activities based on available sources of statistical data such as landings and effort data held by DAERA. Where appropriate these data have been supplemented by anecdotal information gathered during consultation with individual fishermen and from the Fisheries Liaison Officer (FLO).

The potential impacts assessed, during construction and operation, included the following:

- temporary displacement from traditional fishing grounds;
- long term displacement from traditional fishing grounds;
- temporary obstruction to regular fishing vessel routes;

- long term obstruction to regular fishing vessel routes;
- temporary change in abundance and distribution of target species; and
- long term change in abundance and distribution of target species.

With respect to temporary displacement from fishing grounds, although no significant impact has been identified, due to the safety aspect of this impact the following mitigation measures have been provided on a precautionary approach to ensure this remains the case:

- FHTEP will hold discussions with local marine users in advance of any works commencing to review procedures associated with the construction stage to ensure that they address local concerns as far as possible;
- fishermen will be notified of the schedule works taking place, location of safety zones and partially installed infrastructure, which will involve the appointment of a FLO; and
- for surface piercing devices, partially installed infrastructure will be marked and lit appropriately.

It was concluded from the impact assessment that the only potential for significant impacts is associated with the long term displacement of fishermen from fishing grounds within the AfL area. Therefore, in order to minimise these impacts, the following mitigation measures will be put in place. These measures are based on recognised industry good practice and focus mainly on engagement with local fishermen during all phases of the Project:

- FHTEP will support the setting up of a fisheries working group;
- all on-going consultation and liaison to be carried out in line with FLOWW Best Practice Guidance for Offshore Renewables Developments: Recommendations for Fisheries Liaison (January 2014); and
- other standard measures to be implemented in accordance with recognised industry best practice with regard to navigational safety including Notices to Mariners, notifications of location of safety zones etc. in appropriate publications and use of navigational aids including lighting where required.

Even with the implementation of the mitigation measures outlined above, there will still be long term displacement of local fishermen from fishing grounds within the AfL area. The purpose of the mitigation measures, in this case, is not to assume the impact won't occur but to try to work with local fishermen in a proactive way in order to reduce the overall impact that long term restrictions to these fishermen might have on local fishing activities in the Fair Head and wider North East Antrim coast area.

3.8 Marine Archaeology and Cultural Heritage

Archaeological receptors may be buried within seabed sediments or may rest upon the seafloor, either with or without height. As such, direct impacts to these receptors can occur during any development or related activity that makes contact with the seafloor or cuts through seabed deposits. Archaeological receptors with height, such as wrecks, may also be impacted by development or activities that occur within the water column. Indirect impacts may occur as a result of changes to prevailing physical processes caused by the project. In general, archaeological receptors exposed to marine processes will deteriorate faster than those buried within seabed sediments inducing an adverse effect.

During the construction phase, , direct impacts to the marine archaeology and cultural heritage may be caused by the use of embedment anchors, clump weights and chains and the installation of physical equipment such as TEC support structures, cables and subsea substations.

During the operation and maintenance phase, physical impacts to marine archaeology and cultural heritage receptors may be caused by anchoring service vessels to the seabed and certain maintenance operations such as the repairs to cables.

Potential indirect impacts arise when direct impacts have effects beyond their primary footprint and can affect archaeological sites or material some distance away. Indirect impacts can include changes to erosion patterns, sediment transport, currents and water quality during installation, caused by the direct impacts listed above.

A total of fifteen submerged archaeological features were identified, six of which were classified as P1s (features of probable archaeological interest) and nine of which were classified as P2s (features of possible archaeological interest).

The following measures are designed to mitigate any predicted adverse effects upon submerged prehistory receptors from direct impacts:

- adopt the Protocol for Archaeological Discoveries: Offshore Renewables Projects for the duration of the Project; a system for reporting and investigating unexpected archaeological discoveries encountered during the course of the Project; and
- if archaeological material is recovered during any proposed borehole or vibrocores sampling, corresponding logs and samples of interest should be assessed by a suitably qualified marine personnel.

Following the implementation of the above mitigation measures, the residual impact is assessed as not significant.

A total of twelve anomalies of possible archaeological interest were identified. The following measures are designed to mitigate any predicted adverse effects upon submerged prehistory receptors from direct impacts:

- any further archaeological work will be detailed in advance the Project starting;
- avoidance of geophysical anomalies is recommended in the first instance;
- preservation by record (i.e. archaeological excavation and recording prior to an impact occurring) is recommended for offsetting disturbances to archaeological sites or material where preservation in situ is not practicable. Sites that have been destabilised, but not destroyed, may be re-stabilised and subject to detailed analysis; and
- adopt the Protocol for Archaeological Discoveries: Offshore Renewables Projects for the duration of the Project.

Following the implementation of the above mitigation measures, the residual impact is assessed as not significant.

3.9 Seascape and Landscape Visual Impact Assessment

The identified Seascape Character Areas (SCAs) and Landscape Character Assessment (LCAs) (refer to Figures 14.3 and 14.4 in the ES) enabled an understanding to be formed of the inherent value and importance of separate seascape and landscape components; the processes that have created features such as field patterns, coastlines and settlement forms; and the processes that may alter seascape and landscape character in the future.

The assessment of effects on seascape and landscape character concluded that during the construction phase, there will be no significant change in seascape or landscape character. This is due in part to the limited views of the construction area, the method of construction that is proposed to be used and the existing character of the seascape/landscape in which construction activity will be seen.

Effects on visual amenity during the construction phase will predominantly be due to the movement of the jack-up vessel, which will be most noticeable from areas extending from Fair Head to Torr Head, where construction activity will be an apparent feature within view. From coastal locations further to the west, including Carrick-a-rede and from Rathlin Island to the north west, any construction works are predicted to be a noticeable, although due to distance, not a prominent feature of views.

Effects on seascape and landscape character during the operational phase of the Project are predicted to be most significant from locations within close proximity to the site.

Effects on seascape and landscape character are predicted to be most significant from within SCA 8 – Torr Head. From this SCA, the surface piercing hubs will form a defining feature that will partially alter the underlying character of the SCA and which may result in the sense of remoteness that is experienced. Effects are considered to be significant. From other SCAs and LCAs effects are not predicted to be significant or adverse. From these areas, effects following construction of the Project will not be direct, or be to the extent that any changes to character of the seascape or landscape will result in a fundamental change to the elements that currently define their character.

It is predicted that any significant effects on visual amenity following construction of the Project will be restricted to areas within and immediately surrounding Murlough Bay. From this location, the combination of local topography and distance to the surface piercing hubs will result in the Project becoming an immediately apparent feature and focal point to views.

From other locations assessed, including Fair Head (viewpoint 5) it is predicted that due to a combination of the scale of the receiving seascape/landscape, screening by topography and distance to the Project from sensitive viewpoint locations, effects on visual amenity are not predicted to be significant. It is considered that the Project can be incorporated into the view without changing the characteristics that define them.

Due to the sub surface nature of the adjacent Torr Head tidal development, there will be no cumulative effects on seascape/landscape character or visual amenity.

It is predicted that there will be no significant effects on landscape character or visual amenity from the statutory and non-statutory designations, plus from any driving, cycling and walking routes that have been assessed. This is due to the limited areas from where the views of the Project will be available from and also the scale of the receiving seascape/landscape.

Effects on seascape and landscape character, plus effects on visual amenity during the decommissioning phase will be similar to those experienced during the construction phase of works.

As noted in table 1.1 a number of design options for the surface piercing hubs, all extending 20m above the surface water, have been considered. These included electrical hubs mounted on monopole type structure, or jacket type structure, with and without supporting bracing above the water line.

It was considered that the monopile and jacket type with support bracing above the water line represented the 'worst case' options in terms of effects on seascape/landscape character and visual amenity and the latter option has been illustrated in the photomontages (refer to figures 14.6 –14.11). The final design will be subject to further engineering studies and site surveys. There is scope to provide further mitigation through the design of the final surface piercing structure (eg. curved roof), finishing colours (subject to any navigation marking requirements), and potentially final layout of the tidal array and the location of the surface piercing structures within this.

The significance of effects on landscape/seascape character and visual amenity may however reduce, if following final turbine selection a shorter hub height is selected. Any reduction in the significance of effects on visual amenity is likely to be greatest from VP4 – Murlough Bay, where currently effects are considered to be significant.

3.10 Commercial Shipping and Navigation

A Navigation Risk Assessment was carried out in-line with the Maritime and Coastguard Agency (MCA) guidance for such assessments. This included baseline data collection to obtain information on the vessel activities in the vicinity of the Project, comparing seasonal vessel information and radar data, visual surveys, desk-based information and consultation with local stakeholders / experts.

During the winter survey there were nine transits through the Fair Head AfL area, of which five were cargo vessels, three fishing vessels and one was a workboat. In the summer period, there were 93 transits through the AfL area, the majority by recreational vessels followed by passenger vessels and fishing vessels.

The potential hazards to this vessel activity posed by the Project were assessed based on consultation, a Hazard Review Workshop involving a cross-section of local stakeholders, and quantitative risk modelling. By applying standard industry practice and additional, project-specific mitigation identified during consultation and at the Hazard Review Workshop, all of the risks were assessed to be either broadly acceptable or tolerable (As Low As Reasonably Practicable (ALARP)) with mitigation.

The quantitative modelling results indicated the allision and collision risks are moderate, at an estimated one additional incident in 86 years based on current traffic levels. This was based on the worst realistic case design option for navigation, comprising 100 underwater turbines at a minimum of 5m below Lowest Astronomical Tide (LAT) and 10 surface hubs aligned in two rows.

Further consultation will be carried out with key stakeholders such as the MCA and Commissioners of Irish Lights (CIL), to confirm the final layout is within the design envelope assessed, with further risk reduction in the design where possible, and that risk control measures, such as marking and lighting, are implemented appropriately.

3.11 Recreation and Tourism

The overall level of offshore recreational activity is considered to be relatively low and the main use being for recreational crafts transiting the AfL and the surrounding area.

There are likely to be impacts on recreational sailing, sea angling and sightseeing tours during construction of the Project. There would likely be exclusions during the construction phase that would require recreational, sea angling, diving and sightseeing vessels to avoid the site. This would be a short term and temporary impact and would not be significant.

Some recreational and tourist activities may be affected temporarily during cable landfall operations, e.g. disruption of access, noise. Disruption to tourists and recreationists (e.g. walkers) may occur during cable landfall operations but this expected to be minimal. Cable landfall activities would be undertaken outside periods of peak tourist and recreational activity, where possible, and would be small scale and of a temporary nature and therefore not significant.

An area of around $4.2km^2$ will likely be out of bounds for recreational sea angling which could be compounded by the nearby TVL project. However, much of the coastline in the study area would remain open for this activity and therefore the impact of the Project on sea angling is not considered to be significant.

The development may provide a small scale positive effect on tourism, through acting as an additional topic of interest. This could have a benefit to the community as the increase in visitors to the area, although small, would provide a boost to the local economy.

3.12 Socio-Economics

The majority of socio-economic impacts from the Project are positive. This is true nationally, regionally and locally. Nationally, it is estimated that 340 temporary jobs could be created during the Project's construction and 75 full-time equivalent (FTE) jobs created, per year, during its operation, for the full scale (100MW) Project. There is potential for up to 51 temporary jobs to be created in the Causeway Coast and Glens Borough Council (CCGBC) region during the Project's construction and up to 30FTE jobs per year created in this region throughout the operational phase of the Project.

There is potential for construction of the Project to result in a GVA impact of up to £12.5million at the national scale, with £1.9 million being attributed to the regional economy. Over a 25 year operational phase a GVA impact of £69.8 million in NI and £27.9 million in CCGBC is estimated.

The consultees within the assessment were all supportive of the Project and some were willing to consider using their resources to help mitigate any issues. There will be an impact to local fishermen operating in the area. However, there is also potential for significant benefit to fishermen through the ability to use their vessels and seamanship to contribute to the Project’s construction and O&M activities. FHT will set up a working group for local fishermen to discuss potential compensation/mitigation measures.

There would be a lasting benefit from the Project in whichever area the construction or the O&M base is located; these benefits will be larger in the more rural and remote areas and there will be significant business opportunities for the supply chain from the Project.

The Project fits into the national aspirations as well as regional and local economic development strategies and climate change reduction and renewable energy generation targets.

4 Environmental Monitoring

The first tidal turbine arrays in the world are only just being built and commissioned, and there is therefore limited operational experience, mainly from individual (test) device deployments upon which to base aspects of assessment. Where devices have been operating and potential environmental interactions have been monitored, the results to date indicate no significant adverse environmental impacts (Strangford Lough for example). However, it is appreciated that the potential interactions of an array of devices is to some extent unknown, and pending operational data from the early arrays, assessments must be largely based on data for single devices together with expert judgement based on knowledge of potential receptors and current understanding of the potential effects of single devices extrapolated to encompass an array.

In the developing tidal energy sector, research and environmental monitoring works are either on-going, or planned, at a number of locations in the UK and internationally. In this evolving climate, there is no significant benefit to proposing detailed monitoring plans, the details and premise of which may require considerable revision in the light of new knowledge expected post consent.

An Environmental Monitoring Plan (EMP) will be developed through discussion with the regulatory authorities to ensure that the purpose of the monitoring is agreed; that objectives are set according to consensus on the ability to detect change attributable to the development; and that this is considered according to a reasonable cost / scale of studies, proportionate to the level of risk identified. This will be programme defined over an appropriate timescale, with defined reporting intervals.

5 Conclusions

The Environmental Impact Assessment (EIA) has been carried out by FHTEP in accordance with relevant EU, UK and Northern Ireland regulations and has robustly assessed the potential environmental impacts of the Project.

The EIA has assessed the worst-case scenario that would have the greatest effect on the environment. This approach results in a maximum impact assessment, and should provide confidence to the consenting authorities, and the Project stakeholders, that the environmental impact will be no greater than that which is set out within the Environmental Statement and, in fact, may be considerably less.

Prior to construction of the commercial 100MW project, it is expected that significant operational experience will be available from demonstration arrays in UK waters, potentially including an up to 10MW array at Fair Head, and further afield, and possibly one at Fair Head. This experience will feed into the final design for the 100MW array.

The Fair Head Tidal Energy Park represents an important development step for tidal stream technology in terms of the scale of development and in the transition from prototype technology and demonstration arrays to full commercial development. The development of marine renewables is a key energy objective for Northern Ireland and the Project represents a key part of the Northern Irish and UK renewable energy strategies.