

TIDAL ENERGY Limited

DeltaStream Demonstration Ramsey Sound, Pembrokeshire



**Scoping Report
November 2008**



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1.0 Introduction

1.1 The Proposed Development

Tidal Energy Limited (TEL) is proposing to develop a prototype demonstrator tidal stream project in Ramsey Sound, off the Pembrokeshire coastline, West Wales. The project will comprise of a single DeltaStream device with a nominal installed capacity of 1MW, deployed for 12 months, at the following site; 51° 52' 40" N and 05° 19' 34"W. At this stage a limit of deviation of 200m from this location is proposed to allow for micrositing once detailed survey work has been carried out.

The project will also include the provision of a sub-sea cable, a small onshore package control room/substation and associated electrical infrastructure works to allow connection to the local distribution network. The ancillary onshore components of the project will, however, be limited in extent as TEL intends to utilise the existing infrastructure associated with the St Justinian's lifeboat station, to minimise potential impacts.

Figure 1 shows the proposed location of the prototype demonstrator project and proposed subsea cable route.

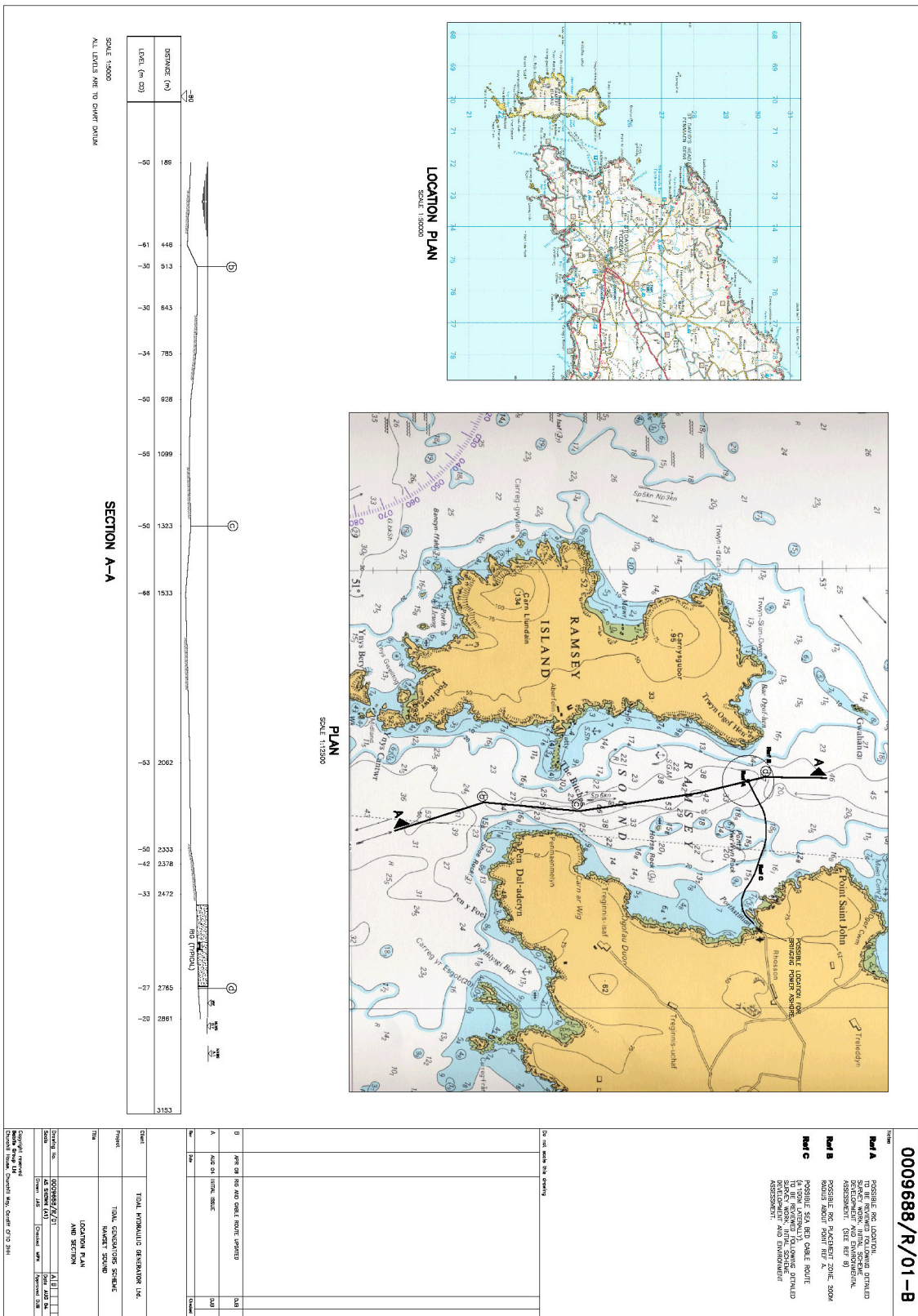


Figure 1 – Proposed location of DeltaStream and cable route

1.2 The Developer

TEL is a privately financed company located in Cardiff. It was set up by a group of marine engineering and renewable energy experts, to develop DeltaStream, an innovative technology designed to generate electrical power from tidal stream resources.

TEL has secured the support of Eco2 Limited (“Eco2”), an experienced developer of renewable energy resources. TEL has also obtained support and investment from Carbon Connections UK Limited (CCUK), who support projects that are designed to make a measurable reduction in carbon emissions.

To date the company has filed two patents for the DeltaStream technology; the first for its structural arrangement and deployment/ retrieval method and the second for a unique blade design. The first patent ensures the stability of the device at all lifecycle stages, as well as ease of deployment/retrieval. The patented blade design enables the turbine to automatically shed excess power. This both avoids damage to the turbine from excessive peaks in tidal flow and permits consistently high energy conversion from within the optimal band of flow.

The company has an experienced management team, whom has significant expertise within the marine engineering and renewable energy industries. Team members have successful track records on numerous projects; including ports and harbours, biomass, hydropower and onshore and offshore wind.

1.3 Objectives of the Development

The UK energy policy focuses on two important issues; tackling climate change and ensuring security of supply. The UK has thus set itself a domestic target of reducing the UK’s carbon emissions by 80% by 2050 and aims to achieve 15% of energy sourced from renewables by 2020. This target is in addition to the EU target of sourcing 20% of the EU’s energy from renewable sources by 2020.

The UK is also committed to securing energy supply, to ensure that the UK does not become dependent on one supplier or technology. Therefore tidal stream technology can play an important role in the development of renewable energies in the UK, with the ability to produce 5% of the UK’s electricity from this source alone.

In Wales, the Welsh Assembly Government (WAG) has published its commitment to meeting the UK energy goals. Technical Advice Note 8 (2005) and the Renewable Energy Routemap for Wales (2008) highlight the importance of renewable energy in Wales and states that support should be given to renewable energy projects. The Renewable Energy Routemap for Wales further highlights that by 2025, the potential of marine renewable projects in Wales could be more than half of Wales’ current electricity consumption.

Tidal stream flow is a sustainable, predictable source of renewable energy. The use of DeltaStream technology can play a significant role in reaching the UK’s target for reducing carbon emissions and contributing to the UK’s energy mix that will ensure security of supply.

In order to commercialise DeltaStream’s innovative technology a full size prototype needs to be tested in real situation for a set period. TEL considers a 12 month period to be long enough to allow sufficient testing to be carried out. The Assessment of Performance for Tidal Energy

Conversion Systems guidance recently issued by Department of Business Enterprise and Regulatory Reform (BERR) will be used to guide the testing protocol.

After the 12 month test period the device, offshore cable and onshore package control room will be removed. Improvements to the local distribution electricity network will remain.

1.4 Site Selection

Ramsey Sound has been selected as the site for the deployment of the DeltaStream demonstration. The site has been chosen as the best available site after careful consideration of a number of options.

Initially a report produced by ABPmer, on behalf of TEL, identified a number of locations in the UK that could be potential sites for the DeltaStream prototype. This screening process was based on the available tidal resource and constraint issues that included, but were not limited to, water depth, navigation, grid connections and environmental issues. Potential sites short-listed included the European Marine Energy Centre (EMEC) test centre in Orkney, Pentland Firth and Pembrokeshire.

TEL considered deploying the DeltaStream device in EMEC which is the only established offshore test centre in the UK. There are a limited number of berths at the test centre but all have either been leased out to, or earmarked for other developers. As a result there is at least a 3 year wait to locate at EMEC. This timeframe does not meet the time requirements of TEL.

Pembrokeshire was seen as a viable site for the deployment of the DeltaStream demonstrator prototype based upon the tidal stream resource and the water depths that are available. In addition TEL has a strong community link with Pembrokeshire. In fact the DeltaStream device was first conceived with the support of the Pembrokeshire Coast National Park (PCNP) to design an environmentally sensitive device. In 2001 PCNP funded the trialling of the DeltaStream device in the Cleddau Estuary.

In addition the region is particularly focused on renewable energy with the City of St David's as a main focus. St David's has a well established Energy Group which is working toward St David's becoming a renewable city. The installation and commissioning of the prototype DeltaStream device in Ramsey Sound will demonstrate that the community can achieve its goal, as the unit will generate enough electricity to feed approximately 800 homes.

Results from the ABPmer report and final site selection will be detailed further in the Environmental Statement (ES).

2.0 Consents and EIA

As part of developing a site within the UK, TEL will be required to obtain a number of consents before development commences. Those required are summarised in the following sections.

2.1 Device Consents

TEL intends to seek consent for the following consent permissions:

- Section 5 Food and Environment Protection Act (FEPA) 1985 Part II
- Section 34 Coast Protection Act (CPA) 1949
- Safety Zone under the provisions of the Energy Act 2004
- Conservation (Natural Habitats, &c.)(Amendment) Regulations 2007

Subject to the actual installed capacity of the prototype and the potential requirement for navigation rights consent under Section 36 of the Electricity Act 1989 may also be required.

2.2 Onshore consent

It is not intended that the onshore works to the grid network will require any consent either by TEL or the local electricity distribution company, Western Power Distribution (WPD). Should a new length of overhead connection be required this would be included and assessed in the ES and consent would be made under Section 37 of the Electricity Act by WPD.

TEL intends to locate a package control room/substation onshore and cable to the existing electricity infrastructure in the vicinity of the Royal National Lifeboat Institution (RNLI) base at St Justinians. The onshore substation will be a non permanent structure, similar to the size of a container, see Figure 2. The exact location of the container has not been confirmed but it will be located either on the foreshore beneath the cliffs or on the headland. As the substation structure will be present for a period of 12 months a planning application will be made to Pembrokeshire Coast National Park under the Town and Country Planning Act.



Figure 2 – Standard Package Control Room intended to be used in Ramsey Sound project.

It is intended that the package control structure will include interpretative display boards explaining the tidal stream concept and demonstration project including environmental issues.

2.3 Environmental Impact Assessment (EIA)

The project will produce electricity and will be connected to the local distribution network. Under UK legislation any development that generates electricity in the sea must carry out an Environmental Impact Assessment (EIA). The EIA is defined under the Environmental Impact Assessment Directive (97/11/EC) and has been interpreted into the Town and Country Planning (EIA) (England and Wales) Regulations (1999). The proposed project and supporting documentation will also take into consideration the requirements of the Habitats Regulation (Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora). Within the ES a Test of Significance and, if necessary, Appropriate Assessment will be provided.

The ES, which reports the findings of the EIA process, will also accompany the formal application for consent under Section 5 of FEPA (1985) and Section 34 of CPA (1949) consents. The level of detail produced in the ES will follow the DTI guidance on consenting arrangements in England and Wales for pre-commercial demonstration phase of wave and tidal stream energy devices (marine renewables, 2005). Here it states:

*“In view of the current stage of industry development and the importance of marine renewable energy to future renewable energy generation and therefore the environment, it is essential that devices and their impacts are understood in a timely and efficient manner. It is therefore essential that the demonstration phase be allowed to commence expeditiously where appropriate. **Projects will only be required to provide levels of data for EIA and Habitats Regulations, as applicable that are proportionate to the perceived risk and scale of adverse impacts.** Where potentially greater impacts are identified, assessment requirements will be more rigorous, and any mitigation measures and monitoring requirements will be more onerous. It will be important for a dialogue with stakeholders to be maintained during the life of the projects to enable proper assessments of the data gained.”*

It is appreciated that the site selected for the one-year trial is European Designated and is particularly sensitive with respect to marine mammals. However, as discussed in Section 1.4, the origin of the device was for it to be “environmentally sensitive”, and significant design effort has gone into meeting this objective. As part of the EIA that will be undertaken for the project, marine mammal interactions and the potential effects on designated species and habitats will be assessed.

2.3.1 Structure of the Environmental Statement

The ES will be prepared in discrete chapters in order for the complete picture to be presented for each individual subject area. The preliminary chapters will set the scene for the project. Subsequent to this an overview of the proposed development will be provided. This information will be for both the offshore and the onshore components of the project, and will include construction and deployment/retrieval details.

The main body of the ES will cover the key environmental subject areas likely to be affected by the construction, operation and decommissioning of the proposed demonstrator tidal energy device. The environmental subject areas have been determined through consultations with statutory and non-statutory consultees as well as from guidance documentation. Further details on this can be found in Section 3.0.

Each subject section will consider the environmental impacts of the proposed development and will evaluate the potential impacts that may occur as a result of the project. Within each environmental subject area a methodology for the assessment will be presented. A description of the baseline environmental conditions will then be provided followed by an assessment of the effects of construction, operation and decommissioning. Subsequent to this mitigation measures and monitoring will be discussed where appropriate. A summary of the results of the

assessment, highlighting, the significant aspects, both positive and negative, will be presented within the conclusions.

2.3.2 Cumulative Effects Assessment

The EIA Directive and the various interpretations express the need for EIA to consider the potential cumulative effects that a proposed development may have on the existing and reasonably foreseeable environment. At present there are no marine renewable projects or other developments of similar nature in the area.

However, E.ON has proposals to install a tidal stream farm in 2011 up to 8MW, within the general area. The final location of this farm has yet to be finalised and there are ongoing surveys in the area to determine a suitable site. In addition to this Wave Dragon has submitted an Environmental Statement (Wave Dragon website) for the development of a 7MW demonstrator device at a site off Marloes Sands. This is located approximately 20km to the south of this DeltaStream project past the Deer Park/Marloes Peninsular and therefore no cumulative impacts are anticipated. No other renewable energy projects or other offshore energy installations are proposed in the area.

There are plans for a new RNLI base to be built south of the existing RNLI facility. The construction of the new RNLI facility may coincide with the deployment of the DeltaStream project in spring 2010. Close communication with RNLI will be held throughout the project.

The potential cumulative impact of the EON tidal energy device and the new RNLI facility in conjunction with DeltaStream will be assessed where appropriate within the ES.

2.3.3 Non-Technical Summary

At the start of the ES a Non-Technical Summary will be produced detailing the key aspects of the project in non-technical language. This will also be provided as a separate A4 leaflet, which can be provided in response to enquiries both within the local and wider area. This would meet the requirements of the Aarhus Convention and the proposed Directive COM (2000)839 amending the EIA Directive which indicates the importance of the dissemination of information to the public.

3.0 Scoping Document

This scoping document has been prepared to document both potential sources of data and key issues that will be addressed during the EIA and reported in the subsequent ES. The scoping study comprised site visits, initial consultation, identification of data sources and clarification of survey requirements with relevant statutory consultees. The document identifies possible environmental effects of the project throughout its life cycle, from installation to decommissioning and will highlight the proposed studies/surveys that will be undertaken to support the EIA process. The surveys that are outlined throughout the document will be carried out to ensure that robust data is collated, but the scale of the surveys will be in keeping with the scale of the proposed development, namely a 12-month demonstrator prototype project.

In order for the reader to gain a better understanding of the proposed project and its potential effects, information is provided on DeltaStream, with respect to its scale, the deployment techniques, and the onshore ancillary requirements. Subsequent to this details are given of the proposed site and its designations, in particular with respect to the Habitats Directive. At this stage those features that will not be affected by the proposals are “scoped out”. More detailed information about DeltaStream, the designation and this “scoping out” stage will be provided within the ES.

The scoping document then goes on to identify the subject areas that will be assessed in the EIA process, the data sources and additional data collection requirements. A summary table is then presented showing the potential impacts that will be assessed within the EIA. Finally where specific subjects are not included, justification will be provided in the relevant section.

The document should be used by all Consultees to comment on the proposed project and to agree the scope of EIA required in support of consents for the proposed development.

4.0 Project Description

4.1 DeltaStream

The DeltaStream concept was first conceived in 2001 with the support of Pembrokeshire Coast National Park (PCNP). PCNP required an innovative project that would generate sustainable electricity and would also be environmentally sensitive with respect to the marine ecology. TEL believes this has been achieved through the design of the DeltaStream device. The device is non intrusive and the rotors rotate slower than other tidal stream devices which allow marine animals to avoid them.

Further advantages of DeltaStream are that there are no requirements for permanent foundation structures associated with its deployment. In addition, vegetable based oils and other benign fluids will be utilised in the nacelle. With the limited advanced works required for its deployment, the cost of electricity produced per kW is highly competitive with other renewable projects.

4.1.1 Device Description

DeltaStream is made up of three individual horizontal axes turbines, positioned on a single triangular frame approximately 30m wide (Figure 3). The concept of the triangular frame is that it produces a low centre of gravity. This enables the device to satisfy its structural stability requirements including the avoidance of overturning and sliding. To hold the device on the seabed a gravity base concept is used, whereby no positive anchoring or seabed drilling is required. This allows ease of deployment and retrieval, thus limiting the time a vessel is required to be on site, thereby minimising potential disturbance to the surrounding area. Installation can be carried in deep water without the need for divers, remote operating vehicles and jack-up barges.

The base technology utilised in this project is the experience and expertise previously developed by Tidal Hydraulic Generators Limited. This includes the results of the full size sea trial in 2001, which was sponsored by PCNP. The data from the sea trial was subsequently correlated using computational fluid dynamic calculations by Cardiff University and was also used for structural design analysis by Jacobs. The proven principals behind this early work form the basis of the design technology of DeltaStream.

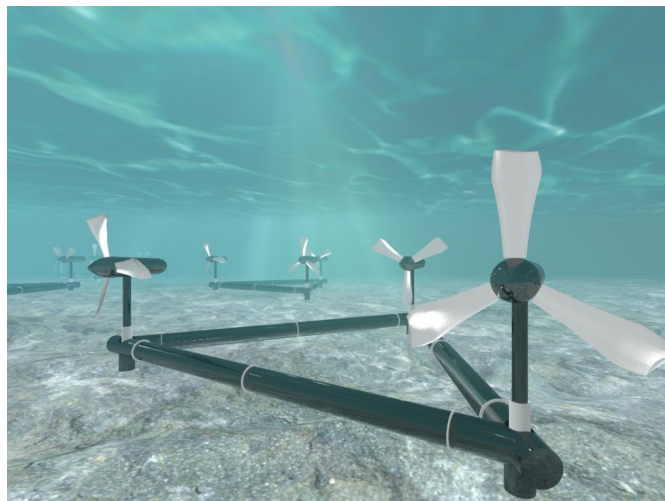


Figure 3 – Artist Impression of DeltaStream Farm. The Ramsey Sound Project will deploy only one of these DeltaStream Units.

Table 1 below, summarises the key design components of DeltaStream.

Table 1 – Summary of DeltaStream Device.

Component	Description	Material
Foundation	30m wide 2m diameter	Steel Circular hollow section
Vertical Support	1m diameter	Steel Circular hollow section
Nacelle(s)	4m long x 1m diameter	Steel Circular hollow section
Hub	3m diameter	Steel
Blades	5 to 6m long Fixed Pitch	Carbon or glass reinforced Fibre
Total height of device	Sea bed to blade tip 18.5m	
Blade Clearance to seabed	Minimum 3.5m	
Cable connection box		Filled with Midel
Onshore substation	12m x 2.6m x 3.3m (w x d x h)	
Transformer	3m x 4m	
DeltaStream Device	250 Tonnes total dry weight	

4.1.2 Installation

Throughout the design process of DeltaStream, installation has been a key concern, and the device has been designed for ease in this area. It is proposed that installation of the DeltaStream demonstrator will take place during spring 2010.

TEL will commission a Crane Barge with deck capacity >500 Tonnes and a dry lift weight of 250 Tonnes to undertake the installation process.

All device components will be delivered to Pembroke Dock for assembly. Post assembly, the commissioned barge will transport the device to the trial site where it will be deployed around slack water.

As part of the installation process it will be necessary for a mooring chain to be deployed. This chain will support the sub-sea cable for ease of “cable to device” connection (further details of the cable can be found in Section 4.1.5). As such it will be necessary for two concrete blocks to be deployed on the seabed. These will act as anchors for the chain and cable during deployment and they will be removed during device decommissioning following the 12month testing period. A further 3 or 4 temporary anchors will be required to support the Crane barge during the installation and removal operation (for approximately 1 week).

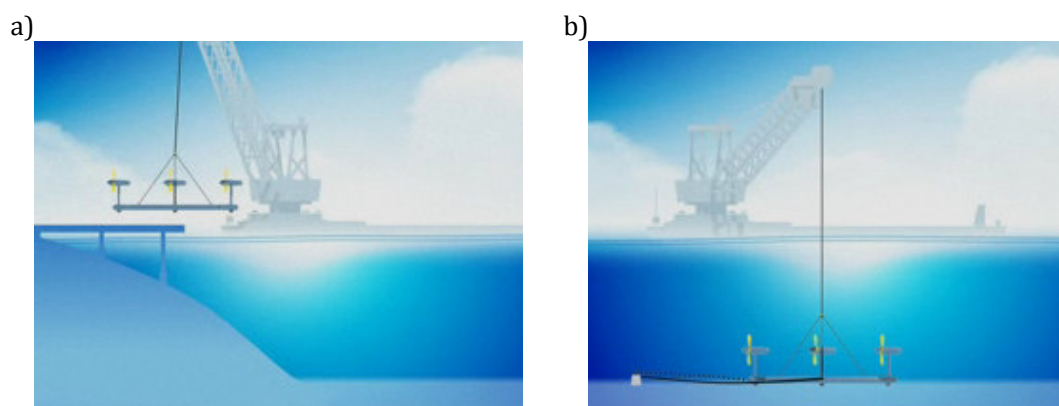


Figure 4 – Installation Process. The crane barge lifts the device (assembled on quayside) by its lifting bridle (a) and mobilises to deployment site, where it is connected to the cable and positioned on the seabed (b).

4.1.3 Operation and Maintenance

During operation, DeltaStream will use the kinetic energy from the tidal current to rotate the turbine blades. This in turn causes the rotation of the gear hub and generator.

Each turbine will have the ability to yaw itself to face the rotor into the tidal flow. This ensures that each turbine is maximising its power output by utilising the tidal current both on the ebb and flood tides. Each turbine has its own control system (sited within the nacelle), which ensures that safety is maintained and each turbine is working to its desired capacity.

During operation two concrete blocks approximately 3mx3mx3m will be required to sit on the seabed, either side of the device. These sinkers will anchor the lifting bridle, cable and mooring chain, taut on the sea floor, as described in Section 4.1.2.

For the prototype demonstrator project, the use of at least one marker buoy (identified through consultation with Trinity House and MCA) will be considered, to aid in the retrieval process.

Maintenance of the device is simple if required. The retrieval of the entire device uses the reverse method of installation. Each nacelle can be maintained or replaced either on the deck of the lifting vessel or at the quayside, and the device can be re-deployed with minimum downtime.

4.1.4 Decommissioning

DeltaStream has been designed to make decommissioning simple. Disconnection from the cable will be undertaken first, followed by the lifting of the device. As no seabed fixing is used to deploy the device, during decommissioning, the crane will simply connect to the device and a straightforward lifting manoeuvre will be undertaken. This method will follow the same process as for maintenance retrieval.

As there is no positive anchoring system involved with the project, there will be no permanent features left on the seabed once the device, anchors and cable have been removed.

4.1.5 Cables

A single industry standard, 3phase double armoured sub-sea cable with fibre optics will be utilised for this project. The cable will connect to the device and will be positioned on the sea floor. The exact cable route will be confirmed once further survey work has been undertaken. It is anticipated that for the duration of this project no trenching will be required and the cable will rest on the sea floor. Should appropriate ballast, anchors or fixings be required to hold the cable to the sea floor, this will be considered by TEL, and further details will be provided in the ES.

It is proposed that the cable will land fall at the St Justinians RNLi base. The proposal is to fix the cable to the underside of the RNLi ramp, located approximately 1.2km from the proposed deployment site. There will, therefore, be no impact on the intertidal and cliff zones, both of which are designated under the St David's peninsula Site of Special Scientific Interest (SSSI).

4.1.6 Onshore Works

A single package control room/substation enclosed within a steel container (approximately 12m x 2.6m x 3.3m) will be positioned either on the foreshore at St Justinian's or on the top of the cliff. The substation will be connected to the local distribution network at this point. The existing 11kV single-phase network is not suitable for this project and as such the existing network will need to be upgraded. This will be achieved by the replacement of the existing wires, which are currently in use. There will be no need for any new poles or long lengths of overhead lines. WPD has been contacted in this respect.

4.1.7 Markings

At least one buoy will be considered for the demonstrator prototype. The type of buoy that will be considered will depend on the outcomes of discussions held with the Maritime and Coastguard Agency (MCA) and Trinity House. Those that may be required are:

- Notice to Mariners
- Safety Zones
- Surface Buoy (in accordance with IALA Buoyage system)
- Marking on navigational charts

4.1.8 Benefits

The ES will include a section to assess the benefits of the project both in terms of power generated and emissions saved by the test rig and the potential environmental and socio-economic benefits of future development of DeltaStream technology. This will include reference to planning policy and government aspiration in this sector.

4.2 Site Location

The deployment site will be located within a limit of deviation of 200m radius from 51° 52' 40" N and 05° 19' 34" W. The cable route also identified in Figure 1 has been chosen with a +/- 200m limit of deviation corridor. Confirmation of the exact location of the device and the cable route will be identified in the ES once further site surveys have been undertaken.

4.2.1 Designations

The proposed deployment site in Ramsey Sound is covered by the Pembrokeshire Marine SAC (Figure 5). The marine SAC covers an area of approximately 138,070ha, extending from the coast north of St David's around to Manorbier beach in the southeast and extends 1 to 4km offshore. As such it encompasses a wide range of the habitats and species of conservation significance. Those that have been identified for the designation of the region as a SAC are highlighted below:

Habitats (Annex I) and species (Annex II) present that are primary reason for site selection:

- Large Shallow inlets and Bays
- Estuaries
- Reefs
- Grey Seal (*Halichoerus grypus*)
- Shore dock (*Rumex rupestris*)

Habitats (Annex I) and species (Annex II) present as qualifying feature, but not a primary reason for site selection, are:

- Atlantic Salt Meadow
- Mud-Flats and Sand-Flats not covered by sea water at low tide
- Coastal Lagoons
- Submerged or partially submerged sea caves
- Sandbanks which are slightly covered by seawater all the time
- Allis shad (*Alosa alosa*)
- Twaite shad (*Alosa fallax*)
- River lamprey (*Lampetra fluviatilis*)
- Sea lamprey (*Petromyzon marinus*)
- Otter (*Lutra lutra*)

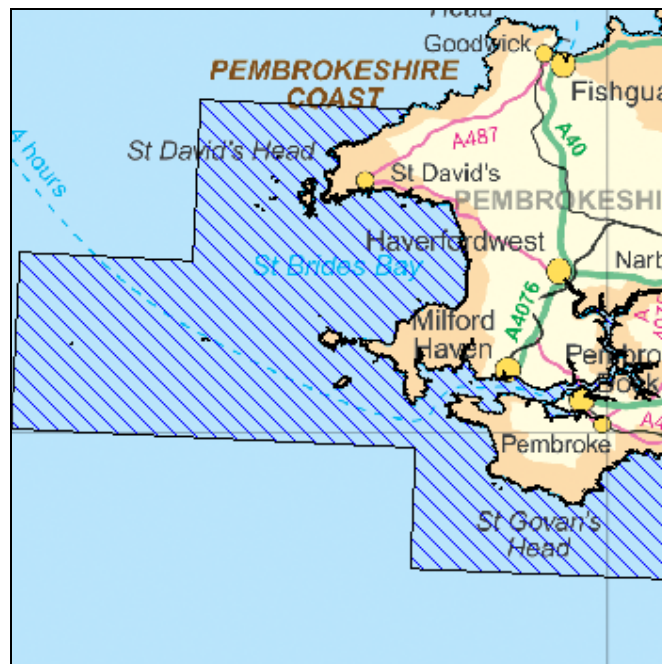


Figure 5 – The boundary of Pembrokeshire Marine SAC

Ramsey Sound also lies adjacent to a number of other environmentally sensitive areas. These include:

- St David's SAC
- Ramsey and St David's Special Protection Area (SPA)
- St David's Heritage Coast
- Ramsey Island Royal Society for the Protection of Birds (RSPB) Nature Reserve
- Pembrokeshire Coast National Park

In addition Pembrokeshire also has a Local Biodiversity Plan (LBAP), which has been set up to improve the status of habitats within the region. The following species/habitats, identified within the Pembrokeshire LBAP, are present in and around the proposed deployment site for the DeltaStream device.

- | | |
|----------------------------|---------------------------|
| • Grey Seal | • Northern Gannet |
| • Harbour Porpoise | • Razorbill |
| • Atlantic Puffin | • Common Scoter |
| • Common Guillemot | • Commercial fish species |
| • European Shag | • Tidal Rapids |
| • Maritime Cliff and slope | |

The marine SAC covers an extensive area and many of the above features are not in the vicinity of the proposed deployment site. As such they will not have the potential to be affected. A summary of those features of interest within the SAC as a whole, their status with regard to the proposed area of interest, and whether there is a potential to be affected is given in Table 2.

In addition to those habitats and species covered by the Pembrokeshire SAC highlighted above, Harbour Porpoise, although not part of the SAC, are an important species in the area and are part of the Local Biodiversity Action Plan. Harbour Porpoise frequent Ramsey Sound, and have therefore also been included in Table 2.

Table 2 – Features of the Pembrokeshire Marine SAC potentially affected by DeltaStream.

	Sensitive Feature	Presence within Ramsey Sound	Potential to be affected - when?	Further Assessment
Primary Feature of SAC	Grey seal	Yes – frequently recorded in area	Yes – installation, operation, maintenance and decommissioning	Yes
	Shore dock	No	No	No
	Large Shallow inlets and Bays	No	No	No
	Estuaries	No	No	No
	Reefs	Yes	Yes	Yes
Qualifying feature of SAC	Otter	Yes	No	Yes
	Sea lamprey	No	No	No
	River lamprey	No	No	No
	Twaite shad	No	No	No
	Allis shad	No	No	No
	Mud-Flats and Sand-Flats not covered by sea water at low tide	No	No	No
	Coastal Lagoons	No	No	No
	Submerged or partially submerged sea caves	No	No	No
	Sandbanks which are slightly covered by seawater all the time	No	No	No
	Atlantic Salt Meadow	No	No	No
Part of LBAP	Harbour Porpoise	Yes – recorded in area	Yes – installation, operation, maintenance and decommissioning	Yes

Of the European Directive Annex I and II habitats and species identified as primary or qualifying features in the Pembrokeshire Marine SAC, Grey Seal and reefs are identified within Ramsey Sound. In addition Harbour Porpoise have been identified as locally important species (form part of the LBAP) and therefore the effects of DeltaStream on Harbour Porpoise, Grey Seal and reefs will be assessed further as part of the EIA. No further assessment on the other features of the SAC will be undertaken as they are not present within Ramsey Sound. Maritime Cliffs, although present within the area, will not be assessed further as it is TEL's intention to utilise the existing onshore infrastructure at St Justinians therefore avoiding interference with the cliffs.

Assessments on other local habitats, which do not form part of the SAC will also be made; this will include bird and fish species.

4.2.2 Oceanographic Environment

The proposed deployment site lies approximately 0.3km from Trwyn Ogof Hen on Ramsey Island and approximately 1.2km to the shoreline at St Justinians. It lies in the Northern part of Ramsey Sound, and is situated on seabed of approximately 30m below Chart Datum (approximately the level of Lowest Astronomical Tide (LAT)). The proposed site has no existing pipelines or cables, and is not used for MOD activities, aggregate dredging or as a marine disposal site.

As there is a lack of detailed bathymetric data at the site, a detailed bathymetric survey using a high resolution multibeam echo sounder (MBES), will be carried out. This survey will cover a 400m corridor (East to West) across the northern part of the sound and the proposed cable route.

Tidal streams in Ramsey Sound can reach up to 6 knots (3ms^{-1}) during mean spring tides, based on UKHO admiralty charts. The tidal regime varies throughout the Sound with flows varying between 5 knots (2.5ms^{-1}) in the North and 7 knots (3.5ms^{-1}) in the South. As part of the environmental surveys for this project, site specific data will be collected over a full lunar cycle (30days) using an Acoustic Doppler Current Profiler (ADCP). The ADCP will be deployed at the site and it will collect tidal stream velocity and direction data for the duration of the survey.

The wave climate is not well documented in Ramsey Sound however; there is data available west of Ramsey Island. West of the island, waves generally originate from the south-west and 4-5m significant wave height can be experienced. Ramsey Sound is protected from these south-westerly waves by Ramsey Island and a lower significant wave climate is expected. The ADCP will also collect wave height and direction data at the deployment site at the time of survey.

The geology of the area is characterised by mudstones and sandstones, and the sea floor surface is covered by sandy gravel (extent of coverage unknown). Further geophysical investigations either desk or survey based will need to be undertaken as part of the project to determine the sediment coverage and seabed forms. In addition to this a drop down camera survey will be undertaken of the deployment site and cable route. This will not only provide information on seabed substrate, but also benthic ecology. The results of the bathymetric/video camera survey will also be used to determine if there are any Reefs (SAC designated feature) or reef habitat in the deployment area or along the cable route. If present, micro-siting of the DeltaStream device will be undertaken to minimise potential impacts.

Presented below (Table 3) is a summary of the likely potential affects that could arise from the various life stages of the proposed project. Within the ES these areas will be further investigated and assessed. Table 3 also identifies whether there is a potential to affect a SAC designated feature.

Table 3 - Summary of Potential Effects on the Physical Environment

Parameter	Physical Environment		
	Designation	Installation / Decommissioning	Operation and Maintenance
Tidal Stream	N/A	N/A	Possible change in existing tidal flow downstream due to extraction of energy.
Wave environment	N/A	N/A	Possible change in existing wave regime.
Suspended sediment	N/A	Additional sediment produced through water column when device/anchor placed on seabed.	N/A
Seabed	N/A	Disturbance from anchor during installation	Scouring around base of device, anchors and cable route
Water Quality	N/A	Increased risk of pollution, increased suspended sediment during installation	Potential release of oils/lubricants from device
Reef/reef habitats	SAC	Disturbance from anchor/device/cable during installation	Scouring around base of device, anchors and cable route

4.2.3 Marine Mammals

As identified in Section 4.2.1, one of the key species for which Pembrokeshire Marine SAC is designated is the Atlantic Grey Seal (*Halichoerus grypus*). The West Wales Coast area in fact supports the most southerly breeding population of Grey Seals in Europe with approximately 5000 individuals in total, and 1400 pups born per year. This represents approximately 4% of the UK population, which equates to approximately 2% of the world population of Grey Seals (Pembrokeshire Marine SAC website). Most pups are born in September but the pupping season can extend from August through to December. During the months of December to February the adults can be found to congregate in large numbers on beaches to moult. In Ramsey Sound the congregation can be found mostly at the south east coast of the island, although Grey Seal are recorded throughout the SAC as a whole.

Other marine mammal species are also recorded regularly in the inshore waters off St David's including:

- Harbour Porpoise (*Phocoena phocoena*)
- Bottlenose dolphin (*Tursiops truncatus*)
- Northern minke whale (*Balaenoptera acutorostrata*);
- Risso's dolphin (*Grampus griseus*);
- Short-beaked common dolphin (*Delphinus delphis*).

In addition to Grey Seal, Harbour Porpoise also frequent Ramsey Sound and off the coast of St David's head throughout the year, with movement patterns being influenced by tidal state. The actual presence of Grey Seal and Harbour Porpoise has become part of the tourist industry with boat, sightseeing trips regularly undertaken in the summer months around the island. In order to minimise potential effects of local marine activities on the Porpoise in particular, a Porpoise sensitive area has been identified in the Sound in the Pembrokeshire Marine Code. This area covers the total length of Ramsey Island, with "cautionary" and "extreme caution" areas being identified in the North and Southern parts of the Sound, respectively. Also there is consultation

ongoing by the conservation authority (CCW) to designate Ramsey Sound and its surrounding area as a SAC for Harbour Porpoise.

Assessment of Potential Effects

The main focus of the marine mammal assessment will be centred on the potential for impact on Grey seal and Harbour Porpoise, the most frequent marine mammal species found in the area. In particular the assessment will relate to the conservation objectives for the area as outlined in Pembrokeshire Marine SAC regulation 33 advice note.

Baseline Data

Baseline data will be collated from literature review and desk based assessment. Initial discussions have been undertaken with Pembrokeshire College with respect to studies and data on Grey Seal and Harbour Porpoise in the area. Site specific data for Harbour Porpoise has been collected between 2007 and 2008 and this will be used in the assessment. The site specific information includes data on the number of porpoise sighted, direction of movement, behaviour and speed of movements all recorded in relation to tidal state. Anecdotal observations of birds present in association with porpoise at the time of sightings and the presence and orientation of boats within the survey area at the time of sightings will also be presented.



Figure 6 – Grey Seal in Ramsey Sound

Assessment of Impacts

Literature review (Scottish Marine Renewables SEA, 2007) has identified a number of potential ways in which tidal energy devices could affect the behaviour or use of an area by marine mammals during construction, operation and decommissioning. These include:

- Increased disturbance from marine vessels during deployment and decommissioning
- Interaction with device during operation.
- Loss of, disturbance to or displacement from habitat
- Displacement of food source
- Underwater noise
- Barrier to movement
- Potential marine water contamination during deployment retrieval and operation phase
- Electro-Magnetic Field (EMF)

As discussed in Section 4.1 the design of the proposed marine tidal energy device has already taken a number of these issues into consideration during the design stage of the project. As such the potential degree of impact from the tidal energy device has already been significantly reduced. Within the ES the design features will be outlined and how they minimise potential impacts will be discussed. An overall assessment will be made of the potential of DeltaStream to impact on marine mammals and additional mitigation will be proposed where necessary.

Monitoring

The deployment of tidal and wave energy devices for energy production are still in the early stages. As such one of the key issues, which become evident when reviewing information on these devices, is that there is a short fall of information with regard to marine mammals and other animal interaction when operational. In terms of design, as discussed above, the proposed DeltaStream device has incorporated a number of features which are specifically designed to reduce the environmental impact of a tidal stream device. As identified in the baseline data section, two years baseline data is currently available for Ramsey Sound from a research project on Harbour Porpoise that is nearing completion. It is proposed that this research project is continued. The methodology utilised during the research project will be reviewed with regard to frequency of collection, vantage points etc and improvements made where appropriate. The data collected over the monitoring period will then be assessed against the baseline data and information on the effects of the tidal stream device, for instance subtle changes in behaviour or acclimatisation can be examined in more detail. In addition to this data is routinely collect on Grey Seal by the Warden of Ramsey Island and also through ad hoc studies in the area. Discussions will be held to ensure that data collection on Grey Seals is continued and to see how additional information can be collected during the Harbour Porpoise and other specific surveys for Grey Seal. Further details of these will be provided in the ES.

4.2.4 Ornithology

Ramsey Sound lies adjacent to Ramsey Island, a RSPB Nature Reserve to the west and the Ramsey and St David's SPA (845.63ha) on the mainland to the east. The Island and the Coastal area of St David's are designated because of the presence of Chough (*Pyrrhocorax pyrrhocorax*) which breeds on Ramsey Island and represents at least 3.2% of Great Britain's breeding population.

The region is host to a number of seabird species that nest, both around the Pembrokeshire coastline and on Ramsey Island. These are not covered by European conservation status; however Razorbill, Puffin, Guillemot, Shag, Gannet and Common Scoter are covered by the LBAP as noted in Section 4.2.1.

Assessment of Potential Effects

Diving Species have been identified as being the most at risk from tidal stream devices (Scottish SEA 2007) and will therefore form the basis of the assessments carried out for this project. Table 4 highlights the diving bird species that have been observed in Ramsey Sound, their maximum recorded dive depths and residency status.

Table 4 – Summary of diving bird species said to be found in the vicinity of Ramsey Sound

Species	Dive Depths (Maximum Recorded)	Residency Status
Shag	60m	Breeding
Guillemot	180m	Breeding
Razorbill	120m	Breeding
Puffin	60m	Breeding
Cormorant	26m	Migratory
Gannet	34m	Migratory
Red throated Diver	20m	Migratory
Great Northern Diver	70m	Migratory
Common Scoter	20m	Migratory

Data taken from RSPB website

Baseline Data

A desk based survey will be undertaken to identify the diving species which are most common at Ramsey Island and within the sound. A site specific survey will also be undertaken, to observe the numbers and species that dive at the proposed deployment site over different states of the tidal cycle, within a given radius (to be confirmed).

Anecdotal bird observations have been collected for 2007 to 2008 in association with Harbour Porpoise movements (Section 4.2.3). This data will be reviewed and utilised accordingly to aid the desk based survey and assessment.

Assessment of Impacts

The main construction/assembly activity associated with the DeltaStream will be remote from the site and therefore any potential to disturb will be reduced. There will be some disturbance during cable set up and deployment of the tidal device but this will be very short term. During operation there are a number of ways in which diving birds may be affected. The potential impacts during construction and operation are identified as follows:

- Temporary disturbance during deployment/retrieval
- Displacement of prey species
- Interaction with device during operation

As discussed in Section 4.1 the DeltaStream device has been designed to minimise impacts. These design features will be discussed in further detail within the ES and any residual impacts on birds will be identified.

4.2.5 Fish

Sea Lamprey and River Lamprey, Twaité Shad and Allis Shad are all Annex II species present as a qualifying feature, but not a primary reason for site selection of the Pembrokeshire Marine SAC (Figure 5). Shad are also protected under the Wildlife and Countryside Act 1981 and are priority species in the UK BAP.

Records for the area indicate that there have been few observations for each of the Annex II species, but the following species of fish and shellfish in the area are known to be:

- | | |
|-----------|------------|
| • Cod | • Turbot |
| • Bass | • Rays |
| • Whiting | • Pollock |
| • Herring | • Mackerel |
| • Sole | • Wrasse |
| • Plaice | • Lobsters |

Turtles, especially Leather Back Turtles, are also a feature of the marine environment in Pembrokeshire. The presence and potential effect on these (if present in Ramsey Sound) will be assessed in the EIA.

Baseline Data

A desk based study will collate and review the existing data that is currently available for Ramsey Sound and the immediate surrounds. Where specific data is not available, data for the wider area or for similar habitats will be sought. No site specific fish survey work is proposed for the short term deployment of DeltaStream.

Assessment of Potential Impacts

During the life cycle of the project, the potential impacts on the fish and shellfish in the region are:

- Disturbance/Displacement during all project life stages
- Underwater noise
- Interaction with devices pressure field / device
- Behavioural effect from cable EMF on elasmobranches /migratory fish
- Loss of spawning /nursery grounds
- Reduced fishing pressure in vicinity of turbine

These will be discussed accordingly within the Environmental Statement.

4.2.6 Benthic

Admiralty Charts and tidal currents in the area indicate that the benthic community in Ramsey Sound will be defined by the high tidal streams and rocky sea floor. Predominant species will include kelp (*Laminaria* spp) in the sublittoral zone and molluscs, spider and edible crabs, nudibranchs, starfish spp and anemone spp. Within the Marine SAC as a whole, less common species such as sea fans and cup corals are also found.

Survey

As the substrate in Ramsey Sound will be predominantly hard, it is proposed to use a non-invasive survey technique to assess the species present. A drop down camera survey will be undertaken to determine the benthic community that exists at and around the deployment site and along the cable route. The quality of the images from drop down camera can vary depending on the visibility at the time of survey, sea conditions and the angle of image, which is affected by the currents. Where possible appropriate analysis (and mapping), will also be undertaken.

Assessment of Impacts

The following issues will be assessed and reviewed within the Environmental Statement.

- Disturbance from vessel anchors and chains during deployment/retrieval
- Disturbance from devices' feet, anchors, lifting bridle and chain
- Disturbance from cable route

4.2.7 Marine Navigation

Ramsey Sound is a hazardous narrow water passage with tidally submerged rock and strong currents. As such it is not a main through passage for larger vessels, even in adverse weather conditions. Larger vessels and commercial shipping accessing Milford Haven tend to follow a route to the West of Ramsey Island.

Vessels that use Ramsey Sound are mostly smaller recreational vessels, small fishing boats, the RNLI lifeboat, tourist trip boats and the Ramsey Island vessel transiting to and from the Island. The day trip boats, which operate mainly in the summer, mostly follow a circular route through the sound and around the island before returning to the mainland. The Ramsey Island vessel which operates between Easter and 31st October each year departs from St Justinians and follows a route to the South of the proposed deployment site. St Justinians itself acts as a mooring site for a number of small boats, with numbers and activity increasing in the summer months.

Assessment of Potential Effects

The vessels using Ramsey Sound have small draughts up to a maximum of approximately 5m. The assessment within the ES will therefore consider all types of vessels, but the focus will be on those vessels which predominantly undertake activity in or through Ramsey Sound.

Baseline Data

During land based observations on Harbour Porpoise movements in Ramsey Sound, ferry vessel movements have also been recorded. It is intended to continue recording vessel movements via a land based survey in the area during future marine mammal surveys. The records will also include the size and type of vessel and the direction in which the vessel is transiting.

All vessels over 300 gross tonnes by law must carry an on board Automatic Identification System (AIS). The data from this system is compiled by the MCA and is available on request. This data will be requested and reviewed to confirm the movements of larger vessels in the area of interest.

Assessment of Impacts

Areas that will be assessed and reviewed within the ES will include:

- Increased navigational risk during installation/retrieval from deployment vessel presence
- Increased navigational risk from turbine presence
- RNLI operations
- Porthstinian boat owner's club

As discussed in Section 4.1.7, discussions will continue with the MCA and Trinity House with respect to the required markings for the tidal device over the 12 month period. Notwithstanding this, a Navigational Risk Assessment (NRA) will be undertaken prior to device installation and will be based upon the results of both the desk based and land based surveys.

4.2.8 Commercial Fisheries

Trawling is not undertaken in Ramsey Sound, due to the nature of the seabed and the fast tidal streams, but it is undertaken at other various sites within the SAC.

Ramsey Sound itself is exploited by fishermen using potting and possibly fixed netting techniques. There are known to be a number of fishing boats which fish Ramsey Sound using the above mentioned techniques, but the numbers vary seasonally, with less in winter and more in summer. Some, but not all, of the fishermen who fish the Sound are members of the South West Wales Fisheries Community (SWWFC).

Baseline Data

Baseline data will be collated through a desk based study. In addition to this land based surveys will be undertaken to identify fishermen who regularly use Ramsey Sound. Consultation will also be undertaken with South West Wales Fisheries Community concerning known activity in the area and fish landing sites.

Assessment of Potential Impacts

Areas that will be further evaluated within the EIA process include:

- Interruption to fishing activities during cable laying/device installation /maintenance and retrieval
- Increased navigational risk at all stages of project
- Loss of fishing ground due to exclusion zone

4.2.9 Recreation and Tourism

Pembrokeshire is popular with tourists with a variety of activities available. These range from water sports to visiting ancient monuments and wildlife watching. Pembrokeshire is host to the UK's only Coastal National Park and it is estimated that tourism in the county generates £343,000,000 total visitor spend each year, through 7,200,000 visitor days and 5,100,000 visitor nights (Pembrokeshire Tourist Industry 2008).

Along the coast, from St David's Head to Porthclais there is easy access to a number of activities including diving, canoeing and regular boat trips for fishing and wild life spotting. Ramsey Sound, the Bitches especially, is also a nationally important kayaking spot. Such activities are more frequent during the summer months.

Boat trips are a frequent occurrence within Ramsey Sound, with a number of daily trips mobilising from St Justinians or White Sands, near St David's. These trips vary in character, some transit to Ramsey Island (Easter to October each year) and others follow a route around the island.

More recently, Pembrokeshire has become an extreme sports centre, with support from extreme sports stars to promote the area.

As part of the project TEL propose to provide interpretation display boards explaining the issues surrounding the project including the technical challenges and environment issues. These boards would be attached to the control room structure to explain its purpose and could attract its own visitors interested in renewable energy.

Baseline Data

Data is available from Pembrokeshire Council/PCNP regarding the tourist industry monetary values and people numbers. This baseline data will be collated through a desk based study. In addition discussions will be held with local activity operators to identify the number of people who utilise the area, activities undertaken and the seasonal variation.

Assessment of Potential Impacts

The areas for potential impact with respect to recreation and tourism that will be reviewed within the ES include:

- Disruption to boat based activities during deployment and retrieval
- Exclusion to recreational fishing during operation in vicinity of turbine
- Opportunity for increased interest from renewable energy and links to promote St David's' "green" image.

4.2.10 Other Issues

Noise

Consultation will be undertaken with the local environmental health officer, with respect to available background noise data or anticipated background noise levels. However, it is expected that there will be little terrestrial and marine noise data available for Ramsey Sound and the adjacent areas. Notwithstanding this the area is a dynamic environment, which is frequented by engine driven recreational and fishing vessels. This will give a higher background noise level, than one would expect in a rural environment.

Onshore there is limited traffic movement around the coast, but there is frequent activity at St Justinians. Here there are a limited number of car parking spaces available to tourists visiting the RNLI station or booked on one of the boat trips.

Offshore, during installation and retrieval, the presence of the deployment vessel will have the potential to emit the greatest noise. However this will be short-term as the installation method has been designed to be simple. The simplicity of the process reduces the length of time the installation vessel is required on site. It is proposed that the installation of the device can be carried out over 2 days. The cable laying process be carried out at a different time and will require a separate vessel to be on site for approximately 3 days. The limited duration needed for the vessels to be on site, minimises the noise effects on the surrounding habitats, especially marine mammals and prey species.

Once deployed, the device generator and blade movement will generate some noise and vibration, through the running of the generator and blade pass, although the use of three blades as opposed to two will help reduce this. Onshore during operation, some noise is expected to be emitted from the onshore substation and transformer. An assessment will be undertaken to determine the likely extend of noise generated from the various aspects of the project. Where appropriate monitoring during the deployment phase will be identified to confirm the findings and support other aspects of the operational monitoring. Further details will be provided within the ES.

Archaeology

Ramsey Sound has been chosen due to its strong tidal streams. As a result there are a number of wrecks in and around the region, which have been recorded over history. Within the Sound, Count D`Aspremont Wreck (1903) located at 51° 52'25"N 05° 18'58"W is classed as dangerous.

A desk-based study will be undertaken and the results from the high resolution multibeam echo sounder survey will be reviewed to determine exact locations of any site of archaeological importance. The potential for the tidal device to affect any sites will be assessed.

Visual

The project is located adjacent to Pembrokeshire Coast National Park and St David's Peninsula Heritage Coast. DeltaStream is a sub surface device, as such the potential for visual impact from the project will be negligible offshore. Requirements for the marker buoys will be determined in consultation with Trinity House and MCA.

The onshore substation will have some effect on the localised visual setting of the area. However, due to its size and its temporary nature, it is not proposed to undertake a full Landscape and Visual Assessment. Notwithstanding this further information on the size, appearance, exact location and any signage for the substation will be provided in the ES.

6.0 Consultation

As identified above, the proposed site for the TEL project is sensitive with regard to certain species and habitats, some of which are designated under the European Habitats Directive.

TEL acknowledges that the project has the potential to affect the physical and biological features of the area and is committed to ensure that a sufficiently detailed assessment is undertaken. All relevant competent authorities will be contacted throughout the process to discuss certain aspects of the project. The developer notes the importance of maintaining good communication with stakeholders and advisors throughout all stages of the project, to ensure that adequate information is collected and presented in the ES.

Consultation has been undertaken with a number of key stakeholders and this will continue throughout the duration of the project. Table 5 outlines the organisations that have been/will be consulted.

Table 5 – Stakeholders and interested parties who will be/ have been consulted on relevant environmental issue identified during the EIA (non exhaustive list)

Stakeholder / interested group	
Associated British Ports (ABP)	Porthstinian Boat Owners Association
Chamber of Shipping	RSPB
Countryside Council for Wales (CCW)	Royal Yachting Association
Centre for Environment Fisheries and Aquaculture Science	RNLI
CADW	Sea Trust
Campaign for the protection of rural Wales (CPRW)	South and West Wales Sea Fisheries Committee
DBERR	St David's City Council
Environment Agency Wales	The Crown Estate
Friends of the Earth	The National Trust
Friends of Pembrokeshire coast National Park	Trinity House
Greenpeace	Wales Coastal and Maritime Partnership
Joint Nature Conservation Committee	Wales Tourist Board
Marine Conservation Society	Welsh Canoeing Association
Maritime and Coastguard Agency	Welsh Federation of Sea Anglers
Ministry of Defence	Welsh Federation of Fisherman's Associations Ltd
Milford Haven Port Authority	Welsh Yachting Association
Pembrokeshire Coastal Forum	Welsh Assembly Government Marine Consents Unit
Pembrokeshire Coast National Park Authority	Wildlife Trust of South and West Wales
Pembrokeshire College	Whale and Dolphin Conservation Society
Pembrokeshire County Council	World Wildlife Fund (WWF)
Pembrokeshire Biodiversity Partnership	Western Power Distribution

Local, private tourist companies will also be contacted during the projects development.

TEL intend to hold a formal public consultation exercise as part of this project to communicate to the public the facts surrounding the project and to take onboard where possible, any issues that are raised. The consultation will include liaison with local government groups and organisations including St David's City Council, Pembrokeshire Coastal Forum and local councillors and politicians. TEL will invite local people and interested parties to exhibitions and provide regular updates including articles in the St. David's Quarterly Newsletter.

7.0 Monitoring and Mitigation

TEL recognises the project is a prototype and that limited device specific data on potential impacts will be available prior to the project commencing. However, the device has been designed with the sensitivity of the site in mind and has been specifically designed to prevent or reduce as much as possible, any environmental impact.

As discussed previously, it is intended that the project be used to gain information with regard to technical and environmental performance of the prototype whilst deployed. This will then be used to refine and improve the technology and further reduce potential impacts where possible. As part of preparing the monitoring plan, TEL will consult with various stakeholders, to ensure that relevant comments are taken onboard.

8.0 Summary

This report has been produced to assist with the scoping opinion for the deployment of a prototype tidal stream device in Ramsey Sound Pembrokeshire. The prototype device will be deployed for a 12month period and will have a nominal capacity of 1MW.

Pembrokeshire has been identified in independent reports and a report commissioned by the Welsh Development Agency (WDA) as a potential site for tidal stream devices. This identification has been made due to the high tidal flows, suitable water depths and the proximity to the local distribution network. Throughout this document it has been highlighted that DeltaStream was conceived in Pembrokeshire as an “environmentally sensitive device” with support from PCNP. The nature of the environment in Ramsey Sound, with strong tidal flows, suitable water depths close to shore and existing grid connection provides a unique location to monitor and test the performance of DeltaStream.

The developer is committed to ensure that a sufficiently detailed Environmental Impact Assessment is undertaken which reflects current best practice methods. TEL will ensure communication routes are set up between stakeholders and that communication is continued throughout the project. TEL is aware and appreciates the sensitivity of the proposed deployment site and is committed to ensure that Favourable Conservation Status is maintained throughout and following the decommissioning of the project.

The scoping study has identified a number of potential environmental impacts that may occur as part of the project. These will be reviewed and assessed further within the EIA and mitigation proposed where appropriate. The developer is keen to ensure that any potential impact is reduced as much as possible and have identified various surveys that will be undertaken, to gain baseline data that will assist in this process.

Table 6 summarises the surveys that have been proposed by TEL and the purpose of the survey as part of the EIA.

Table 6 – Summary of surveys to be undertaken as part of the EIA

Environmental parameter	Survey/Study	Purpose
Seabed	Multi Beam Echo Sounder	To determine the seabed topography at proposed test site and along cable route
Tidal Stream	ADCP	To determine the tidal stream flow and direction
Wave	ADCP	To determine the wave direction and heights
Geological character	Desk based study Geophysical survey if necessary Drop Down Camera Grab sample if necessary	To characterise the seabed geology and coverage. To identify presence of Reefs in the vicinity of the proposed deployment.
Marine Mammals	Literature Review and Desk based study Various Land Based Observation Surveys	To identify the behaviour and numbers of Harbour Porpoise and Grey Seal within the site

Ornithology	Desk based studies Site specific land based survey	To identify diving birds who forage at the site and their diving behaviour
Fish	Desk based survey Observations from drop down Camera survey	Characterise the fishes that migrate through or reside within the Sound. Identify the presence of turtles in the region.
Benthic Community	Drop Down camera Discussion with local divers/fishermen.	To characterise the benthic community that exists at the proposed site and along the cable route
Navigation	Navigational Risk Assessment Desk based survey Land based observation surveys for smaller craft	Identify regular and infrequent users of the site
Commercial Fisheries	Desk based survey Liaison with fisherman and fishing organisations	Identify all fishermen who use the area and those who may be affected by the project
Recreation and tourism	Desk based survey and discussions with local operators	Identify all recreational groups of the area and the activities which are undertaken.
Noise	Methodologies to be confirmed if background noise survey deemed necessary.	
Archaeology	Desk based survey High resolution Multibeam Echo Sounder Survey	Identify all sites of archaeological interest in Ramsey Sound
Visual	Landscape and visual assessment will be considered if deemed necessary	
Other developments	Close communications with developers throughout project.	To ensure cumulative impacts are minimised as much as possible

9.0 References

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