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Sound of Islay Demonstration Tidal Array

Volume 1: Environmental Statement

July 2010

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Sound of Islay Demonstration Tidal Array

Volume 2: Technical Appendices

July 2010

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1. Introduction

1.1 Background

1.1. ScottishPower Renewables (UK) Limited (hereafter referred to as ScottishPower Renewables or SPR), is wholly owned by Iberdrola Renovables S.A., the global leader in wind energy. At the end of 2009 Iberdrola Renovables S.A. had 10,752MW of global installed capacity, nearly 97% of which is wind. Of this capacity, 802MW was owned and operated by SPR, making it the leader in onshore wind in the UK.

1.2. SPR aims to continue to expand its renewables capacity in the UK order to help the Scottish and UK Governments to meet their 2020 electricity generation targets from renewable sources. This includes the development of some of the newer renewable technologies including wave and tidal renewables.

1.3. SPR wishes to construct, install and operate a demonstration tidal array within the Sound of Islay (Figure 1.1) (hereafter referred to as "the Development"). The Development will utilise the tidal flow running through the Sound to power tidal turbines during the flood and ebb tidal flows and generate electricity throughout these flow periods. The Development will comprise of up to 10, 1MW tidal turbines, which will be owned and operated by SPR.

1.4. The proposed Development could be the first tidal array in UK waters and it will deliver power directly into the National Grid. This will assist both the Scottish and UK Governments in meeting their future energy targets and their reduction of greenhouse gas emissions. The Development capacity of 10MW equates to an average production of 26.3GWh p.a., which is enough to supply over 5500 average domestic households (http://www.bwea.com/edu/calcs.html)[1].

1.5. An outline project description including the process involved is provided in *Chapter 5: Project Description*.

1.6. This Environmental Statement (ES) is a description of the process and findings of the Environmental Impact Assessment (EIA) procedure. It is submitted to the Scottish Ministers, along with an application for the proposed Development for consent under Section 36 of the Electricity Act 1989 ('the Act'). Additionally, Coastal Protection Act (CPA) and Food and Environment Protection Act (FEPA) consents will also be sought. The submission of an ES with a planning application is required for certain classes of project under the Environmental Impact Assessment Regulations (Scotland) Regulations 1999. An application for Section 36 consent under the Act comes with deemed planning permission, thereby removing the requirement for a separate planning application.

1.7. The preparation of this ES report is also an integral component in ensuring that the investigation of any environmental impacts of the proposed project is robust and comprehensive. It highlights the key environmental issues that were considered to be associated with the development, and allows an unbiased prediction of their effects and relative significance. This has ensured that these issues were fully addressed and integrated into the final design of the Development. This report will also assist Scottish Ministers and Argyll and Bute Council in reaching a decision as to whether permission should be granted for the proposals.

1.2 Brief Description of the Development Site and its Setting

1.8. The Development is to be located within the Sound of Islay, a narrow channel that separates the Isles of Islay and Jura on the west coast of Scotland (see Figure 1.1). The tidal resource of this channel is recognised as one of the best on the west coast of Scotland and is a preferred location for the first array of its kind as the local topography of the area provides an optimised working environment due to its shelter from westerly storms that are prevalent elsewhere along the coast.

1.9. The array will take advantage of the Hammerfest HS1000 tidal turbine technology (Figure 1.2), a fully submerged tripod mounted 1MW rated device, which will be deployed within the Sound of Islay at depths greater than 48m. The device is designed to generate electricity when the tidal flow rotates the turbine. It is capable of generating during the flood and ebb phases of the tidal cycle.

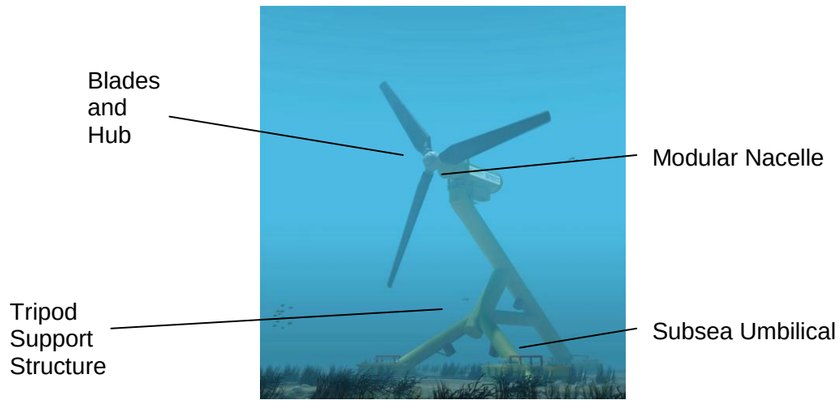


Figure 1.2: Representation of the tidal device to be installed in the Sound of Islay as part of the demonstration array

1.3 Proposed Development

1.10. The Development is described in detail in *Chapter 5: Project Description* and summarised here.

1.11. The Development comprises an array of 10 tidal turbines (Hammerfest HS1000) arranged below the 48m bathymetric contour (with the shallowest turbine being located in 50m of water) in the Sound of Islay, a channel of water between the islands of Islay and Jura. The turbines will comprise of a tripod substructure supporting a nacelle and three-bladed rotor turning about the horizontal axis – bearing much similarity with a modern wind turbine. However, the rotor diameter will be considerably smaller than a wind turbine, at only 23m. The maximum height to blade tip from the seabed is 33.5m. This will allow a minimum clearance from the surface of the water to the top of the blade of 16.5m.

1.12. The turbine to be employed for the purposes of the Development is the Hammerfest Strøm HS1000.

1.13. In addition to the turbines there will be some ancillary structures involved in the proposed Development. These include cabling to the island of Jura and a subsequent connection to a substation located there.

1.14. The operational life of the Development will be for a minimum of 7 years, with a potential extension of a further 7 years (totalling 14 years). After this there will be a decommissioning plan in place to remove the turbines and associated infrastructure; however, there may be the option at that time to gain further consent to extend the project beyond its 14 year life.

1.15. The Development will require a grid connection, which will be subject of a separate Section 37 consent under the Electricity Act 1989. This will be conducted separately to this EIA process and will not be considered further here.

[1] Note: This has been calculated using windfarm figures as none are currently available that are specific to tidal technology.

1.16. A description of the design and is provided in *Chapter 4: Site Selection* and a full description of the Development is provided in *Chapter 5: Project Description*.

1.4 Renewable Energy

1.17. Global Climate Change is seen as being one of the greatest environmental challenges facing the world today. One of the primary reasons for the current rate of temperature increase is the higher concentrations of greenhouse gasses in the atmosphere. One of the principal gasses is Carbon Dioxide (CO_2) primarily produced through our dependence on the burning of fossil fuels to generate our electricity.

1.18. Renewable energy sources (such as tidal, wave and wind) are infinite resources and create no CO_2 or other air pollutants during operation. Therefore, developments designed to capture such energy resources do not contribute to climate change during operation.

1.19. Renewable energy is an integral part of the UK Government's longer-term aim of reducing CO_2 emissions by 60% by 2050. In 2000 the UK Government set a target to produce 10% of electricity supply from renewable energy by 2010, and in 2006 announced its aspiration to double that level to 20% by 2020 (BERR, 2009). In November 2007 the Scottish Government set a new target to generate 50% of Scotland's electricity from renewable sources by 2020, with an interim target of 31% by 2011 (Scottish Government, 2007).

1.20. The energy produced from the Development would contribute to meeting the Scottish Governments target of providing 50% of Scotland's energy generation from renewable sources by 2020.

1.21. The Future Generation Group Report 2005: "Scotland's Renewable Energy Potential: Realising the 2020 Target", published by the Scottish Executive on behalf of the Forum for Renewable Development in Scotland (FREDS – a Government/Industry forum) in June 2005. This identifies for the first time that an installed capacity of 6,000MW is required to meet this 2020 target.

1.22. The Development has been proposed, in part, to respond to these requirements for renewable energy production.

1.5 Scotland's Tidal Resource

1.23. According to Scottish Government figures (Scottish Government, 2009) Scotland possesses 25% of the total European tidal resource.

1.24. The UK and Scottish Governments are committed to increasing the proportion of electricity produced through marine renewable sources. Costs remain high at the moment for both wave and tidal projects; however, this is a new industry sector and costs are likely to fall as they have done within the wind sector over the last decade. The experience of early projects will play a key role in promoting cost reduction.

1.6 Benefits in Reduced Emissions of Carbon Dioxide

1.25. The Development will provide significant benefits through the avoidance of fossil fuels for electricity generation. The potential reduction in emissions of CO_2 as a result of the 10 turbine tidal development is estimated to be approximately 11,300 tonnes of CO_2. This assumes that the 10MW tidal development operates at a capacity factor of 0.30 and is based on the calculations on the Renewable UK website (http://www.bwea.com/edu/calcs.html)[2].

1.7 Planning Policy Context

1.26. The proposed footprint (Figure 1.1) of the Development (marine and terrestrial components) lies entirely within the local authority area of Argyll and Bute.

1.27. The planning policy context of the Development is summarised in *Chapter 6: Planning Policy Context*.

1.8 Environmental Statement Structure

1.8.1 Environmental Statement and Technical Appendices

1.28. This written volume is the main body of the ES (there is also a Non-Technical Summary volume and the various Technical Appendices). It is divided into a number of background and technical chapters detailing the various studies that have been carried out to support the production of the ES. A set of Appendices is also provided giving appropriate additional information to support the chapters. A list of the appendices is provided in Table 2.4 (*Chapter 2: Scoping and Assessment Methodology*):

1.29. SPR have secured a lease option for a substantial new tidal project at Ness of Duncansby in the Pentland Firth. At 95MW this is a major project which, in itself, could be a precursor to even larger developments in that area, although this is outwith the scope of this ES. The Islay Demonstration Tidal Array will provide technical, environmental and commercial learning which will be essential to facilitate the deployment of projects in the Pentland Firth.

1.8.2 Non-Technical Summary

1.30. A separate summary is presented, providing an overview of the Development, site selection and design alternatives, environmental effects and mitigation measures.

1.9 Project Team

1.31. The ES has been compiled by Royal Haskoning (UK) Ltd. and presents the results of the assessment of environmental effects undertaken by a number of specialist consultants. These consultants are presented in Table 1.2, along with their respective disciplines and contribution to the ES.

[2] Note: This has been calculated using windfarm figures as none are currently available that are specific to tidal technology.

1.32.

TABLE 1.2 EIA AND DESIGN TEAM	
Organisation	**Expertise/ES Input**
ScottishPower Renewables	Specialist project consultant to HSUK.
Royal Haskoning (UK) Ltd.	Environmental consultants responsible for the ES production.
Islay Energy Trust	Local knowledge and fisheries consultation.
Natural Research Projects Ltd.	Ornithological studies and report writing as well as marine mammal data gathering.
SeaStar Survey Ltd.	Benthic survey of array footprint.
Headland Archaeology	Cultural heritage assessment and report writing.
Abbot Risk Consulting	Navigational and Safety Risk Assessment and report writing.
Sea Mammal Research Unit	Assessment of the marine mammal data gathered during the course of fieldwork.
Hebridean Whale and Dolphin Trust	Provision of marine mammal data for the wider west coast of Scotland area.
Scottish Association of Marine Science	Underwater noise assessment of the Sound of Islay.
Office and Project Services	Initial archaeological assessment and review of project reports.
CD Campbell Marine Contracts	Technical support to the project throughout fieldwork.
ETA	Cabling assessment for the project.
Garrad Hassan	Flow modelling of the Sound of Islay to assist the turbine placement.

1.10 References

Scottish Government (2009). Renewables Action Plan. Renewable Energy Division, June 2009.

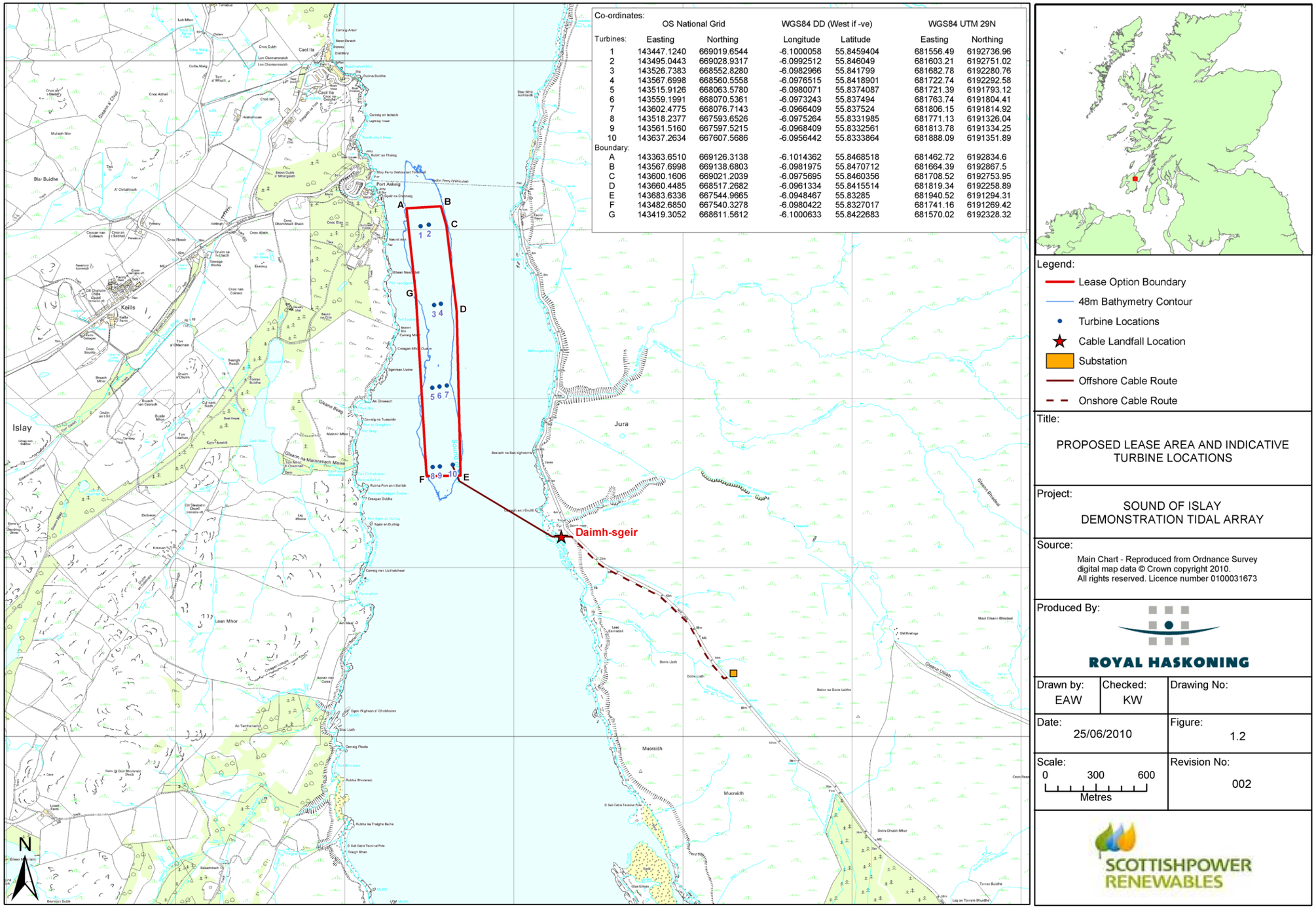


Figure 1.1: Proposed Lease Area and Indicative Turbine Locations

2. Scoping and Assessment Methodology

2.1. Introduction

2.1. This chapter of the Environmental Statement (ES) is designed to provide the reader with an overview of the Environmental Impact Assessment (EIA) process, and in particular the EIA requirements as set in place by The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 (the "Regulations"; Scottish Executive (2000)).

2.2. This chapter has one technical appendix (Appendix 2.1) containing the Scoping Response from the Scottish Executive.

2.2. General Approach

2.3. The above EIA Regulations state that any development likely to have a significant effect on the environment must be subject to an EIA with the resulting ES submitted alongside the appropriate Section 36 consents application.

2.4. Schedule 1 of the Regulations lists all of the developments for which an EIA is mandatory. Schedule 2 describes those projects for which an EIA is determined on a case-by-case basis by the Scottish Ministers.

2.5. The proposed Sound of Islay Demonstration Tidal Array is classed as a Schedule 2 development – "*(1) a generating station, the construction of which (or the operation of which) will require a Section 36 consent but which is not Schedule 1 development*". If a project is classified as a Schedule 2 development and it is likely to have significant environmental effects due to factors such as its proposed size, location or nature, it is classified as "EIA development" and a mandatory EIA is required. Whether or not a Schedule 2 development is classified as an EIA development can be confirmed via a request to the Scottish Government through a "screening opinion" under Part 2 Regulation 5 of the Regulations. However, on the basis that the proposed demonstration tidal array is a Schedule 2 development, ScottishPower Renewables elected to undertake an EIA without seeking the aforementioned "screening opinion".

2.6. Under the EIA Regulations, an applicant may submit a "Request for Scoping Opinion". ScottishPower Renewables sought a "scoping opinion" re: the Islay tidal development from the Scottish Executive on the 8th August 2008 under Regulation 7. This requested the Scottish Executive to state in writing their opinion on the information that was to be provided within the main text of the ES. This "scoping opinion" was received on 12th January 2009 and the ES has been prepared on this basis. Appendix 2.1 contains the Scoping Opinion.

2.3. EIA Methodology

2.7. EIA is a systematic process, which identifies the issues of proposed works likely to have a significant impact upon the receiving environment. This process includes an assessment of the likely effects and the identification of a range of suitable mitigation options and management measures.

2.8. The assessment is carried out based on the data supplied by the developer proposing the works and the information gleaned from the scoping response and other consultee engagement processes (statutory consultees, stakeholders and public engagement).

2.9. The EIA process is designed to be as transparent as is possible and has a number of distinct stages. These include:

1. **Screening** – this stage determines whether the proposed development is likely to have a significant effect on the environment (see Section 2.2);
2. **Scoping** – this stage involves a formal process requesting an opinion on the proposed development from statutory consultees and coordinated by the Scottish Executive. The scoping process also identifies the existing environmental data present and the key issues at the site, thereby identifying any additional studies that are required for their assessment;
3. **Baseline studies** – this stage identifies the current status of the receiving environment and carries out further desk and field studies as required and/or identified during Stage 2;
4. **Assessment of Impacts** – this stage includes the assessment of the significance of the potential impacts related to the proposed development as well as the proposed mitigation and the resulting residual effects;
5. **Environmental Reporting –** compilation of the ES and the supporting documentation (e.g. appendices and technical reports.); and
6. **Submission and Consenting** – this stage involves the submission of the ES along with the appropriate consent applications. These then go through a determination process with the appropriate consenting body (e.g. Marine Scotland).

2.10. Although the EIA process has to cover the above areas it should be noted that it is designed to be an iterative process rather than a single appraisal of a finalised development design. Therefore, the EIA can then inform the project in order that the most appropriate final design is reached (see *Chapter 4: Site Selection*).

2.11. With respect to the EIA carried out for the Sound of Islay Demonstration Tidal Array the procedure that was followed is shown in Table 2.1.

Table 2.1: EIA Process stages undertaken for the Sound of Islay Demonstration Tidal Array

Stage	Date
Request for a Scoping Opinion	August 2008
Receipt of Scoping Opinion	January 2009
Survey start date	April 2009
Continued consultation	Throughout
Development and finalisation of project design (see *Chapter 4: Site Selection*)	Throughout
Public exhibition	February 2009
Impact assessments, mitigation and residual impact assessment	April 2009 – May 2010
Completion of ES	May 2010
Consent Applications	May 2010
Statutory consultation on the ES	May-July 2010
Second public exhibition	June 2010

2.4. Assessment Methodology

2.12. The ES (the end point of the EIA process outlined in Section 2.3) is based on a number of activities. These include:

- Consultee consultation;
- Consideration of relevant local, regional and national planning policies, guidelines and legislation;
- Development of significance criteria;
- Assessment of alternatives;
- Review of available data already present and not collected directly in relation to this specific ES (e.g. previous Environmental Statements, publicly available information, etc.);
- Surveys (desk-based and field) and monitoring; and
- Modelling (particularly of the tidal flow characteristics within the Sound of Islay).

2.13. The ES not only addresses the direct effects likely to be caused by the development, but also the indirect effects, cumulative effects, short, medium and long term effects, those that are both permanent and temporary and those effects that are beneficial or adverse in nature. Within each of the assessment chapters there are proposed mitigation measures, which have been designed to avoid, reduce or offset the most significant adverse effects of the proposed development. *Chapter 24: Mitigation, Monitoring and Management* provides a summary of the residual effects and mitigation measures for the development.

2.14. Additionally a standard approach, wherever possible, has been taken when outlining the geographical area to be considered in each of the technical chapters. This area usually termed the "study area" is of a different scale depending on the topic of the specific assessment chapter. Other terminology such as "area of interest" and "wider region area" are used to describe different geographical scales, and an explanation of these terms (if/when used) are included in each of the assessment chapters. For example in Chapter 15: Commercial Fisheries this will be:

- The entire Sound of Islay as the "study area";
- The lease Boundary option as the "area of interest"; and
- The area around the Sound which includes the Sound of Jura, the Kintyre peninsula, Colonsay etc. as the "wider region area".

2.15. The project design and EIA process follows a series of stages, which are outlined below:

- Site selection and project initiation;
- Screening – is an EIA required;
- Pre-application discussions;
- Scoping – consultation on the proposed scope to identify the potential effects of the project and the methodology on how these should then be assessed;
- Environmental baseline studies – an establishment of what is there;
- Assessment of the potential effects of the proposed development;
- Mitigation – modify the proposal in order to integrate the mitigation measures and then re-assess the residual effects;
- Production of an ES;
- Submission of consent applications supported by the ES;
- Consultation by the Scottish Government with the appropriate consultees, stakeholders and members of the public;
- Consent application consideration by the Scottish Government;
- Application decision with or without conditions; and
- Implementation and monitoring as required.

2.16. The process of identifying and assessing the environmental effects of the proposed development is iterative and cyclic and runs in parallel with the project design. If any of the potential effects are identified a being adverse in nature then the design can be altered, as and if required, to mitigate these effects. Consultation is ongoing throughout the EIA process and contributes to the identification of effects as well as the mitigation measures to avoid, reduce or offset these effects.

2.17. The Site selection and Scoping processes are detailed in *Chapter 4: Site Selection* and Section 2.5 of this chapter respectively. Due to the requirement for an EIA for the proposed development (as defined in the Regulations) a formal Screening process was not undertaken. The results of all of the environmental baseline studies, the assessment of effects and all of the mitigation measures proposed are outlined in Chapters 7 – 23 of this report, with a summary of all mitigation being outlined in *Chapter 24: Mitigation, Monitoring and Management*.

2.5. Scoping and Consultation

2.18. The purpose of the Scoping process is to identify the principal environmental issues at the earliest possible stage of the development process through the responses that are gained from the consultees. This assists in the appropriate targeting of the assessment studies and the identification of which elements of the development have the potential to cause significant environmental effects.

2.19. Consultation enables mitigation measures to be incorporated into the design of the project, thereby avoiding, reducing or offsetting any environmental effects. SPR identify the consultation process as being crucial to the success of any project and have, therefore, created a specific chapter to cover this topic. Thus, consultation beyond the Scoping process that has been undertaken by the project team is detailed in *Chapter 3: Consultation*. The remainder of this chapter will only deal with responses specific to the Scoping process.

2.20. A formal request for a Scoping Opinion from the Scottish Executive was submitted in August 2008. This took the form of an official Scoping Report with supporting letter requesting opinions on the proposed scope of work and methodologies related to the Sound of Islay Demonstration Tidal Array. The Scoping Report highlighted what, at this early stage in the process, were likely to be the main effects associated with the development and how these effects were proposed to be assessed. A response to this Scoping Opinion was received on the 12th January 2009.

2.21. Table 2.2 lists all of the consultees whose opinion was sought during the Scoping process.

2.22. The Scoping Opinion, which was received on the 12th January 2009, set out the views of the statutory consultees and what they felt the requirements were for the subsequent EIA, including what impact assessments should be undertaken.

2.23. In addition to the opinions of the statutory bodies the views and opinions of non-statutory bodies to the Scoping Report were also sought. These can also be seen in Table 2.2.

Table 2.2: List of consultees approached for a scoping opinion

Approached for a Scoping Opinion by the Scottish Executive
Argyll and Bute Council (incl. Port Authority and Pier Authority)
British Telecom Wholesale
Civil Aviation Authority (CAA)
Chamber of Shipping
The Crown Estate (TCE)
Defence Estates (MoD)
Forestry Commission
Health and Safety Executive (HSE)
Historic Scotland (HS)
Maritime and Coastguard Agency (MCA)
NATS
Northern Lighthouse Board (NLB)
Royal Yachting Association (RYA)
Royal Society for the Protection of Birds (Scotland) (RSPB)
Scottish Government Energy Consents Unit (ECU)
Scottish Government CPA Section 34 Team
Scottish Government FEPA (licensed by Fisheries Research Services (FRS) (now known as Marine Scotland: Science))
Scottish Government Transport Scotland
Scottish Fishermen's Federation (SFF)
Scottish Wildlife Trust
Scottish Environment Protection Agency (SEPA)
Scottish Natural Heritage (SNH)
Western Isles Fishery Trust
Approached for a Scoping Opinion by SPR
Argyll District Salmon Fisheries Board (ADSFB)
Argyll Fisheries Trust

Argyll Marine SAC Management Forum
Department for Business Enterprise and Regulatory Reform (BERR)
British Marine Aggregate Producers Association (BMAPA)
Caledonian MacBrayne Ferries (CalMac)
Islay Energy Trust (IET)
Joint Nature Conservation Committee (JNCC)
Laggan and Sorn (Islay) DSFB
Marine Conservation Society (MCS)
Royal National Lifeboat Institution (RNLI) – Islay
Scottish Federation of Sea Anglers
Scottish Fisheries Protection Agency (SFPA) (now known as Marine Scotland: Compliance)
Serco Denholm (operates Port Askaig to Feolin ferry)
Scottish Surfing Federation
Scottish Canoe Association
Scottish Fisheries Committee
Scottish Water
Scottish Creelers and Divers
Scotways
Scottish Coastal Forum
Sea Mammal Research Unit (SMRU)
Sea Fish Industry Authority
Scottish Southern Energy
Transco
West Highlands and Islands Sailing Club
Islay Community Council
Jura Community Council
Robin Currie (Islay Councillor)
Anne Horn (Islay Councillor)
John Mcalpine (Islay Councillor)
Landowner (c/o Malcolm Younger)

2.5.1. Public Consultation

2.24. Public consultation is a key element of any EIA process and essential to the production of a balanced and comprehensive EIA. Shortly after receiving the "scoping opinion" from the Scottish Executive (based on the statutory consultee responses) a public exhibition was held on Islay at the Columba Centre (Ionad Chaluim Chille Ìle) in Bowmore in February 2009.

2.25. This exhibition provided the local community to respond to the proposal for the tidal development at an early stage prior to the various EIA studies having been commenced. The concerns and issues that were raised at the meeting were fed into the EIA process and the design of the tidal array. A leaflet providing details of the development was available along with copies of the full Scoping Report. Additionally a questionnaire was available to enable the attendees of the exhibition to provide their views on the proposals and request additional information on the development from SPR. A further round of public consultations is also planned after the applications for consent have been submitted.

2.6. Key Issues

2.26. Following the scoping and consultation process re: the Scoping Report there were several key environmental concerns that were identified as requiring detailed assessment during the EIA process and these have been included within this ES. These were:

- Marine Mammals (incl. Otters);
- Ornithology (especially diving birds);
- Marine benthic habitats;
- Terrestrial habitats;
- Commercial fisheries;
- Underwater noise;
- Maritime Navigation;
- Construction traffic;
- Cultural Heritage;
- Landscape and Seascape;
- Fish (especially Elasmobranchs and Anadromous species); and
- Recreational sea users.

2.7. ES Composition

2.27. The ES comprises a number of elements which include:

- A Non-Technical Summary. This is a stand-alone document, although is also included at the beginning of the main ES. It summarises in non-technical language the findings of the ES.

- The ES (this document). This comprises of two principal parts. Chapters 1 – 6 describe the project and the legal and policy framework within which the application will be determined. This includes details of how the project design has evolved through time, especially after various rounds of consultation in order that potential effects can be avoided or mitigated against early on. Chapters 7 – 23 contain the individual assessments relating to the environmental (and other) issues that were identified during the scoping process and/or by SPR. The likely significant effects of the development on these are contained within this portion of the document, along with the proposed mitigation and the residual effects remaining. The full contents of the ES are listed in Table 2.3.

Table 2.3: Contents of the ES

Chapter Number	Chapter Title
NTS	See Paragraph 2.27
1	Introduction
2	Scoping and Assessment Methodology
3	Consultation
4	Site Selection
5	Project Description
6	Planning and Policy Context
7	Physical Environment and Coastal Processes
8	Benthic Ecology
9	Marine Mammals
10	Onshore Noise
11	Marine Fish and Shellfish Resources
12	Anadromous Fish
13	Elasmobranchs
14	Ornithology
15	Commercial Fisheries
16	Terrestrial and Intertidal Ecology
17	Landscape and Seascape
18	Cultural Heritage
19	Transport and Traffic
20	Socio-economics, Tourism and Recreation
21	Water and Sediment Quality
22	Munitions and Military
23	Air Quality
24	Mitigation, Monitoring and Management
Appendices	See Paragraph 2.27

- The Technical Appendix is a single document that contains all of the supporting documentation (e.g. technical reports, survey reports, etc.) that relate to each of the individual assessments. The full list of Appendices is provided in Table 2.4.

Table 2.4: List of Appendices

Appendix Number	Appendix Title
2.1	The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000: Response to a request for a Scoping Opinion for the Proposed Demonstration Tidal Site, Sound of Islay.
8.1	Islay Demonstration Tidal Array - Site Surveys 2009: Drop-down camera survey report.
8.2	Sound of Islay Proposed Tidal Array Cable Route: Drop Down Video Survey.
9.1	Sound of Islay Demonstration Tidal Array: Marine mammal data for Environmental Statement.
9.2	Report to ScottishPower Renewables on the marine mammal species and basking sharks occurring in the Sound of Islay study region.
9.3	Acoustic characterisation of the proposed Sound of Islay tidal energy site.
9.4	Tidal turbine in Kvalsund, western Finnmark - underwater sound measurements.
12.1	Sound of Islay Demonstration Tidal Array: Salmonid Habitat Survey.
14.1	Sound of Islay Bird Report, 2010
15.1	Additional Statistics.
15.2	Fishermen Interviews – 25th May 2009.
15.3	Commercial Fishing Questionnaire.
15.4	Summary of fishermen questionnaire responses.
16.1	Sound of Islay Demonstration Tidal Array Phase 1 Habitat survey of potential cable routes.
16.2	Sound of Islay Demonstration Tidal Array Inter-tidal survey of potential cable routes.
16.3	Sound of Islay Demonstration Tidal Array Phase 1 Habitat survey of the Isle of Jura.
16.4	Sound of Islay Demonstration Tidal Array Inter-tidal survey of the Isle of Jura.
18.1	Gazetteer and Concordance.
18.2	Sources Consulted.
18.3	Shipwrecks recorded in the Sound of Islay derived from Moore and Wilson 2003.
18.4	Ship losses recorded in the vicinity of the Sound of Islay by the Royal Commission of Ancient and Historic Monuments (data acquired 14th September 2009) (does not include wrecks which can be matched to entries in Appendix 18.3).
18.5	Vertical aerial photographs consulted in the Royal Commission of Ancient and Historic Monuments search room.
19.1	Navigational Safety Risk Assessment for ScottishPower Renewables (UK) Limited: Proposed Demonstration Tidal Site, Sound of Islay.

2.28. In addition, the following confidential appendix is available for view by appropriate bodies:

- Appendix 14.2 Confidential Annexe to Sound of Islay Bird Report 2010.

2.8. Structure of Technical Chapters

2.29. Where practicable a standard approach has been taken to the structure of each of the technical chapters. However, there are some chapters that have not lent themselves to this structure (e.g. Cultural Heritage) and have been treated individually.

2.9. Effect Assessment and Mitigation

2.30. The Impact Assessment section within each of the technical chapters considers the identified potential effects of the development on the baseline conditions present during the construction, operation, maintenance and decommissioning phases of the development.

2.31. The significance of each effect is discussed and any mitigation measures that are appropriate to reduce this significance level. These mitigation measures aim to avoid, reduce or offset the most significant adverse effects of the proposed development and there is a commitment from SPR that they will be implemented where possible during the appropriate phase (e.g. construction, operation [including maintenance] and decommissioning) of the development.

2.32. Throughout the design process a number of mitigation measures have been identified and implemented to avoid, reduce or offset effects, even where these were not deemed to be significant. Therefore, some of the mitigation measures that have been identified throughout the assessment chapters do not necessarily relate to significant adverse effects, but have been included to further reduce the levels of effects related to the Development.

2.10. Significance Criteria

2.33. The significance of residual effects has been assessed for each of the assessment chapters. Where possible this has been based on quantitative evidence; however, where it has not been possible to quantify these effects they have been assessed qualitatively based on the best available knowledge at the time and professional judgement.

2.34. The standardisation of the significance criteria generally lead to a common classification of the significance of effects. These are classified as Major, Moderate, Minor or Negligible. The effects are also described according to whether they are Adverse, Neutral or Beneficial. However, as noted in Paragraph 2.27 certain assessments have not married well with the defined chapter and/or significance criteria structure and, as such, have been treated individually.

2.35. The potential impacts for each issue related to the Sound of Islay Demonstration Tidal Array have been developed with regards the following:

- Extent and magnitude of the impact (Table 2.5);
- Duration of the impact (short, medium or long-term);
- Nature of the impact (direct or indirect; reversible or irreversible);
- Whether the impact occurs in isolation or is cumulative in nature;
- Sensitivity of the receptor (Table 2.6);
- The significance of effect, and whether the effects are beneficial or adverse; and
- The level of mitigation that can be implemented to avoid, reduce or offset the effect (where the significance of effect is noted at being low, medium or high).

Table 2.5: Magnitude of Impact

Magnitude of Impact	Description
High	A fundamental change to the baseline condition of the receptor.
Medium	A detectible change resulting in the non-fundamental temporary or permanent condition of a receptor.
Low	A minor change to the baseline condition of the receptor (or a change that is temporary in nature).
Negligible	An imperceptible and/or no change to the baseline condition of the receptor.

Table 2.6: Sensitivity/Value/Importance of the Receptor

Receptor Sensitivity/Value/Importance	Description
High	Environment is subject to major change(s) due to impact. For example, sites contain features of international or national conservation or cultural designation, or permanent reduction of anthropogenic activity such as fish landings
Medium	Environment clearly responds to effect(s) in quantifiable and/or qualifiable manner. For example sites contain features of national or regional conservation or cultural designation, permanent modification of anthropogenic activity.
Low	Environment responds in minimal way to effects such that only minor change(s) are detectable. For example sites of local conservation or cultural value or temporary modification of anthropogenic activity.
Negligible	Environment responds in minimal way to effect such that only minor change(s) are detectable. For example sites contain features of local interest, little or no change to anthropogenic activity.

2.36. Sensitivity criteria can be based both on the degree of environmental response to any particular impact, as well as the 'value' of the receptor (for example; an area of international significance should be considered more sensitive to impact than an area of little or no conservation value). The sensitivity for each impact is determined by consideration of at least one of the following points:

- Comparison with Regulations or standards e.g. British Standards;
- Compliance with policy, plans and guidance documents e.g. Local Plan;
- Reference to criteria such as protected species, designated sites and landscapes;
- Consultation with stakeholders; and
- Experience and professional judgements by specialists on environmental sensitivity.

2.37. A detailed description of the criteria used to assess sensitivity or value or importance for each receptor is provided in the relevant assessment chapter.

2.38. By combining the magnitude of the impact and the sensitivity of the receptor in a matrix (see Table 2.7) the final significance of the effect (prior to the implementation of mitigation measures) can be obtained. It should be noted that any residual effect (the effect after the implementation of mitigation) which remains at the level of 'Moderate' or 'Major' is still regarded by the EIA Regulations as being significant.

Table 2.7: Impact Significance Matrix

Magnitude of Impact	Receptor Sensitivity/Value/Importance			
	Negligible	Low	Medium	High
High	No significant effect	Moderate	Major	Major
Medium	No significant effect	Minor	Moderate	Major
Low	No significant effect	Negligible	Minor	Moderate
Negligible	No significant effect	Negligible	Negligible	Minor

2.39. Due to the differences between the individual technical assessments throughout this ES there is no specific definition that can be applied. Therefore, each of the individual assessments have also carried out their own impact assessment and defined the criteria levels for defining the level of residual effect. Where it has been possible to do so this has been based upon accepted criteria (e.g. for onshore noise and vibration effects and their associated guidelines), as well as by employing expert interpretation and value judgements in order that the extent of any given effect can be established.

2.11. Cumulative Effects

2.40. In accordance with the EIA Regulations the ES has given consideration to cumulative effects. These are effects that result from the combined changes to the environment in the vicinity of the proposed Development caused by past, present and foreseeable developments in combination with this development.

2.41. Development schemes that may cause cumulative effects with regards the Sound of Islay are:

- The Argyll Array (proposed offshore windfarm);
- Kintyre (proposed offshore windfarm);
- Islay (proposed offshore windfarm);
- The west of Islay tidal farm (proposed by DP Energy); and
- Port developments on Islay.

2.42. The possibility of cumulative effects within the Sound of Islay does not exist for all of the assessment chapters. Where there is deemed to be no potential for cumulative effects to occur, then this is clearly stated.

2.12. Assumptions and Limitations

2.43. The principal assumption, which has been made during the preparation of this ES is that:

- The information provided by third parties, including publicly available information and databases, is correct at the time of publication.

2.44. The EIA has been subject to the following limitations:

- Baseline conditions have been assumed to be accurate at the time of the physical surveys; however, due to the dynamic nature of the environment, conditions may change during the various phases of the development; and
- The assessment of cumulative effects has been reliant on the availability of accurate information on the proposed developments that may act in combination with the one outlined within this ES.

2.13. Project Team

2.45. For a full list of the Project Team see Table 1.2 in *Chapter 1: Introduction*.

2.14. References

Scottish Executive (2000). Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000.

3. Consultation

3.1. Introduction

3.1. This Chapter of the Environmental Statement (ES) is designed to provide the reader with an overview of the additional consultations that have been undertaken by ScottishPower Renewables (SPR) throughout the Environmental Impact Assessment (EIA) process – a process which can be seen as open and transparent in the progression of the Development. The EIA process is detailed in *Chapter 2: Scoping and Assessment Methodology*.

3.2. Community Consultation

3.2. The consultation programme in relation to the Scoping Report was supplemented by ongoing consultation throughout the Development with the local community. This additional community consultation was undertaken in accordance with Planning Advice Note 81 (PAN 81) "Community Engagement – Planning with People" (Scottish Executive, 2007). This note provides advice on how communities can be engaged in the planning process and on how developers can listen to and engage with the community in order to take into account what the community would like for their area. In addition to this, Scottish Planning Policy (SPP), "A Statement of the Scottish Government's policy on nationally important land use planning matters" (SPP, 2010) also refers to community consultation and states that PAN 81 should be referred to.

3.3. Although not bound by the requirements for pre-application consultation or the submission of a pre-application planning report with a planning application under the Planning (Scotland) Act 2006 since this is not a planning application, this ES is, however in support of a Section 36 application and SPR have chosen to carry out a vigorous pre application consultation to demonstrate best practice. Details and dates of consultations are set out in Table 3.1.

3.4. SPR recognise the importance of the marine industry to local communities in both social and economic terms. Because of this, SPR ensured that it engaged early and actively with the Islay Energy Trust (IET), a local community energy organisation. This relationship, which has been formalised in a Memorandum of Understanding, has provided the EIA process with strong links to key community stakeholders. This close relationship with the local community is an important part of the Development. As part of this work, a local Tidal Project Officer has been employed to provide support and liaison for the development of the project.

3.5. Public consultation exercises began in February 2009 with the visit of SPR staff to Islay to present the Scoping Report to the community and stakeholders (see *Chapter 2: Scoping and Assessment Methodology*). This allowed for opinions from a cross section of the community to be taken into consideration when identifying those effects most likely to occur during the life of the Development.

3.6. The communities on Islay and Jura have been regularly updated on the progress of the Development through various media as well as being invited to drop into the IET offices in Bowmore to discuss the project at any time with the local representative for the development. The principal point of contact has been through the local independent newspaper, known as the Ileach (www.ileach.co.uk). This is widely distributed and read across Islay and Jura and is the best way of reaching the whole population. Additionally, the local IET project officer has been very active in updating the IET website (http://islayenergytrust.wordpress.com) and detailing the ongoing activities in relation to the Development (e.g. surveys, ministerial visits, media interviews, etc.) and also with updates as to the general progress.

3.7. An important aspect of the community involvement in the consultation process was the aspect of education. SPR staff attended four primary schools and Islay High School on Islay whilst present for the open day in February 2009. Since that time the schools have all kept a close eye on the IET website for Development updates and there was also a visit to Islay in April 2010 by students from Reid Kerr College, which was attended by IET staff and some of the local high school pupils. SPR and IET have also assisted a sixth year pupil at Islay High School with information to assist them in their biology project.

3.8. In addition to the local media exposure there have been efforts to involve national press and media organisations, given its importance to the tidal industry as being the first proposed tidal array in Scottish waters. In the past year the project has been featured in The Guardian (25/07/2009), The Herald, The Daily Record (27/08/2009) and The Scotsman newspapers. There has also been television coverage on BBC Reporting Scotland (10/09/2010), BBC Newsnight Scotland (10/09/2010) and pieces also featured on BBC Radio Scotland.

3.9. On a European and global level there has also been strong public interest in gaining information on the Development. Various film crews have visited the island to discuss the project with representatives of the IET. These have included Al Jazeera (the VT is available on YouTube at www.youtube.com) and France3 (see http://info.francetelevisions.fr/).

TABLE 3.1: Local, European and Global Meetings/Media Reporting

Date	Description
1st January 2009	Islay Energy Trust (IET) website – regular updates on the tidal project.
4th February 2009	Tidal Project Open Day (Scoping Report presented to the community by SPR and IET).
4th February 2009	IET AGM – Presentation given on the tidal project.
4th February 2009	SPR representatives visit four Islay Primary schools and the Islay Secondary school.
6th June 2009	Article in the Ileach – "Renewable Energy on Islay".
20th June 2009	Article in the Ileach announcing the seabed surveys being undertaken in the Sound of Islay.
15th July 2009	Article in the Ileach on the visit by Roseanna Cunningham to IET.
18th July 2009	Article in the Ileach on the visit by Jim Mather to IET.
25th July 2009	Article in the Guardian – "Islay to be powered by the tides".
29th July 2009	Article in the Ileach relating to the signing of a MoU with Diageo.
13th August 2009	Both SPR and IET have staff and stands at the Islay Show.
27th August 2009	Article in The Daily Record.
10th September 2009	BBC Newsnight Scotland and Reporting Scotland – Report on the Sound of Islay project.
16th November 2009	Al Jazeera visit Islay and discuss the tidal project with IET.
5th December 2009	Article in the Ileach on the IET AGM.
30th January 2010	IET Renewables Roadshow.
21st January 2010	Reid Kerr College and Islay High School students discussion of renewable technology on Islay with representatives from IET.
17th April 2010	France 3's European affairs programme Avenue de l'Europe reports on the Sound of Islay tidal project.

3.3. Government and Council Consultation

3.10. In addition to the reports in the media and the open days, it was deemed best practice to inform the local councils and public bodies directly on the progress of the project. Therefore, the local community councils and Argyll and Bute Council have been met face to face by members of the SPR project team or by members of IET (see Table 3.2). The board of SPR's community partner, the IET has a representative from both the Jura and Colonsay communities, as well as a representative from the Islay Community Council.

3.11. Jim Mather (MSP for Argyll and Bute and the Minister for Energy, Enterprise and Tourism) and Roseanna Cunningham (MSP for Perth and Minister for Environment) visited Islay in July 2009 and spoke with the IET on their work and renewable energy projects on the island, including the Development. This meeting was also reported in the local press (see Table 3.1). Jim Mather also met with IET on the 4th of June 2010 for an update on IET's projects, including this Development.

TABLE 3.2: Consultation and Meetings with Local Councils and National Government	
Date	**Meeting**
22nd April 2009	Argyll and Bute Council Environment PPG.
27th April 2009	Islay Community Council.
19th June 2009	Sally Loudon – Chief Executive Argyll and Bute Council.
14th July 2009	Jim Mather – Constituency MSP & Minister for Energy, Enterprise and Tourism in the Scottish Parliament.
28th July 2009	Rosanna Cunningham – Environment Minister in the Scottish Parliament.
16th December 2009	Jura Community Council.

3.4. Landowner Consultation

3.12. Much of the land on the islands of Islay and Jura is owned by private landowners and the local council (Argyll and Bute). Early discussions have been held between representatives of the landowners and SPR since the potential cable landing sites and onshore cabling will require crossing land belonging to one or more of the landowners.

3.13. The landowners with whom the project team has entered into these discussions with and/or provided regular updates to include Dunlossit Estate, Islay Estates, Port Askaig Harbour (Argyll and Bute Council), Port Askaig Hotel, Diageo (Caol Ila Distillery); Inver Estates and Ardfin Estates.

3.5. Commercial Fisheries Consultation

3.14. The potential effect that the Development may have on the local fishermen is of particular importance to the progression of the Development. This was highlighted during the scoping process and as such letters have been sent to and several meetings have been held with the local fishermen and the Clyde Fishermen's Association (CFA) (see Table 3.3).

3.15. The liaison with the fishermen on Islay has taken the format of formal meetings with the CFA and the fishermen themselves, informal meetings at the quayside, a day trip out on a creel boat, the sending out of questionnaires in order that the project team can better understand the local industry and regular update letters on the project development. Of the formal meetings the most important ones that have been carried out relate to the consultation process in support of the Navigational Safety Risk Assessment (NSRA) process (Appendix 19.1). The responses from the fishermen have been incorporated into this independent report as well as being considered within *Chapter 15: Commercial Fisheries*.

3.16. Additionally, the letters that have been sent out to the fishing community have invited those involved to visit the IET offices in Bowmore to discuss the project with the local representative there. Some of the local fishermen have also taken the opportunity to discuss the Development with SPR and IET staff at the initial Open Day and at the Islay Show 2009.

TABLE 3.3: Consultation and Meetings with Local Fishermen and the CFA	
Date	**Description**
5th January 2009	Preliminary Hazard Assessment (PHA) meeting.
4th February 2009	Tidal Project Open Day.
5th March 2009	Meet with the Clyde Fishermen's Association (CFA) representative.
16th April 2009	Project update to the CFA.
1st May 2009	Informal interviews carried out with the local fishermen.
13th May 2009	Project update to the CFA.
16th September 2009	IET representative taken out on a fishing trip on a local creel boat.
21st October 2009	Project update to the CFA.
29th October 2009	Update letter sent out to local fishermen with invite to navigational discussion.
3rd November 2009	Navigational Safety Risk Assessment meeting with Islay fishermen.
9th November 2009	Navigational Safety Risk Assessment meeting with CFA.
9th December 2009	NSRA Minutes and industry questionnaire sent out to local fishermen and the CFA.

TABLE 3.3: Consultation and Meetings with Local Fishermen and the CFA	
Date	**Description**
10th March 2010	Project update letter sent out to local fishermen and the CFA.
6th July 2010	Meeting with local fishermen and CFA representative.

3.6. Anadromous Fish Consultation

3.17. The scoping process identified potential effects on anadromous fish within the Sound of Islay.

3.18. Meetings were arranged and initial discussions were held with the Argyll Fisheries Trust (AFT), the Argyll District Salmon Fisheries Board (Argyll DSFB), and the Laggan and Sorn DSFB in July 2009. This highlighted the importance of this species in the area and the lack of general knowledge as to their general ecology and use of the Sound. Therefore, it was agreed that a specific assessment would be carried out within the EIA process to cover anadromous fish (see *Chapter 12: Anadromous Fish*).

3.19. The July meeting with the local DSFB's and AFT was followed up by a meeting with Marine Scotland: Science. Marine Scotland: Science are the body who will ultimately determine the effects of the Development on anadromous fish in the Sound of Islay area and whether or not these effects are deemed to be significant. The meeting ensured that SPR were aware of the available data for the area and, thus, determine the level of assessment that would be required for the ES.

TABLE 3.4: Anadromous Fish Consultation	
Date	**Description**
23rd July 2009	Discussion on the possible effects of the proposed Development on salmonids in the Sound of Islay area.
14th October 2009	Marine Scotland: Science meeting to discuss salmonids in the Sound of Islay and the possible effects of the proposed Development.

3.7. Environmental Consultation

3.20. As part of the consultation process it was agreed to have a Science Group meeting with representatives of Scottish Natural Heritage (SNH) to discuss the proposed methodology related to ecological surveys and the results that arose from them. An initial meeting was held on the 3rd November 2009. This will be followed up with regularly scheduled meetings to discuss the project and the data being gathered.

3.21. In addition to these formal meetings there have been many informal discussions with SNH related to the project throughout 2009 and 2010, which have enabled SPR and their environmental consultants to clarify several ecological issues and outstanding questions in relation to the project and this ES.

3.8. Other Consultations

3.22. Several other important groups that have not been included above have also been consulted on the project (a fuller list of consultees can be seen in Table 2.2 in *Chapter 2: Scoping and Assessment Methodology*) including Caledonian MacBrayne (CalMac) and the Royal National Lifeboat Institution (RNLI). These consultation responses have been taken into consideration, where appropriate, in this ES.

3.9. References

Scottish Executive (2007). Planning Advice Note 81 (PAN 81): Community Engagement – Planning with People.

SPP (2010). Scottish Planning Policy. The Scottish Government. ISSN 1741 1203.

4. Site Selection

4.1. Introduction

4.1. This Chapter describes the site selection process and the design considerations and constraints that have led to the final proposed development.

4.2. The requirement to outline the project alternatives comes from the Electricity Works (Environmental Impact Assessment) Scotland Regulations 2000. This stipulates that development alternatives be described and reasons given for the final preferred proposal.

4.2. Consideration and Constraints

4.3. Prior to the selection of the Sound of Islay as the location for the demonstration tidal array an extensive selection process was undertaken by ScottishPower Renewables. Various parameters were considered, including:

- Technical (tidal resource, grid and accessibility);
- Environmental (habitats, species and seabed profile);
- Commercial (fishing, shipping and recreation);
- Economics; and
- Policy and Designation.

4.4. In addition to the above, an extensive consultation exercise was also undertaken of various organisations to assist in the selection of the most appropriate area for the proposed development (see *Chapter 2: Scoping and Assessment Methodology*). These included:

- Scottish Natural Heritage (SNH);
- Joint Nature Conservation Committee (JNCC);
- Maritime and Coastguard Agency (MCA);
- Chamber of Shipping;
- Fisheries Research Services (FRS – now known as Marine Scotland Science);
- The Crown Estate (CE);
- Ministry of Defence (MoD);
- Royal Society for the Protection of Birds (RSPB);
- Scottish Government; and
- Argyll and Bute Council.

4.5. Using the above constraints and after the wide-ranging consultation process a number of locations around the coast of the United Kingdom were identified as potential locations for the placing of the proposed demonstration tidal array. The suitable locations were then shortlisted to:

- Pentland Firth; Scotland
- Sound of Islay, Scotland; and
- North Channel, Northern Ireland.

4.6. Field data was gathered for these locations (e.g. resource profile, seabed characteristics) and a review of the environmental and planning considerations undertaken in order to inform on the most suitable location for the tidal devices (see Section 4.5). The main points that highlighted Islay as being the most suitable location for this particular project were:

- Good tidal resource;
- Sheltered location;
- Accessibility;
- Minimal nature conservation designations on site and the areas surrounding the site; and
- Nearby grid access point, with access either to Islay or Jura.

4.3. Site Location

4.3.1. Background

4.7. Islay is the most southerly of the main Inner Hebridean Islands and is located south and west of Jura on the west coast of Scotland. The Sound of Islay is the stretch of water that separates the islands of Jura and Islay. The Sound is approximately 1km wide and reaches approx. 60m in depth. The proposed location for the array is shown in Figure 1.1 (*Chapter 1: Introduction*). The site lies within the local authority area of Argyll and Bute Council.

4.8. Figure 1.1 (*Chapter 1: Introduction*) shows indicative locations for the tidal devices within the site. However, these may be subject to micro-siting corrections dependant on detailed seabed assessments during the pre-installation phase. The devices will not be sited in depths less than 48m. The tidal conditions throughout the proposed area of the Sound are suitable for deployment of the HS1000 tidal device.

4.9. In addition to the tidal devices there is also a requirement for an export power cable from the tidal array to the onshore infrastructure (e.g. substation) (see Section 4.7.2). The planned route for the export power cable will come ashore near Daimh-sgeir on Jura.

4.10. A grid connection has also been secured with Scottish Hydro Electric Power Distribution Ltd. (SHEPD), which will allow the Development to go-ahead and supply the electricity it produces into the National Grid.

4.3.2. Islay and Jura

4.11. The site has been selected to avoid International and National designations. The potential area of interest is not subject to any existing nature conservation designations; however, consideration is given to designations in the vicinity of the area of interest as required under Regulation 48 of The Conservation (Natural Habitats, & c.) Regulations 1994. Details of relevant marine, coastal and terrestrial designations are provided in later chapters.

4.12. Port Askaig is one of the two main ports (the other main port is Port Ellen in the south-east) on the Isle of Islay and is located by the Sound close to the proposed tidal array site. It is accessed by land via the A846 and by sea via one of several ferry routes:

- Port Askaig (Islay) and Feolin (Jura);
- Port Askaig and Kennacraig; and
- Port Askaig and Colonsay (summer only)

4.4. Site Ownership/Land Use

4.4.1. Islay

4.13. The Dunlossit Estate owns much of the land on the Islay side of the Sound adjacent to the proposed area for the Development; however, the local council owns the harbour area of Port Askaig, with the area around the Port Askaig Hotel being privately owned.

4.14. Land to the north of the area of interest surrounding the Caol Ila distillery is owned by Diageo. Discussions are also being held with this landowner in connection to the possibility of mooring barges in the bay adjacent to the distillery. North of the distillery the land is owned and run by Islay Estates, who have been kept informed of the progress of the project.

4.4.2. Jura

4.15. Inver Estates own the land at the south-west end of Jura (from approximately 1km to the north of Feolin, where the Jura ferry comes over from Islay). At present Inver Estates are proposing the construction and operation of an 850kW hydro scheme on their land. This will be connected to the grid at a new substation location next to the A846 approximately 3km south of Feolin. The Development is unlikely to affect the land owned by Inver Estates as cable landfall will likely be made south of Feolin; however, SPR are in discussions with Inver over the joint operation of a substation, which could be utilised to service both the hydro scheme as well as the development.

4.16. Ardfin Estates own the land at the south of Jura. As they own all of the land adjacent to the proposed Development it is probable that they will be affected by the Development, particularly where the cable makes landfall and with the construction of a substation and control building and for the connection to the grid. Ardfin Estates have been kept informed on the progress of the Development.

4.4.3. Sound of Islay

4.17. The Crown Estate has been approached for the appropriate lease as they are the owners of the seabed from the Low Water Mark to 12 nautical miles (nm).

4.5. Sea Use

4.5.1. Existing Sea Use

4.18. Currently the primary traffic within the Sound of Islay relates to the ferry services serving Islay and Jura. These include the Islay-Jura ferry that runs across the Sound from Port Askaig, Islay to Feolin on Jura. Other, larger, ferries also operate a service linking Islay to Mainland Scotland and the Isles.

4.19. Cargo vessels, and other vessels in transit, that travel up and down the west coast of Scotland occasionally utilise the Sound as a short route to ports such as Oban. This allows them to shorten their sailing times as the route to the west of Islay would take considerably longer, thereby incurring additional costs in both time and fuel. Large vessels do not use the Sound due to shallower water at the north of the Sound.

4.6. Designated Areas

4.20. One of the specific reasons why this location was selected as a proposed area for the demonstration array was the lack of any conservation designations in the immediate vicinity. However, there are designations that will be considered within relevant chapters within the ES. These include the Special Protection Area (SPA) sites on the western part of Islay, the harbour seal Special Area of Conservation (SAC) to the south-east of Islay and the National Scenic Area (NSA) that covers much of Jura and the Sound.

4.7. Assessment of Alternatives

4.7.1 Tidal Array

4.21. The macro site selection process is detailed in Section 4.2. During this, the Sound of Islay was selected ahead of several other proposed locations as the optimum location for a demonstration tidal array. After this high level process there was a micro selection process looking at the Islay site in more detail.

4.22. Detailed bathymetric surveys were undertaken to chart the seabed within the Sound. When this data and the design of the tidal turbine were taken into account, it was decided that the best area for the Development would be the central portion of the Sound, below the 48m bathymetric contour.

4.23. It was initially proposed to install 20 tidal turbines into this area; however, after review of the planning and consenting considerations, it was decided that the installation of a maximum of 10 devices would be the most suitable for the site and maintain the demonstration status of the array (Iteration 1). Environmental considerations were also taken into account. Further iterations were then taken in response to the resource of the area and the maximising of the capacity factor for the tidal turbines.

4.24. As can be seen from Figure 1.1 (*Chapter 1: Introduction*) the 48m bathymetric contour forms a figure of eight shape. The initial array design was that all ten of the tidal turbines would be located in either the northern or southern portion of this figure of eight over a total of three rows (Iterations 2 and 3). This would have kept the area of the site relatively compact and would have kept open the rest of the figure of eight for potential future tidal development.

4.25. However, after a resource review by Garrad Hassan it was deemed necessary to spread out the tidal turbines further than initially anticipated to maximise their capacity factor (Iteration 4). Therefore, the entirety of the figure of eight has now been taken up by the ten tidal turbines arranged over four rows.

4.26. This process relating to the Development layout set out above has reduced the site from 20 to 10 tidal turbines. The iterations can be seen in Table 4.1.

Table 4.1: Summary of Iterations to Array Layout

Iteration Development Stages	Number of Turbines	Purpose in Change of Layout
Scoping Report	20	N/A
Iteration 1	10	Maintain the development as a Demonstration Site – 10MW or less
Iteration 2	10	Maintain discrete site within the southern portion of the Sound – perceived better resource and minimise impact with other sea users
Iteration 3	10	Maintain discrete site within the northern portion of the Sound – surveys and modelling show better resource present here
Iteration 4 - FINAL	10	Maximise capacity factor of array by increasing turbine spacing

4.7.2 Array Cabling and Cable Landfall

4.27. Initially it was proposed in the Scoping Report that the cable landfall would be defined once the proposed site for the array had been identified. Early work on the cable landfall indicated that the eastern shore of Islay would be the most suitable, given the infrastructure available on the island.

4.28. Once scoping report responses were received the site for the array was narrowed down to the area of the Sound below the 48m bathymetric contour. This allowed for the identification of four potential landfall locations on Islay (Iteration 1), which were determined by a number of factors including distance from turbines to the shore, cable distance to grid connection, local onshore infrastructure and access, any habitats that the cabling may pass through, potential cultural heritage (archaeological) impacts, landowners, seabed difficulty and suitability of bringing cable ashore.. After further consideration of the environmental and cultural heritage implications for each of the locations, this was reduced to three (Iteration 2).

4.29. Discussions with Diageo (one of the landowners on the eastern shores of Islay) identified their Caol Ila distillery as being a potential landfall location, thus increasing the number of options for landfall on Islay back up to four (Iteration 3).

4.30. A cabling study was undertaken and the conclusions of this showed that the Islay side of the Sound as being potentially difficult to bring a cable ashore due to the steep slopes at these potential

landfall locations. Therefore, the number of landfall locations on the Islay side was reduced to one (Iteration 4).

4.31. Finally, Jura was viewed as a potential landfall location. This had been previously discounted due to the National Scenic Area (NSA) designation covering much of the island and the whole of the coastline adjoining the Sound. After discussion with Scottish Natural Heritage (SNH) and various field visits to assess the potential effects of the substation location on the NSA. Jura was selected as being the most favoured option as it posed the least amount of potential impacts. Additionally, a proposed development in this area allowed for the possibility of collaboration between the tidal project and the Inver Hydro project, which would clearly assist in being able to reduce land take, disturbance and the impacts of two developments going ahead in the same location. Three potential landfall locations were identified; however, after terrestrial, intertidal and subtidal surveys of the area, this has been reduced to one favoured site, close to the mouth of the Abhainn an Daimh-sgeir. If this location is deemed to be inappropriate by the consenting authorities there would be the possibility of making landfall at the more industrial area of the Feolin ferry slipway on Jura as all studies carried out in support of this ES also covered this area. However, only the Daimh-sgeir landfall has been assessed as part of this ES. The selection of the Daimh-sgeir landfall location also means that the length of cabling onshore is kept to a minimum.

4.32. A list of the iterations can be seen in Table 4.2.

Table 4.2: Summary of Iterations to Cable Landfall Location

Iteration Development Stages	Number of Landfall Locations	Purpose in Change of Layout
Scoping Report	TBC	N/a
Iteration 1	4	Identification of the potential area most suitable for the proposed array
Iteration 2	3	Study of the environmental and cultural heritage resources at each landfall location
Iteration 3	4	Discussions with Diageo opened up Caol Ila distillery as a potential landfall location
Iteration 4	1	Cabling studied identified that the Islay side of the Sound was difficult to cable over given its bathymetric profile
Iteration 5 - FINAL	1	Jura opened up as a landfall option after discussions with Inver Estates who are developing a hydro scheme

4.33. The site will most likely have 1 or 2 subsea cables laid from the device(s) to the selected cable landfall point onshore. When the Tidal Site is developed each device will be interconnected with other devices on the array via an umbilical.

4.34. As part of the cabling study (Paragraph 4.30) work is being undertaken to look at the optimum tidal array cabling design and installation approach. This work will ensure that the offshore cabling will be installed in a safe, cost effective and environmentally sensitive manner, whilst ensuring long-term reliability, maintainability and fault tolerance.

4.35. The final layout of the device(s) and therefore cables will largely depend on the site seabed conditions and bathymetry. However, the layout will be designed to minimise the cable lengths while maximising the level of redundancy. The techniques adopted for the laying of the subsea and landfall cable will depend on the local conditions and will either be buried or armoured, as appropriate.

4.7.3 Substation Location

4.36. The Scoping Report proposed that the location of any substation and other associated onshore infrastructure would be defined once the proposed site for the array had been established. However, in line with the initial thoughts for the cable landfall location, the most suitable location was thought to be Islay.

4.37. As the initial location for the array was narrowed down to the area of the Sound below the 48m bathymetric contour and the landfall location on the Islay side, the existing substation at Keills was identified as the most likely area to connect the power output from the Development (Iteration 1).

4.38. After the cabling study had identified the Islay side of the Sound as being difficult for cabling to be brought ashore to due to the steep slopes where the cable would transition onto land. A southerly potential landing point was then identified on Islay, which took advantage of a gentler slope between the Development and the landfall location (Iteration 2).

4.39. Once Jura had been identified as a potential landfall location, the potential for a substation on Jura was then investigated. This had the added advantage of collaborating with the proposed hydro scheme development on Jura (some of the advantages were mentioned in Paragraph 4.29), which had already identified a substation location. The slope between the proposed tidal array location and the coastline of Jura is also considerably more gentle that the slope west to Islay.

4.40. A list of the iterations can be seen in Table 4.3.

Table 4.3: Summary of Iterations to Substation Location

Iteration Development Stages	Location of Substation	Purpose in Change of Layout
Scoping Report	TBC	N/a
Iteration 1	Keills, Islay	Identification of the potential area most suitable for the proposed array and cable landfall on Islay
Iteration 2	Southern Islay	Cabling studied identified a gentler slope to the south – avoiding the steeper slopes connecting the cable to Port Askaig
Iteration 3 - FINAL	Jura	Jura opened up as an option after discussions with Inver Estates who are developing a hydro scheme

4.41. The area for the control building/substation will need to be large enough to accommodate a transformer, switchgear, power electronics, control equipment and auxiliary supplies. An approximate footprint of 14m x 8.65m (121.1m^2)[1] has been assumed; however, this is yet to be finalised. The indicative location of this substation can be seen in Figure 1.1 (*Chapter 1: Introduction*).

4.8. Mitigation through Site Selection and Layout Iteration

4.42. The proposed tidal array has gone through the iterative process detailed above and thus the final project design is seen as being the best solution available. As this final layout has been reached through this iterative process, it can be seen to have already incorporated several layers of mitigation into its final design through the avoidance of specific features of archaeology, ecology and technical difficulties.

4.43. The section of the site within the Sound of Islay has avoided International and Nationally designated areas where possible (with the exception of the Jura NSA).

4.44. The details of all mitigation measures are outlined in the technical chapters (Chapters 7-23) within the main body of the ES.

[1] Note: The substation will be combined with the transformer site for the Inver Hydro Scheme. A small footprint (40x40m – 1600m^2) has been purchased for this purpose.

5.0 Project Description

5.1 Introduction

5.1 ScottishPower Renewables (SPR) is proposing to develop a Demonstration Tidal Array in the Sound of Islay. The proposed Tidal Array will have a capacity of up to 10MW of renewable power for export to the grid and will contribute to meeting the Scottish Government's targets of providing 50% of Scotland's electricity generation from renewable sources by 2020.

5.2 The Tidal Array will consist of up to 10 pre-commercial demonstration submerged tidal stream-generating devices, deployed in an array.

5.3 The candidate tidal device will be the HS1000, developed by Hammerfest Strom UK. This design is based on an existing 300kW prototype device developed by Hammerfest Strøm AS. Hammerfest Strøm UK (a subsidiary of Hammerfest Strøm AS) is developing the design with adaptation for UK tidal conditions and an increased maximum output of 1MW. A 1MW turbine will be deployed at the European Marine Energy Centre (EMEC) for a period of testing, after which up to 10 devices will be deployed to form the demonstration tidal array in the Sound of Islay (SoI).

5.4 The deployment will be subject to the required Consents and Licenses being obtained (see *Chapter 6: Regulatory and Policy Context*). The Tidal Array will be the first of its kind and is, therefore, viewed as a 'Demonstration Tidal Array'.

5.5 In addition to the tidal device(s), there will be associated onshore/offshore infrastructure including Sub Sea and landfall cable(s), a control building, substation and onshore access. A grid application has been submitted to the National Grid and Scottish Hydro Electric Power Distribution Ltd. (SHEPD).

5.6 SPR are working with the Islay Energy Trust (IET), a community owned charity. SPR and IET have signed a Memorandum of Understanding (MoU) covering the joint development of the Sound of Islay tidal project, with SPR funding a full time development officer on the island under the employment of the IET.

5.7 SPR have secured a lease option for a substantial new tidal project at Ness of Duncansby in the Pentland Firth. At 95MW this is a major project which, in itself could be a precursor to even larger developments in that area. The Islay Demonstration Tidal Array will provide technical, environmental and commercial learning which will be essential to facilitate the deployment of the Pentland Firth resource.

5.2 Site Location

5.8 Islay is the most southerly of the main Inner Hebridean Islands and is located south west of the island of Jura on the west coast of Scotland. The Sound of Islay is the stretch of water that separates the islands of Jura and Islay. The Sound is approximately 1km wide and reaches 62m in depth. The site is shown on Figure 1.1 in *Chapter 1: Introduction*. The site lies within the local authority area of Argyll and Bute Council.

5.9 The array is to be located within the figure of eight created by the 48m contour line and below the route of the Islay - Jura ferry boundary line (allowing for at least 200m clearance to the nearest turbine location). Figure 1.1 also gives indicative coordinates for each of the tidal devices within the site; however these will be subject to micrositing. Depth and tidal conditions are all suitable for deployment of the tidal device within the proposed area.

5.10 In addition to the Tidal Array there will also be a requirement for an export power cable route from the Tidal Array as well as onshore infrastructure components such as a grid connection point, control building and substation. The location for these components is proposed for the island of Jura, as this connection gives the most favourable subsea cable routing as well as the least likely onshore effects of the proposed works. The grid connection point selected is on Jura where the Islay/Jura 33kV interconnector comes ashore.

5.11 Islay is home to some of Scotland's most spectacular birds and other wildlife, from the golden eagle to the rare and secretive corncrake. The RSPB Scotland Reserve at Loch Gruinart (on the north of the island) is internationally important for barnacle geese in winter and for breeding wading birds including snipe and lapwings in spring.

5.12 The site has been selected to avoid International and National designations (this is further detailed in *Chapter 4: Site Selection)*. The potential area of interest is not subject to any existing nature conservation designations. However consideration is being given to designations in the vicinity of the area of interest as required under Regulation 48 of The Conservation (Natural Habitats, & c.) Regulations 1994. Details of relevant marine, coastal and terrestrial designations are provided in *Chapter 8: Benthic Ecology; Chapter 9: Marine Mammals; Chapter 14: Ornithology; Chapter 16: Terrestrial and Intertidal Ecology and Chapter 17: Landscape and Seascape*.

5.3 Offshore Site Description

5.13 The stretch of water known as the Sound of Islay lies between the islands of Jura and Islay and is a deep-water U-shaped channel. The bathymetry of this channel constitutes a relatively flat and deep seabed (depths of up to 62m) with very steeply sloped sides. The steepest slope is on the Islay side with the Jura side of the channel having a slightly gentler gradient. The Sound is generally sheltered from the wave action which affects the west coast of the island. At the northern end of the Sound the bathymetry shallows to only 11-12m, whereas to the south it remains at up to 20m in depth.

5.14 The benthic environment consists of various sediment types ranging from sandy areas to areas dominated by pebbles, cobbles and boulders. The biological environment is typical of that found in highly tidal areas along the west coast of Scotland. This constitutes high abundances of filter-feeding organisms such as soft corals, hydroids, bryozoans, large sponges and anemones. In shallow water, kelp is a major constituent of the biological environment with areas of maerl also identified within the Sound.

5.4 Onshore Site Description

5.15 The varied geology of Islay supports a range of natural environments, ranging from heather moorland, peat bogs, wetlands and saltmarsh to deciduous and coniferous woodlands, rich grassland and scrub forest.

5.4.1 Land Ownership

5.16 Land ownership is discussed in detail in *Chapter 4: Site Selection*.

5.4.2 Tidal Resource and Monitoring

5.17 Tidal resource measurements have been taken within the Sound. These have allowed an assessment of the flow regime to be made with the principal aim in identifying the most beneficial turbine siting locations in order to maximise the yield of the array in terms of power generated. Studies thus far have shown that the maximum flow within the Sound as being 3.7m/s, with a mean of 1.2m/s. However, the flow within the Sound is variable and dependant on the locations where the measurements are taken. SPR have commissioned modelling of the flows within the sound, therefore, the work leading towards the hydrodynamic modelling is critical to maximising the power output from the project.

5.5 Site Design and Layout

5.5.1 General Project Description

5.18 The proposed project will comprise of up to ten 1MW devices installed in deep water (>48m depth) on an area of the seabed within the Sound of Islay, just south of Port Askaig. These will then be linked by cable to Jura.

5.19 Flow modelling has been carried out in the Sound of Islay and this has been used to inform the design of the turbine layout. The ten turbines will be arranged so that they are spread out in four rows, the split being 2/2/3/3 from north to south of the sound. The flow modelling work has determined that the optimum spacing for the turbines at this location.

5.6 Tidal Turbines

5.20 Hammerfest Strøm UK (HSUK) are currently developing the HS1000, a 1MW demonstration tidal stream turbine. This will be deployed in Scotland, at the EMEC test facility on Orkney. Once proven, this design will be used for the 10 turbine array in the Sound of Islay. This work builds on the development work undertaken for the Hammerfest Strøm AS device in Norway where a 300kW scale device has been successfully designed, built and has operated for over 4 years. This makes Hammerfest Strøm AS (HSAS) the first company in the world to successfully convert kinetic energy from a tidal flow to electricity and connect it to the grid.

5.21 The HS device is a fully submerged, bottom mounted, three-bladed, variable pitch turbine, similar in arrangement to horizontal axis wind-turbine. The nacelle houses the turbine, gearbox, generator and associated components. The nacelle is attached to the tripod support structure and does not yaw like a traditional wind turbine.

5.22 The turbine features aerofoil section blades, which generate lift when presented to an oncoming flow. This lift force on the turbine blades causes the turbine to rotate and energy is extracted via a gearbox and generator.

5.23 In the 300kW machine, the generator is connected to the grid by means of a power export cable with a dry mate connection. An onshore transformer provides the step up grid connection voltage. The control system has been developed to allow remote operation and monitoring via a control room.

5.24 The pitch of the blades is varied to present the most efficient angle of incidence to the oncoming flow, thereby generating the maximum energy from the flow at any given flow speed. When the tide reverses, the blades pitch so that the turbine extracts energy from the flood, as well as the ebb tide. The turbine rotates in the opposite direction on the ebb tide.

Figure 5.1: Graphical Representation of the tidal device to be installed.

5.25 There has been no requirement to remove the nacelle due to any faults occurring during the 4-year operational period in Norway. However, the device was taken onshore in order to assess component wear and a forensic examination carried out. The components were found to be in good order and the device has since been successfully reinstalled (during August 2009).

5.26 Hammerfest Strøm are one of the few tidal device developers who have successfully installed a device and they have now proven the installation methodology a second time through the reinstallation of the refurbished nacelle in Norway.

5.6.1 Device Structure

5.27 The tripod support structure dimensions are 15m by 22m and the nacelle will sit on the substructure with a hub height of 22m from the seabed.

5.28 A rotor diameter of 23m will give the device a total height from the seabed of approximately 33.5m. The siting of the devices in areas that have a minimum water depth of 48m (the shallowest turbine is proposed to be in 50m of water) will ensure that there is sufficient clearance draft to enable vessels to use the sound unaffected by the turbines (a minimum of 16.5m is anticipated).

5.6.2 Operation

5.29 The turbine will be orientated to face the current in order to take advantage of the maximum tidal flow. The rotational speed of the turbine will be 10.2rpm with a maximum blade tip speed of approximately 12m/s.

5.30 The device can be controlled remotely via the SCADA connections and control system which can be used to start and stop the turbine, pitch the blades and operate the onshore electrical equipment to allow grid connection. They also communicate with the various operating systems and condition monitoring systems to provide status reports and alarms on a wide variety of performance indicators such as generator temperature, voltage, and water ingress amongst others. Under normal operating conditions the device can be operated automatically and will not require constant supervision to optimise output and carry out start up and shut down operations. However, it is possible to manually intervene with the device using the control systems.

5.6.3 Hydraulic Systems

5.31 The hydraulic system provides actuation as part of the pitch control mechanism for the turbine blades. In addition this system is used to operate the mechanical brake (during normal stop and emergency stop of the turbine, the pitch mechanism will act as a brake). The hydraulic system is sealed and contains oils for lubrication. Only recognised marine standard materials and substances will be used in the device.

5.6.4 Corrosion Protection

5.32 In compliance with established North Sea standards cathodic protection will be applied to all sub sea equipment. Any paint added to exposed surfaces will be applied in accordance with ISO 16272-1:2007.

5.6.5 Antifouling Protection

5.33 Methods for preventing marine growth will be investigated and tested on the test device at EMEC, primarily copper and thermoplastic based. Additionally a blade cleaning technology will also be tested.

5.6.6 Power Conversion System

5.34 The nacelle of the device will have a power rated capacity of 1MW and the rotational speed of the turbine blades will be approximately 10.2rpm.

5.35 Within the nacelle the gearbox will step up the rotational speed prior to the generator. This arrangement is similar to that found in many wind turbine designs. The low speed shaft connects the gearbox to the turbine rotor. The gearbox increases the rotational speed to allow the generator to produce electrical output at the required frequency for network connection. Electrical power is then transferred to shore via the connecting power and control cable.

5.6.7 Heating & Cooling Systems

5.36 A number of components within the nacelle produce heat during their operation. This is removed by a common cooling system, which is cooled, via a heat exchanger, by water from the external environment. The main heat producing components in the nacelle are the:

- Generator.
- Gearbox; and
- Main bearings;

5.6.8 Gravity Based Foundations

5.37 A tripod base, fixed to the seabed using gravity ballast in the legs, will support the nacelle and the blade structure. The structure is designed to withstand the appropriate level of loading. A review of various foundation and batch deployment options has identified the tripod base arrangement (as used in the 300kW device) as the optimum approach. It is possible that the device foundations will require to be pinned to the seabed as part of the installation procedure. However, at this stage of the Development this is deemed unlikely and only the ballasting of the devices has been considered as part of the assessment process within this ES. Development and testing installation methodologies are planned as part of the single device deployment at EMEC in 2011. Installation methods have already been demonstrated at Kvalsund. The test device at EMEC will provide the opportunity to trial improved open sea methods. When the devices for the Demonstration Array are deployed in the Sound of Islay, this will allow batch array deployment in a relatively sheltered environment, thus providing learning that will assist in developing effective procedures for installation of the devices at the Pentland Firth site.

5.38 The estimated mass of the tripod substructure itself will be 160 tonnes. The total mass of ballast used will be 800 tonnes and the nacelle will be approximately 160 tonnes. The tripod structure will be manufactured from carbon steel and the ballast weights are likely to be a mix of concrete and carbon steel.

5.6.9 Electrical Systems

5.39 The current generator design is a six pole, synchronous ac generator which will be rated at 1MW. The operating voltage of the generator is dependent on the availability of a suitably rated wet mate connector. The generator will generate at a voltage of 6.6kV.

5.6.10 Onshore Infrastructure and Facilities

5.40 The output from the array will be delivered to the network with a transformer being used to step up the voltage as required to connect to the local network.

5.6.11 Pre-construction Requirements

5.41 Site preparation and construction will consist of the following principal operations:

- Sourcing of aggregate from off-site sources for construction of the hardstanding area required by the substation;
- Construction of site substation;
- Deployment of substructures and nacelles;
- Subsea cable laying and trenching intertidally/onshore; and
- Connection of distribution cables.

5.42 Several of these operations will be able to be implemented and carried out concurrently. With this type of development the onshore works and the subsea works (with the exception of cabling) can be carried out entirely independently of one another.

5.43 Site restoration will be programmed and carried out to allow rehabilitation of disturbed areas as early as possible in the construction programme, for both marine and terrestrial habitats. Onshore, the construction methodology will minimise the storage of any excavated material on vegetation and will facilitate restoration at the earliest opportunity.

5.44 In the event that unsuitable seabed conditions are encountered during the installation of the substructures then there may be the need to micro-site some of the tripods. Micro-siting will be agreed with our environmental marine ecological advisor and Marine Scotland (with regards to the FEPA application) prior to their installation.

5.45 Due to the proximity of the onshore element of the works being adjacent to the A846 on Jura and the construction vehicles utilising this road for access then the contractor will adopt measures to ensure that this road is kept clean and free of debris. Wheel-wash facilities are likely to be located at the entrance/exit to the site. If conditions are such that site dust is likely to be an issue then measures (e.g. the watering of site access areas) will be carried out to mitigate this situation. Plant would access site via the A846 on Jura.

5.46 Vehicles working at the site will require a compound/laydown area when not in use. There are two options being considered in this regard if required. The limited number of construction vehicles will be located at the construction site itself on a separate area or the area near to the Feolin Ferry will be utilised. The area next to Feolin Ferry is already a large, well surfaced location and the storage of 3-4 vehicles will not inhibit access to the ferry link at this location. However, if the Feolin Ferry option is taken forward, this will have implications for the level of construction traffic utilising the A846. This is assessed in *Chapter 19: Traffic and Transport.*

5.7 Tidal Array

5.7.1 Installation Techniques

5.47 It is estimated that the devices can be installed over a period of approximately 72 days (not including weather downtime). This has made allowances for spring and neap tidal cycles. Offshore cable and pre-substructure installation activities will be conducted in advance of the installation of the nacelles.

5.48 The HS1000 is designed so that it can be installed without the need for specialised marine installation equipment or specially designed vessels. This will enable multiple competitive tender for installation works to be undertaken thus ensuring the most economic solution for the installation. Furthermore, the HS1000 will be designed to reduce the requirement for the use of divers during the installation and thereby minimise safety implications.

5.49 It is anticipated that the installation will consist of four phases:

- Pre installation of mooring systems and arrival of barges in preparation for construction activities;
- Heavy lift vessel on site to lift and move the substructures onto the barges;
- Anchor handling vessel to move substructures from the barge onto location for ballast operations and cable pull in; and
- A lift vessel will be used to install the nacelles once the site is prepared.

5.50 The principal option being considered for moored barge location is the bay at the Caol Ila distillery. Detailed bathymetric surveys were undertaken in summer 2008 but further survey work will be required to determine the optimum area to be used, taking into account the bathymetry of the near shore areas. In addition to this, analysis of the relevant depth contours and profiles will be undertaken to ensure that the sites selected are suitable and any impact on navigation for vessels transiting the Sound of Islay will be reviewed.

5.51 Each substructure can be lifted, transported and set down during a neap tide slack period. Once the substructure is in position, ballast weight will be installed onto the substructure to prevent sliding through the spring tide cycles prior to the nacelle installation and cable connection.

5.52 Once moved into position, additional ballast will be loaded onto the substructure to secure it against the overturning loads imposed by the turbine.

5.53 Once the substructure is secured into position and stabilised, the high voltage cable will be lifted to the substructure, pulled in and then secured ready for final mating.

5.54 The positioning, installation of ballast and/or pinning and the cable pull in will take approximately 56 hours. This preparatory work would take place during all tides and main installation activity during neap tide cycle phases. Pinning operations will be able to continue through spring tides.

5.55 In the Sound of Islay, the use of more than one installation vessel in parallel is unlikely to be possible due to navigational constraints.

5.56 A Navigational Safety Risk Assessment (NSRA) has been carried out, which assessed the possible impact of the installation activities (see Appendix 19.1).

5.8 Onshore Infrastructure

5.8.1 Access Track into Site

5.57 There will be no tracks constructed for access to the site. All construction traffic will utilise the existing road network (primarily the A846, which can be seen on Figure 1.1, *Chapter 1: Introduction*), which is the principal road on both Islay and Jura, and larger structures (e.g. the tidal turbines) will be transported in by sea.

5.8.2 Onshore Electrical Infrastructure

5.58 The electricity generated by the tidal turbines will be transmitted to the substation at 6.6kV and the turbines will be laid out in two separate electrical arrays. Once the cables (each will be approximately 100mm in diameter) reach the intertidal and terrestrial zones they will be installed in trenches approximately 0.45m wide and 1m deep.

5.59 Cables will be laid in sand or peat, and the trenches will then be backfilled with excavated subsoil and peat topsoil. Earthing cables and communications cables will be installed within the same trench.

5.8.3 Grid

5.60 It is anticipated that the cabling design will have two export cables coming ashore in a ring configuration with the turbines connected in series. This will mean that should one export cable fail over half the array will still be generating power, thus providing a certain level of redundancy within the system. The proposed onshore infrastructure site control building / substation will hold a transformer, switchgear, power electronics, control and communications equipment and auxiliary supplies.

5.61 The tidal array will generate electricity at 6.6kV. Two subsea cables would take the power to the shore providing some resilience and redundancy, after which a buried cable will run onshore to the substation where a transformer would step-up the voltage to 33kV for distribution.

5.8.4 Health, Safety and Environmental Management System

5.62 ScottishPower Renewables have an Environmental Policy and an Environmental Management System. Our Environmental Policy is the public statement of our commitment to manage our environmental impacts and improve our environmental performance. A copy of our Environmental Policy can be viewed http://www.scottishpowerrenewables.com/userfiles/file/SPR-ENV-001%20Environmental%20Policy.pdf

5.63 Our Environmental Management System is certified to IS0 14001 (awarded February 2010) and details the approach and procedures for ensuring compliance with applicable legislation, identifies the significant negative environmental impacts of our business and how these impacts are managed. The scope of the System is the development and outline design, detailed design, construction, operation and maintenance of renewable power generation sites.

5.64 Key construction activities are managed by setting out our minimum environmental requirements within our tender and contract documentation. This includes the requirements for the implementation of an Environmental Management System, Procedures and/or Environmental Site Plans, as appropriate, to the level of work to be undertaken. Compliance to these requirements are internally audited by the ScottishPower Renewables Environmental Team and also by our Project Managers.

5.65 During Operations, a requirement of our Environmental Management System is for all of our Operational sites to have an Environmental Site Plan. Our Operational sites are also internally audited by the ScottishPower Renewables Environmental Team.

5.9 Operation and Maintenance

5.66 The maintenance interval for the nacelle is scheduled to occur once every 5 years and the systems and their components are being designed so that this can be achieved.

5.67 In order to carry out maintenance, the nacelle will be removed from the substructure in a method similar to the installation in reverse, using a similar number and type of vessels. The nacelle will be taken from site to shore, where it will be maintained and any faults addressed in a clean environment.

5.68 Maintenance and intervention requirements out with the 5-year intervention period for the array will be minimal. Redundant systems and high reliability components will be used to extend the period between maintenance operations. ROV and possibly diver inspections will be carried out to visually inspect the condition of the nacelle, blades, structure and cabling.

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

5.10 Decommissioning

5.70 SPR are obliged under Section 105 of the Energy Act 2004 to ensure a full decommissioning plan is submitted for the removal of the turbine structures, power cables and all other infrastructure.

5.71 The HS1000 turbine device has been designed to allow ease of installation and decommissioning. The nacelle can be removed from the substructure in a single lift and brought to surface for transportation ashore for maintenance. The nacelle lift procedure will be well established by the time the array requires to be decommissioned.

5.72 The high voltage cable at the foot of the structure will be cut with ROV-deployed cutting equipment and recovered from the onshore end. The cables may be cut in the near shore locations and recovered by traction winch, with the deeper water lengths being recovered by a reverse deployment method that will require the cable end to be retrieved and spooled onto a cable drum.

5.73 The next step is the removal of the solid ballast weight to allow the substructure to be lifted. Solid ballast is designed for installation by placement into circular cells and stacking on the substructure feet. During deployment, remote recovery systems are utilised and the reverse principle is carried out for ballast recovery. The lifting mechanisms have been designed for a 25-year life. In addition, the substructure has been designed to allow lift of the substructure complete with ballast weight to aid the decommissioning process.

5.74 The final stage will then be the removal of the substructure. Lift and recovery to the deck of a vessel is the preferred option. However, the substructure could be lifted by smaller vessels and transported subsurface into shallow water ‘wet Storage’ areas whereupon a heavy lift vessel can then recover several units and install on the deck of a barge for tow away.

5.75 Following decommissioning, high-resolution, multi-beam surveys will be conducted to ensure the seabed is left clear. This is the proposed method of survey due to the limited amount of bottom survey time that can be conducted by ROV over such a large area.

5.76 Any unexpected objects identified from the survey will be investigated and construction debris recovered by ROV, as required. All of the above will be designed to satisfy the requirements of the BERR Decommissioning Guidelines.

5.11 Project Timescales

5.77 The planned installation start date for the Development is in early 2013 with the installation expected to be finished during the summer of 2013 and first power exported shortly after. In order to achieve this, the negotiation of wayleaves and leases for grid connections is expected to be completed early 2012.

6.0 Regulatory and Policy Context

6.1 Introduction

6.1. This chapter identifies the International and European legal drivers for climate change, decarbonisation and renewable energy, and the corresponding UK and Scottish policies which set the objectives and targets to meet these legal obligations. This chapter also shows how the proposed development fits within all relevant policy frameworks and, as such, how it will make a significant contribution to meeting these targets.

6.2. This chapter also outlines the regulatory and consenting requirements relating to the construction, operation and decommissioning of the proposed development, including the submerged turbines, the export cable route and onshore ancillary infrastructure[1].

6.2 Consent Requirements

6.3. New guidance on consenting of renewable energy developments in Scotland was issued by the Scottish Government in April 2010. The new approach to consenting will not come into force until 2011 and ScottishPower Renewables (SPR) expect consenting of this development to fall under the existing regime.

6.2.1 Seabed Leasing

6.4. Prior to any development on the seafloor, a seabed lease must be obtained from The Crown Estate (TCE). SPR is close to completing a lease agreement with TCE for the proposed development.

6.2.2 Section 36 Consent, FEPA, CPA and Marine License

6.5. The construction, extension or operation of a marine based generating station over a determined capacity within Scottish Territorial Waters[2] (over 1MW) or the Scottish Renewable Energy Zone[3] (REZ) (over 50MW) requires Scottish Ministers consent under Section 36 of the Electricity Act 1989 (s36). Licensing under s36 for marine renewable energy projects is now managed by Marine Scotland.

6.6. The proposed development will have an installed capacity of up to 10MW; this exceeds the 1MW threshold stipulated in the Electricity Act and therefore s36 consent is required.

6.7. A licence is currently required under Part II of the Food and Environment Protection Act 1985 ('FEPA licence') for the deposit of materials in, on or under the seabed. The Marine Scotland Licensing Operations Team (LOT) administer the FEPA licensing system in the waters adjacent to Scotland on behalf of the Scottish Ministers. The FEPA licensing process aims to protect the marine ecosystem and human health, and minimise interference and nuisance to others. Licence conditions are used to minimise impact if necessary, and monitoring activity may be requested to confirm that impacts are as predicted, and satisfactorily localised.

6.8. Consent under Section 34 of the Coast Protection Act 1949 (CPA) is also currently required for the construction, alteration or improvement of any works, under or over any part of the seashore, the deposit and movement of materials on/from the seashore below the level of mean high water springs. Consent is also now managed by the Marine Scotland CLPT. The CPA consenting process restricts works which may be detrimental to the safety of navigation, and in some circumstances also takes account of the potential environmental effects of works.

6.9. To simplify the consents application process, the Marine Scotland LOT, in Aberdeen, now provides a single point of application and initial enquiry for licensing under Section 36 of the Electricity Act (for marine projects), FEPA and CPA. This single point of application has been in place since 1st April 2010.

6.10. Section 20 of the new Marine (Scotland) Act 2010 will allow for FEPA and CPA licenses to be consolidated into one Marine Licence, to be administered by Marine Scotland's Licensing and Policy Team. Marine Scotland have indicated that applications for Marine Licence will be possible from Spring 2011 (the final date is still to be set), at which point FEPA and CPA licensing will cease in Scotland. The Development is expected to proceed through consenting prior to this date.

6.11. Section 35 of the Marine (Scotland) Act 2010 allows special procedures to be put in place for management of s36 Electricity Act 1989 applications alongside applications for a Marine Licence. Scottish Ministers may modify by order the procedural provisions of the Electricity Act to allow this single licensing process to operate satisfactorily.

6.12. Applications under s36 may also include associated onshore works such as an electrical sub-station. In those circumstances, the applicant can apply to the Scottish Ministers for deemed planning permission under Section 57 of the Town and Country Planning (Scotland) Act 1997 as amended by the Planning etc (Scotland) Act 2008 to cover those associated works.

6.3 EIA Legislation

6.13. The following set of regulations applies to applications made under s36 of the Electricity Act 1989 and should be particularly noted by developers:

- The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000; and
- The Electricity Works (Environmental Impact Assessment) (Scotland) Amendment Regulations 2008.

6.14. Section 36 development that is considered likely to have significant effects on the environment must be subject to EIA and an Environmental Statement (ES) submitted with the s36 application. Schedule 1 of the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 lists those developments for which EIA is mandatory, whilst Schedule 2 describes projects for which the need for EIA is judged by the Scottish Ministers on a case-by-case basis through a screening process. Schedule 3 describes the criteria to be used by the Scottish Ministers to determine if a development is 'EIA development'.

6.15. Where EIA is required, environmental information must be provided by the developer in an ES.

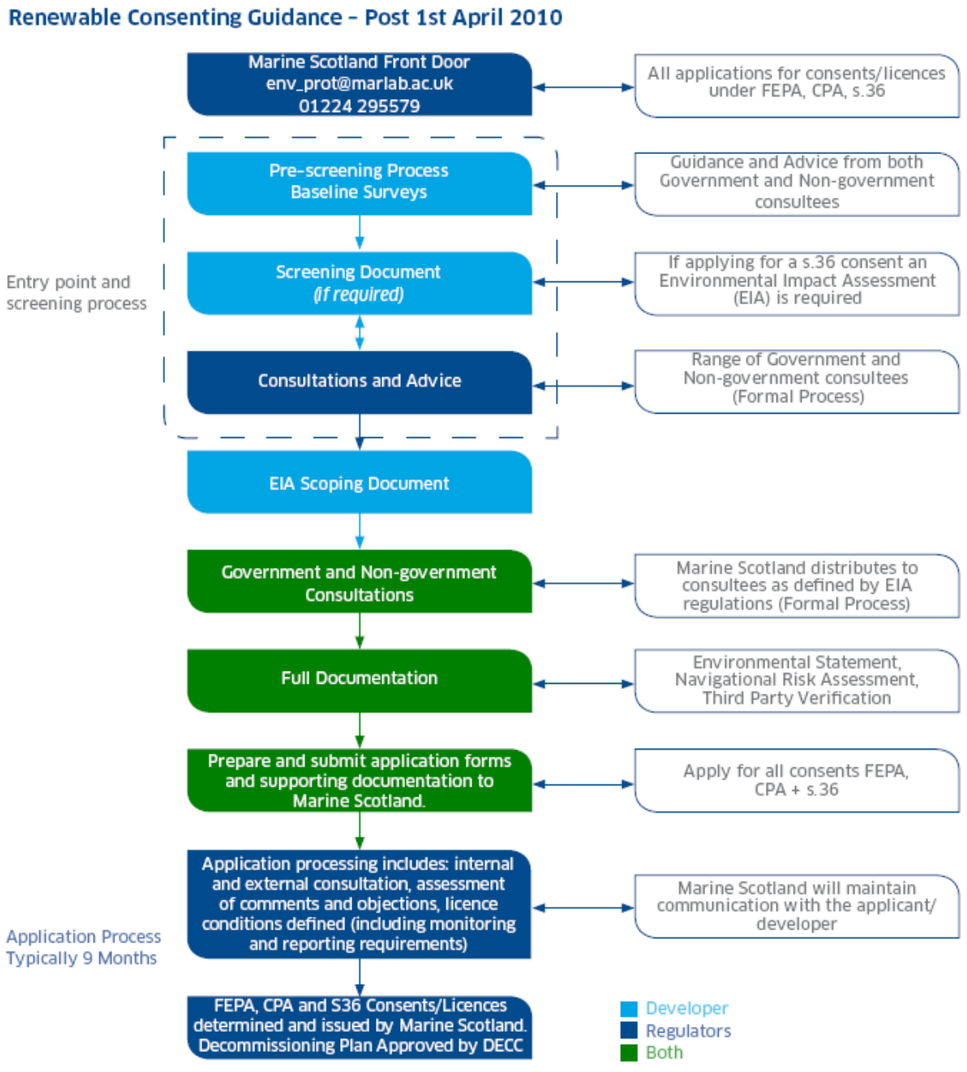
6.16. The Regulations prohibit the Scottish Ministers from granting consent for an EIA development without taking into account an ES, together with any associated environmental information.

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

[1] The Developer may opt to include onshore infrastructure (i.e. substation and associated cabling) within their consent application, requesting deemed planning permission for onshore works associated with the tidal array project.
[2] Scottish coastal waters out to 12 nautical miles.
[3] Area of the sea beyond the Territorial Sea which may be exploited for energy production, as defined in The Renewable Energy Zone (Designation of Area) (Scottish Ministers) Order 2005.

6.18. SPR has completed an EIA for all elements of the proposed development including those works associated with the offshore cable, landfall and onshore substation[4]. This ES supports application for consent under s36, FEPA, and CPA as well as deemed planning permission for onshore works under the Town and Country Planning (Scotland) Act 1997.

6.19. Renewables consenting procedures are outlined in Marine Scotland Topic Sheet No. 10 V3 – 'Progress Towards the One Stop Shop for Licensing in Scotland'. The flow chart below is taken from that Topic Sheet. Note that while the application process typically takes 9 months, this period can be significantly extended as a result of requests for further information from the consenting body, or possibly public inquiry, which can run for 6 – 18 months.



6.4 Habitats Regulations

6.20. Designated sites which have protected status for features, habitats and species etc. are fully considered within the assessment process and in establishing the impact significance criteria throughout this ES. Sites that are protected under national and international legislation are naturally considered to be more sensitive to change than those which are not and a greater significance is typically attributed to potential effects in designated areas.

6.21. Of particular importance to the designation of habitats and species is the Natura 2000 suite of sites (Special Areas of Conservation (SAC) and Special Protection Areas (SPA)). Under the European Union (EU) Habitats Directive (European Commission (EC) Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora) Member States are required to nominate sites to be designated as SAC. Similarly under the Birds Directive (Council Directive 79/409/EEC) Member States are required to nominate sites as SPA for the conservation of wild birds. These sites are subject to the protection measures provided by the Directive to ensure that they will not be adversely affected by activities taking place.

6.22. Under the European Habitats and Birds Directives and the transposing Conservation (Natural Habitats, & c.) Regulations 1994, as amended by The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007 and The Conservation of Habitats and Species Regulations 20105 the competent authority (in this case the Scottish Government) must consider the effect of a development on European sites when considering whether to grant an application for consent.

6.23. The Directive and the Regulations require that an Appropriate Assessment is conducted in respect of any plan of project, which is not directly connected with the management of a site for conservation purposes and which is likely to have a significant effect on a European site (i.e. SAC or SPA) either alone or in combination with other plans or projects.

6.24. Studies undertaken in support of this EIA, and consultation with regulatory bodies, indicate that no Appropriate Assessment will be required for the Development if it can be determined at Habitats Directive screening that the Development is not likely to have a significant effect.

6.25. Under the regulations it is an offence to disturb or to recklessly capture or kill European protected species (EPS), including all cetaceans. A license to damage or disturb EPS can be applied for from Scottish Ministers; however, in granting such a license Scottish Ministers must make arrangements for monitoring the incidental capture and killing of EPS, as well as make arrangements for the carrying out of such research or the taking of such conservation measures as are necessary for ensuring that such incidental capture and killing does not have a significant negative impact on the species considered.

6.5 Policy Context for Energy

6.26. This section identifies the policy context and drivers for renewable energy developments at an International, European, UK and Scottish level.

6.27. With regard to the onshore elements of the project, a review of how the project fits within the planning context of the local authority is made.

[4] Note that onshore elements of the development (i.e. those above Mean Low Water Springs) are considered within the relevant chapters of this ES (i.e. where environmental receptors have the potential to be impacted by onshore development).

[5] The Conservation of Habitats and Species Regulations 2010 consolidate all the various amendments made to the 1994 Regulations in respect of England and Wales. In Scotland, the Habitats Directive is transposed through a combination of the Habitats Regulations 2010 (in relation to reserved matters) and the 1994 Regulations.

6.5.1 International Energy Context

6.28. The UK plays a leading role in tackling climate change at an international level, working through the EU, G8 and UN Framework Convention on Climate Change.

6.29. The 1997 Kyoto Protocol set internationally agreed and binding targets for reducing emissions of greenhouse gases up to 2012. The Kyoto targets must be seen as only a start, as it has been estimated that a 60-70% cut in greenhouse gas emissions will probably be needed to stabilise CO_2 levels in the atmosphere. Through the Kyoto Protocol, the UK has a legally binding target to reduce emissions of greenhouse gases by 12.5% below 1990 levels in the period 2008-2012.

6.30. The EU Climate and Energy package, formally agreed in April 2009, builds on Kyoto and commits the EU to achieving the '20-20-20' targets: a 20% cut in emissions of greenhouse gases by 2020 compared with 1990 levels; a 20% increase in the share of renewables in the energy mix; and a 20% cut in energy consumption.

6.31. The EU has also established an EU Emissions Trading System (EU ETS) to help meet these targets. Member states must ensure that each industrial or electricity generation plant covered by the scheme holds a greenhouse gas emissions trading permit - in effect, a licence to operate and to emit CO_2. Each permitted installation will receive an allocation of allowances, based on the Member State's National Allocation Plan. Companies that emit less CO_2 than envisaged in the cap arrangement can sell or bank surplus trading permits. However, if they exceed their cap, they will have to buy additional permits. The ETS therefore provides financial incentives for large energy users to reduce CO_2 emissions.

6.32. EU energy policy also sets targets for sectors not covered by the EU ETS, namely Directive 2001/77/EC of the European Parliament and Council, 27th September 2001, on the promotion of electricity from renewable energy sources in the internal electricity market, and Directive 2009/28/EC On the Promotion of the Use of Energy from Renewable Sources and Amending and Subsequently Repealing Directives 2001/77/EC and 2003/30/EC.

6.5.2 UK Energy Context

6.33. Table 6.1 summarises significant policy developments relevant to renewable energy over the past decade.

6.34. Increasing energy provision from renewable sources is seen as key to achieving the desired low-carbon energy future. The UK has signed up to the EU Renewable Energy Directive, which includes a UK target of 15% of energy from renewables by 2020.

6.35. Approaches to achieving this target have most recently been set out in the Government's UK Renewable Energy Strategy, published in 2009. The Strategy includes measures to strengthen the UK renewable industry and whilst acknowledging the importance of onshore and offshore wind in contributing to renewables targets, the strategy also recognises the potential contribution that could be made by wave and tidal energy.

Table 6.1: UK Energy and Climate Change Policies and Acts

POLICY	KEY ELEMENTS
UK Climate Change Programme (2000)	Sets out package of policies to deliver UK's Kyoto target. Policies included stimulating new, more efficient sources of power generation.
DTI White Paper (2003)	Expressed overall priorities for UK energy policy in the first quarter of the 21st Century. Aims including cutting CO_2 emissions by 60% by 2050 and maintaining the reliability of Britain's energy supplies.
Energy Review (2006)	Proposed to strengthen the framework that supports the development of renewable technologies in the UK in order to achieve a target of 20% electricity from renewable energy by 2020.
Energy White Paper (2007)	Entitled 'Meeting the Energy Challenge', detailed how measures set out in the 2006 review were being implemented in the UK to reduce CO_2 emissions and secure clean and affordable energy.
Energy Act (2008)	Implements the legislative aspects of the 2007 White Paper and reflects the availability of emerging renewable technologies.
Climate Change Act (2008)	Creates a new approach to managing and responding to climate change in the UK and sets a legally binding target of a reduction in emissions of 34% by 2020 against a 1990 baseline.
Low Carbon Transition Plan (2009)	Sets out the UK Government's response to climate change by setting out a Transition Plan for becoming a low carbon economy. This plan will deliver emission cuts of 18% on 2008 levels by 2020 (and over a one third reduction on 1990 levels), and updates the 2003 White Paper to state that by 2020 the UK will achieve a target of 30% of its electricity from renewable sources.
UK Renewable Energy Strategy (2009)	Sets out how and why the UK Government intends to increase our use of renewable electricity, heat and transport. It also sets out how the UK Government will meet their legally binding target to ensure 15% of electricity comes from renewable sources by 2020 and provides a route map for the implementation of the Climate Change Act (2008).

6.5.3 Scottish Energy Context

6.36. The Scotland Act 1998 established devolved government for Scotland. The Scottish Government has an energy policy for Scotland at variance with UK policy, and has planning powers to enable it to put its policy priorities into effect. Scotland's objectives as a devolved government are discussed below.

6.37. The Scottish Government is committed to promoting the increased use of renewable energy sources and has set the following ambitious targets, which move beyond those set by the UK Government:

- 80% reduction in greenhouse gas emissions by 2050, with an interim target of a 42% emissions reduction by 2020; and
- 50% of demand for Scotland's electricity to be met from renewable sources by 2020, with an interim milestone of 31% by 2011.

6.38. Statistics show that in 2008, renewables met 22% of Scottish electricity demand[6]. With 6.5GW of renewables capacity installed, under construction or consented around Scotland, the Scottish Government is set to surpass its 2011 target.

6.39. Table 6.2 summarises significant policy developments relevant to renewable energy in Scotland.

[6] http://www.scotland.gov.uk/News/Releases/2009/12/23114900

Table 6.2: Scottish Energy and Climate Change Policies and Acts	
POLICY	**KEY ELEMENTS**
Securing a Renewable Future: Scotland's Renewable Energy (2003)	Published by the Scottish Executive in 2003 after extensive consultation, this document proposed that Scotland should aspire to generate as much as 40% of the electricity generated within the country from renewable sources by the year 2020.
Scotland's Renewable Energy Potential: Realising the 2020 Target (2005)	This study concluded that Scotland is well placed to meet the renewables target laid out in the 2003 document, perhaps before 2020, and could aspire to a greater renewables capacity if that was considered desirable.
Changing Our Ways: Scotland's Climate Change Programme (2006)	Sets out Scotland's plan of action for tackling climate change. The document states that 18% of Scotland's electricity should come from renewable sources by 2010, with this figure reaching 40% by 2020. Following a change in Scottish Government, a new target to generate 50% of Scotland's electricity from renewables by 2020, with an interim target of 31% by 2011, has been set.
Renewables Obligation Order (Scotland) (2009)	Encourages the development of Scotland's abundant renewable energy resources by obliging licensed electricity suppliers to provide a specified and increasing volume of the electricity they supply to customers from renewable sources. The Renewables Obligation (Scotland) Amendment Order 2009 introduced the concept of 'banding', a system which involves the award of different numbers of Renewables Obligation Certificates[7] (ROCs) in respect of generation from different renewable technologies. The Renewables Obligation (Scotland) Amendment Order 2010 was recently introduced. It makes a number of changes, including extending the Renewables Obligation to 2037, and introducing that new generators joining the RO now receive different numbers of ROCs, depending on their costs and potential for large-scale deployment.
10 Energy Pledges (2009)	The Pledges, set by the Scottish Government, form a coherent approach to energy issues in Scotland. The actions - ranging across key areas of energy generation and transmission, energy efficiency and transport - are focused on addressing both short and longer term opportunities for Scotland to benefit from competitive advantage. They are aimed at creating new jobs, reducing emissions and saving households and businesses money, thereby contributing to economic recovery and growth and to addressing climate change.
Renewables Action Plan (2009)	An Action Plan that sets out what needs to happen and by when to meet the Scottish Government's Renewable Energy targets, with a focus on the next 24-36 months. For example, in terms of marine energy, it identified the need for the development of a Marine Energy Road Map (published in 2009 – see Table 6.3). The Action Plan will be updated every 6 months with a focus on Scotland, but this will also consider how targets contribute to the UK Renewable Energy Strategy under the renewables obligation..
The Climate Change (Scotland) Act (2009)	Following the enactment of the Climate Change Act (2008), this Act aims to reduce greenhouse gas emissions and guide transitioning to a low carbon economy. Part 1 of the Act, creates the statutory framework for greenhouse gas emissions reductions in Scotland by setting an interim 42% reduction target for 2020, with the power for this to be varied based on expert advice, and an 80% reduction target for 2050. To help ensure the delivery of these targets, this part of the Act also requires that the Scottish Ministers set annual targets, in secondary legislation, for Scottish emissions from 2010 to 2050.
Climate Change Delivery Plan (2009)	Identifies transformational outcomes which will need to be substantially delivered by 2030 to put Scotland on the correct pathway to meet the 2050 target. Stresses aim for a largely decarbonised electricity generation sector by 2030, primarily using renewable sources for electricity generation with other electricity generation from fossil fuelled plants utilising carbon capture and storage.
Towards a Low Carbon Economy for Scotland (2010)	This discussion paper sets out the Scottish Government's plans to move towards a low carbon economy in Scotland, as part of the overarching Government Economic Strategy. The purpose of the paper is to invite views on the low carbon economic opportunities that offer the greatest potential to stimulate sustainable economic growth for Scotland, to inform the development of a Low Carbon Strategy that provides strategic direction for the public and private sectors alike.

6.6 Marine Energy in Scotland

6.40. In terms of tidal energy, the Scottish Government has stated that 'Scotland is uniquely placed to be a world leader in tidal power.'[8] This statement is supported by a number of recent studies and strategies, the most recent of which estimates that up to 2,000MW (2 Gigawatts (GW)) of marine energy could be installed in Scottish waters by 2020 (see Table 6.3)**.**

6.41. In 2007, and following from the results of these assessment of energy potential, the Scottish Government commissioned a Strategic Environmental Assessment (SEA)[9] to examine the potential effects on the environment from the development of wave and tidal power. The primary objective of the SEA was to assess, at a strategic level, the effects of meeting or exceeding the Marine Energy Group's (MEG's) estimate of 1,300MW of marine renewable energy capacity around Scotland by 2020. The results of the SEA show that it may be possible to meet MEG's estimate of 1,300 MW of capacity with, generally, minor effects on the environment. The SEA Environmental Report does note, however, that there are notable gaps in knowledge and that there are important exceptions to this general conclusion. Furthermore, the likelihood of the more significant effects occurring is very dependent on the particular characteristics of the projects being developed, in combination with the locations where they are being deployed. The Sound of Islay is identified as an area with exploitable tidal energy resource.

[7] A Renewables Obligation Certificate (ROC) is a green certificate issued to an accredited generator for eligible renewable electricity generated within the United Kingdom and supplied to customers within the United Kingdom by a licensed electricity supplier. One ROC is issued for each megawatt hour (MWh) of eligible renewable output generated.

[8] http://www.scotland.gov.uk/News/Releases/2008/09/09111618

[9] Include relevant legislation for SEA (if relevant – it was very dodgy)

Table 6.3: Marine Energy in Scotland	
Study / Strategy	**KEY ELEMENTS**
Opportunities for marine energy in Scotland (2002)	This Scottish Executive study investigated the potential for Scotland to benefit from the emerging marine energy industry and considered a number of incentive mechanisms by which it could be encouraged to meet its potential. The report recognised the strengths that Scotland has to offer the industry, including a significant indigenous energy resource and a suitably skilled workforce. It recommended that strong policy direction, support for Research and Development, and a robust market support mechanism are all needed to help marine energy achieve its full potential.
Harnessing Scotland's Marine Energy Potential (2004)	The Marine Energy Group (MEG) was established by the Forum for Renewable Energy Development in Scotland (FREDS) in 2003. An early task for MEG was to assess the potential for developing wave and tidal energy in Scotland, and to produce an action plan for developing that potential framework. The MEG report published in 2004 identified that up to 10% of Scotland's electricity (about 1,300MW) could come from wave and tidal stream power by 2020, significantly contributing to Scottish Government renewable energy targets.
Scottish Marine Renewables Strategic Environmental Assessment (SEA) (2007)	Following from the findings of the 2004 report, "Harnessing Scotland's Marine Energy Potential", the Scottish Government commissioned an SEA to examine the potential effects on the environment from the development of wave and tidal power. The SEA process was used to inform the preparation and delivery of the Scottish Government's Strategy for the development of marine energy, which was published in 2009 as The Scottish Marine Energy Road Map (see below). The SEA covered waters off the west coast of Scotland, from the North Channel northwards to Orkney and Shetland and the Pentland Firth.
Scottish Marine Energy Road Map (2009)	In August 2009 the Scottish Government published the Scottish Marine Energy Road Map developed by FREDS, which charts a course for the development of wave and tidal power around Scotland. The Road Map reflects an up-to-date assessment of the status and potential of the marine energy industry in Scotland, alongside recommended actions to ensure its continuing growth. It considers three marine energy development scenarios, with the 'low' scenario envisaging 500MW installed by 2020, the 'medium' scenario looking at 1,000MW by 2020, and the 'high' scenario considering 2,000MW by 2020. The 'high' scenario would deliver the greatest benefits in terms of renewable energy generation and economic benefit and the Road Map recommends that this scenario, whilst very ambitious, should be aimed for and achieved. The study recognises that although marine energy in Scotland has not developed as quickly as predicted in the 2004 report "Harnessing Scotland's Marine Energy Potential" – due in part to technical difficulties and financial constraints relating to technology development – the sector as a whole has made some significant steps forward over the last five years. The study sets out scenarios for growth of the industry and identifies five key issues which will be vital in terms of realising the high growth scenarios; these are finance, grid, planning, infrastructure / supply chain, and Europe. Progress against the Road Map will be reviewed in 2012.

6.42. As the first operational commercial tidal array in the world, the Sound of Islay Demonstration Tidal Array will help towards meeting the renewables targets set by the Scottish and UK Governments. Most importantly, the project represents a significant and exciting step forwards in proving the viability of tidal energy and to aiding in the development of more of these projects in the future.

6.7 Marine Planning in Scotland

6.43. Marine spatial planning is recognised as the mechanism for achieving a more integrated, simplified and sustainable approach to the management of marine sectors and activities and increased protection of the natural marine and coastal environment. The Marine (Scotland) Act 2010 sets out provisions for marine planning in Scottish waters, and while not yet in force (they will be brought into force on 1 July 2010 (The Marine (Scotland) Act 2010 (Commencement Order No. 1) Order 2010)), it is recognised that the following may apply.

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

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

6.45. The statutory status of the proposed plans has not yet been determined. However, it is anticipated that renewable energy developments would be incorporated as part of the proposed regional level planning. It is possible that plans may be in place during the period proposed for construction of the Development.

6.7.1 Scotland (National) Level Plans

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

6.7.2 Regional Level Plans

6.47. These will be prepared for Scottish Marine Regions to take forward policies and priorities defined in the National Marine Plan. Regions will be defined by Marine Scotland and managed by a Marine Planning Partnership which will comprise some one nominated by the Scottish Ministers as well as one or more public authorities and/or stakeholders. The Partnership's will prepare a regional plan for their area, which is likely to include a vision for the marine area covered by the plan, management policies for specific sectors, and a framework for decision making in relation to development consents. The regional plans could take around 2 years to produce.

6.7.3 International Level Plans

6.48. The focus at the international level would be to set Scottish Waters within the wider UK, European, North Atlantic and global frameworks.

6.8 Land-based Planning in Scotland

6.49. As stated earlier, consent for the onshore project components associated with the Sound of Islay Demonstration Tidal Array will be sought as deemed planning permission (under Section 57 of the Town and Country Planning (Scotland) Act 1997 as amended by the Planning etc (Scotland) Act 2008) from the Scottish Ministers.

6.50. In granting deemed planning permission, the Scottish Ministers will need to be assured that the proposed onshore works accord with national and local planning policies, which guide development onshore above Mean High Water Springs. The relevant policies are summarised below.

6.8.1 National Planning

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

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

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

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

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

6.56. Scottish Planning Policy (SPP) is the statement of the Scottish Government's policy on nationally important land use planning matters. It was published in February 2010 as a result of the commitment to proportionate and practical planning policies. The SPP replaces a series of planning guidance documents, providing a shorter, clearer and more focused statement of national planning policy.

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

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

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

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

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

6.8.2 Local Planning

6.59. The Local Development Plan (LDP) for an area comprises both the approved structure and the adopted local plan. The Development Plan relevant to the Sound of Islay Demonstration Tidal Array proposal consists of the:

- Argyll and Bute Structure Plan 2002; and
- Argyll and Bute Local Plan 2009.

6.60. The Argyll and Bute Local Plan is accompanied by an Action Plan (Argyll and Bute Local Plan (Action Plan and Monitoring Report) 2010-2012) that provides information on how the plan will be implemented by the Council and its community planning partners. The Action Plan was updated in June 2010.

6.61. The Planning etc (Scotland) Act 2006 requires Argyll and Bute Council to replace the existing Structure Plan and Local Plan with a single LDP. The LDP will set out the long-term vision for future development and land use across Argyll and Bute. The LDP is not expected to be finalised until 2012.

6.62. Table 6.4 identifies where relevant aspects of the LDP have been dealt with in this ES. The relevance of these policies is considered in each ES chapter.

Table 6.4: Adopted Development Plan policies.

ES Chapter	Argyll and Bute Structure Plan 2002	Argyll and Bute Local Plan 2009
Chapter 7 Physical Environment and Coastal Processes	None directly applicable.	None directly applicable.
Chapter 8 Benthic Ecology	STRAT DC 7 – Nature Conservation and Development Control	ENV 6 – Development Impact on Habitats and Species CST 4 – Development Impact on the Natural Foreshore
Chapter 9 Marine Mammals	STRAT DC 7 – Nature Conservation and Development Control	ENV 6 – Development Impact on Habitats and Species
Chapter 10 Noise and Vibration Affecting Human Receptors	None directly applicable.	None directly applicable.
Chapter 11 Marine Fish and Shellfish Resources	STRAT DC 7 – Nature Conservation and Development Control	ENV 6 – Development Impact on Habitats and Species
Chapter 12 Anadromous Fish	STRAT DC 7 – Nature Conservation and Development Control	ENV 6 – Development Impact on Habitats and Species
Chapter 13 Elasmobranchs	STRAT DC 7 – Nature Conservation and Development Control	ENV 6 – Development Impact on Habitats and Species
Chapter 14 Ornithology	STRAT DC 7 – Nature Conservation and Development Control	ENV 6 – Development Impact on Habitats and Species
Chapter 15 Commercial Fisheries	REC CP 2 – Sea-Fishing Interests	None directly applicable.
Chapter 16 Terrestrial and Intertidal Ecology	STRAT DC 7 – Nature Conservation and Development Control STRAT FW 2 – Development Impact on Woodland	ENV 6 – Development Impact on Habitats and Species ENV 7 – Development Impact on Trees / Woodland CST 4 – Development Impact on the Natural Foreshore
Chapter 17 Landscape and	STRAT SI 1 – Sustainable Development	ENV 9 – Development Impact on National Scenic Areas

Table 6.4: Adopted Development Plan policies.		
ES Chapter	**Argyll and Bute Structure Plan 2002**	**Argyll and Bute Local Plan 2009**
Seascape	STRAT DC 8 – Landscape and Development Control	ENV 10 – Development Impact on Areas of Panoramic Quality ENV 19 – Development Setting, Layout and Design
Chapter 18 Cultural Heritage	STRAT DC 9 – Historic Environment and Development Control	ENV 11 – Development Impact on Historic Gardens and Designed Landscapes ENV 13a – Development Impact on Listed Buildings ENV 13b – Demolition of Listed Buildings ENV 14 – Development in Conservation Areas and Special Built Environment Areas ENV 15 – Demolition in Conservation Areas ENV 16 – Development Impact on Scheduled Ancient Monuments ENV 17 – Development Impact on Sites of Archaeological Importance ENV 18 – Protection and Enhancement of Buildings
Chapter 19 Traffic and Transport	PROP TRANS 1 – Development Control, Transport and Access	TRAN 4 – New and Existing, Public Roads and Private Access Regimes
Chapter 20 Socio-Economics, Tourism and Recreation	REC TOUR 1 – Water Related Tourism Opportunities	TOUR 2 – Safeguarding of Primary Tourist Areas
Chapter 21 Water and Sediment Quality	STRAT SI 1 – Sustainable Development	ENV 12 – Water Quality and Environment
Chapter 22 Military Activity and Munitions	None directly applicable.	None directly applicable.
Chapter 23 Air Quality	STRAT SI 1 – Sustainable Development	None directly applicable.

6.9 Summary

6.63. This chapter identifies relevant legislation and policies for the proposed Development and shows that SPR is cognisant of them.

7.0 Physical Environment and Coastal Processes

7.1 Introduction

7.1. This chapter describes the existing physical environment and coastal processes in the vicinity of the proposed development and at the location of the preferred cable landfall site. Baseline considerations include (amongst others) hydrodynamic and meteorological conditions, as well as geomorphology (seabed and coastal). Potential impacts arising from the construction, operation, maintenance and decommissioning activities have been assessed and mitigation measures outlined where appropriate. Reference is made throughout this chapter to the study area. This is defined as the Sound of Islay.

7.2 Potential Effects

7.2. Current, wave and tidal characteristics (the hydrodynamic regime) can be changed/ modified by the introduction of energy extraction devices to a water body, thereby altering the presently observed hydrodynamic regime. Such modifications may result in associated change(s) to sedimentary regimes and geomorphological expression of the seabed and coastline. Effects on the hydrodynamic and sedimentary regime maybe localised (in the immediate vicinity of devices), at the near-field scale (on the vicinity of the entire development), or at far-field scale (beyond the area of the development). This is as detailed in Chapter 3 of the Scottish Marine Renewables SEA (Scottish Executive, 2007, para. C3.4).

7.3. The development of any coastal or offshore infrastructure may alter hydrodynamic processes and coastal morphology. In this instance, the construction and operation of an offshore array, seabed cable and coastal infrastructure at the landfall has the potential to change the physical environment through alteration of existing hydrodynamic patterns (i.e. waves, currents), sediment patterns (i.e. scour at devices, transport and deposition change through alteration of hydrodynamics) and coastal erosion (i.e. introduction of hard points on the coastline).

7.4. Although the motion of water waves is most evident as a surface phenomenon, there are also movements below the water surface that decrease with depth, which could be influenced by the proposed array. In deep water, the water particles beneath a wave orbit around a circular path and wave motion does not tend to reach the seabed, except in shallow water environments, while in shallow water, the water particles have an elliptical orbit and wave motion is felt at the seabed. Modelling work completed by Garrad Hassan showed minimal impacts on wave conditions within the Sound once the array is deployed as a result of its depth and position. The array is to be sited in water depths averaging approximately -50m CD.

7.5. The above statement can be quantified via consideration of the interaction of wave orbital velocity and water depth at the location of the device.

$$Lo = (9.81/2PI)\ T^2$$

Where Lo = 9.81, PI =3.14, T = 13seconds

7.6. The maximum wave height recorded from site surveys was 1.2m with a wave period of 13 seconds. In terms of British Standards guidance, wave motion is most greatly affected by the presence of the sea bed where the water depth is < L/20 with L being the wavelength. Assuming deep water conditions the deep water wavelength Lo = (9.81/2PI) T^2 where T is equal to the wave period corresponding to the maximum wave expected (1.2m). Based on T being equal to 13 seconds, Lo = 264m Lo/20 = 13 metres.

7.7. Therefore, as long as the water depth to the structure is not less than 13m, which in the case given that the depth of the tidal array is 28m from tip of blade, there will be minimal effect on waves. Wave conditions are therefore not likely to be affected by the development and are not considered further within this ES.

7.3 Summary

The physical environment and coastal processes within the study area are dominated by strong tidal flows through the sound of Islay, the geomorphological form of which results from previous glacial activity and subsequent sub-aerial weathering and erosion to form the landscape seen today. In the study area, man is noted as having had very little impact which would have resulted in anthropogenic modification to hydrodynamic processes or the physical appearance of the Sound.

The impacts of the proposed development on the physical environment and coastal processes are deemed to be of **negligible** significant effect due to the limited scale of the footprint of the array and the low amount of energy that is to be extracted from the physical system during operation of the proposed Development.

7.4 Methodology

7.4.1 Legislation, Guidelines and Policy Framework

7.8. Legislation concerning Section 36 Consent, FEPA and CPA are discussed in *Chapter 6: Regulatory and Policy Control*.

7.9. There are no specific EIA guidelines developed for tidal turbines; however, in the case of the physical environment and coastal processes the guidelines developed for offshore wind farm EIA by CEFAS (2004) are largely applicable (Chapter 3 of that document – Coastal and Sedimentary Processes). These guidelines highlight that consideration should be given for direct impacts on both hydrodynamics and sediment dynamics, alongside potential indirect impacts, such as subsequent effects on water quality or benthic ecology which are covered within separate chapters of the ES (*Chapter 8: Benthic Ecology* and *Chapter 21: Water and Sediment Quality*).

7.10. The European Marine Energy Centre (EMEC) high level EIA Guidance for wave and tidal test sites has been considered (EMEC, 2005). This outlines legal and consenting requirements (EMEC EIA Guidance Section 1.2) and summarises survey and additional data requirements to inform the impact assessment.

7.11. Both of the above guidance documents have been utilised in the production of this impact chapter.

7.4.2 Data Collection

7.12. Partrac Ltd was commissioned by SPR to collect water current velocities via the deployment of Acoustic Doppler Current Profiler (ADCP) during the early stages of the development, in order to inform SPR of the possible energy yield from the site. Three bottom mounted ADCPs and one Acoustic Wave and Current Profiler (AWCP) were placed on the seabed within the Sound at four different locations shown on Figure 7.1. These were deployed after discussion with SPR to provide a high quality data set of current speed and direction within the Sound of Islay to enable an energy yield assessment to be undertaken. The ADCP were used to obtain current readings through the water column whereas the AWCP measured wave speed and

current at surface and near surface. This would enable SPR to ensure that yield is maximised and currents would not be to the detriment of the turbines.

7.13. A marine resource site investigation was also undertaken by iXSurvey (2009), providing the basis for assessment of potential impacts on the physical environment. The investigation included:

- Measuring tidal current data – both as transects and static stations(further ADCP and AWCP);
- Mapping boundaries where seabed sediments change;
- The defining of subsurface geology; and
- The collection of accurate bathymetry data.

7.14. A detailed study of fluid movement was undertaken by Garrad Hassan providing the basis for assessment of potential impacts on existing currents and flow regimes. This study included:

- Analysis of temporal variation to inform long term flow regime estimation;
- Analysis of spatial variation to calculate the flow models to be used in the energy yield analysis;
- Long term flow variation estimation over the lifetime of the development (planning consent is being sought for an initial period of 7 years, with potential for extension for a further 7 years); and
- Flow field modelling - estimation of the flow variation across the development site and through the water column.

7.15. The reports from the intertidal surveys of potential cable landfall sites (Appendix 16.2 and Appendix 16.4) were taken into consideration for this chapter.

7.16. Other information has been collected through a desk-based data search. Important sources of information include:

- Scottish Executive (2007). Scottish Marine Renewables SEA;
- ScottishPower Renewables (2008). Proposed Demonstration Tidal Site, Sound of Islay. Request for a Scoping Opinion;
- Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody, J.P., Davidson, N.C. and Buck, A.L. (Eds). (1997). Coasts and seas of the United Kingdom, Region 14 South-west Scotland: Ballantrae to Mull. Joint Nature Conservation Committee;
- Ramsay, D.L. and Brampton, A.H. (2000). Coastal Cells in Scotland: Cell 5 – Cape Wrath to the Mull of Kintyre. Scottish Natural Heritage RSM Report No. 147; and
- DTI (2004). Atlas of UK Marine Renewable Energy Resources. Produced by ABPmer, the Met Office, Garrad Hassan, Proudman Oceanographic Laboratory.

7.4.3 Consultation

7.17. Consultation with statutory bodies and key stakeholders was undertaken by SPR as part of the scoping exercise as detailed within '*Proposed Demonstration Tidal Site, Sound of Islay. Request for a Scoping Opinion*' (SPR, 2008). Responses made by Marine Scotland (formally, Fisheries Research Services) and Scottish Environment Protection Agency (SEPA) are relevant to this chapter. Consultation responses focused on alteration to the hydrodynamic and sedimentary regimes within the Sound and potential loss of substrate. For full details of the consultation process, including a summary of all the responses, see *Chapter 2: Scoping and Assessment Methodology*, Appendix 2.1 and *Chapter 3: Consultation*.

7.5 Assessment of significance

7.18. This section describes how the impacts of the construction, operation, maintenance and decommissioning of the development on the physical environment and coastal processes have been assessed.

7.19. Impacts have been assigned a level of likely significance (from major to negligible), according to the definitions described in *Chapter 2: Scoping and Assessment methodology*. The assignment of significance includes consideration of the coastal and near-shore system and the inherent uncertainty within a dynamic environment. The impacts are described quantitatively where possible.

7.20. Table 7.1 provides a description of the criteria used to assess impact magnitude. Levels of magnitude are shown with a general description of the meaning of each 'level' applied within the context of coastal processes.

TABLE 7.1 MAGNITUDE OF IMPACT

Magnitude of Impact	Description
High	A fundamental change to the baseline condition of the receptor.
Medium	A detectible change resulting in the non-fundamental temporary or permanent condition of a receptor.
Low	A minor change to the baseline condition of the receptor (or a change that is temporary in nature).
Negligible	An imperceptible and/or no change to the baseline condition of the receptor.

7.5.1 Sensitivity of receptor

7.21. The sensitivity or value of the receptor is determined from a set of accepted criteria these are outlined within *Chapter 2: Scoping and Assessment methodology*. A detailed description of the criteria used to assess sensitivity or value for each receptor is provided in Table 7.2 below.

TABLE 7.2 SENSITIVITY/VALUE OF THE RECEPTOR

Receptor Sensitivity/Value	Description
High	Environment is subject to major change(s) due to impact. For example, sites contain features of international or national conservation or cultural designation, or permanent reduction of anthropogenic activity such as fish landings
Medium	Environment clearly responds to effect(s) in quantifiable and/or qualifiable manner. For example sites contain features of national or regional conservation or cultural designation, permanent modification of anthropogenic activity.
Low	Environment responds in minimal way to effects such that only minor change(s) are detectable. For example sites of local conservation or cultural value or temporary modification of anthropogenic activity.
Negligible	Environment responds in minimal way to effect such that only minor change(s) are detectable. For example, sites contain features of local interest, little or no change to anthropogenic activity.

7.22. Table 7.3 combines the assessment for the sensitivity of a receptor with the potential impact magnitude to give an overall assessment of the environmental impact significance. Impacts can be either beneficial (positive) or adverse (negative).

TABLE 7.3 IMPACT SIGNIFICANCE MATRIX				
Magnitude of Impact	**Receptor Sensitivity/Value**			
	Negligible	**Low**	**Medium**	**High**
High	No significant effect	Moderate	Major	Major
Medium	No significant effect	Minor	Moderate	Major
Low	No significant effect	Negligible	Minor	Moderate
Negligible	No significant effect	Negligible	Negligible	Minor

7.23. It should be noted that any residual effect (the effect after the implementation of mitigation) which remains at the level of 'Moderate' or 'Major' is regarded by the EIA Regulations as being of 'significant effect'.

7.6 Baseline description

7.6.1 Coastal and Seabed Geology and Geomorphology

7.24. The exposed coastal geology of the islands around the development comprises a complex mixture of metamorphic Dalradian rocks, including schists and quartzites, belonging to the Argyll and Appin Groups (Barne *et. al.,* 1997). This rock is relatively hard and is resistant to erosion by wave and tidal processes and, therefore, provides a stable platform for development purposes. Swathe bathymetry, geophysical survey and drop-down video surveys show that bedrock is exposed across some parts of the development site and cable route.

7.25. The geomorphology of both the coastline and the seabed of the Sound are formed from the result of extensive fault formation during the end of the Caledonian Orogeny. These have then been eroded by glacial action and subsequent weathering to form the features seen today.

7.26. The overall morphology of the sound of Islay and the development area within it is consistent with a glacial scoured valley. The western (Islay) side of the Sound has in general a shallower gradient between 6° and 10° compared to 11° and 18° seen on the eastern (Jura) side. Side scan sonar revealed that the seabed throughout the site is composed of two main lithologies:

- Exposed bedrock and subrock (bedrock partially exposed or just below the seabed); and
- Gravel and sand.

7.27. The bedrock morphology within the Sound, channels the flow of water in an approximate north-south orientation. Prominent rock outcrops occur in the northern part of the site, narrowing the channel from approximately 356m to 240m. As the channel widens further southwards, a centrally located outcrop approximately 900m long and 192m wide divides the channel into two, with deeper water found in the western channel.

7.28. Further isolated rocky outcrops also occur in the southern half of the Sound, these are mainly small exposed outcrops and pinnacles within a predominantly gravel seabed.

7.29. Much of the seabed throughout the study area is composed of gravel and sand; mainly in depressions within the bedrock and at the base of channels. It is anticipated that this sediment exists as a thin veneer overlying the bedrock, though this statement requires quantification. Throughout the site, numerous scattered boulders occur and these are most numerous in the middle region of the Sound, especially in an area just to the east of Port Askaig. (See Figure 7.2).

7.30. Surveys completed for the proposed development, have identified several discrete and relatively small areas of mega ripples in the sand and gravel; these are most numerous towards the southern end of the sound at -52m CD, where the ripples are up to 1m high with a wavelength of 10-15m. Larger mega ripples up to 1.5m high with a wave length of 25-35m were found to be present on the slopes and summit of a rise that is located in the centre of the channel offshore from Coal Ila (Figure 7.2).

7.31. Megaripples are common bedforms in estuaries, seas and sounds throughout the world where tidal currents in the range 0.6 - 1.3 m/s are encountered. They can be used to determine the prevailing direction of current as they will be aligned perpendicular to the current. The asymmetrical form of megaripples can also be used to indicate net sediment transport (Shepherd and Hails, 1984) as the least steeply angled side (the lee side) will orientate in the direction of predominant net sediment transport. These were not confirmed by the SeaStar Surveys (*Chapter 8: Benthic Ecology*).

7.32. Asymmetry of the mega ripples found in the Sound of Islay (as identified from previous geophysical surveys carried out (Shepherd and Hails, 1984)) is very slight; however, the general orientation of the ripples indicates a sediment transport direction of 343° from N (concurrent with the alignment of the Sound). This correlates with the ADCP data which indicates flow is primarily in a northerly direction during flood and a southerly direction during ebb tide.

7.33. The presence of mega ripples has been identified as a constraint of turbine location; as turbine performance will be hindered where deployed at angles > +/-15 ° from vertical therefore micro-siting techniques will be used to ensure that these formations are avoided. In addition, whilst completing modelling SPR, in discussion with Garrad Hassan, has scoped out slopes of greater than 6°, which are considered to be a constraint to site development.

7.34. The coastline of Islay adjacent to the development is comprised primarily of cliffs and raised beaches, with a shoreline dominated by gravel and exposed rock platform with boulders (Barne *et. al.,* 1997).

7.35. The coastline of Jura adjacent to the development is also comprised primarily of maritime cliff but also often displays a pebble and cobble dominated foreshore. On Jura, parts of the route of the A846 (the main road through the island) separates the cliffs from the foreshore.

7.36. Potential cable landing options were identified based on a review of video footage of the shoreline of the Sound, Ordnance Survey maps and Admiralty Charts, as well as limited on-site examination (See *Chapter 16: Terrestrial and Intertidal Ecology*). The preferred cable landing point at Daimh-sgeir is characterised by narrow pebble, cobble and boulder shoreline with exposed areas or rock platforms.

7.6.2 Bathymetry

7.37. At the northern and southern entrances to the Sound of Islay, the seabed depth generally varies between -10m CD and -20m CD. The bathymetry across the study area (shown in Figure 7.3 is characterised by a steep sided channel, typical of a glacially scoured valley, which is constricted between the islands of Jura and Islay. Along the western side of the channel the seabed rises steeply up from a maximum depth of -62m CD to the shoreline. On the eastern shore this also occurs at the narrowest point of the channel but in the wider sections the seabed rises to a plateau at around -10m CD to -20 m CD.

7.38. The morphology of the whole area of the Sound of Islay is such that there is very little in the way of flat seabed that is suitable for deployment of the tidal devices. However, there are two areas of seabed, at approximately -50m CD average depth, which have gradients of generally <5 degrees, and which have been identified as suitable for deployment. The preferred cable route to Daimh-sgeir on Jura, would ascend a fairly steep slope up to the -25m CD contour, approximately 1km from the shore.

7.6.3 Wind and Wave Climate

7.39. There are limited data for wind and wave climate specifically available for the Sound itself, the bulk of available data is focused on the western side of the island. Data indicate that the dominant winds are incident from the south-west, characteristic with much of Great Britain. Mean wind speeds exceeded 4m/s for 75% of the time (recorded between the years 1915-1960 across Islay and Jura) and the wind speed exceeded 20m/s for 0.1% of the time (averaged) across the western part of Islay (Barne *et.al.,* 1997). The critical fetches for local wind wave generation are 0° N and 150° N from the site. Previous work completed for a harbour development at Port Askaig, approximately 300m from the development, illustrated that the offshore/nearshore wave regime was characterised by wave heights of up to 2.9m as shown in Table 7.4 (Royal Haskoning, 2010).

7.40. The Sound of Islay is protected from open oceanic waves by the land mass of Islay. Locally generated wind waves, rather than swell waves, have a much greater influence across the development site. Another significant influence is waves generated by wind pushing against the tide. AWCP was deployed for a period of 31 days in the summer of 2009 capturing a full spring-neap-spring-neap monthly tidal cycle. Maximum wave heights of 1.2m, with a wave period of 13 seconds, were recorded over the monitoring period. The surveys carried out showed that the peak wave is relatively small in comparison to swell waves found in the open ocean.

Table 7.4: Wave parameters at Port Askaig - Calculated for MHWS (2.1 m CD)

Return period (years)	Direction (dgr. N)	Fetch (Km)	Wind speed (m/s)	Duration (hours)	Wave @ Port Askaig		
					Water depth (m)	Hs (m)	Tm (s)
1	0	45	18.1	6	10	1.7	6.1
	150	40	24.7	6	10	2.1	7.0
50	0	45	28.5	6	10	2.4	7.8
	150	40	37.5	6	10	2.8	8.8
100	0	45	30.4	6	10	2.5	8.1
	150	40	39.8	6	10	2.9	9.1

7.6.4 Tidal Range

7.41. Tidal water movement is a key characteristic of the Sound and the reason the site has been selected for the development. The main tidal flood stream flows up through North Sound and around the western coastline of Islay. Along the western mainland coast, the flood flows to the north along the coastline of the Kintyre peninsula and through the Sound of Jura and into the Firth of Lorn (HR Wallingford, 2000). The ebb acts in a reverse direction (Figure 7.4).

7.42. Tidal data is available to predict tidal range for various shoreline locations around the sound of Islay and inshore. Principally it is available from relevant Admiralty Chart (Chart No. 2168) for which locations are shown in Figure 7.5 below. In addition to the relevant Admiralty data SPR have also fitted tide gauges to the pier at Port Askaig to provide accurate local data to inform the project. The data collected by the tide gauge is shown within Table 7.5 below.

Table 7.5: Tidal levels and ranges

Location	MHWS	MLWS	Spring Range (m)	MHWN	MLWN	Neap Range (m)
Rubha a'Mhail	3.7	0.6	4.3	2.8	1.5	4.2
Ardnave Point	3.6	0.6	4.2	2.7	1.5	4.2
Orsay Island	2.6	0.5	3.1	2.3	1.3	3.6
Bruichladdich	2.3	0.8	3.1	1.5	1.4	2.9
Port Ellen	0.9	0.3	1.2	0.8	0.5	1.3
Port Askaig*	2.1	0.4	1.7	1.5	1.0	0.5
Craighouse	1.2	0.3	1.5	0.9	0.4	1.3
Sound of Gigha	1.5	0.6	2.1	1.3	0.8	2.1
*Taken from tidal gauge readings						

7.43. The geographical location of where these shore line measurements were taken is illustrated in Figure 7.5. The majority of the locations lie outside of the Sound; however, the data may be utilised herein to illustrate the potential tidal range to be expected within the geographical area for the purposes of assessment.

7.6.5 Tidal Currents

7.44. Strong tidal currents characterise the rapid constriction of the channel between Islay and Jura. An initial appraisal of currents can be gained from the information published on the Admiralty Chart for this coastline, which in this case details measured current speeds and directions for three locations, as illustrated in Figure 7.5. Data from the charts is reproduced in Table 7.6 and although none of the locations fall within the Sound of Islay, they provide an understanding of wider regional tidal conditions. Position A is located in the deep-water channel between Islay and Gigha (south-east of the Sound of Islay), Position B is located in shallow waters between the Kintyre peninsula and Jura (east of the Sound of Islay), and

Position C is located in shallow waters in the Sound of Gigha (south-east of the Sound of Islay).

Table.7.6: Tidal streams

Time relative to HW Oban	Position A 55°40'.0N 5 53.0W			Position B 55° 53'.2N 5 49.0W			Position C 55° 40'.8N 5 42.6W		
	Dir (°N)	Speed (knots)		Dir (°N)	Speed (knots)		Dir (°N)	Speed (knots)	
		Spring	Neap		Spring	Neap		Spring	Neap
-6	359	0.3	0.1	350	0.8	0.3	000	1.0	0.3
-5	024	0.6	0.2	352	1.7	0.7	009	1.2	0.4
-4	018	0.5	0.2	000	1.8	0.7	012	1.1	0.4
-3	008	0.3	0.1	008	1.4	0.6	015	0.8	0.3
-2	358	0.1	0.0	017	0.9	0.4	011	0.5	0.2
-1	197	0.2	0.1	093	0.2	0.1	150	0.1	0.0
0	198	0.5	0.2	165	0.5	0.2	185	0.8	0.2
+1	198	0.6	0.2	182	1.0	0.4	193	1.2	0.4
+2	191	0.4	0.2	189	1.6	0.6	183	1.3	0.4
+3	181	0.2	0.1	192	1.6	0.6	174	1.0	0.3
+4	143	0.1	0.0	190	1.0	0.4	193	0.6	0.2
+5	010	0.1	0.0	190	0.2	0.1	312	0.2	0.1
+6	359	0.3	0.1	358	0.5	0.2	353	1.0	0.3

7.45. Admiralty data points are useful, but a more detailed appraisal of tidal currents across the development can be derived from field measurements. Current profiles were measured at 3 transect locations in the Sound of Islay through a 13-hour tidal cycle by IX Survey in 2009. The 13 hour timescale only provides limited data for current profiling. In addition to the transects completed, 3 fixed location ADCPs were setup on the seabed alongside the AWCP. These were in position and recording for a period of 31 days from 15th June to 17th July 2009.

7.46. Table 7.7 presents the highest recorded flows found from both sets of surveys. The highest recorded current speed (2.80 m/s or 5.44kts) occured at two hours after high water at the most northerly of the transects, indicating that the strongest tidal flows are associated with the flood phase of the tidal cycle.

Table 7.7: Highest recorded current flows during mid tides using vessel mounted ADCPs in the Sound of Islay. (See Appendix 7.3)

Transect	Highest Recorded Flow (m/s)	Highest Recorded Flow(Knots)	High Water (± hrs)	Flow Direction (degrees)	Depth (m)
B	2.64	5.13	HW -4	024	24
C	2.62	5.09	HW +3	204	32
D	2.80	5.44	HW +2	180	8

7.47. The reason for high current speeds recorded at this transect is due to a shallow area in the middle of the transect (Figure 7.1) where there is a rock outcrop. The water here is constrained between the rock outcrop and the east coast of Islay. This constraining of the flow accelerates the water, then, once past the narrow area the deeper channel widens and the current speeds slow. This increase in current speed due to the constriction imposed by the geomorphological and bathymetric expression on the tidal flow is expressed within the law of continuity which outlines the conservation of volume and hence states that current speed must increase as an increased water volumes moves through a constricted space, such as found within the sound.

7.48. A review of vessel mounted ADCP data and bathymetric data (collection commissioned by SPR for the development) shows that on the ebb tide (when the flow is moving south) the fastest region of flow holds close to the west side of the channel (Islay side). The reason for this is three fold: an upstream bathymetric form forces more of the flow to that side, a slight change in channel direction after Port Askaig forces the flow to the outside of the bend and a fairly steep side on the western bank of the channel (Appendix 7.1). The bathymetry of the sound is shown at Figure 7.2 and 7.3

7.6.6 Seabed Processes and Sediment Transport

7.49. Seabed transport is driven by the direction and strength of hydrodynamic flows (tidal currents and combined wave and tidal current) with the degree of sediment transport being governed by sediment type (primarily cohesiveness, grain size, density and shape) alongside overall availability of bed sediment.

7.50. Sediments transport into the Sound of Islay is inferred to be from both the northern and southern entrances, driven predominantly by the tidal currents shown in Figure 7.2. Any sediment suspended carried within the tidal currents is likely to have originated from the Kintyre peninsula to the east of the Sound. There is an abundance of sediment along parts of the Kintyre peninsula, much of which is derived from glacial deposits. However, because there is little net transport of sediment away from these beaches (HR Wallingford, 2000), the amount of suspended sediment within the sound is likely to be low. Sediment that remains within the sound is likely to be coarse grained and of relatively high density, being typically more difficult to entrain and subsequently transport. Larger sediment sizes also have a tendency to settle to the seabed rapidly, subsequent to any transportation.

7.51. The very slight asymmetry of mega ripples found within the Sound (see Figure 7.2 and Paragraph 7.28) indicates that although there is little sediment transport; what limited transport there is, is likely to be in a north north-westerly direction of 343 degrees.

7.7 Assessment of Effects and Mitigation

7.52. In this section likely impacts of the proposed Development on the physical environment are assessed using the methodology described above and as outlined within *Chapter 2*: *Scoping and Assessment Methodology*.

7.7.1 Do nothing scenario

7.53. This section assesses how the physical environment may be altered in the future if the proposed development is not constructed.

7.54. Under a do nothing scenario it would be expected that the currently observed physical environment of the study area would remain largely unchanged except for anticipated change to sea level. The International Panel Climate Change(IPCC) third assessment, indicates that sea level is predicted to rise at an accelerated rate with sea level rising up to 10cm in Scotland by 2020 (Worst case scenario relative to 1961-1990 for the full range of global sea-level changes estimated by the IPCC, incorporating the updated isostatic adjustment data).(IPCC 2001).

7.55. There are no known plans for major development within the Sound of Islay itself or to its coastline. It is likely, however, that there will be some small scale development of the eastern coastlines of both Islay and the south western coastline of Jura, which will be

primarily as a result of tourism (harbour and infrastructure development) (see *Chapter 20: Socio-economics, Tourism and Recreation*).

7.56. A proposed small-scale hydroelectric scheme (currently at the planning stage) is proposed on Jura as that area currently has no permanent electricity supply. It is unknown as to the extent that this development is likely to have on the overall physical environment and coastal processes that occur in the area.

7.57. Scottish and Southern Energy is currently progressing plans to develop an offshore wind farm to the west of Islay, which may lead to additional development at Port Askaig. The extent of development and further infrastructure required is currently unknown and therefore the impact should this proceed cannot be assessed.

7.7.2 Potential Impacts during Construction Phase

Impact 7.1: Displacement of sediment resulting in alteration or loss of bedforms and geomorphology

7.58. There is potential for seabed substrate (habitat) loss, which could alter sediment supply and mobility of presently occurring bedforms within the Sound of Islay at a) the site of the turbines, and b) the route of the cabling to shore. Loss of substrate will result from the footprint of the turbines and cable on the seabed, while bedform alteration may occur from laying the cable towards landfall and further onshore.

7.59. The footprint of each turbine is supported by three circular feet in a triangular layout. Each foot has a base of approximately 3.5m in diameter. This gives each foot a footprint of 10.99m² or 32.97m² per turbine. If the proposed 10 turbines are installed this will equate to a seabed (substrate) area of 329.7m^2 being lost due to the physical footprint of the turbines within the Sound.

7.60. The methodology for cable installation is to be confirmed but cable armouring is the preferred option of cable installation on the seabed. The only area of the seabed disturbed will be the footprint of the cable on the seabed. This has been estimated worst case scenario at 45cm width (providing a 35cm buffer of the 100 mm diameter of armoured cable). There is approximately 5km of cable to be laid for the device (this includes the inter-array). The cable footprint area therefore predicted is (5000m length x 0.45m) = 2250m².

7.61. The cable route may also alter the seabed bedforms currently seen on the site via alteration of near bed hydrodynamic and sedimentary processes. Sediment movement can be assessed by analysis of the Hjulstrom curve (Figure 7.7), which illustrates the relationship between the current velocity and mean grain size in terms of the expected dominant sedimentary regime (erosion, transport or deposition). Using the near bed velocity (obtained from ADCP survey) estimated to be <0.5m/s and a mean sediment grain size of 2-256mm for gravel the Hjulstrom curve illustrates that the environment is transport dominated. The proposed cable route lies perpendicular to the dominant flow direction, which is 160°-180° from North. The cable will therefore act as temporary barrier to sediment transport along this axis until sediment accretion attains an elevation sufficient to allow sediment bypassing of the structure. The scale of inhibition to bedform mobility within the development site is anticipated to be negligible. This is as a consequence of the proposed cable thickness being 10cm in elevation compared with mobile bedforms which attain elevations in the region of 1.0-1.5m. Due to the size of the cable relative to the migratory bedforms within the system a new dynamic equilibrium between the hydrodynamic and sedimentary regimes and the seabed infrastructure will quickly establish.

7.62. An area of cable trenching at landfall is proposed where sediment will be excavated. However, the trenching will be restricted to an area limited spatially to approximately 100m offshore. The trenched area will be infilled once the cable is in place with no anticipated permanent change to seabed or coastal morphology. The present environment is dominated by sediment transport and deposition, as shown by the shaded area beneath the curve in Figure 7.7. At present, it is assumed that the landfall will be achieved either by ploughing (with the volume being ploughed being restricted to 45m³ (worst case scenario) (0.45m wide x 1m depth x 100m from the shoreline). Horizontal directional drilling (HDD) is not being considered at this stage. If trenching is the methodology chosen, then there will be minimal impact on the shoreline Impacts during construction will be minimised provided that the foreshore levels are reinstated using the trenched material immediately following cable laying. The areas identified for cable landing are dominated by gravel and pebble beaches those materials are replaced then the coastal processes will not be affected by trenching as the material and profile that currently exists will remain.

7.63. During backscatter mapping of the Sound of Islay an area of approximately 3.57km^2 was mapped, covering less than 1/10th of the area of the entire Sound of Islay. The mapped area was found to be composed of almost 76% gravel (Figure 7.6) which equates to approximately 2.71km^2. The calculated footprint of the turbines is therefore likely to result in the loss of 0.05% of the development site and 0.005% of the full Sound of Islay.

7.64. Due to the grain size found within the Sound, gravel and coarser grained fractions, any sediment displaced as a result of the construction processes is likely to settle within metres of disturbance. Any material moved due to the construction methodology will rapidly return to the seabed, helped by installation of the proposed infrastructure during periods of slack water when sediment transport potential is reduced, with current velocity below the critical threshold for gravel size sediment entrainment and transport. Water quality issues are discussed in *Chapter 21: Water and Sediment Quality*.

7.65. Due to the small area (substrate) of the Sound lost as a result of the turbine footprint, the magnitude of the impact upon the sedimentary regime is considered to be low, while sensitivity of substrate loss is also deemed to be low. The overall impact of potential sediment loss is deemed to be **negligible**.

7.66. There is no change anticipated to the status of the geomorphology of the sound both at the coast and on the seabed as a result of the Development. The magnitude of impacts on geomorphological processes will be low with a short term localised restriction to sediment transport until such times as sediment accretes to the 10cm elevation of the emplaced cable. The observed sedimentary regime will return to present condition rapidly and it is expected that bedforms will be back to original condition within 12 months. Displaced material from any development is not expected to migrate long distances and the sensitivity of substrate/geomorphology is also low. Therefore the impact on substrate/geomorphology caused by displacing sediment is likely to be of **negligible** significant effect.

MITIGATION IN RELATION TO IMPACT 7.1
• No mitigation required

Residual impact:

7.67. As no mitigation is required, the impact of displacing sediment is likely to be of **negligible** significant effect.

Impact 7.2: Increase in suspended sediment

7.68. Seabed sediment could potentially be disturbed as a result of construction activities on the seabed including:

- Installation of the turbines and gravity-based foundation structures (including any seabed preparation);
- Installation of inter-array and export cables; and
- Construction vessel activity (Potential anchoring, if required).

7.69. Any sediment that is disturbed and enters into suspension could subsequently be transported and dispersed by the prevailing tidal currents, and will be re-deposited on the seabed. This disturbance to surface sediments and bedrock has the potential to impact on water quality (also discussed in *Chapter 21: Water and Sediment Quality)* as a result of increased suspended sediment concentrations. The impact of suspended sediments on biological communities is discussed in the relevant chapters e.g. *Chapter 8: Benthic Ecology* and *Chapter 9: Marine mammals*.

7.70. Table 7.8 details estimated areas of substrate which could be disturbed and factors influencing dispersal. The amount of substrate lost has been estimated using the base surface area (footprint) of the devices and a buffered cable footprint. The results of this are considered minimal, due to the substrate within the Sound being predominantly gravel and exposed bedrock.

Table 7.8: Outline estimate of sediment displacement

Turbine details	Value
Size of turbine footprint (m^2)	32.97²(per device) 329.7m^2 (for array)
Water depth	48m approx
Type of seabed substrate	Bedrock/ boulders/ gravel
Loss of substrate and change of seabed morphology from subsea export cable	Mooring will be used to secure cables to the seabed. The only area of the seabed to be disturbed will be the seabed substrate lost by the placement of the armoured cable on the seabed. This has been estimated conservatively at 45cm width (providing a 35cm buffer of the 10cm diameter of armoured cable) giving 2250m^2 . The placement of cable on the seabed will result in a temporary alteration in the bedform which is much smaller than current seabed features. The cable diameter is 10cm which will temporarily act as a barrier to sediment movement on the seabed until accretion results in cable burial.
Volume of sediment to be excavated and returned from trenching as the cable comes ashore	Landfall will be achieved either by ploughing (with the volume being ploughed being restricted to 45m^3 (worst case scenario) (0.45m wide x 1m depth x 100m from the shoreline).

7.71. If the near bed velocity is high enough to exceed the critical shear threshold of the seabed and enable sediment to be entrained and subsequently brought into suspension, subsequent dispersion is inferred to occur within the wider environment of the Sound. The strength of the tide, the potential for dispersion, and the settling characteristics of the suspended sediment will determine the footprint over which the sediment will be deposited.

7.72. Due to the generally coarse nature (mostly gravel and larger grain sizes) of sediments, reworking of seabed bedforms under tidal currents is likely to continue to be the dominant sedimentary regime within the wider study area. Should sediments be suspended they are expected to settle back to the seabed very rapidly and therefore the sediment dispersion footprint is unlikely to extend any great distance from the cable route or the turbine and the magnitude of potential impact and sensitivity of the receptor are both considered to be low.

7.73. Construction will be undertaken during slack water which is assumed to have very low current velocities of less than 0.1ms^{-1}. As shown within Figure 7.7, due to the Sound having gravel >2mm there will be no sediment transport taking place during this period. Cable installation will also take place during periods of low current velocity and over a limited area. Therefore, the significance of effect of the potential impact of sediment re-suspension is assessed as being **negligible**.

MITIGATION IN RELATION TO IMPACT 7.2
• No mitigation required

Residual Impacts

7.74. As no mitigation is required, the residual impact will remain of **negligible** significant effect.

7.7.3 Potential Impacts during Operation and Maintenance Phase

7.75. The impacts of sediment displacement or increase in suspended sediments are not predicted to be an issue post construction. Impacts during operation and maintenance are discussed below.

Impact 7.3: Alteration of the hydrodynamic regime

7.76. Currents would be modified in the immediate vicinity of the tidal devices and support structures. In the immediate lee of each device there will be a flow separation zone and downstream turbulence. Hydrodynamic modelling has been completed by Garrad Hassan to assess the most efficient layout and turbine height within the water column; however, to show any alteration in hydrodynamics, total energy of the tidal system within the Sound of Islay must be assessed.

7.77. There are limited data available to address the energy being removed from the tidal system by the turbines. For the proposed layout of the array newly developed modelling methodologies were used, although at the time of writing full scale validation of the models was still being undertaken. All the energy yield models used assume that the extraction of energy within the Sound does not significantly affect the flow.

7.78. Observations of two existing tidal turbine devices which have been developed by Marine Current Turbines (MCT) indicate that the overall impact of energy extracted by Seaflow (their first device which was located off the north Devon coast) was negligible and Computational Fluid Dynamics (CFD) modelling predicted the same to be true of Seagen (second device which is generating within Strangford Lough, Northern Ireland) (Royal Haskoning, 2005). The modelling studies undertaken for the MCT tidal devices “Seagen” in Strangford Loch found that there would be no measurable change in the tidal currents beyond 500m from the device. (Scottish Executive, 2007).

7.79. From studies completed by Garrad Hassan there are expected to be no significant changes predicted from the proposed development to the hydrodynamics of the Sound of Islay. There are likely to be negligible localised effects around the turbines themselves but these will not affect the broad scale flow regime within the Sound. This correlates with previous studies on devices of a similar nature completed within UK waters (see Paragraph 7.77). Even without any turbines installed, there is a substantial amount of 'work done' to push flow through the Sound. From basic mechanics (work = force x distance, pressure = force / area and flowrate = velocity x area), it can be shown that the power required to push a flowrate through a pressure loss in a steady-state system = pressure x volume flowrate. This is the standard way of calculating power losses in pipework systems. Note that this is not an 'available power' or an 'extractable power'; it is the power expended simply to push the water through the constriction of the channel. Any additional 'blockage' put in the channel will add to the power required to push a given amount of water through it. (Internal Email Scottish Power Renewables July 13th 2010).

7.80. Using a Mike21 model of the channel, the average power over the tidal cycle is 240MW. For comparison, the average power extracted by the turbines is (nameplate power x capacity factor / efficiency =) 3.3MW. This means that if the velocity through the channel remained unchanged by the introduction of the turbines, the pressure difference would increase by 1.37%. In practise, the pressure difference will remain roughly constant and the velocity through the channel will reduce. For a given loss coefficient, pressure drop is proportional to velocity squared, so the velocity will reduce by around 0.7%. Using the average power available during a tidal cycle comparing the average energy extracted by the array during a tidal cycle:

3.3/240(MW) =1.4% of available energy is extracted per cycle.

7.81. This can be used as a conservative estimate of energy extraction within the Sound. The amount of energy extracted is therefore of negligible sensitivity in comparison to the energy from tidal movement throughout the Sound, and the impact is predicted to be of low magnitude.

7.82. Therefore, the alteration of currents by the Development on a larger scale is likely to be of **negligible** significance.

7.83. Due to the **negligible** significance in altering hydrodynamics of the scheme there will be **no impacts** on potential sediment displacement during operation of the array. There is therefore **no significant effect** upon potential sediment displacement or alteration of bedforms.

MITIGATION IN RELATION TO IMPACT 7.3
• No mitigation required.

Residual Impact:

7.84. The impact of alteration of currents is likely to remain of **negligible** significance, with **no significant effects** upon potential sediment displacement or alteration of bedforms.

Impact 7.4: Impacts on the coastal hydrodynamic and sediment regime around the development site from operation of the tidal development.

7.85. The only impact will be from the cable lying on the seabed which will act as a temporary barrier to sediment movement. Sediment will accrete around the cable, returning to original condition within 12 months (as discussed within Paragraph 7.56). The magnitude of the potential impact is considered to be low.

7.86. Given that the foreshore and nearshore zone will be returned to pre-construction conditions immediately after trenching, the depth and distance to the underwater array and the low sensitivity of the receptor there will be **no significant effect** on coastal processes during operation. The cable route will be installed over a period of 6-8 weeks and will be trenched prior to be being put into operation.

MITIGATION IN RELATION TO IMPACT 7.4
• No mitigation required

7.87. As no mitigation is required, the impact on coastal processes will remain of **no significant effect**.

7.7.4 Potential Impacts during Decommissioning Phase

7.88. At the current time, no specific proposals have been set out for the decommissioning of the development or cables at the end of the project. It is assumed that permanently buried cables would be left in place, and that devices and support structures would be entirely removed. Any exposed or potentially exposed cable lengths would also need to be removed. Under this situation there would be no broad scale or long term impacts on seabed or coastal processes. Impacts would be similar to those identified during the construction phase, but with lower initial magnitude. As these were identified as being of **negligible** significance there is no requirement to detail these here. A decommissioning plan will be produced to outline how the approach to decommissioning will be undertaken.

7.8 Cumulative Impacts

7.89. There are a number of other projects underway that may have the potential to cumulatively impact on the proposal these include:

- Argyll Array (Offshore Wind farm under consideration to the West of Tiree, may alter the regional sedimentary regime.)
- DP Energy ((Tidal Farm at scoping stage) may act cumulatively to alter local hydrodynamic regime and sediment movement).
- SSE Jura Hydro Scheme (Through alteration of estuarine hydrodynamics)
- SSE proposed wind farm to the west of Islay, (may alter regional sedimentary regime)
- Coastal development for Port Askaig (Through alteration of the coastline).

7.90. As there are no impacts that are deemed to cause significant effects on the physical environment or coastal processes from the development there is no further potential for this development to act in combination with any other existing or proposed activities or projects to result in cumulative impacts on coastal processes.

7.9 Summary of significance of impacts

A summary of effects for all impacts is presented in Table 7.9 below.

Table 7.9 Summary of Effects

	Construction/ Decommissioning				Operation/Maintenance			
Impact	**Magnitude of Impact**	**Sensitivity / value of receptor**	**Significance of effect**	**Residual significance of impact after mitigation**	**Magnitude of Impact**	**Sensitivity / value of receptor**	**Significance of effect**	**Residual significance of impact after mitigation**
Displacement of sediment altering bedforms / geomorphology	Low	Low	Negligible	Negligible	N/A	N/A	N/A	N/A
Increase in suspended sediment	Low	Low	Negligible	Negligible	N/A	N/A	N/A	N/A
Alteration in hydrodynamics	N/A	N/A	N/A	N/A	Low	Negligible	Negligible	Negligible
Impacts on coastal processes	N/A	N/A	N/A	N/A	Low	Low	No significant effect	No significant effect

7.10 Statement of significance

7.91. It is concluded that the potential impacts identified for impacts on the physical environment and coastal processes will be of **negligible** significant effect.

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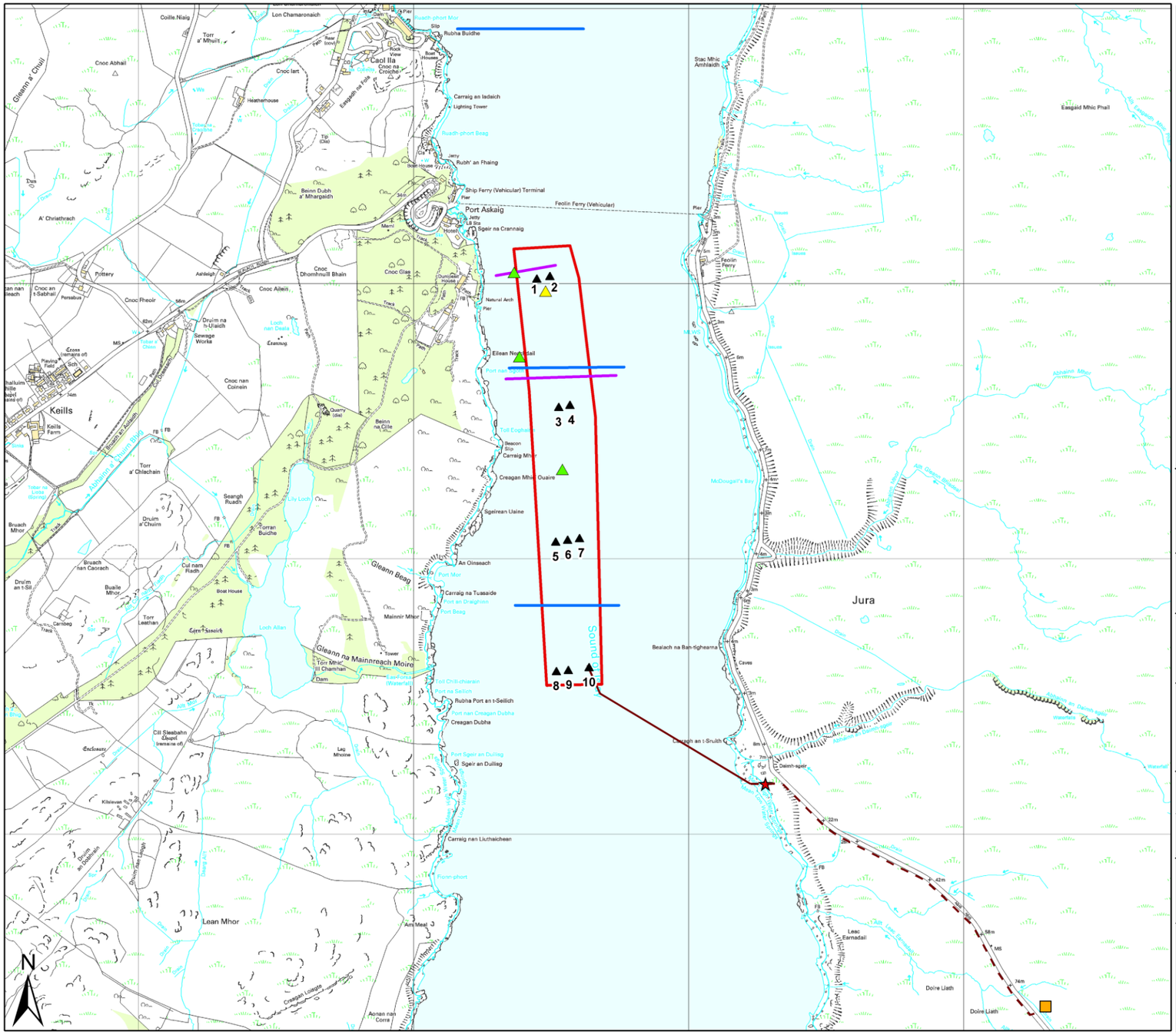

Legend:

- Lease Option Boundary
- Turbine Locations
- Substation (to scale 40m x 40m)
- Onshore Cable Route
- Offshore Cable Route
- Cable Landfall Location
- BMADCP Transects
- VMADCP Transects

ADCP Locations

- ADCP
- AWCP

Title:

LOCATIONS OF VESSEL MOUNTED ADCP TRANSECTS (IX SURVEY, 2009)

Project:

SOUND OF ISLAY
DEMONSTRATION TIDAL ARRAY

Source:

Produced By:

ROYAL HASKONING

Drawn by:	Checked:	Drawing No:
GMC	KW	
Date: 23/06/2010		Figure: 7.1
Scale: 0 0.2 0.4 Kilometers		Revision No: 001

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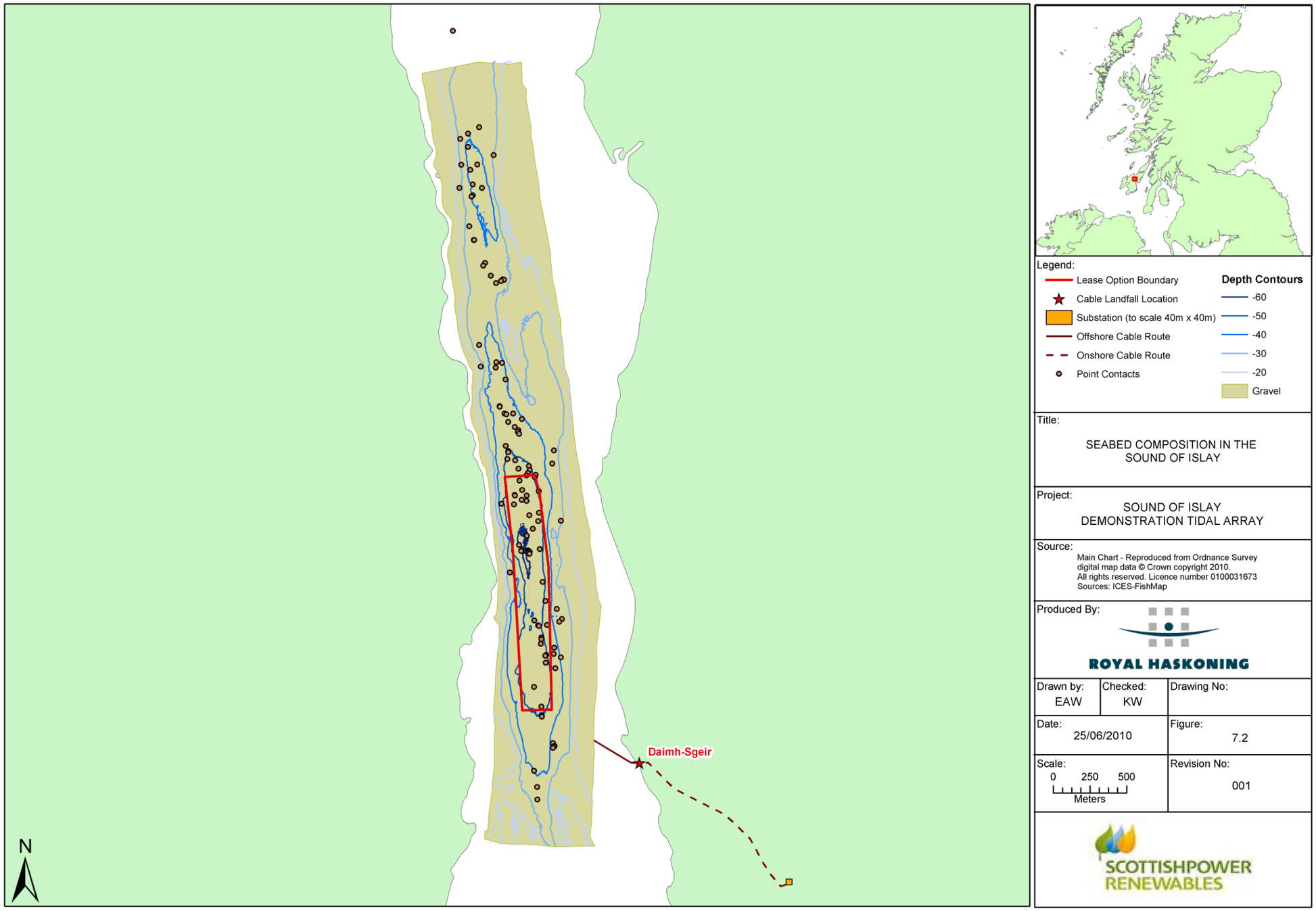
Daimh-Sgeir
N
Legend:
Lease Option Boundary
Cable Landfall Location
Substation (to scale 40m x 40m)
Offshore Cable Route
Onshore Cable Route
Point Contacts
Depth Contours
-60
-50
-40
-30
-20
Gravel
Title:
SEABED COMPOSITION IN THE SOUND OF ISLAY
Project:
SOUND OF ISLAY DEMONSTRATION TIDAL ARRAY
Source:
Main Chart - Reproduced from Ordnance Survey digital map data © Crown copyright 2010. All rights reserved. Licence number 0100031673
Sources: ICES-FishMap
Produced By:
ROYAL HASKONING
Drawn by: EAW
Checked: KW
Drawing No:
Date: 25/06/2010
Figure: 7.2
Scale: 0 250 500 Meters
Revision No: 001
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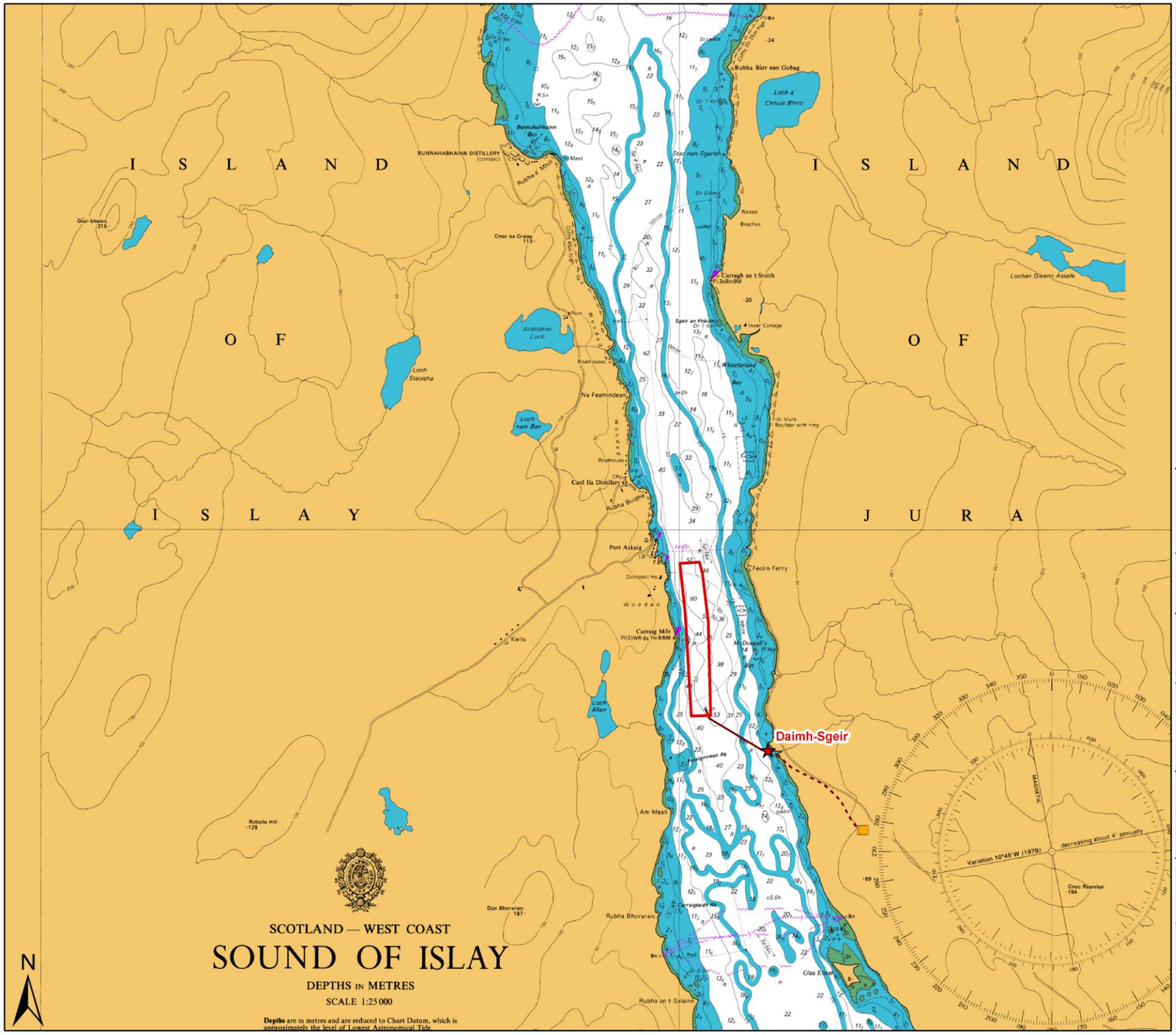

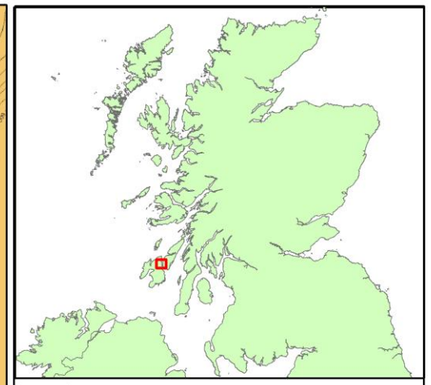

Legend:
- Lease Option Boundary
- Cable Landfall Location
- Substation
- Onshore Cable Route
- Offshore Cable Route

Title: ADMIRALTY CHART SHOWING THE SOUND OF ISLAY		
Project: SOUND OF ISLAY DEMONSTRATION TIDAL ARRAY		
Source: Main Chart - Reproduced from Ordnance Survey digital map data © Crown copyright 2010. All rights reserved. Licence number 0100031673		
Produced By: ROYAL HASKONING		
Drawn by: EAW	Checked: KW	Drawing No:
Date: 25/06/2010		Figure: 7.3
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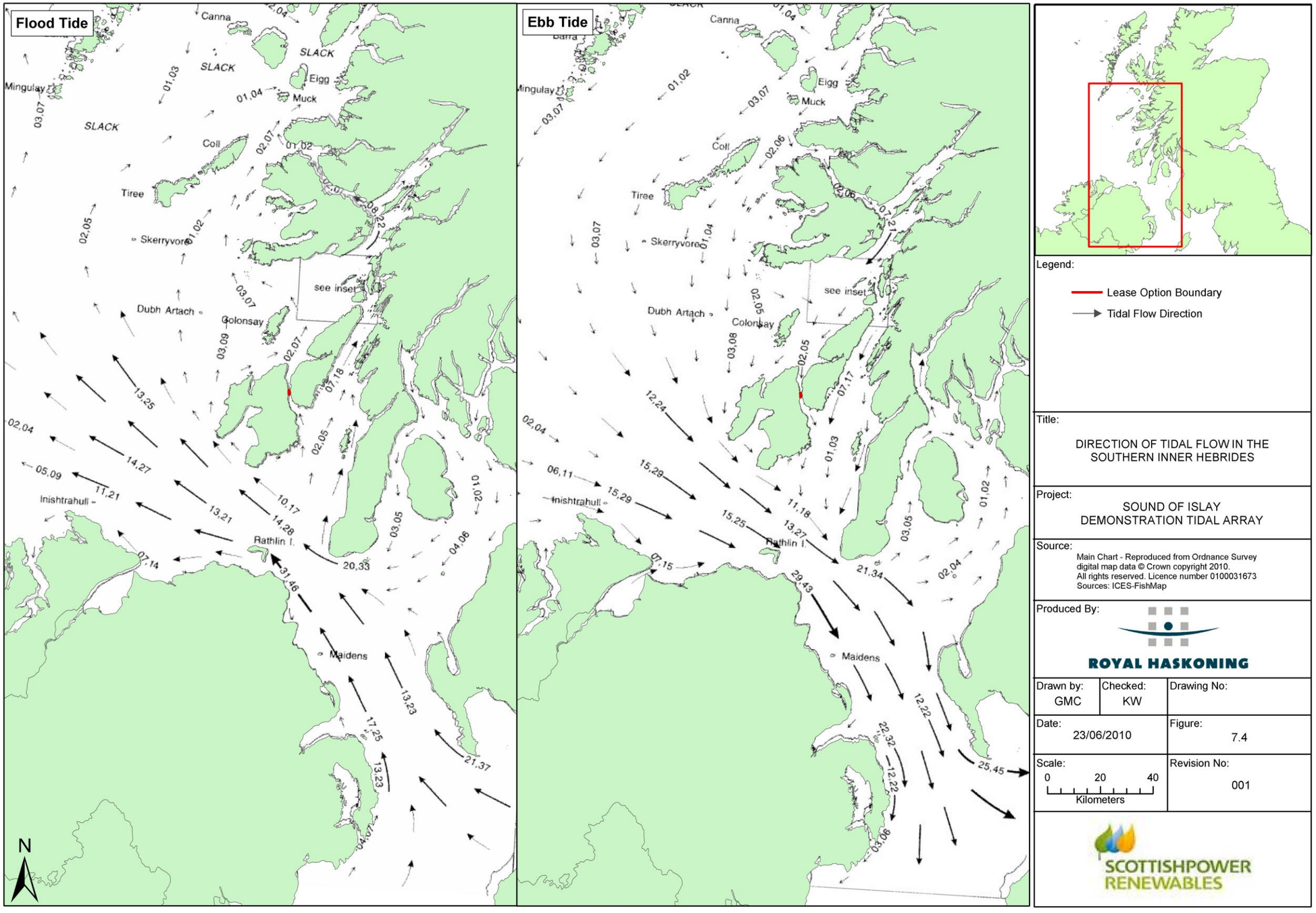
Flood Tide
Ebb Tide
Canna
Barra
Mingulay
Eigg
Muck
Coll
Tiree
Skerryvore
Dubh Artach
Colonsay
see inset
Inishtrahull
Rathlin I.
Maidens
SLACK
N
Legend:
Lease Option Boundary
Tidal Flow Direction
Title:
DIRECTION OF TIDAL FLOW IN THE SOUTHERN INNER HEBRIDES
Project:
SOUND OF ISLAY
DEMONSTRATION TIDAL ARRAY
Source:
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Sources: ICES-FishMap
Produced By:
ROYAL HASKONING
Drawn by: GMC
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Date: 23/06/2010
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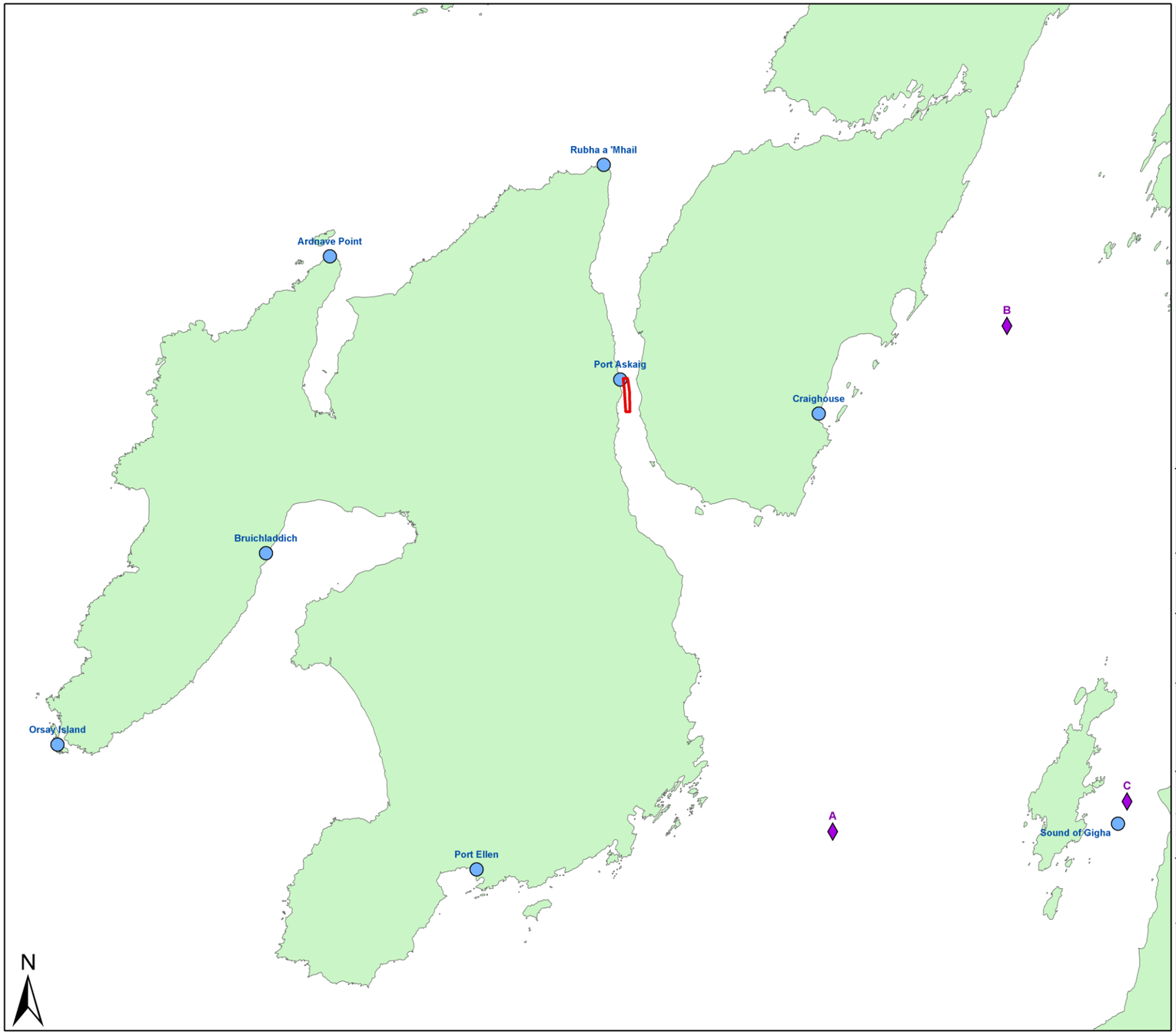

Legend:

- Lease Option Boundary
- Location of Tidal Guages
- Tidal Diamonds

Title:

LOCATIONS OF DATA TAKEN FROM ADMIRALTY CHART: DISPLAYED IN TABLES 7.2 AND 7.3

Project:

SOUND OF ISLAY
DEMONSTRATION TIDAL ARRAY

Source:

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Produced By:

ROYAL HASKONING

Drawn by:	Checked:	Drawing No:
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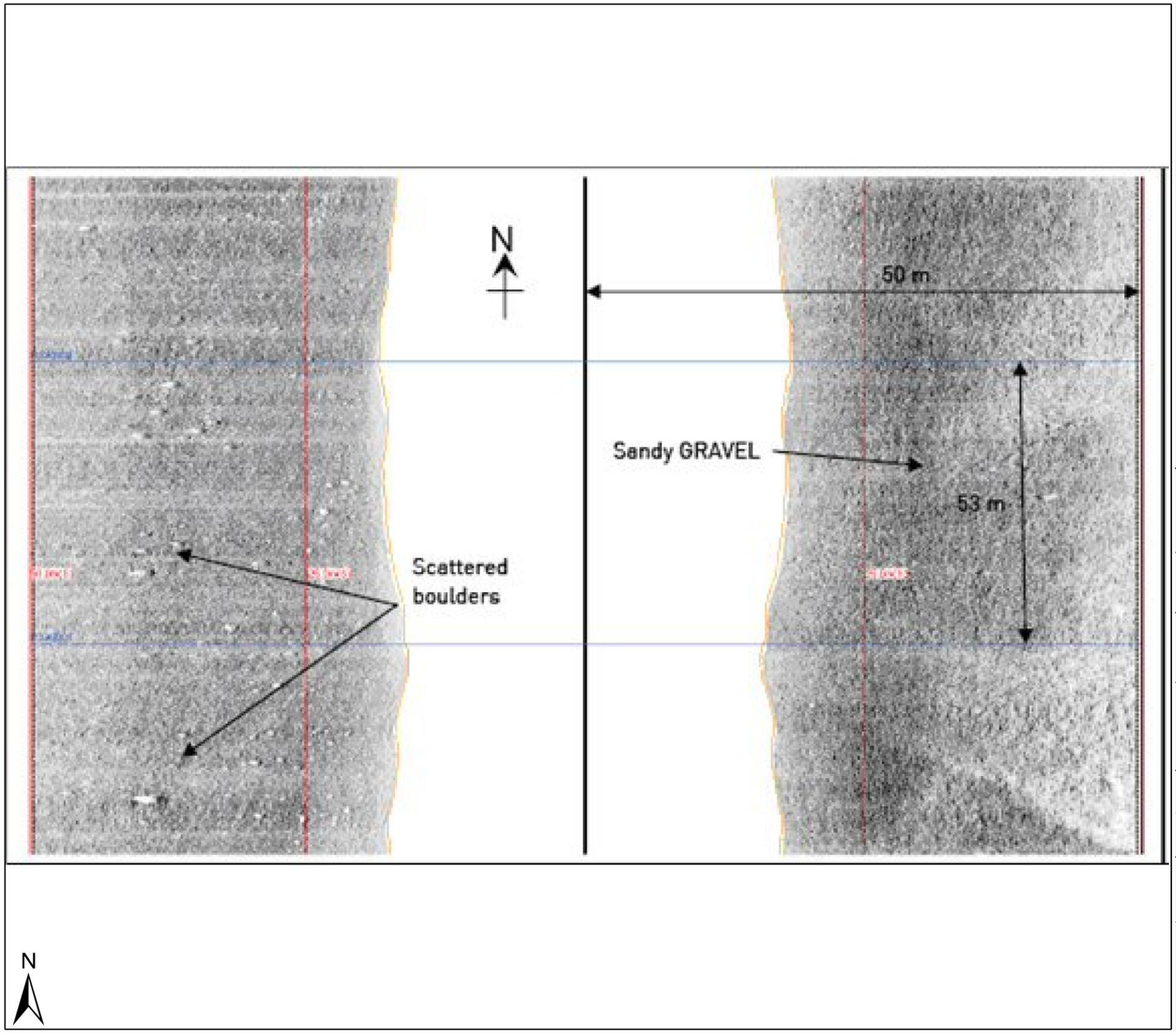
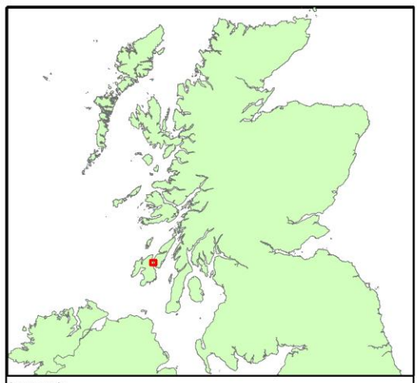
SCOTTISHPOWER RENEWABLES





Legend:

Title:
SIDE SCAN SONAR IMAGE SHOWING SANDY GRAVEL AND SCATTERED BOULDERS

Project:
SOUND OF ISLAY
DEMONSTRATION TIDAL ARRAY

Source:
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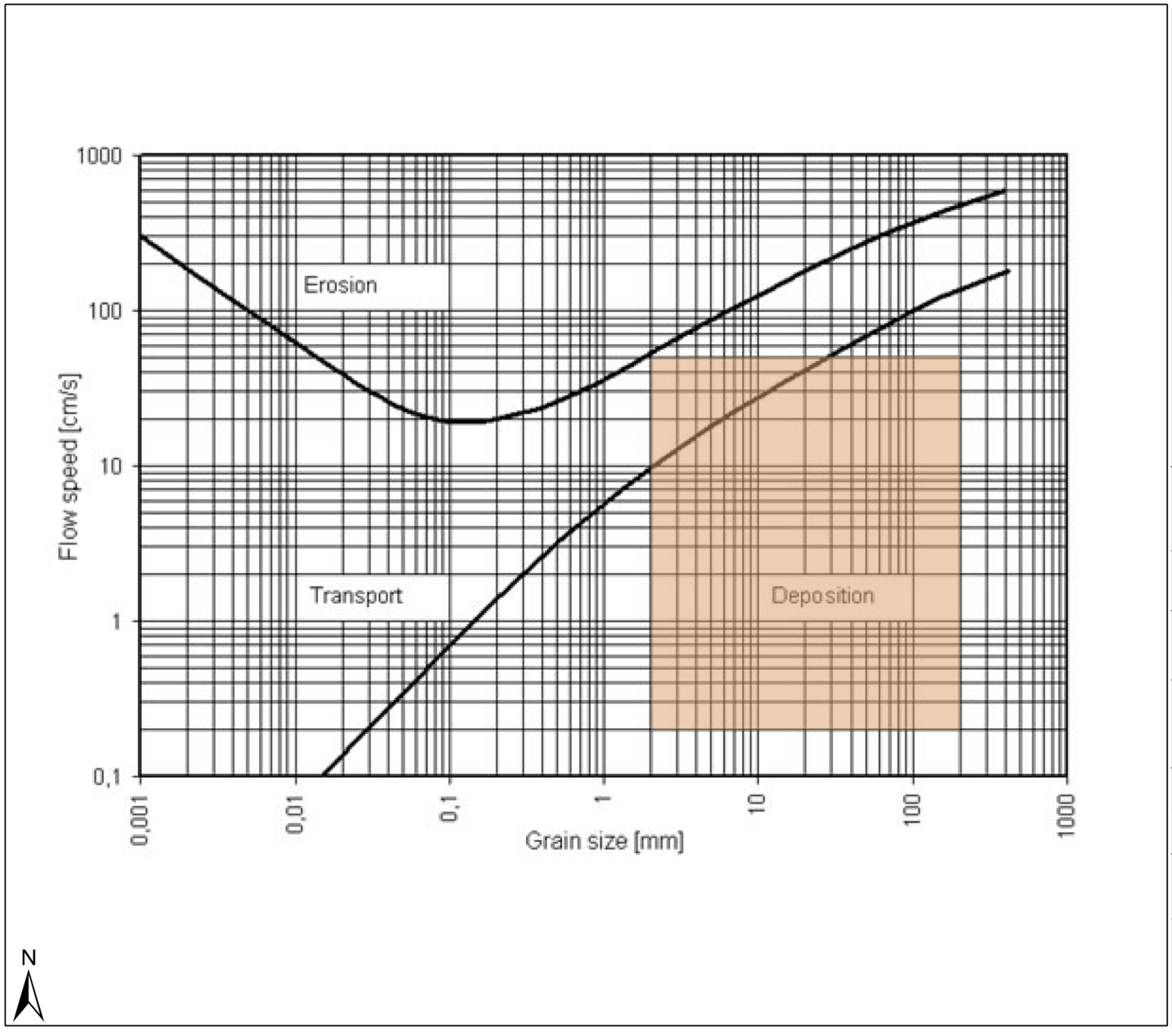


Legend:

Sound of Islay interaction

Title:

INTERACTION BETWEEN NEAR BED VELOCITY AND PARTICLE GRAIN SIZE IN SOUND OF ISLAY

Project:

SOUND OF ISLAY
DEMONSTRATION TIDAL ARRAY

Source:

Main Chart - Reproduced from Ordnance Survey digital map data © Crown copyright 2010. All rights reserved. Licence number 0100031673

Produced By:

ROYAL HASKONING

Drawn by:	Checked:	Drawing No:
EAW	KW	

Date:	Figure:
29/06/2010	7.7

Scale:	Revision No:
Not to Scale	001

SCOTTISHPOWER RENEWABLES

8.0 Benthic Ecology

8.1 Introduction

8.1. This chapter provides information on the presence, character and sensitivity of seabed communities within the vicinity of the proposed Sound of Islay Demonstration Tidal Array and export cable route.

8.2. In addition it also reviews the potential impacts to marine benthic communities in relation to the proposed development during construction, operation/maintenance and decommissioning. If required, potential mitigation measures to reduce these impacts are also discussed, along with the residual impact that remains post-mitigation.

Summary of Benthic Ecology: No habitats or species of conservation importance have been recorded within the development site. The impacts are expected to be of low magnitude and, therefore, the significance of all potential effects on benthic ecology is expected to be negligible.

8.2 Potential Effects

8.3. The footprint of the 10 turbine foundations and associated cable will lead to a loss of benthic habitat for the duration of the 15 year project. Dynamic positioning vessels will be used for turbine installation, avoiding the need for anchorage and therefore minimising habitat loss during the construction phase. Installation is predicted to take a maximum of 72 days during which time dumb storage barges will be present within Caol Ila bay. The gravity base structures are expected to cause minimal residual impact after the turbines have been removed from the Development site.

8.4. Localised changes to tidal stream characteristics within the Sound of Islay are possible as a result of the installed devices, and this may alter the benthic environment. The rotating blades of the turbine are designed to extract energy from the flow of water. As the amount of water passing through the swept rotor area is the same as the amount leaving it, the water occupies a larger cross section behind the rotor, resulting in some localised decrease in flow speed down current of the turbine. The amount of energy removed from the system is expected to be small in comparison to the total tidal energy available. This is discussed further in *Chapter 7: Physical Environment and Coastal Processes.*

8.5. Increased suspended sediments during construction can smother benthic organisms, particularly sessile filter feeders; however, surveys have shown limited sediment available for re-suspension. There are no known sources of seabed contamination with the Sound of Islay (*Chapter 21: Water and Sediment Quality*) and so disturbance of contaminated sediments is not a concern for the proposed scheme.

8.6. Possible leaching of compounds from the devices e.g. paints, hydraulic fuels and antifouling could cause localised toxicity to benthic species.

8.3 Methodology

8.3.1 Legislation, Guidelines and Policy Framework

8.7. The Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora ('The Habitats Directive') aims to conserve biodiversity, providing a list of priority habitats (Annex I of the Directive) and species (Annex II of the Directive) to be protected by a Network of 'Natura 2000' areas including Special Areas of Conservation (SAC). The Conservation (Natural Habitats, & c.) Regulations, 1994 (including 2004 and 2007 amendments in Scotland) transpose the Habitats Directive into national law and outline the designation and protection required for 'European sites' and European Protected Species' (EPS).

8.8. The Nature Conservation (Scotland) Act 2004 places duties on public bodies in relation to the conservation of biodiversity and outline the required protection for Sites of Special Scientific Interest (SSSI).

8.9. The 1992 Convention on Biological Diversity in Rio de Janeiro called for the creation and enforcement of national strategies and action plans to conserve, protect and enhance biological diversity. In 1994 the UK government outlined the UK Biodiversity Action Plan (UK BAP) in response to the Rio Convention

8.10. Species of importance that are likely to be found within the Sound of Islay include *Modiolus modiolus* (horse mussel), *Lithothamnion* spp. (maerl) and *Phymatolithon calcareum* (maerl). Maerl and horse mussel beds are both a UK BAP priority habitat, *P. calcareum* and *Lithothamnion corallioides* are also UK BAP species and Habitats Directive Annex V species (animal and plant species of community interest whose taking in the wild and exploitation may be subject to management measures).

8.11. The application for the proposed Development will come under Section 36 of the Electricity Act 1989 as currently managed by Marine Scotland. A licence for placement of structures on the sea bed under the Food and Environmental Protection Act (FEPA) is also required. Further details regarding the legislative context for this application are provided in *Chapter 6: Regulatory and Policy Context*

8.12. There is no specific guidance available for the assessment of impacts of tidal arrays on benthic ecology. The equivalent guidance for offshore wind farm EIA by CEFAS (2004) has therefore been applied to this impact assessment. These guidelines highlight the need for potential impacts to be identified prior to commencement of benthic survey in order to inform survey design. The guidance indicates that the main impacts to benthic ecology are likely to occur during the construction period of any development and may include physical disturbance of seabed substrata and alterations to the local habitat, as well as indirect effects arising from the re-distribution of sediment.

8.13. The European Marine Energy Centre (EMEC) have produced high level EIA Guidance for their wave and tidal test sites in Orkney which has been considered (EMEC, 2005) in this chapter. This guidance outlines legal and consenting requirements (EMEC EIA Guidance Section 1.2) and summarises survey and additional data requirements to inform the impact assessment.

8.3.2. Consultation

8.14. Consultation with statutory bodies and key stakeholders was undertaken by SPR through the following scoping document: 'Proposed Demonstration Tidal Site, Sound of Islay. Request for a Scoping Opinion' (SPR, 2008). The responses made by Scottish Natural Heritage (SNH) are particularly relevant to this chapter. SNH provide statutory advice to Marine Scotland on nature conservation and have a particular interest in species and habitats of local and national importance.

8.15. SNH advised that the ES should provide an account of habitats within the development area. In response, SPR commissioned SeaStar Survey Ltd to carry out a drop down video survey to provide species and habitat (biotope) information. In order to extend the area of search, Royal Haskoning was later commissioned to undertake a further drop down video survey, collecting species and biotope information.

8.16. SNH highlighted that, if present, any rare and threatened habitats or habitats of conservation importance, including Biodiversity Action Plan priority habitats, should be identified.

8.3.3 Data collection

8.17. The presence, distribution and character of potential Annex I habitat and Annex II species (Habitats Directive EC/92/43/EEC) within the deployment site and the cable route has been assessed by drop down video.

8.18. The baseline conditions at the proposed deployment site and cable route have also been determined from information derived from existing data sources and discrete surveys. Existing biological information was available from historical diver surveys held within published reports or within the National Biodiversity Network (NBN) gateway website, as well as through consultation with local fishermen and recreational divers. Where knowledge gaps were identified, a Remotely Operated Vehicle (ROV) survey was conducted in August 2008 (Islay Energy Trust, 2008), followed by a more targeted drop down video survey in June 2009 (SeaStar Survey Ltd, 2009a). The timing and scope of the drop video survey (SeaStar Survey Ltd, 2009a) was agreed through consultation with the relevant stakeholders, including SNH. Following the identification of possible landfall sites on Jura, further drop down video work was carried out in March 2010 (Royal Haskoning, 2010) along two potential cable routes, including the eventual cable route option shown in Figure 8.1

8.19. The principal biological and physical data sources relevant to the marine benthic communities are shown below in Table 8.1.

Table 8.1 Existing benthic data for the Sound of Islay

Data source	Coverage	Author(s)	Year
NBN gateway	Limited to 3 diver surveys within the infralittoral zone close to Port Askaig	Christine Maggs, Dale Rostrum, Annette Little, Sarah Fowler	1982
Sublittoral diver survey	Limited to 7 sublittoral areas, mainly within the northern channel	Keith Hiscock	1983
SeaZone data – provides bathymetry data and some limited information on seabed texture. The shapefiles also include details of active/inactive aquaculture areas.	Entire area of interest	SeaZone	2007
Brodie *et al* (2007)	Maerl beds have been identified 0.8km NE of Port Askaig in the centre of the Sound (Grid reference NR435700). No mapping or survey information to accompany the citation. Recorded in the centre of the channel, at depth; therefore unlikely to be from Hiscock's 1982 diver survey.	Plantlife International	2007
Swath bathymetry and side scan acoustic surveys – provides seabed sediment interpreted from acoustic data (no ground truthing)	Entire area of interest	iX Survey	2008
IET ROV survey	2 day survey, with inshore circalittoral and infralittoral data on Islay side of Sound. Some penetration into deeper water (50-60m) to the north of the site. Also footage at 44-54m in central section of the site.	Robert Gordon University	2008
Sound of Islay drop video survey. June 2009 (Appendix 8.1)	Proposed northern and southern deployment sites as well as Islay potential cable route areas. The aim of the survey was to ground-truth existing sidescan data of the Sound using a drop-down video and stills camera. This ground-truthing enabled the nature of the seabed communities within the proposed lease option boundary (shown on Figure 8.2) and immediately surrounding area to be confirmed.	SeaStar Survey Ltd Survey Ltd	2009
Sound of Islay drop video survey. March 2010 (Appendix 8.2)	Proposed Jura cable route areas.	Royal Haskoning	2010

8.3.4 Assessment of significance

8.20. The significance of the effect imposed by the development is based on the intensity or degree of disturbance to baseline conditions and is categorised into four levels of magnitude, high, medium, low or negligible. The definitions of each of these are given in Table 8.2.

Table 8.2: Description of magnitude.	
Magnitude of Impact	**Definition**
High	Fundamental change to the baseline condition of the receptor. Resulting in major alteration of the habitats, species or biodiversity.
Medium	Detectable change resulting in non-fundamental temporary or permanent consequential changes. Some deterioration observed in the quality of the most sensitive receptor leading to a partial alteration of habitats, species or biodiversity.
Low	Minor change with only slight detectable changes, which do not (or only temporarily) alter the baseline condition of the receptor.
Negligible	An imperceptible change to the baseline condition of the benthic community

8.21. To consider the sensitivity of the species and biotopes present in the development area and immediately surrounding area, the protocols and advice available from the Marine Life Information Network (MarLIN, accessed Jan 2010) have been used. The MarLIN sensitivity assessment allows a comparative assessment to be made of the sensitivity and recoverability of marine habitats and species.

8.22. The sensitivity/value/importance of the receptor for each effect is characterised as one of four levels, high, medium, low or negligible. The definition of each level is given below in Table 8.3.

Table 8.3: Sensitivity/Value/importance of marine flora and fauna environment.		
Receptor Sensitivity/Value	**Marine flora and fauna Importance**	**Site designations**
High	International/National	Sites or species that have been designated for their internationally or nationally important biodiversity or habitat (SACs, SPAs, Ramsar, SSSIs, NNR, UK BAP of Habitats).
Medium	Regional	Sites or species that have been designated for their regionally important biodiversity or habitat (LBAP species).
Low	Local	Sites or species that have been designated locally for their flora or fauna (LNR) or undesignated sites of some locally important biodiversity or habitat.
Negligible	-	Other sites or species with little or no locally important biodiversity

8.23. Table 8.4 combines the definitions of magnitude with the level of sensitivity/value/importance of receptor to provide a prediction of overall significance of the effect.

Table 8.4 Significance Prediction Matrix.				
Magnitude of Impact	**Receptor Sensitivity/Value**			
	Negligible	**Low**	**Medium**	**High**
High	Negligible	Moderate	Major	Major
Medium	Negligible	Minor	Moderate	Major
Low	Negligible	Negligible	Minor	Moderate
Negligible	Negligible	Negligible	Negligible	Minor

8.24. Once the significance of the effect is determined, a suffix of “adverse” or “beneficial” can be attached to indicate the perceived nature of impact. It is not always clear weather an effect will be adverse or beneficial and as a consequence this approach is only taken when describing some of the impacts identified in section 8.5.1 and below.

8.25. It should be noted that any residual effect (the effect after the implementation of mitigation) which remains at the level of ‘Moderate’ or ‘Major’ is regarded by the EIA Regulations as being significant.

8.4 Existing Environment

8.4.1 Habitat within the proposed array site

8.26. The location of the Sound of Islay Demonstration Tidal Array, along with associated onshore and marine infrastructure is shown in *Chapter 5: Project Description*.

8.27. The substrate within the proposed development area and immediately surrounding area was characterised by SeaStar Survey Ltd (2009a) as comprising mixed coarse sediments of sandy gravelly cobbles and small boulders. The SeaStar survey also recorded bedrock and boulders along the western edge of the 48m contour of the survey area and to a lesser extent on the eastern boundary. Acoustic data acquired by IX Surveys (2009) identifies that the array site is predominantly gravel, with turbine 8 located on megaripples (Figure 8.1). However, the video data also indicates a seabed of mixed substrata, with cobbles, pebbles, some gravel and occasional small boulders, not the megaripple feature suggested from the acoustic data (Figure 8.2).

8.28. The substrate to the north of the Sound (outwith the proposed array area) consists primarily of gravely sand and sand. Farrow *et al*. (1979) describe the seabed at the northern entrance of the Sound of Islay as having areas of *Lithothamnion* spp (maerl) gravel (‘some of it live’), megaripples and shell gravel. To the south of the Sound (and also outwith the proposed array area) the seabed sediments are comprised of gravely sand, sand, muddy sand and mud (British Geological Surveys, 1997).

8.29. Within the Development site, diverse benthic communities typical of a tide swept environment were recorded during the drop down camera survey (SeaStar Survey Ltd, 2009a). Dominant, widespread species include: dead man's fingers *Alcyonium digitatum*, the hydroid *Tubularia indivisa*, the anemones *Urticina* sp., *Actinothoe sphyrodeta*, and *Corynactis* and the byrozoans *Flustra foliacea* and *Alcyonidium diaphanum*. The sponges *Halichondria panicea*, *Esperiopsis fucorum, and Pachymatisma johnstoni*; crustacea (e.g. *Pagurus* sp.); Mollusca (e.g. *Calliostoma zizyphinum*) and Echinodermata (e.g. *Echinus esculentus*, *Asterias rubens*, *Henricia* sp. and *Crossaster papposus*); were also commonly recorded (SeaStar Survey Ltd, 2009a)

8.30. Species composition was found to be relatively similar throughout the majority of the proposed development site and immediately surrounding area. Some areas of deeper water were dominated by Serpulidae worms and barnacles, while shallower infralittoral areas were dominated by kelp, mainly *Laminaria hyperborea* and *Laminaria saccharina* (SeaStar Survey Ltd, 2009a).

8.31. Data from diver surveys (also outwith the Development site) identifies the presence of the horse mussel *Modiolus modiolus*, 2km north of Port Askaig (Seasearch, 1999). *M. modiolus* can form a UK BAP habitat if present as a dense bed. No *M. modiolus* was recorded within the development site during the 2009 drop down video survey (SeaStar Survey Ltd, 2009a).

8.32. Abundant (using the Marine Nature Conservation Review 'SACFOR' scale[1]) maerl was recorded in 1982 at two stations on the Islay coast, approximately 300m from the proposed array site in depths of between 3 to 13m. There were also six records (from various surveys conducted during a similar time period) 2km to the north, ranging in abundance of occasional to common as well as two records of abundant maerl near Jura, off Claig Castle, 6km to the south of the Development site at the southern entrance to the Sound (NBN Gateway, 2008). Foliose algae and sabellid polychaetes were noted among the associated flora and fauna of these maerl beds (Hiscock, 1983). A few of the nationally-rare or scarce benthic species listed by Plaza & Sanderson (1997) are believed to be confined to maerl habitats and, therefore, may occur in the Sound of Islay (Wilding *et al* 2005). Barne *et al.* (1997) reported that the central Sound of Islay contained maerl features, mostly consisting of dead maerl. No maerl was recorded within the development site during the SeaStar Survey Ltd (2009a) or Royal Haskoning (2010) surveys.

8.33. SeaStar Survey Ltd (2009a) recorded only one thallus of maerl (*Phymatolithon calcareum*); however, this was outside the proposed development site, 280m west of the proposed array. Footage was also collected of maerl beds approximately 2km to the south west of the development (SeaStar Survey Ltd, 2009b).

8.34. Images showing the biotopes recorded in closest proximity to each proposed turbine in the array are provided in Plate 8.1, with Figure 8.1 showing the location of the development in relation to the SeaStar Survey Ltd (2009a) biotope map. Stations were sampled using still photography and assigned Connor *et al* (2004) biotopes. The dominant biotope was classified by SeaStar Survey Ltd (2009a) as circalittoral mixed sediment (SS.SMx.CMx) combined with a biotope of *Alcyonium digitatum* with dense *Tubularia indivisa* and anemones on strongly tide-swept circalittoral rock CR.HCR.FaT.CTub.Adig, recorded by SeaStar Survey Ltd (2009a) as a combined biotope of "SS.SMx.CMx.(CTub.Adig)".

8.35. At stations where the SS.SMx.CMx and CTub.Adig combined biotope was recorded close to proposed turbine locations by SeaStar Survey Ltd (2009a), the substrate is shown in Figure 8.2 to be of cobbles and boulders and as a result may be best described as the Connor *et al* (2004) biotope CR.HCR.FaT.CTub.Adig

8.36. Stations close to four of the ten proposed turbine locations supported *Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles, the biotope (SS.SCS.CCS.PomB). This biotope has been used for much of this impact assessment due to the availability of sensitivity details on MarLIN (accessed Jan 2010).

Plate 8.1: Drop down images from the station closest to each proposed turbine (Source: SeaStar Survey Ltd, 2009a). Turbine locations shown in Figure 8.1). Biotope codes according to Connor *et al* (2004)

a) Turbine 1, Station 1_22, Biotope SS.SCS.CCS.PomB

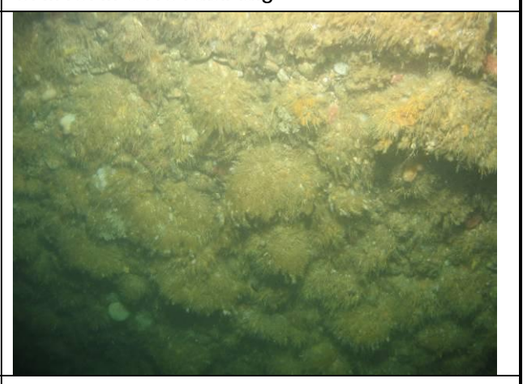
b) Turbine 2, Station 1_23, Biotope SS.SCS.CCS.PomB

c) Turbine 3, Station 2_41, Biotope CR.HCR.FaT.CTub.Adig

d) Turbine 4, Station 30_8, Biotope CR.HCR.FaT.CTub.Adig

[1] http://www.jncc.gov.uk/page-2684

Plate 8.1: Drop down images from the station closest to each proposed turbine (Source: SeaStar Survey Ltd, 2009a). Turbine locations shown in Figure 8.1). Biotope codes according to Connor *et al* (2004)

<table>
<tr><td>  </td><td>  </td></tr>
<tr><td>e) Turbine 5, Station 8_21, Biotope SS.SCS.CCS.PomB</td><td>f) Turbine 6, Station 7_25, Biotope CR.HCR.FaT.CTub.Adig</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>g) Turbine 7, Station 31_12, Biotope CR.HCR.FaT.CTub.Adig</td><td>h) Turbine 8, Station 8_10, Biotope CR.HCR.FaT.CTub.Adig</td></tr>
<tr><td></td><td>  </td></tr>
<tr><td>Turbine 9, No image</td><td>i) Turbine 10, Station 6_14, Biotope SS.SCS.CCS.PomB</td></tr>
</table>

8.4.2 Habitats along the preferred and potential cable routes

8.37. Cable routes for potential landfall sites at Caol Ila, Islay, Feolin, Jura and to the north and south of Daimh-sgeir, Jura have been investigated as part of the EIA. Subsequent to these surveys it was decided that the preferred landfall option would be at Daimh-sgeir and a summary of the existing environment including all cable route surveys, but with a focus on the Daimh-sqeir site is provided below.

8.38. A mixed rocky substrate of boulders, cobbles and pebbles were recorded across much of the survey area. Some small areas of bedrock and sand overlying bedrock were also recorded. No species of conservation interest were identified during any of the cable route surveys. Common species which are widely distributed around the UK were recorded including kelps and fucoids, the echinoderms *Crossaster papposus* and *Asterias rubens*, the anemone *Urticina spp* and a number of red seaweeds including *Chondrus crispus, Porphyra and Phycodrys, Dilsea* and *Plocamium.*

8.39. Kelp park of the Connor *et al* (2004) biotope code IR.MIR.KR.LhypTX.Pk and kelp forest IR.MIR.KR.LhypTX.Ft were recorded in the inshore areas at the Daimh-sgeir site as well as robust fucoid and/or red seaweed communities LR.HLR.FR. Mixed kelp and red seaweeds on infralittoral boulders, cobbles and gravel in tidal rapids IR.MIR.KT.XKTX was recorded close inshore at the Caol Ila site.

8.40. High abundances of red coralline algae were recorded during the cable route surveys. Within this algal crust high numbers of echinoderms were found to be present in discrete areas along the Daimh-sgeir routes and so the 'echinoderms and crustose communities' Connor *et al* (2004) biotope CR.MCR.EcCr was assigned. The most inshore transect on the southern Daimh-sgeir route (Figure 8.2) was found to have high levels of *Sabella pavonica* and so the SS.SMx.IMx.SpavSpAn biotope was assigned.

8.41. Two transects close to the array, along the Daimh-sgeir cable route were found to have high numbers of deadman's fingers *Alcyonium digitatum* and the hydroid *Tubularia indivisa* CR.HCR.FaT.CTub.Adig. The majority of the cable route option to Caol Ila was also found to have this biotope; however, a mixed substrate was recorded and so the biotope was classified by SeaStar Survey Ltd (2009a) as the combined SS.SMx.CMx and CTub.Adig biotope. Along the Caol Ila route, *Urticina felina* and sand-tolerant fauna on sand-scoured or covered circalittoral rock CR.MCR.EcCr.UrtScr were also recorded at a number of stations.

8.42. Although the decision was taken (with the help of the cable route surveys) to identify the Daimh-sgeir cable route as the final option; survey data of the other cables routes remained very useful in determining the existing environment of the study area and informing impact assessment.

8.5 Impact Assessment

8.5.1 Do nothing Scenario

8.43. Due to the lack of detailed historical datasets or on going monitoring in this area, it is not possible to know how the benthic community has changed naturally over time. However, in high energy environments, such as the Sound of Islay, natural changes will occur frequently within benthic communities.

8.44. During a 'do nothing scenario' the substrate type and tidal currents would not be expected to show any non natural change in the benthic environment.

8.4.1. Potential Impacts during Construction Phase

Impact 8.1: Habitat loss

8.45. The footprint from the turbine foundations cabling, and the anchors used to moor the dumb (storage) barges in Caol Ila bay, will result in the loss of benthic habitat within the Development site. The combined footprint of the ten devices is predicted to be 329.7m^2. Installation procedure (e.g. use of dynamic positioning in place of anchoring) will allow the development to cause minimal disturbance to the seabed.

8.46. All cabling will be 10cm in diameter and armoured, providing a maximum footprint diameter of 50cm at the point of contact with the seabed. For impact assessment purposes, a 200cm width along all cabling has been used to provide a conservative impact assessment and to allow for slight movements of the cables on the seabed.

8.47. The footprint for inter-array cables will be approximately 3506m^2 (assuming a cable running the length of the array, north – south with four perpendicular rows joining the turbines). The export cable route, from the array to the cable landfall site at Daimh-sgeir, creates a potential footprint of 1946m^2. The biotopes potentially impacted are present across the area covered by the benthic surveys (SeaStar Survey Ltd, 2009a and Royal Haskoning, 2010). The surveys covered an area in excess of 577,501m^2 and the area impacted by the turbine bases and cable route is small (0.02%) by comparison.

8.48. The nature and extent of the anchors used in the mooring of the dumb barges at Caol Ila is yet to be determined and therefore an assessment of impact associated with this activity can not currently be completed. It is not anticipated however, that the anchoring activity will result in the loss of benthic habitat over a large area.

8.49. The highly changeable nature of benthic habitats of this type and the relatively short life span (up to 15 years) of the Development suggest that any impact during installation will be both difficult to distinguish and rapidly reversible.

8.50. CR.HCR.FaT.CTub.Adig is the dominant biotope throughout the development site and is also a dominant biotope of Strangford Narrows, Northern Ireland (Royal Haskoning, 2005). Recent studies at Strangford have indicated that there has been no significant change (above those that would be expected as a result of natural variation) to the benthic community there following installation of the SeaGen tidal turbine (SNH, 2009).

8.51. As discussed previously (Paragraph 8.36), the biotope SS.SCS.CCS.PomB is an appropriate biotope to use for the assessment of possible impacts caused by the Development. This is because information on the sensitivity of this biotope is publically available on the MarLIN website and this biotope is present at four of the ten turbine locations. SS.SCS.CCS.PomB is expected to have very high recoverability to substratum loss (MarLIN, accessed Jan 2010).

8.52. In addition, it is likely that much of the array structure will provide suitable hard substrate for colonisation by marine species adapted to tidal environments, with the surface area available, being greater than the seabed area directly affected (as a result of the greater 3 dimensional scale of the device structure, compared to the impacted seabed).

8.53. No benthic species or habitats of local, national or European importance are expected to be impacted and, therefore, the receptor sensitivity of the receptor is negligible. The footprint of habitat loss will be relatively small compared to the available resource of similar habitats in the Development site and the effect will be temporary giving a medium impact magnitude. The effects of habitat loss are therefore expected to be of **negligible** significance.

MITIGATION IN RELATION TO IMPACT 8.1
• No mitigation required

Residual impact

8.54. The impact of habitat loss on the benthic ecology during construction will remain of **negligible** significance.

Impact 8.2: Increased suspended sediments/ smothering

8.55. The disturbance of seabed sediments during installation of the gravity base and the potential impact on water quality are discussed in *Chapter 21: Water and Sediment Quality*.

8.56. Smothering may occur within the immediate vicinity of works with disturbed finer sediments carried in suspension potentially affecting sessile filter feeding species. However, limited quantities of fine sediments are present in the area. The tidal device has been designed to limit the need for intrusive seabed works by using gravity bases. This approach means that construction will be quick, will be completed in a single operation and will not use intrusive activities such as piling or levelling, resulting in limited scope for disturbance and re-suspension of fine sediments.

8.57. In a high energy environment, such as the Sound of Islay, rapid dispersal of any disturbed fine sediments means effects will be temporary and short term providing low magnitude. This combined with the negligible receptor sensitivity means that the effects of increased suspended sediments are likely to be of **negligible** significance.

8.58. Increases in suspended sediment concentrations may also be caused by changes to sedimentation patterns as a result of localised changes to tidal energy in the immediate vicinity of the array. However, the changes to tidal stream characteristics will be extremely localised, and may not be detectable given the high energy within the wider resource of the Sound of Islay and the small scale of the proposed array. This is further discussed in *Chapter 7: Physical Environment and Coastal Processes*

MITIGATION IN RELATION TO IMPACT 8.2
• No mitigation required

Residual impact

8.59. The impact of suspended sediments on the benthic ecology during construction will remain of **negligible** significance.

Impact 8.3: Risk of pollution incident during installation

8.60. The risk of spillage of contaminants from the devices and construction vessels during installation has been considered within *Chapter 21: Water and Sediment Quality*. Collision of vessels could result in spillages of contaminants, such as diesel.

8.61. The risk of pollution events will be minimised by following standard good practice, such as the Pollution Prevention Guidelines issued by SEPA (e.g. PPG 5: Works and maintenance in or near water). Additionally, any chemicals used during construction will require prior approval through the FEPA licensing process and any lubricants will be non toxic, biodegradable and capable of dispersal in seawater.

8.62. Installation contractors will have in place appropriate Site Environmental Management Plans and Pollution Control and Spillage Response Plans that have been agreed with the relevant statutory bodies prior to offshore construction activities commencing. These plans will act to reduce the potential for accidental pollution and in the unlikely event of a pollution incident, will ensure a rapid and appropriate response.

8.63. Given these management strategies and controls it is expected that should a spill occur, its scale and the nature of the contaminant will result only in a temporary and localised impact which will be of low magnitude. Due to the controls mentioned in paragraph 8.61 the sensitivity of the receptor will ne negligible. Therefore the overall effect of a pollution incident on the benthic ecology is likely to be of **negligible** significance. In a high energy marine environment, contaminants can be expected to rapidly disperse.

MITIGATION IN RELATION TO IMPACT 8.3
• No mitigation required

Residual impact

8.64. The impact of suspended sediments on the benthic ecology during construction will remain of **negligible** significance.

Impact 8.4: Noise disturbance

8.65. The majority of sessile benthic species such as tube worms, barnacles, hydroids, Cnidarians and bryozoans are unlikely to be sensitive to noise or vibrations. As the vast majority of organisms recorded during the benthic surveys (SeaStar Survey Ltd, 2009b and Royal Haskoning, 2010) were sessile, the benthic habitat is considered to be insensitive to noise impacts. Mobile species such as crabs and lobsters may be temporarily displaced from an area experiencing high levels of noise or vibration but this effect is of low magnitude to species and habitats of negligible sensitivity resulting in noise impact being of **negligible** significance to the benthic community.

MITIGATION IN RELATION TO IMPACT 8.4
• No mitigation required

Residual impact

8.66. The impact of noise on the benthic ecology during construction will remain of **negligible** significance.

8.4.2. Potential Impacts during Operational Phase (including maintenance)

Impact 8.5: Habitat alteration

8.67. Changes to tidal energy have the potential to impact on habitats and species which are sensitive to changes in tidal flows, with modification potentially resulting in long term effects on the richness and diversity of benthic flora and fauna. The preliminary results of benthic monitoring during operation of the SeaGen turbine, Strangford Lough, which were presented at recent conferences, show no change in the benthic community which can be attributed to the presence of that tidal turbine (SNH, 2009).

8.68. During operation, potential colonisation of the structures may increase the biodiversity providing a potentially beneficial impact. However an artificial substrate could alter the nature and composition of the species present and a bare surface could potentially enable non-native species to colonise providing an adverse effect.

8.69. No benthic species or habitats of local, national or European importance are expected to be lost giving a negligible receptor value and low magnitude of impact and so the overall effect is likely to be of **negligible** significance.

MITIGATION IN RELATION TO IMPACT 8.5
• No mitigation required

Residual impact

8.70. Following mitigation the impact of habitat alteration on the benthic ecology during operation/maintenance will remain of **negligible** significance.

Impact 8.6: Impacts due to accidental pollution incident during operation

8.71. The risk of spillage of contaminants during the operational phase is considered within *Chapter 21: Water and Sediment Quality*.

8.72. Given the lower levels of on-site activity, the risk of pollution caused by vessel collision during maintenance (e.g. spillage of vessel fuel) can be expected to be lower than during the construction phase.

8.73. Maintenance operations are expected to provide less risk to accidental spillage than during construction; however, any use and discharge of chemicals during maintenance will be subject to controls as part of consent requirements and it is expected that even should a spill occur, its scale and the nature of the contaminant will result only in a temporary, localised and impact which will be of low magnitude. In a high energy marine environment, contaminants can be expected to rapidly disperse. The benthic community is of negligible sensitivity and so the overall effect of pollution is likely to be of **negligible** significance.

MITIGATION IN RELATION TO IMPACT 8.6
• No mitigation required

Residual impact

8.74. Following mitigation the impact of accidental spillages during operation/maintenance on the benthic ecology will remain of **negligible** significance.

Impact 8.7: Noise

8.75. Predictions of noise levels that may be created during the operational phase of the Development were made by SAMS (2010). This was achieved by comparing the noise generated by the Hammerfest Strøm device with baseline noise levels from within the Sound of Islay created by both natural and anthropogenic sources. As a high energy tidal site, the Sound of Islay has high levels of ambient noise and in addition to high levels of naturally generated noise the site is subject to noise generated by vessels, primarily the ferries and any fishing vessels in the area. SAMS (2010) conclude that the Development will have little impact on existing noise levels within the Sound of Islay. Further information regarding the key findings of SAMS (2010) is outlined in *Chapter 9: Marine Mammals.*

8.76. The majority of sessile benthic species such as tube worms, barnacles, hydroids, Cnidarians and bryozoans are unlikely to be sensitive to noise or vibrations. As the vast majority of organisms recorded during the benthic surveys (SeaStar Survey Ltd ,2009b and Royal Haskoning, 2010) were sessile, the benthic habitat is considered to be insensitive to noise impacts. Mobile species such as crabs and lobsters may move away from the devices to avoid vibrations but the distance is expected to result in low magnitude impact and as a result of the negligible receptor sensitivity the overall effect is likely to be of **negligible** significance to the benthic community.

MITIGATION IN RELATION TO IMPACT 8.7
• No mitigation required

Residual impact

8.77. The impact of noise on the benthic ecology during operation/maintenance will remain of **negligible** significance.

8.4.3. Potential Impacts during the Decommissioning Phase

8.78. The potential impacts during decommissioning are expected to be of the same type and magnitude to those predicted during the construction phase. The loss of habitat during construction will transpose to a loss of artificial habitat during decommissioning and a return to the original situation (as described in the existing environment: section 8.4). Returning to the natural state has not been considered as an impact and due to the dynamic and changeable nature of a high energy environment, such as the Sound of Islay, it is expected that recoverability would be quick.

8.79. As discussed previously, CR.HCR.FaT.CTub.Adig is the dominant biotope throughout the development area and after decommissioning it is likely that much of the disturbed area would return to this biotope. However as discussed previously the biotope SS.SCS.CCS.PomB has been used during impact assessment due to the availability of sensitivity information on the MarLIN website. SS.SCS.CCS.PomB was present at four of the ten turbine locations and is expected to have very high recoverability to substratum loss (MarLIN, accessed Jan 2010) following decommissioning. Therefore after decommissioning has taken place it is likely that the benthic habitats would rapidly return to those detailed in the existing environment section (8.4).

8.6 Cumulative Impacts

8.80. There are currently no other developments proposed for construction within the Sound of Islay which are expected to impact on the benthic ecology (Argyll and Bute Council, 2009).

8.7 Conclusions

8.81. Within the proposed development area and immediately surrounding area there are no recent records of any rare and threatened species or habitats or those of conservation importance (e.g. UK BAP). Any impacts within the Sound of Islay are expected to be relatively localised to the foundations of the devices and along the cable route. It is considered that disturbance to benthic ecology will be across a limited area, reversible and occur within an already dynamic and changing biological environment. In high energy environments, such as the Sound of Islay, natural changes will occur frequently within benthic communities, as such changes as a result of the array will be of overall **negligible** significance. It is worth noting that preliminary results from the monitoring of the benthic habitat around SeaGen turbine in Strangford Lough, presented at recent conferences, has shown no significant change in the broad benthic community structure that can be attributed to the turbine presence (SNH, 2009). Biotopes potentially impacted by the SeaGen device (Environmental Statement, Royal Haskoning, 2005) are similar to the main biotopes identified within the lease area for the Sound of Islay.

8.8 Summary

Impact	Construction/ Decommissioning				Operation/ Maintenance			
	Magnitude of Impact	Receptor Sensitivity	Significance level	Residual impact	Magnitude of Impact	Receptor Sensitivity	Significance level	Residual impact
Habitat Loss	Medium	Negligible	Negligible significance	Negligible significance	N/A	N/A	N/A	N/A
Increased suspended sediment /Smothering	Low	Negligible	Negligible significance	Negligible significance	N/A	N/A	N/A	N/A
Pollution incident	Low	Negligible	Negligible significance	Negligible significance	Low	Negligible	Negligible	Negligible significance
Habitat alteration	Low	Negligible	Negligible significance	Negligible significance	Low	Negligible	Negligible	Negligible significance
Noise	Low	Negligible	Negligible significance	Negligible significance	Low	Negligiblee	Negligible significance	Negligible significance

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8.10 Figures

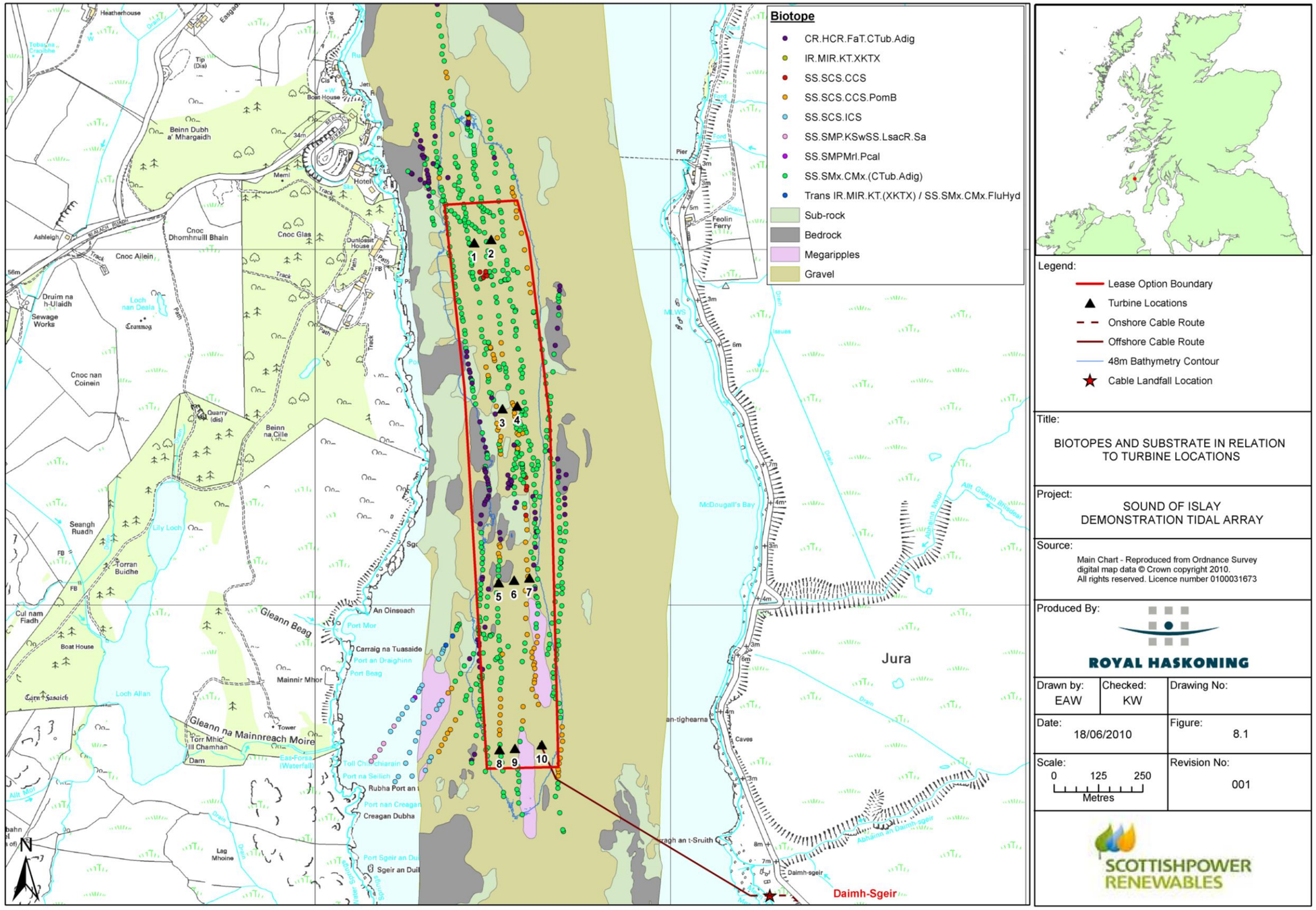

Figure 8.1: Biotopes and substrate in relation to turbine locations.

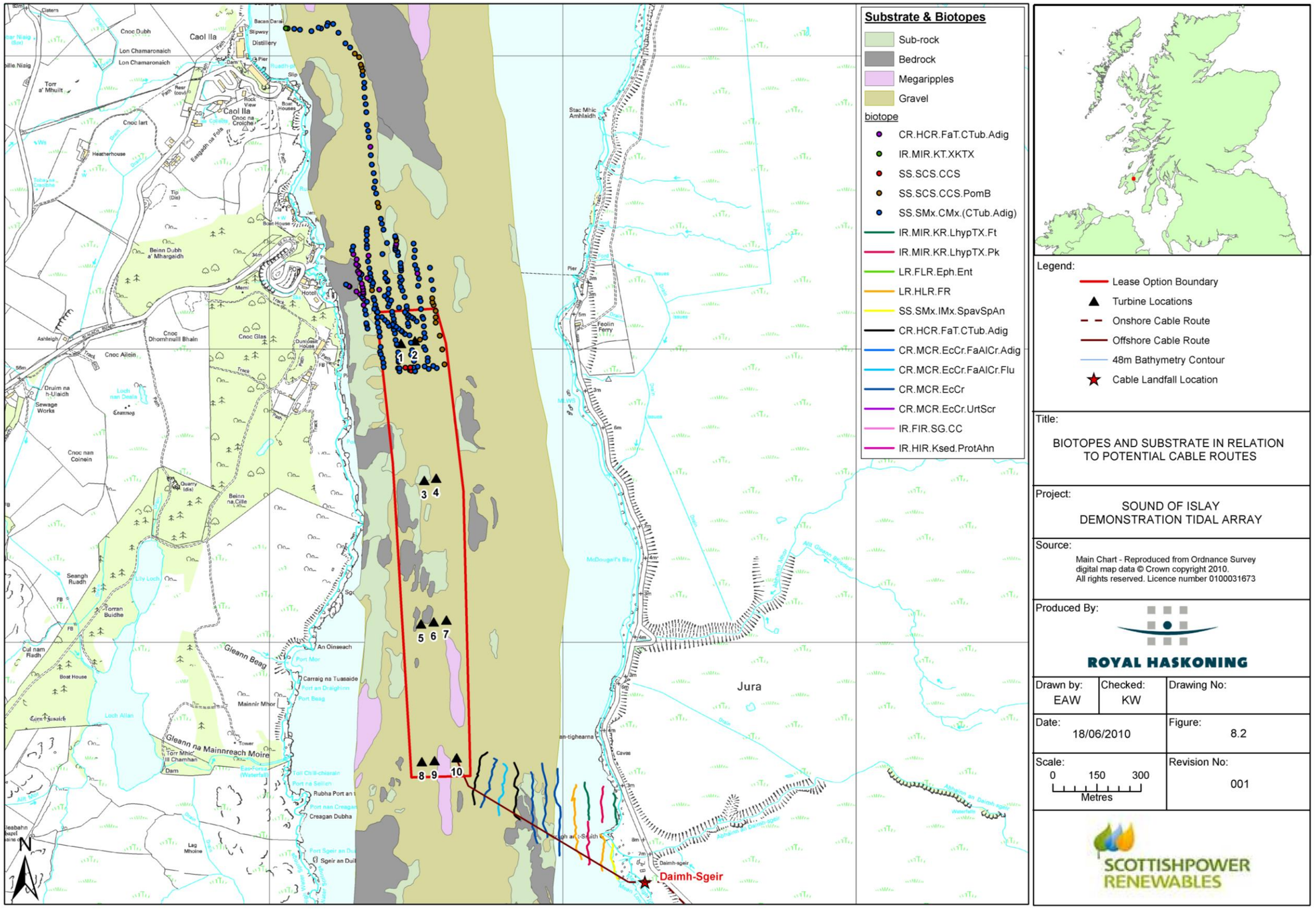

Figure 8.2: Biotopes and substrate in relation to final cable route.

9.0 Marine Mammals

9.1 Introduction

9.1. This Chapter provides information on the likely presence, relative abundance and distribution of marine mammals, and how they vary spatially and temporally, within the vicinity of the proposed Development and export cable routes.

9.2. In addition, it also reviews the potential impacts to marine mammals in relation to the proposed development during construction, operation/maintenance and decommissioning. Possible mitigation measures to reduce these impacts are discussed as are potential cumulative impacts.

9.3. This chapter should be considered with other chapters of this Environmental Statement (ES), including *Chapter 8: Benthic Ecology*, and *Chapter 11: Marine Fish and Shellfish Resources*, which discuss possible prey species for marine mammals.

9.4. *Chapter 15: Commercial Fisheries*, and *Chapter 20: Socio-economics, Tourism and Recreation*, discuss anthropogenic activities which may contribute to in-combination impacts on marine mammals, through activities such as commercial fishing and tourist sight seeing excursions.

9.5. Marine mammal species which use the Sound of Islay include the harbour porpoise *Phocoena phocoena*, bottlenose dolphin *Tursiops truncatus*, grey seal *Halichoerus grypus* and harbour seal *Phoca vitulina* (Appendix 9.1; SMRU, 2010). A killer whale *Orcinus orca* was recorded within the Sound of Islay during the intertidal survey work (Appendix 16.2).

9.6. Other species which may occur within the proximity of the Development include minke whale *Balaenoptera acutorostrata*, white beaked dolphin *Lagenorhynchus albirostris*, common dolphin *Delphinus delphis*, Risso's dolphin *Grampus griseus*, Atlantic white-sided dolphin *Lagenorhynchus acutus*, long finned pilot whale *Globicephala melas* and humpback whale *Megaptera novaeangliae* (Reid *et al.,* 2004). Marine mammal species in and around the study area are discussed further in Section 9.3 Baseline Description.

Summary of Impact on Marine Mammals:

The Sound of Islay is not believed to be an area of high importance for marine mammals however studies have shown a presence of some marine mammal species within the Sound of Islay and with the nearby South East Islay Skerries SAC, harbour seals are the most common species.

As a result of the high conservation importance of marine mammals the significance of some impacts has been assessed as **moderate**, however, this represents a worst case and is a function of the high level of national and international protection afforded these species combined with a certain degree of uncertainty regarding the effects of an array of turbines on marine mammals.

SPR is committed to monitoring marine mammals following installation of the Development and providing mitigation to protect marine mammals if deemed necessary in the light of monitoring results. We anticipate that the significance of effects can be reduced to **minor,** either in the light of better understanding of the effects of the Development on Marine Mammals, or based upon implementation of mitigation.

9.2 Methodology

9.2.1 Legislative Background

Cetaceans

International

9.7. The Convention on the Conservation of Migratory Species (The Bonn Convention) aims to conserve migratory species and their habitats. The common dolphin is afforded strict protection as an endangered migratory species, listed under Appendix 1 of the Convention. This has been ratified in the UK by the Wildlife and Countryside Act (1981) (see Paragraph 9.12).

9.8. Common dolphin, bottlenose dolphin and harbour porpoise are awarded strict protection under Appendix II of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention). All remaining cetaceans not listed in Appendix II are listed in Appendix III of the Bern Convention providing these species with more limited protection. The Bern Convention was ratified by the Habitats Directive (92/43/EEC).

9.9. The bottlenose dolphin and harbour porpoise are listed as Annex II species within the Habitats Directive and should to be protected by the designation of a network of Natura 2000 sites.

9.10. All cetaceans are included in Annex IV of the Habitats Directive. These are European Protected Species (EPS) whose natural range includes Great Britain. These species must be protected against any deliberate killing, destruction or taking of eggs, and deterioration/ destruction of breeding or resting sites. These animal species are also listed under Schedule 2 of The Conservation (Natural Habitats, &c) Regulations (1994) as amended, often referred to as the Habitats Regulations (see Paragraph 9.18). The Habitat Regulations transcribe the Habitats Directive into UK law.

9.11. The OSPAR Convention outlines species and habitats which require further protection. Of the species expected within the Sound of Islay study area, the harbour porpoise is listed as threatened and declining (Annex IV).

National

9.12. The Wildlife and Countryside Act 1981 (as amended) ratifies the Bonn Convention (Paragraph 9.7) and provides for the protection of all cetaceans found within UK territorial waters. Under Section 9 of the Act, it is an offence to intentionally kill, injure or take cetaceans; and to cause damage or destruction to certain areas used by cetaceans for shelter and protection, or to intentionally disturb animals occupying such areas.

9.13. The Nature Conservation (Scotland) Act 2004 amends and improves the species protection provided by the Wildlife and Countryside Act 1981 (Paragraph 9.12) to provide extension to existing protections for cetaceans from intentional disturbance to encompass protection from reckless disturbance as an offence.

Phocidae

9.14. All seals found within Scottish waters are protected by a range of national and international obligations:

International

9.15. Harbour seal and grey seal are listed as Annex II species under the Habitats Directive and should be protected via Natura 2000 sites. Annex V (a) provides additional restrictions on methods of taking or killing of all phocidae.

9.16. Under Schedule 3 of The Conservation (Natural Habitats, &c) Regulations (1994), grey and harbour seals are listed as animals which may not be taken or killed in certain ways.

9.17. Where there is potential for disturbance to occur to European Protected Species (EPS) as a result of a plan or project (such as the proposed development), an application for a licence to undertake such disturbance can be made to the competent authority. Such a licence can be granted if an appropriate Monitoring and Mitigation plan is put in place.

National conservation

9.18. The Conservation of Seal Act 1970 will be replaced by Section 130 of the Marine (Scotland) Act 2010 when it comes into force later this year and the Development will fall under the Marine (Scotland) Act. Under the Marine (Scotland) Act it is an offence to kill, injure or take a seal at any time of year except to alleviate suffering or where a licence has been issued to do so by the Scottish Government. It will also be an offence to harass seals at haul-out sites. This contrasts with the lower level of protection under the Conservation of Seals Act, under which restrictions are only placed on the management of seals at prescribed times of the year, coinciding with breeding and moulting.

9.2.2 Consultation

9.19. Consultation with statutory bodies and key stakeholders was undertaken by SPR on the following scoping document: 'Proposed Demonstration Tidal Site, Sound of Islay. Request for a Scoping Opinion' (ScottishPower Renewables, 2008). The responses made by SNH are particularly relevant to this chapter.

9.20. SNH advise that the Firth of Lorn should be considered for its importance for harbour porpoise. SNH also provided advice regarding the European Protected Species (EPS) which could be expected to occur within the Sound of Islay.

9.21. SNH advised that the usage of the Sound of Islay by marine mammals should be established by the use of field work as well as literature review. SPR commissioned the following:

- HWDT to collate their effort corrected visual and acoustic data collected between 2003 and 2009 during vessel-based line transect surveys as well as sightings data reported by the public between 2000 and 2008;
- SMRU to carry out land based visual observations and aerial surveys; and
- SAMS to complete an acoustic characterisation of the Development site.

9.2.3 Data collection

9.22. Information has been collected through a desk-based data search and through the commissioning of specialist field surveys. Important sources of information include:

Table 9.1: Catalogue of marine mammal data for the proposed Development

Data source	Coverage	Author	Year
Scottish Marine Renewables Strategic Environmental Assessment (SEA).	Scotland wide	Faber Maunsell	2007
JNCC SAC database	SAC	JNCC	2009
SMRU shore-based visual observations[1]	Sound of Islay Study Site	SMRU	2010
SMRU aerial surveys	SAC data of moult and breeding surveys across Argyll and Bute	SMRU	2010 (ongoing)
HWDT visual and acoustic data from boat-based surveys [2]	Argyll and Bute. Limited coverage of the Sound of Islay Study Site	HWDT	2009
HWDT collation of public sightings[1]	Argyll and Bute	HWDT	2000-2008
Background information on marine mammals for SEA 7	North west Scotland	Hammond *et al.*	2006
NRP sightings[3]	Sound of Islay	NRP/SMRU	2009-2010

9.2.4 Assessment of Significance

9.23. The significance of the effect caused by the impact is assessed in relation to the sensitivity/value/importance of the receptor and the magnitude of the impact (Table 9.2).

9.24. All marine mammals in UK waters are of national or international importance for nature conservation and therefore are all assessed to be of high sensitivity.

9.25. Table 9.2 is based on the Scottish Executive (2007) Significance Assessment Criteria.

Table 9.2: Magnitude of the Impact

Magnitude of the Impact	Description
High	Affect an entire population / habitat causing a decline in abundance and / or change in distribution beyond which natural recruitment would not return that population / habitat, or any population / habitat dependent upon it, to its former level within several generations of the species being affected.
Medium	Damage or disturbance to habitats or populations above those experienced under natural conditions, over one or more generation, but which does not threaten the integrity of that population or any population dependent on it.
Low	Small-scale or short-term disturbance to habitats or species, with rapid recovery rates, and no long-term noticeable effects above the levels of natural variation experienced in the area. The impacts are not sufficient to be observed at the population level.
Negligible	An imperceptible and/or no change to the baseline condition of the receptor.

[1] Appendix 9.1
[2] Appendix 9.2
[3] Included in Appendix 9.1

9.26. Table 9.3 outlines the matrix used in assessing the significance of effect of each impact to marine mammals using both the importance of the receptor (in this case the marine mammals) and the magnitude of impact should it occur. This provides a worst case scenario and does not take into consideration the likelihood of occurrence. The magnitude of the impact may be influenced by the sensitivity of the receptor to the potential impacts (Table 9.3).

Table 9.3: Significance prediction matrix

Magnitude of Impact	Receptor sensitivity/value/importance			
	Negligible	**Low**	**Medium**	**High**
High	No significant effect	Moderate	Major	Major
Medium	No significant effect	Minor	Moderate	Major
Low	No significant effect	Negligible	Minor	Moderate
Negligible	No significant effect	Negligible	Negligible	Minor

9.27. It should be noted that any residual effect (the effect after the implementation of mitigation) which remains at the level of 'Moderate' or 'Major' is still regarded by the EIA Regulations as being of significant effect.

9.28. It should be noted that because all marine mammals within the study area are of national or international importance and therefore of high sensitivity, the level of significance cannot be assessed as less than Minor and may necessarily be Moderate, even if the magnitude of a particular impact is considered to be low.

9.29. Table 9.4 outlines the sensitivities of marine mammal species to the specific impacts predicted for the Development as discussed by Scottish Executive (2007). While this is not considered directly during the impact assessment it provides some additional context when considering potential impacts.

Table 9.4: Marine mammal sensitivities

		Sensitivity					
Species	**Presence in Sound of Islay**	**noise & vibration**	**collision**	**increased suspended sediments**	**release of contaminants**	**barrier effect[4]**	**habitat exclusion**
Harbour seal	Highly likely	High	High	High	Low-medium	Medium	medium
Grey seal	highly likely	High	High	High	Low-medium	Medium	medium
Harbour porpoise	Highly likely	High	High	Medium	Low	High	High
Bottlenose dolphin	Likely	High	High	Medium	Low	Medium-high	Medium-high
Killer whale	Likely	High	High	Medium	Low	Medium-high	Medium-high
Common dolphin	Unlikely	High	High	Medium	Low	Medium-high	Medium-high
Risso's	Unlikely	High	High	Medium	Low	Medium-high	Medium-high

[4] Estimated in relation to habitat exclusion

Table 9.4: Marine mammal sensitivities

		Sensitivity					
Species	**Presence in Sound of Islay**	**noise & vibration**	**collision**	**increased suspended sediments**	**release of contaminants**	**barrier effect[4]**	**habitat exclusion**
dolphin							
White beaked dolphin	Unlikely	High	High	Medium	Low	Medium-high	Medium-high
Atlantic white-side dolphin	Unlikely	High	High	Medium	Low	Medium-high	Medium-high
Long finned pilot whale	Unlikely	High	High	Medium	Low	Medium-high	Medium-high
Minke whale	Unlikely	Medium	High	Medium	Low	Medium-high	Medium-high
Humpback Whale	Unlikely	Medium	High	Medium	Low	Medium-high	Medium-high

9.3 Baseline Description

9.30. The following species were recorded in the Sound of Islay during the baseline surveys or are likely to be present within the Sound due to their natural range including the Sound and/or surrounding waters. This includes a number of deeper water and less frequently recorded species, which are considered to have potential to passage through the Sound, but for which data are limited.

9.3.1 Phocidae

9.31. Two phocid species are recorded in the UK, the harbour seal *P. vitulina* and grey seal *H. grypus*.

9.32. Sightings per unit effort collected by HWDT (2009) (Appendix 9.2) during boat based surveys show high numbers of grey, harbour and unidentified seals within the Sound of Islay, shown in Figure 9.4. This map shows the proposed array site to have lower numbers of seals as the South East Islay Skerries SAC. The proposed array site has a value of 0.064 to 0.080 seals per Km^2, whereas the SAC has a value of 0.080 to 0.112. Figures 9.5 and 9.6 show the number of grey and harbour seal counts from an aerial survey in August 2009.

Harbour seal

9.33. The harbour seal has a widespread distribution, it is found along most coastlines in the northern hemisphere from polar to temperate regions. There are five subspecies of *P. vitulina* occurring in the eastern north Atlantic. Approximately 85% of the UK harbour seal population is found in Scotland.

9.34. The South East Islay Skerries Special Area of Conservation (SAC) lies approximately 18 km to the south east of the proposed development site within the Sound of Islay (see Figure 9.6). As an Annex II species the harbour seal is the primary reason for the designation of this site. The skerries, offshore islands and rugged coastline between Lagavulin Bay and Ardmore Point (South coast of Islay) support a nationally-important regional group of around 600 harbour seal. This area is extensively used as a pupping, moulting and haul-out site by the seals, which represent between 1.5% and 2% of the UK population.

9.35. A study of harbour seal movements (Cunningham *et al*., 2008) show haul out clusters within the Sound of Islay, as well as a large number around the coast of Islay, in particular on the south coast.

9.36. The Sea Mammal Research Unit (SMRU) carried out aerial surveys of harbour and grey seals along the coast surrounding the Sound of Islay, including Islay, Jura, West Kintyre, Colonsay and Oronsay, on 10th and 12th August 2009. Figure 9.5 shows three groups of up to 50 harbour seals were recorded in the southern part of the Sound of Islay and a number of smaller groups (1-5 seals) were recorded in the centre and to the north of the Sound. This corresponds with sightings made during the intertidal surveys on Jura and Islay, completed as part of this EIA (Appendix 16.2 and 16.4). Individual grey and harbour seals were recorded milling in the water near Feolin Ferry, around 400m to the east of the northern most turbine of the Development and near Traigh Bhan, around 2km to the south west of the Development. A single harbour seal was recorded hauled out at Traigh Bhan and fourteen were hauled out at Toll Chilli-chairain, approximately 800m to the south west of the Development.

9.37. SMRU (2010) recorded 398 harbour seal sightings within the Sound of Islay during their land based observations, April- November 2009. Of these 99% were recorded between July-November. 111 unidentified seals were also recorded within July-November.

9.38. Surveys of harbour seals around Scotland by SMRU in 2008 show the number of harbour seals in the SAC (and across the whole of Islay) to have increased between August 1990 and August 2007 (SMRU, 2008). This pattern is in contrast to the observed widespread decline in numbers at other locations throughout Scotland and the UK over the same period.

9.39. Harbour seals normally feed within 40-50km of their haul out sites, and feed on a variety of prey species including gadoids (particularly whiting), pelagic scad and herring (Pierce and Santos, 2003).

9.40. Harbour seal pupping occurs in June and July while moulting takes place in August and September. Harbour seals haul-out on tidally exposed areas of rock, sandbanks or mud. Individuals are generally faithful to particular haul-out sites within a season (SMRU, 2010).

9.41. Harbour seals can detect noise within the 100Hz to 60kHz range but show peak hearing between 1 and 50kHz at 70dB re 1µPa (Wilson and Carter, 2010).

Grey seal

9.42. Grey seal are found across the North Atlantic with around 45% of the world population being found in Britain. Over 90% of the British population breeds in Scotland. Satellite telemetry data show that grey seals spend approximately 40% of their time near or at haul-out sites, 12% of their time foraging and the remainder travelling between foraging areas and haul-out sites (McConnell *et al.,* 1999, cited in SMRU, 2010). Foraging trips usually last between two and five days, with seals generally feeding within 50km of the haul-out site (McConnell *et al.,* 1999; cited in SMRU, 2010). The shelf waters off the west coast of Scotland are clearly very important foraging habitat for the large numbers of grey seals within the Inner and Outer Hebrides (Hammond *et al.,* 2006). Waters west of Islay and Jura, and east of Lewis are extensively used by grey seals.

9.43. The grey seal moulting season occurs between February and April (SMRU, 2010) and the breeding season occurs during late summer / early autumn each year (Hammond *et al.,* 2006) when mature females will give birth to a single pup.

9.44. Figure 9.6 shows low numbers (1-5) of grey seals at sites within the Sound of Islay. Grey seals are most numerous to the north of the Sound, on the north of Skye and south of Oronsay.

9.45. The grey seal is a notified feature of the Oronsay and South Colonsay SSSI, which lies approximately 20km to the north of the proposed array site. The number of breeding seals within the SSSI remains stable and the site continues to be one of the best sites for pup production in the Hebrides and west coast of mainland Scotland (SNH, Accessed 2010).

9.46. SMRU (2010) recorded 86 grey seals within the Sound of Islay during their land based observations, April- November 2009. Of these 95% were recorded between July-October. In addition, 111 unidentified seals were recorded within July-November.

9.47. SMRU (2010) aerial survey results within the Sound of Islay study area (shown as a black box in Figure 9.6) found that grey seals decreased from 29 to 22 between 1990 and 2000. A large increase to 46 was recorded in 2007 and then a slight decrease to 35 was recorded in 2009. This was in contrast to the total numbers in the wider Strathclyde survey area which found that grey seal numbers fluctuated slightly between years but, on the whole, increased.

9.48. The diet of UK grey seals has been well studied and findings from the Hebrides in 2002 highlighted the importance of sandeels, gadoids and herring. In the Inner Hebrides benthic species are also considered to be an important component of their diet, including flat fish during the summer months (Hammond and Harris, 2006; cited in SMRU, 2010).

9.49. The hearing range of grey seals is expected to be similar to that of the harbour seal which can detect noise within the frequency range of 100Hz to 60kHz, with a peak hearing threshold of between 1 and 50kHz at 70dB re 1µPa.

9.3.2 Cetaceans

9.50. Cetacean species which have been recorded within the Sound of Islay include the harbour porpoise *P. phocoena* and bottlenose dolphin *T. truncatus* (SMRU, 2010).

9.51. The waters around Argyll and Bute have regular sightings of minke whale *B. acutorostrata*. According to UKDMAP, 1998 (cited in Scottish Executive, 2007) white beaked dolphin *L. albirostris*, common dolphin *D. delphis*, and Rissos's dolphin *G. griseus* are also seen regularly around Islay (including the Sound of Islay). Atlantic white-sided dolphin *L. acutus* and long-finned pilot whale *G. melas* have all been recorded with occasional abundance around Islay (including the Sound of Islay) (UKDMAP, 1998; cited in Scottish Executive, 2007). Killer whale *O. orca* was recorded in the Sound of Islay during the Aug 2009 Royal Haskoning intertidal survey (Appendix 16.2).

Toothed Whales

Harbour porpoise

9.52. Harbour porpoise are usually found near shore although they do also occur in deeper water. Porpoises are sighted in small groups or singly, frequently occurring in narrow sounds or bays. They are characteristically shy of boats and other anthropogenic activities; and this species is thought to be easily disturbed.

9.53. The Sea Watch Foundation carried out boat based surveys along the west coast of Scotland during the month of August in 1993, 1994, 1996 and 1997. Harbour porpoise sightings data indicated a preference for waters within 15km of the shore and between 50 and 150m depth. An apparent relationship between tidal currents and porpoise distribution was noted, with

more sightings predicted for areas of high tidal currents and times of high tide. This study also found a high variability in the number of sightings within the study period (Marubini *et al.,* 2009; cited in SMRU, 2010).

9.54. Research by the Hebridean Whale and Dolphin Trust ("HWDT") reports that the Inner Hebrides are particularly important harbour porpoise habitat, with feeding hotspots around Mull, the Small Isles and the Sound of Jura (HWDT, Accessed 2010). This corresponds with a recent paper by Embling *et al.* (2009) (cited in SMRU, 2010) which identified four potential sites for marine protected areas for harbour porpoises in the Inner Hebrides, including the Sound of Jura and the Firth of Lorn, both approximately 17km from the proposed Development. This study found that higher relative densities of porpoises were detected during low tidal currents in contrast to the study discussed previously where porpoises were detected at higher rates during high tidal currents (Marubini *et al.,* 2009; cited in SMRU, 2010). This can be explained by the fact that the Embling study (Embling *et al.* 2009; cited in SMRU, 2010) was further north and the tidal regime in the southern Inner Hebrides has much higher tidal speeds which may not have been preferable to harbour porpoise.

9.55. Figure 9.1 shows acoustic detections per unit effort for harbour porpoise within the Sound of Islay, collected by HWDT (2009). Harbour porpoise were the most common species in the study region, followed by seals. Harbour porpoise detections were widespread in adjacent waters with highest densities in the Sound of Jura; however, there were a small number (0.102-0.186 detections/km) in the Sound of Islay itself and to the north, between Colonsay and Jura.

9.56. Public sightings between 2000 and 2008, collated by HWDT (2009), are shown in Figure 9.2. The dataset supports the findings of the acoustic study (Paragraph 9.54) indicating that harbour porpoise uses the Sound of Islay and is the most common cetacean species. This data is not effort limited and has therefore been interpreted with caution. One harbour porpoise was recorded in October during the SMRU (2010) land based observations which were completed during April-November 2009.

9.57. In UK waters, mating and calving are estimated to take place between May and September (Learmonth, 2006; cited in SMRU 2010) with a peak around June and July (Lockyer, 2007; cited in SMRU 2010). The diet of harbour porpoise in Scottish waters is dominated by small demersal and pelagic shoaling fish. In Scotland porpoises tend to feed primarily on two to four main species, including whiting and sandeels (Santos *et al.,* 2004; cited in SMRU, 2010). The distribution of these prey species is discussed further in *Chapter 11: Marine Fish and Shellfish Resources*.

9.58. Harbour porpoise hearing is expected to be similar to that of bottlenose dolphins which have good hearing at high frequencies with a peak at around 50dB re 1µPa at 50kHz becoming insensitive to sounds above 200kHz. Hearing is poor at low frequencies but they can hear 40 to 70Hz if the amplitude is sufficiently high (Wilson and Carter, 2010).

Bottlenose dolphin

9.59. Bottlenose dolphin is a predominantly coastal species, commonly occurring in groups of one to several dozen individuals but can also be seen in large groups of up to a hundred or more individuals. The Hebrides supports one of three known UK populations of bottlenose dolphin (HWDT, 2009).

9.60. Bottlenose dolphin is widespread on the west coast of Scotland, although numbers are lower relative to the east coast of Scotland. Bottlenose dolphin has been recorded close to the coast around Argyll in all months of the year, suggesting possible year-round residency (Mandelberg, 2006; cited in SMRU, 2010). There is also some evidence that a small resident or semi-resident community of bottlenose dolphins may occur around Islay and can therefore be expected within the Sound of Islay (Evans *et al.*, unpublished data).

9.61. Public sightings of bottlenose dolphins between 2000 and 2008, collated by HWDT (2009) show that the species does occur within the Sound of Islay (Figure 9.3). The data is not effort limited, therefore abundance cannot be determined.

9.62. Bottlenose dolphin has a varied diet. Studies on the Scottish east coast suggest that areas with strong tidal flows are a favoured foraging habitat (Mendes *et al.,* 2002; cited in SMRU, 2010). Santos *et al.* (2001) published dietary information for ten stranded bottlenose dolphin off the east coast of Scotland, the main prey items being cod, saithe and whiting. In contrast to the harbour porpoise, bottlenose dolphins are inquisitive and frequently approach boats.

9.63. Bottlenose dolphin has optimal hearing at high frequencies with a peak at around 50dB re 1µPa at 50kHz becoming insensitive to sounds above 200kHz. Hearing is poor at low frequencies but they can hear 40 to 70Hz if the amplitude is sufficiently high (Wilson and Carter, 2010).

Killer whale

9.64. Killer whale has the widest distribution of all marine mammals, found from the equator to the polar seas. Most sightings in UK waters are of single animals or groups of less than eight individuals, although groups of up to 100 have been reported (Reid *et al.,* 2003). In UK waters, killer whales have been recorded in inshore Scottish waters around the Northern and Western Isles, where sightings are concentrated around Mull and the Treshnish Isles (Bolt *et al.,* 2009; cited in SMRU, 2010), and in the northern North Sea (Reid *et al.,* 2003). A killer whale was recorded in the Sound of Islay during the intertidal survey for the potential landfall sites on Islay in August 2010. The adult male was observed milling approximately 600m to the south west of the Development during low water slack (Appendix 16.2).

9.65. There are reports of killer whales predating upon grey seals, harbour seals and porpoises around Scotland (Weir, 2002; cited in SMRU, 2010). A study on killer whale sightings showed an overlap in the regions of greatest sighting frequency and the largest declines in harbour seal counts (Lonergan *et al.,* 2007; cited in SMRU 2010). Killer whales also forage near pelagic trawlers, taking advantage of the mackerel and herring fisheries off Northern Scotland, primarily between January and February (Luque *et al.,* 2006; cited in SMRU 2010).

9.66. Killer whales breed throughout the year, particularly during September to January in the northern hemisphere. Peaks occur during September to October (CRRU, Accessed 2010).

9.67. Killer whales are most sensitive to mid frequency sounds between 8 and 20kHz, with an upper limit of 120kHz (Wilson and Carter, 2010).

Common dolphin

9.68. Common dolphin has a widespread oceanic distribution in tropical to temperate waters throughout the Atlantic and Pacific. The species is found in continental shelf waters and is common in the Sea of Hebrides and to the south of the Minch, especially in the summer (SMRU, 2010). Common dolphin have occasionally been sighted around the Hebrides during monthly summer surveys carried out by the HWDT between 2003 and 2005; however, no sightings were made in the Inner Hebrides south of Coll and Tiree (SMRU, 2010). There are no known sightings of common dolphin within the Sound of Islay and their tendency towards deep water makes it unlikely that they would enter the Sound.

Risso's dolphin

9.69. Risso's dolphin is found in both hemispheres, mostly in continental slope areas from the tropics to temperate regions. Risso's dolphins have been sighted on occasion in Scottish waters, mainly to the west of the Outer Hebrides, generally between June-September (Hammond *et al.,* 2006). There are no known records of Risso's dolphin in the Sound of Islay. Whilst their presence in surrounding waters make it possible for Risso's dolphin to enter the Sound, their tendency towards deep water make it unlikely.

White beaked dolphin

9.70. The white-beaked dolphin is found in cool temperate and subarctic waters of the North Atlantic (Reid *et al.,* 2003). They are mostly distributed over the continental shelf and in the northern North Sea (off Scotland and northeast England) (Hammond *et al*., 2006). The species is generally found in waters between 50m and 100m depth, and rarely out to the 200m isobath (Reid *et al.,* 2003). Research indicates that white-beaked dolphin numbers are decreasing in north western Scotland and are being replaced by common dolphins (MacLeod *et al.,* (2005, 2007 and 2008); cited in SMRU, 2010). It is not expected that this species will be encountered within the Sound of Islay.

Atlantic white-side dolphin

9.71. The Atlantic white-sided dolphin shares most of its range with the white-beaked dolphin. The two species can be difficult to distinguish so there is a tendency for them to be recorded as *Lagenorhynchus spp*. Around Britain, sightings are largely concentrated in offshore waters to the north and west; however there are currently no abundance estimates for this region. The Atlantic white-sided dolphin has previously been found in the Hebrides (Hammond *et al.,* 2006); however, there are no known records in the Sound of Islay.

Long finned pilot whale

9.72. The long-finned pilot whale is a continental shelf species with a worldwide distribution in temperate and sub-polar seas. In UK waters sightings frequently occur around the 1,000 metre isobath, particularly north of Scotland where they are recorded west of the shelf edge. There are no known records of the long finned pilot whale within the Sound of Islay and with an offshore distribution and preference for deep water it is unlikely that the long finned pilot whale would enter the Sound of Islay on a regular basis.

Baleen whales

Minke whale

9.73. The minke whale is a predominantly coastal species, widely distributed throughout the world and is found from the subtropics to polar regions in both the Northern and Southern hemisphere. Within UK waters, minke whales are most frequently sighted in the north-western North Sea, the Hebrides and in the Irish Sea (Reid *et al.,* 2003). Minke whales have been found to be seasonally resident off the Inner Hebrides (Gill *et al.,* 2000; cited in SMRU, 2010), although some may be present year round (MacLeod *et al.,* 2004, cited in SMRU, 2010). Regular surveys in the Inner Hebrides have shown that minke whales tend to move northward as the summer season progresses, with the areas around Tiree and Coll being more important during May and June. Since 2005 there has been a slight temporal shift in distribution, with peak numbers being observed earlier in the year (July; Sea Watch Foundation unpublished data, P. Anderwald, pers. comm., cited in SMRU, 2010). Opportunistic surveys on the Kennacraig to Port Askaig ferry reported two minke whale sightings in the Sound of Jura, to the south of the Sound of Islay on the 30 June 2009 (SMRU, 2010). While there are no known records of minke whale within the Sound of Islay their presence in surrounding waters make it possible that they could enter the Sound.

9.74. Breeding is thought to occur throughout the year, with apparent peaks in calving during winter months (CRRU, Accessed 2010).

9.75. Minke are known to feed in areas of strong tidal currents and around small islands and headlands (Anderwald *et al.,* 2008, cited in SMRU, 2010). Off the Isle of Mull minke whales tend to occur in sandeel habitat in early summer and pre-spawning herring habitat in late summer (Macleod *et al.,* 2004, cited in SMRU, 2010). In the waters around Mull, shifts in prey distribution and abundance occur between March and November and are the most likely factors governing the distribution and abundance of minke whales. In a study of minke whales stranded along the coast of Scotland, the diet was found to comprise mainly of sandeels and clupeids (Pierce *et al.,* 2004).

9.76. Very little is known about the hearing sensitivities of minke whales; however they are likely to be low frequency specialists, hearing sounds below frequencies of 1kHz but probably up to around 8kHz (Wilson and Carter, 2010).

Humpback Whale

9.77. Humpback whales are widely distributed globally and undertake long seasonal migrations between feeding and breeding areas. This species largely favours inshore waters and the continental shelf. They have been recorded occasionally (one or two per year) in the Hebrides, travelling between breeding grounds and feeding areas (HWDT, 2008)., however, there are no known records within the Sound of Islay.

9.3.3 Baseline Underwater Noise

Properties of Noise

9.78. Various physical parameters have an effect on noise and the propagation of sound waves through water. Temperature variations have a major effect on sound propagation in shallow waters; a mixed isothermal sea surface layer (which will form under certain conditions) may act as a duct which can 'trap' acoustic signals. Sediment types and seabed roughness will also affect noise propagation; a hard seabed such as that found across much of the Sound of Islay (*Chapter 7: Physical Environment and Coastal Processes*) will reflect noise effectively whereas soft silty or muddy seabed will absorb noise (Scottish Executive, 2007). However, low frequency noise can travel considerable distance within the sea-bed substrate to be emitted at distance from the source.

9.79. Background subsea noise results from contributions by many sources. These may be both naturally occurring noise, such as sea state, seismic disturbances, meteorological conditions or noise emitted by marine mammals or anthropogenic noise, such as shipping traffic, aggregate extraction activity or oil and gas production.

Naturally occurring noise

9.80. SAMS (2010) undertook a survey of underwater noise levels within the Sound of Islay study area (Appendix 9.3). The study was designed to avoid, where possible, the recording of anthropogenic noise and therefore concentrate entirely on natural noise levels. The constant operation of the Port Askaig to Feolin ferry meant that this was not possible across the entire study area particularly at the northern extent.

9.81. This study used the “Drifting Ears Method” (Wilson and Carter, 2008) to record underwater sound levels, within the proposed array site, over a period spanning neap and spring tides during September 2009.

9.82. As often is the case in the marine environment (Scottish Executive, 2007), low frequencies were found to dominate the sound spectrum within the Sound of Islay. It was also found that as flow rate associated with tidal conditions within the Sound increased the level of background noise also increased.

9.83. Mean noise levels within the sound were found to range between 69 dB re 1µPa (during slow ebb at a frequency of 20kHz) and 116 dB re 1µPa (during fast flood at a frequency of 5kHz) over the 6 frequencies studied and varied (spatially across the width of the Sound) greatly across a spatial scale. Overall background noise levels were considered, by SAMS, to be high especially when compared with studies that have been conducted in the open ocean. Most sampling took place during sea states 0-2 (noise levels generally increase with greater sea state) and recorded noise levels within the Sound, even at these calm sea states, were considerably greater than recordings during sea state 6 (very rough) in open ocean.

9.84. It was found that noise levels increased as the speed of tidal flow increased and conversely decreased as tidal flow slowed. This suggests that physical processes such as water flow or gravel transport are contributing significantly to the soundscape within the Sound of Islay. During poor weather conditions, noise caused by wind and precipitation can dominate the noise levels in the underwater environment.

Anthropogenic noise

9.85. During the SEA program funded by the DTI (now DECC) a noise study was conducted of background noise within the area known as SEA 7 which contains the waters off western Scotland and therefore the Sound of Islay. This study concluded that “the SEA 7 area carries a significant amount of commercial shipping” (Harland and Richards, 2006). The Scottish Executive SEA (Scottish Executive, 2007) identified that the dominant noise source during calm conditions within the seas around Islay and Jura is that of “distant shipping”.

9.86. The noise spectrum from all powered craft is relatively broadband but with a strong low frequency content and a number of tonal ‘lines’ emanating from engines and machinery. Above 1kHz engine/machinery noise diminishes and the dominant noise source is caused by water displacement and the resulting entrained bubbles. The noise of distant shipping tends to dominate the 50 to 300Hz part of the spectrum (Harland and Richards, 2006).

Ferries

13.1. Within the coastal waters of Scotland a significant contribution to shipping noise will be from the interisland ferries (Harland and Richards, 2006). It is therefore likely that greatest current source of anthropogenic noise emissions in the Sound of Islay are the ferries which operate within the Sound.

9.87. There are two ferry services that operate in the Sound: the Kennacraig to Port Askaig service (which also extends to Colonsay during the summer months) and the Islay to Jura service which operates all year round.

9.88. There is no specific data available on the acoustic output of the Caledonian MacBrayne ferries but a study of the effects of vessel noise on the marine environment found that noise levels produced by ferries ranged from between 137 dB re 1µPa at 220m to 120 dB re 1µPa, at a distance of 950m (Sara *et al.*, 2007). These levels were always greater than the background noise levels in the study area. Whilst gathering data for this study it was found that ferries generated the highest noise levels in the lower frequencies and at about 600m from the noise source all but the lowest frequencies (<6KHz) had dropped below background levels (Sara *et al.*, 2007). Further studies completed have found that a typical ferry creates a sound wave of 160-170dB re 1µPa @ 1m. These studies show that vessels create a virtual wall of "white noise" that has a constant loudness (US Department of Transport, 2010).

9.89. The Kennacraig to port Askaig ferry docks in Port Askaig up to 10 times a week, visiting once or twice a day. Natural background noise levels within the Sound were found to be between 86.8 and 159.8dB re 1µPa and it is, therefore, likely that these ferries make a significant contribution to current background noise levels. It should be noted that the report produced by SAMS (2010) did not include measurements of noise levels when the Caledonian MacBrayne ferries were in the Sound. Therefore, the noise created by these ferries will be in addition to the background noise levels reported by SAMS (2010).

Fishing vessels

9.90. Away from the main shipping lanes within SEA 7 a major contribution to underwater noise is likely to come from fishing boats (Harland and Richards, 2006)

9.91. Approximately 10 small fishing vessels use the Sound, mainly in winter (*Chapter 15: Commercial Fisheries*). A brief search of current literature (Chung *et al.*, 1995; Erikson G 1979; Sara *et al.*, 2007) indicates that fishing vessels produce noise levels of between 50 and 140dB re 1µPa. The vessels that operate within the Sound of Islay are generally small (<10 m in length (*Chapter 15: Commercial Fisheries*)) and as a result it is likely that their acoustic output will be at the bottom of this range. Therefore, it is reasonable to infer that as the background noise levels in the Sound range from 86.8 to 159.8dB re 1µPa, it is unlikely that fishing vessels contribute significantly to background underwater noise levels.

Potential Future Noise Generated by Turbine

9.92. The SAMS (2010) (Appendix 9.3) study takes the recorded acoustic output of the Hammerfest Strøm HS 1000 device reported by Akvaplan-niva (2010) (Appendix 9.4) and uses those figures to calculate the amount of noise these devices would produce within the Sound of Islay. The maximum acoustic output from one device was reported to be 113dB re 1µPa.

9.93. Note the calculations used in the SAMS (2010) report do not attempt to scale up the noise produced by the HS 1000 device which produces 330kW and the device to be used in the Sound of Islay which is predicted to produce 1MW. The scale and general design characteristics of the proposed 1MW device differ only marginally from those of the 300kW device and it is anticipated that differences in terms of noise characteristics will be limited.

9.94. Background noise levels within the Sound of Islay are much higher than those in open ocean (SAMS, 2010) and it is anticipated that they are often at higher levels than those recorded during the SAMS survey (86.8 – 159.8dB re 1µPa), given that survey was conducted in calm conditions and avoided anthropogenic noise such as that from the ferries using the Sound.

9.95. Marine turbines by their nature can (currently) only operate in areas where high ambient sea noise levels already exist (Subacoustech, 2005; Akvaplan, 2010) due to the high energy environments they require. Additionally, tidal turbines typically produce noise at low frequencies (between 50 and 1000Hz). Noise produced by shipping and natural noise associated with high energy coastal environments is also generally around the lower frequencies; therefore it is anticipated that the operational noise of the turbine will be masked by the background noise of shipping as well as natural environmental background noise.

9.96. SAMS (2010) calculated the distance that the noise produced by the Development would travel before it fell below background noise levels. Once below background noise levels it is assumed to have no impact on any receptors.

9.97. Using both the spherical transmission loss formula and the cylindrical spreading formula it was predicted that the distance that underwater noise from each turbine would travel before it dropped below background levels would be between 20m and 400m. Figure 9.7 illustrates spatially the distance that noise may travel from each of the 10 devices. The Akvaplan (2010 pp.19) report concludes that the cylindrical spreading loss formula (which predicted a distance of 400m) is more appropriate for calculating transmission loss from tidal turbines, than the spherical transmission loss formula. However, the propagated noise levels are likely to be at the lower end of this range due to the factors described below.

9.98. The theoretical upper range limit of 400m would only occur if a turbine was positioned in the location of lowest levels of background noise, emitting noise a maximum level. This is an unlikely scenario for the following reasons:

- Soundscape maps produced by SAMS (2010) show that the lowest background noise levels in general occur in the south east or south west of the study area (Appendix 9.3; Figure 6) depending on the state of tide. The proposed turbine locations, which are plotted in Figure 9.7, are in the northern half of the study area, general, is characterised by higher levels of background noise;
- Secondly, it is likely that turbine noise will increase as the rotational speed of the turbine rotors increase as the current flow-rate increases. This will correspond with an increase in background noise levels which was found to occur as a result of the current speed increasing (SAMS 2010). Hence, the increasing turbine noise should be masked by the increase in background noise. However, this factor has not been taken into account when calculating the extent to which noise will travel before it falls below background levels, so allow for conservative assessment of this effect; and
- Due to the shielding effect caused by Islands of Islay and Jura (Scottish Executive, 2007) noise generated by the turbines will be modified and is not likely to travel out of the Sound.

9.99. SAMS (2010) concluded that ten operational turbines within the Sound of Islay would have very little impact on existing noise levels.

13.2. No known underwater noise measurements have been made of gravity support structure installation, and no behavioural observations have been made. However, it may be possible to draw some conclusions from a case study relating to seabed rock placement for scour protection.

9.4 Assessment of Effects and Mitigation

9.4.1 Do Nothing Scenario

9.100. Grey and harbour seal abundances in the South-east Islay Skerries marine SAC have been seen to increase between 1990 and 2007 and human activities within the SAC are currently relatively low and tolerated by seals (JNCC, 2001). However, while harbour seal numbers on the west coast of Scotland and the Hebrides appear to be comparable with numbers for previous years (based on 2005 and 2006 data) numbers for the northern isles and east coast show a decline (SNH, 2007).

9.101. The local increases are expected to include increased movements and haul out within the Sound of Islay. During a 'do nothing scenario' seals in the area could be expected to fluctuate naturally around the current population level.

9.102. Public sightings data from 2000 to 2008 (HWDT, 2009) suggest that harbour porpoise would be expected to be seen on a regular basis in and around the Sound of Islay, bottlenose dolphin is also sighted in this area, although less frequently.

9.103. The sporadic occurrence of other cetacean species such as the minke whale makes the 'do nothing' scenario difficult to predict. For example, natural variation in the distribution of prey species is likely to have a significant effect on their presence.

9.4.2 Potential Impacts during Construction Phase

Impact 9.1: Noise and vibration

9.104. The use of ballasted gravity base tidal devices will reduce the noise generated by construction in comparison to the pile driving or drilling activities which are required for offshore windfarms and some other tidal devices.

9.105. Increased vessel traffic, including some vessels using dynamic positioning (DP), may be a major source of noise during construction. However, due to the number of vessels already using the Sound of Islay, the relatively limited duration over which increased levels of vessel activity will occur, and the existing levels of background noise, the impact is expected to be relatively low. Vessel noise can be reduced by maintaining a consistent speed and slowing down/ accelerating gradually (DSP, 2009).

9.106. The audible range of construction activities will depend on the interplay between: (1) the hearing sensitivities of receptive species; (2) the acoustic output at source; (3) masking effects by background noise; and (4) the propagation potential of the environment (as a function of temperature, underlying substrata, etc). Studies of the noise generated during construction of the SeaGen turbine in Strangford Lough showed that drilling activities produced noise levels resulting in a low likelihood of disturbance to marine mammals up to 115m from the noise source. At 3m from the drilling site the level of noise was expected to cause some avoidance reactions from marine mammals (Nedwell and Brooker, 2008). The construction activities for the Development are expected to produce significantly less noise than the Strangford case study for example due to the absence of drilling activities within the construction programme for the Islay array.

9.107. Marine mammals travelling through the Sound of Islay or seals hauled out close to the site could theoretically be temporarily displaced by the noise generated during construction. However, shore based marine mammal surveys undertaken during the installation of the SeaGen turbine in Strangford Lough, Northern Ireland, showed no evidence of change in relative seal abundance or distribution in the area. Measures of harbour porpoise activity (echolocation 'clicks' collected via passive acoustic monitoring) within Strangford Lough narrow also indicate that passage in and out of the lough remains at similar levels pre and post installation (Scottish Natural Heritage, 2009). It suggested that existing high levels of existing background noise and vibration may have played a role in this lack of response.

9.108. Based upon the lack of evidence of disturbance effects during installation of the SeaGen device and considering the potential noise of installation in the context of the existing, considerable, noise environment of the narrows a negligible magnitude is predicted for the Sound of Islay, with no measurable response or change anticipated. Given that receptor sensitivity must be considered high, due to the legislative status of the species assessed, the impact is predicted to be of **minor** significant effect.

MITIGATION IN RELATION TO IMPACT 9.1
• SPR appreciates that this Development is the first tidal array and that that consideration of magnitude includes consideration of elements where knowledge is incomplete. As a result SPR commits to putting in place a programme of post installation monitoring and any mitigation considered necessary by regulators, as part of an ongoing programme of adaptive management. • There is a theoretical potential to cause disturbance to marine mammals, and while our judgement is that this is of minor significance in this instance, based on industry experience gained from SeaGen and wider assessments, knowledge is incomplete and effects from an array rather than a single device are unknown. A deploy and monitor strategy is proposed, with ongoing monitoring, linked to management of the Development. An important component of that strategy will be an application for a licence to disturb EPS, to enable regulators to allow deployment while further knowledge regarding effects (or lack of effects) from the Development is obtained. • As part of a wider adaptive management and environmental monitoring strategy, SPR is committed to mitigating relevant significant effects identified by ongoing monitoring.

Residual Impact

9.109. Due to the sensitivity of marine mammals as a receptor and our incomplete knowledge the significance of the impact remains **minor**.

Impact 9.2: Collision risk

9.110. Worldwide, shipping collision is a recognised cause of marine mammal (particularly cetacean) mortality (Scottish Executive, 2007). Due to the number of vessels already using the Sound of Islay and the relatively limited duration over which vessel activity will increase as a result of installation of the Development it is considered that the likelihood of collision is low. There is no current evidence of ongoing collisions with marine mammals in the Sound.

9.111. Studies such as the Dolphin Space Programme (DSP) (2009) show that a steady speed should be maintained to allow marine mammals to move away from vessels. A protocol will be established to ensure installation vessels travelling in to the area maintain a suitably safe speed. The vessels involved in installation will move at a steady speed and in a predicable and planned manner throughout the operation.

9.112. There is no evidence suggesting any collisions with marine mammals during construction (or subsequently) for SeaGen in Northern Ireland. A number of monitoring measures are in place there, including specific carcass survey measures (SNH, 2009).

9.113. Based on existing levels of vessel activity in the Sound, the limited scale and timeframe for installation, as well as the lack of any evidence of collision risk from other tidal turbine installation works, a negligible magnitude is predicted. Given the high receptor sensitivity, collision risk is therefore predicted to be of **minor** significant effect.

MITIGATION IN RELATION TO IMPACT 9.2
• The available evidence from existing tidal turbines e.g. SeaGen in Strangford Lough indicates that collision risk during construction is minimal, with no evidence of any interactions. • As detailed previously, SPR is committed to the establishment of any post installation monitoring required in support of a deploy and monitor strategy. It is anticipated that the data from visual observations before, and after installation will play a role in this. In addition, a carcass survey programme proposed by Marine Scotland as part of its ongoing support of wet renewable installations, provide an additional check and reassurance that reasonable measures are in place to detect any serious interaction. • Application of a vessel management protocol based on existing 'best practice' will ensure reasonable mitigation is in place to reduce potential for collision.

Residual Impact

9.114. As a result of the importance of marine mammals as a receptor the significance of collision risk will remain of **minor** significant effect.

Impact 9.3: Increased suspended sediment

9.115. Disturbance of sediment during construction could cause localised and short term increased turbidity and therefore reduced visibility. Harbour and grey seals have been reported as having high sensitivity to poor visibility, whilst cetaceans have moderate sensitivity (Scottish Executive, 2007).

9.116. The site has predominantly coarse gravelly substrate which would be expected to settle out of suspension rapidly. In high energy sites such as the Sound of Islay any fine sediment present would be expected to disperse rapidly. Based on this the magnitude of this impact is considered to be negligible. Given the high sensitivity / value of marine mammals, the impact has been assessed as being of **minor** significant effect.

MITIGATION IN RELATION TO IMPACT 9.3
• No mitigation required

Residual Impact

9.117. As a result of the importance of marine mammals as a receptor the significance of suspended sediments must remain of **minor** significant effect.

Impact 9.4: Accidental release of contaminants

9.118. The risk of spillage of contaminants, such as oils, during the construction phase has been considered within *Chapter 21: Water and Sediment Quality*.

9.119. The risk of pollution events will be minimised by following standard good practice, such as the Pollution Prevention Guidelines issued by SEPA (e.g. PPG 5: Works and maintenance in or near water). Additionally, any chemicals used during construction will require prior approval through the FEPA licensing process and any lubricants will be non toxic, biodegradable and capable of dispersal in seawater.

9.120. Installation contractors will put in place appropriate Site Environmental Management Plans and Pollution Control and Spillage Response Plans that will be agreed with the relevant statutory bodies prior to offshore construction activities commencing. These plans will act to reduce the potential for accidental pollution and in the unlikely event of a pollution incident, will ensure a rapid and appropriate response.

9.121. Seals and cetaceans generally have low sensitivity to contamination, although sensitivity increases for seals in the vicinity during breeding (Scottish Executive, 2007).

9.122. In a high energy marine environment, contaminants can be expected to rapidly disperse and it is expected that should a spill occur, its scale and the nature of the contaminant will be limited.

9.123. As a result a negligible magnitude is predicted and, given the high receptor sensitivity, the impact is predicted to be of **minor** significant effect.

MITIGATION IN RELATION TO IMPACT 9.4
• No mitigation required

Residual Impact

9.124. As a result of the importance of marine mammals as a receptor the significance of accidental release of contaminants must remain of **minor** significant effect.

Impact 9.5: Habitat exclusion

9.125. Noise disturbance and visual presence of the construction works could potentially displace marine mammals (seals) from habitats within the Sound of Islay including potentially feeding, breeding and social areas.

9.126. The Sound of Islay, including the area of the Development and associated installation works, is not known as a particularly important area for marine mammals in terms of feeding or breeding. Important designated haul out areas exist south of the Sound, however, these are sufficiently distant to not experience disturbance through the main mechanisms of visual and acoustic disturbance. Some non designated seal haul out sites are present nearby and there could be some disturbance to animals using these; however, given the limited timescale of the construction works it is expected that the effect, if any, will be short term.

9.127. As detailed earlier in this section an appropriate vessel management protocol will be put in place before commencement of installation. The protocol will identify known haul out areas in the vicinity of the proposed works and associated activity, and reasonable measures will be taken to avoid those locations.

9.128. Evidence from the installation of SeaGen, inside a site designated for seals, indicates no disturbance to the activity of marine mammals as a result of installation (SNH, 2009) or subsequently.

9.129. Based on the limited potential for disturbance indicated by the scale of the works and evidence from other installations of tidal devices, the magnitude of the potential impact is assessed as negligible. Given the high receptor sensitivity (given the conservation status of marine mammals) the significance of effect of habitat exclusion has been assessed as **minor.**

MITIGATION IN RELATION TO IMPACT 9.5
• Appropriate vessel management measures will be put in place to reduce or remove potential disturbance to haul out areas in the Sound. • SPR is committed to mitigating relevant significant effects identified by ongoing monitoring.

Residual Impact

9.130. As a result of the importance of marine mammals as a receptor the significance of habitat exclusion must remain of **minor** significant effect.

9.4.3 Potential Impacts during Operational Phase

Impact 9.6: Noise and vibration

9.131. SAMS (2010) (Appendix 9.3) undertook a survey of baseline underwater noise within the Sound of Islay and carried out modelling of predicted operational noise of the Development.

9.132. Background noise levels within the Sound of Islay are much higher than those in open ocean (SAMS, 2010) and are often likely be at higher levels than those recorded during the SAMS survey (86.8 – 159.8dB re 1µPa) as that survey was conducted in calm conditions and avoided the recording of anthropogenic noise such as the large ferries that frequent the Sound.

9.133. Marine turbines by their nature can (currently) only operate in areas where high ambient sea noise levels already exist (Akvaplan, 2010) due to the high energy environment. Additionally, tidal turbines typically produce noise at low frequencies (between 50 and 1000Hz). Coincidentally, noise produced by shipping and natural noise associated with high energy coastal environments is also generally centred around the lower frequencies; therefore, operational noise of the turbines will be masked by the background noise from shipping and the natural environment.

9.134. Due to the shielding effect caused by Islands of Islay and Jura (Scottish executive, 2007; pp 3) noise generated by the turbines will be modified and is therefore not likely to travel out of the Sound.

9.135. A study for the SeaGen tidal turbine in Strangford Lough prior to installation of the device suggested that mild aversion reactions could be expected at 108m and 15m from the device during operation, for harbour porpoise and common seal respectively. Strong aversion reactions were expected at 9m for harbour porpoise and 1m for common seal (Parvin *et al.,* 2005).

9.136. Data from post installation monitoring of SeaGen has not shown any significant effect on the activity of marine mammals in the area of the device (SNH, 2009).

9.137. The SAMS (2010) study concluded that the devices are unlikely to significantly add to underwater noise. However, the noise generated by the turbines is likely to be audible between 20 and 400m depending on the prevailing tidal conditions (Paragraph 9.145).

9.138. Although during the operational phase there is theoretical potential for disturbance effects from the periodic increase in vessel activity during maintenance operations, as detailed previously for construction, given background noise from the Port Askaig - Feolin ferry, it is expected that marine mammals in the area will be accustomed to vessel noise. Marine mammals continue to use the Sound. Noise effects from maintenance vessels (if any) are expected to be both short term, limited in scale and transitory.

9.139. Based on levels of existing noise and the limited scale of potential noise impacts, combined with evidence of no effect from other tidal turbine sites, the magnitude of any impact is assessed as negligible and, given the high receptor sensitivity, noise and vibrations are predicted to be of **minor** significant effect.

MITIGATION IN RELATION TO IMPACT 9.6
• There is no evidence from existing tidal turbines that noise during operation will have an effect on marine mammals. However, SPR appreciates that this Development is the first tidal array and that that consideration of magnitude includes consideration of elements where knowledge is incomplete. As a result SPR commits to putting in place a programme of post installation monitoring. • There is a theoretical potential to cause disturbance to marine mammals, and while our judgement is that this is of minor significance in this instance, based on industry experience gained from SeaGen and wider assessments, knowledge is incomplete and effects from an array rather than a single device are unknown. A deploy and monitor strategy is proposed, with ongoing monitoring, linked to management of the Development. An important component of that strategy will be an application for a licence to disturb EPS, to enable regulators to allow deployment while further

knowledge regarding effects (or lack of effects) from the Development is obtained.
- As part of a wider adaptive management and environmental monitoring strategy, SPR is committed to mitigating relevant significant effects identified by ongoing monitoring.

Residual Impact

9.140. As a result of the importance of marine mammals as a receptor the significance of noise and vibration during operation and maintenance must remain of **minor** significance.

Impact 9.7: Collision risk

9.141. The interaction of open stream tidal energy devices and marine mammals is largely unknown. The likelihood for collision may depend on other variables such as underwater visibility, how perceptible the devices are to marine mammals above background noise levels and the rotation speed of the rotor blades.

9.142. There may be potential for the turbines to attract aggregations of fish therefore the array site could become an attractive feeding point for marine mammals, increasing the risk of collision with the turbine rotors. The inquisitive nature of some marine mammals, particularly seals, could also draw them towards the turbines. However, carcass studies relating to the SeaGen device in Strangford Lough have shown no marine mammal deaths which are likely to have been caused by the tidal turbine have occurred and no changes in behaviour have been recorded attributable to SeaGen (SNH, 2009).

9.143. The proximity to the South East Islay Skerries seal breeding colony increases the potential for juvenile seals to be exposed to the devices. Studies on seal entanglement (principally in relation to fishing gear) suggest that younger seals may be most susceptible (Gubbay and Knapman, 1999). However, the device structures do not appear to present any obvious mechanism for entanglement based on current knowledge and experience.

9.144. The tip speed of the rotors will be up to 12m/s during full tidal stream, decreasing towards slack water (see *Chapter 5: Project Description*). Because of the far greater density of water compared to air, if a tidal turbine is compared to a wind turbine it can be seen that considerably slower rotation, slower tip speed and shorter rotors are all characteristics of tidal devices, reducing potential for any theoretical collision.

9.145. It is predicted that the noise generated by the devices during peak flow could be detected up to a distance of between 20 and 400m (Carter and Wilson, 2010). This noise will alert mammals to the presence of the devices when they are operating at full power and enable avoidance measures to be taken. Based on these distances, marine mammals drifting with the tide during a peak flow of 5.44 knots (2.78m/s) would have between 7.1s and 142.9s to react. Cetaceans and otariids (including the phocids family) can reverse course in approximately 0.13 – 1.22 and 0.25 seconds respectively (Carter, 2007).

9.146. The progressive reduction of tiers of mitigation has been ongoing for the SeaGen device since shortly after its installation, as part of an adaptive management approach, where mitigation and ongoing monitoring are closely linked. To date no adverse interactions have been reported. It is anticipated that the removal of the last elements of precautionary mitigation, use of active sonar to instigate shutdown if animals are detected approaching within 50m of the device, may be possible in late 2010, allowing monitoring to fully record any active interaction between the operating turbine and marine mammals (SNH, 2009).

9.147. The noise of the devices during operation increasing awareness of the devices, the environmental awareness and maneuverability of the animals, the relatively slow movement of the rotors on each device and the positive reports from other tidal devices of limited evidence of negative interaction, are all assessed as providing a low magnitude of impact. Given the high receptor sensitivity, the impact is assessed to be of potentially **moderate** significant effect.

MITIGATION IN RELATION TO IMPACT 9.7

- The available evidence from existing tidal turbines indicates that tidal turbines have minimal effect on behaviour of marine mammals and that collision risk is low. However, this information is still incomplete and at the time of writing some precautionary mitigation measures were still in place for SeaGen. SPR appreciates that this Development is the first tidal array and that that consideration of magnitude includes consideration of elements where knowledge is incomplete. As a result SPR commits to putting in place a programme of post installation monitoring.
- There is a potential to cause disturbance to marine mammals, and while our judgement is that this is may be negligible, based on industry experience gained from SeaGen and wider assessments, knowledge is incomplete and effects from an array rather than a single device are also unknown. A deploy and monitor strategy is therefore proposed, with ongoing monitoring, linked to management of the Development.
- An important component of the deploy and monitor strategy will be an application for a licence to disturb EPS, to enable regulators to allow deployment while further knowledge regarding effects (or lack of effects) from the Development is obtained.
- Monitoring measures may include monitoring of rotor data to ascertain if any impacts with 'objects' has occurred, visual observations of marine mammal activity to determine there is evidence for any change in behaviour, promotion of the proposed Marine Scotland carcass survey programme for wet renewables in order to determine cause of death.
- As part of a wider adaptive management and environmental monitoring strategy, SPR is committed to mitigating relevant significant effects identified by monitoring.

Residual Impact

9.148. The proposed monitoring programme will ensure impacts are detected and significant effects under the terms of the EIA regulations are avoided. Therefore, the significance of collision risk after mitigation is unlikely to reach the levels of moderate and is likely to be of a **minor** significant effect.

Impact 9.8: Accidental release of contaminants during maintenance

9.149. As with installation, any use and discharge of chemicals during operation/ maintenance will be subject to controls as part of consent requirements. It is expected that should a spill occur, its scale and the nature of the contaminant will be limited and in a high energy marine environment, contaminants can be expected to rapidly disperse.

9.150. The risk of pollution events will be minimised by following standard good practice, such as the Pollution Prevention Guidelines issued by SEPA (e.g. PPG 5: Works and maintenance in or near water). Additionally, any chemicals used during maintenance activities will require prior approval through the FEPA licensing process and any lubricants will be non toxic, biodegradable and capable of dispersal in seawater.

9.151. Installation contractors will put in place appropriate Site Environmental Management Plans and Pollution Control and Spillage Response Plans that will be agreed with the relevant statutory bodies prior to offshore maintenance activities commencing. These plans will act to reduce the potential for accidental pollution and in the unlikely event of a pollution incident, will ensure a rapid and appropriate response.

9.152. As a result a negligible magnitude is predicted and, given the high receptor sensitivity, the impact is predicted to be of **minor** significant effect.

MITIGATION IN RELATION TO IMPACT 9.8
• No mitigation required

Residual Impact

9.153. As a result of the importance of marine mammals as a receptor the significance of accidental release of contaminants must remain of **minor** significant effect.

9.154.

Impact 9.9: *Barrier effects*

9.155. Noise disturbance and visual presence of the turbine array could potentially displace marine mammals from preferred migratory and transit routes within the Sound of Islay.

9.156. During ongoing operation of the SeaGen turbine no significant barrier effect has been observed. Continual passive sonar and acoustic monitoring, using TPODS, indicates that harbour porpoise are able to pass through the narrows where the turbine is located and seals continue to use the area without any significant change to behaviour (SNH, 2009).

9.157. An array of devices could have more potential to act as a barrier than the single SeaGen device; however, with approximately 500m between the array and the shore, towards the Jura side, as well as clearance above and below the rotors in the water column, it is expected that the magnitude will be low. Given the high receptor sensitivity, the impact is predicted to be of **moderate** significant effect.

MITIGATION IN RELATION TO IMPACT 9.9
• The available evidence from existing tidal turbines indicates that barrier effects will be minimal. However, SPR appreciates that this Development is the first tidal array and that that consideration of magnitude includes consideration of elements where knowledge is incomplete. As a result SPR commits to putting in place a programme of post installation monitoring.
• There is a potential to cause disturbance to marine mammals, and while our judgement is that this is may be negligible, based on industry experience gained from SeaGen and wider assessments, knowledge is incomplete and effects from an array rather than a single device are also unknown. A deploy and monitor strategy is therefore proposed, with ongoing monitoring, linked to management of the Development.
• An important component of the deploy and monitor strategy will be an application for a licence to disturb EPS, to enable regulators to allow deployment while further knowledge regarding effects (or lack of effects) from the Development is obtained.
• Monitoring measures may include visual observations of marine mammal activity to determine if there is evidence for any change in behaviour.
• As part of a wider adaptive management and environmental monitoring strategy, SPR is committed to mitigating relevant significant effects identified by monitoring.

Residual Impact

9.158. The proposed monitoring programme will ensure impacts are detected and significant effects under the terms of the EIA regulations are avoided. The significance of collision risk after mitigation is likely to be of **minor** significant effect.

Impact 9.10: Habitat exclusion

9.159. Noise disturbance and visual presence of the turbine array could theoretically displace marine mammals from habitats within the Sound of Islay including feeding, breeding and social areas. However, the Sound of Islay is not known to be important to marine mammals for feeding and breeding.

9.160. Seal haul out sites within designated sites are sufficiently distant not to be affected by disturbance effects, although smaller nearby haul outs, close to the Development but outside the SAC, could theoretically be affected. Given the entirely subtidal nature of the Development and the minimal increase in vessel activity in relation to baseline activity proposed during operation, it is expected that there will be minimal disruption to haul out sites during operation and maintenance resulting in negligible magnitude of impact.

9.161. Evidence from SeaGen suggests that no change to sea and marine mammal use of the area has occurred around that device (SNH, 2009).

9.162. Given the conservation status of marine mammals resulting in high sensitivity/ value the significance of effect of habitat exclusion has been assessed as **minor.**

MITIGATION IN RELATION TO IMPACT 9.10
• It is expected that habitat exclusion during operation is unlikely. However, SPR appreciates that this Development is the first tidal array and that that consideration of magnitude includes consideration of elements where knowledge is incomplete. As a result SPR commits to putting in place a programme of post installation monitoring.
• There is a potential to cause disturbance to marine mammals, and while our judgement is that this is may be negligible, based on industry experience gained from SeaGen and wider assessments, knowledge is incomplete and effects from an array rather than a single device are also unknown. A deploy and monitor strategy is therefore proposed, with ongoing monitoring, linked to management of the Development.
• An important component of the deploy and monitor strategy will be an application for a licence to disturb EPS, to enable regulators to allow deployment while further knowledge regarding effects (or lack of effects) from the Development is obtained.
• Monitoring measures may include visual observations of marine mammal activity to determine if there is evidence for any change in behaviour.
• As part of a wider adaptive management and environmental monitoring strategy, SPR is committed to mitigating relevant significant effects identified by monitoring.

Residual Impact

9.163. As a result of the importance of marine mammals as a receptor the significance of contamination must remain of **minor** significant effect.

9.4.4 Potential Impacts during Decommissioning Phase

9.164. The potential impacts during decommissioning are expected to be of the same nature and significance as the construction impacts.

9.4.5 Cumulative Impacts

9.165. Scottish Territorial Water windfarms are proposed for a site immediately west of Islay (approximately 40km west of the Sound of Islay) and at Kintyre (approximately 50km to the south of the Sound of Islay). The cumulative impacts related to the construction of additional projects will depend on the duration of the installation phase. The period of construction of offshore windfarms depends greatly on the size of the farm however this could be up to approximately one year.

9.166. The cumulative impacts are expected to be of the same type as those for the Development alone:

- Noise and vibration;

- Collision increased;
- Suspended sediments;
- Release of contaminants;
- Barrier effect; and
- Habitat exclusion.

9.167. As discussed previously, the noise generated during construction of offshore windfarms can be significantly higher than the noise expected during the construction of the Islay tidal array due to the level of drilling requirements for offshore windfarms. It is not expected that the construction of both the tidal array and the offshore windfarm would occur simultaneously and so there are not expected to be cumulative construction effects; however, the effects during construction of one project could act cumulatively with operational effects of the other.

9.168. It is not expected that collision risk, suspended sediments or release of contaminants will be of greater significance as a result of cumulative impacts from the proposed wind farm developments.

9.169. During operation, it is possible that the cumulative effects of the wind farm and Islay tidal array could cause disturbance to marine mammals as a result of noise/ vibrations, physical presence and increased activity in the area resulting in cumulative barrier effects and habitat exclusion. It is expected that this would be of **moderate** significance.

9.5 Summary of effects

Table 9.5: Summary of predicted significance of effects								
Impact	Construction/ Decommissioning				Operation/ Maintenance			
	Magnitude of Impact	Receptor Sensitivity/Value/ Importance	Significance of effect	Residual impact	Magnitude of Impact	Receptor Sensitivity/Value/ Importance	Significance of effect	Residual impact
Noise and vibration	Negligible	High	Minor	Minor	Negligible	High	Minor	Minor
Collision	Negligible	High	Minor	Minor	Low	High	Moderate	Minor
Accidental release of contaminants	Negligible	High	Minor	Minor	Negligible	High	Minor	Minor
Suspended sediments	Negligible	High	Minor	Minor	N/A	N/A	N/A	N/A
Barrier effects	N/A	N/A	N/A	N/A	Low	High	Moderate	Minor
Habitat exclusion	Negligible	High	Minor	Minor	Negligible	High	Minor	Minor

9.6 Proposed Monitoring

9.170. Post installation monitoring can be carried out in order to detect any impacts which need to be addressed promptly. The following monitoring is proposed:

- Use of impact sensors on the rotors to detect potential collisions;
- Visual surveys in the first year after deployment to monitor for changes in use of the Development area and wider Sound by marine mammals;
- Passive acoustic monitoring of echolocatory species, particularly harbour porpoise within the Sound of Islay;
- Development with Marine Scotland of procedure for reporting marine mammal carcass findings and carrying out post mortem, as part of wider national support to wet renewable industry by Scottish Government; and
- Ongoing SMRU aerial surveys will provide approximate adult seal and pup numbers/ distribution and highlight any significant changes in the Sound of Islay.

9.7 Statement of Significance

9.171. It is anticipated that the proposed development will have at worst a **moderate** effect on marine mammals. However, continued monitoring to detect impacts and implementation of necessary mitigation measures will reduce the effect to **minor.**

9.172. Collision and barrier effects provide the most potential to impact upon marine mammals during the operation phase.

9.173. While limited mitigation has been outlined at this stage it is felt that a deploy and monitor strategy will help to target any subsequent mitigation should it be required.

9.8 Figures

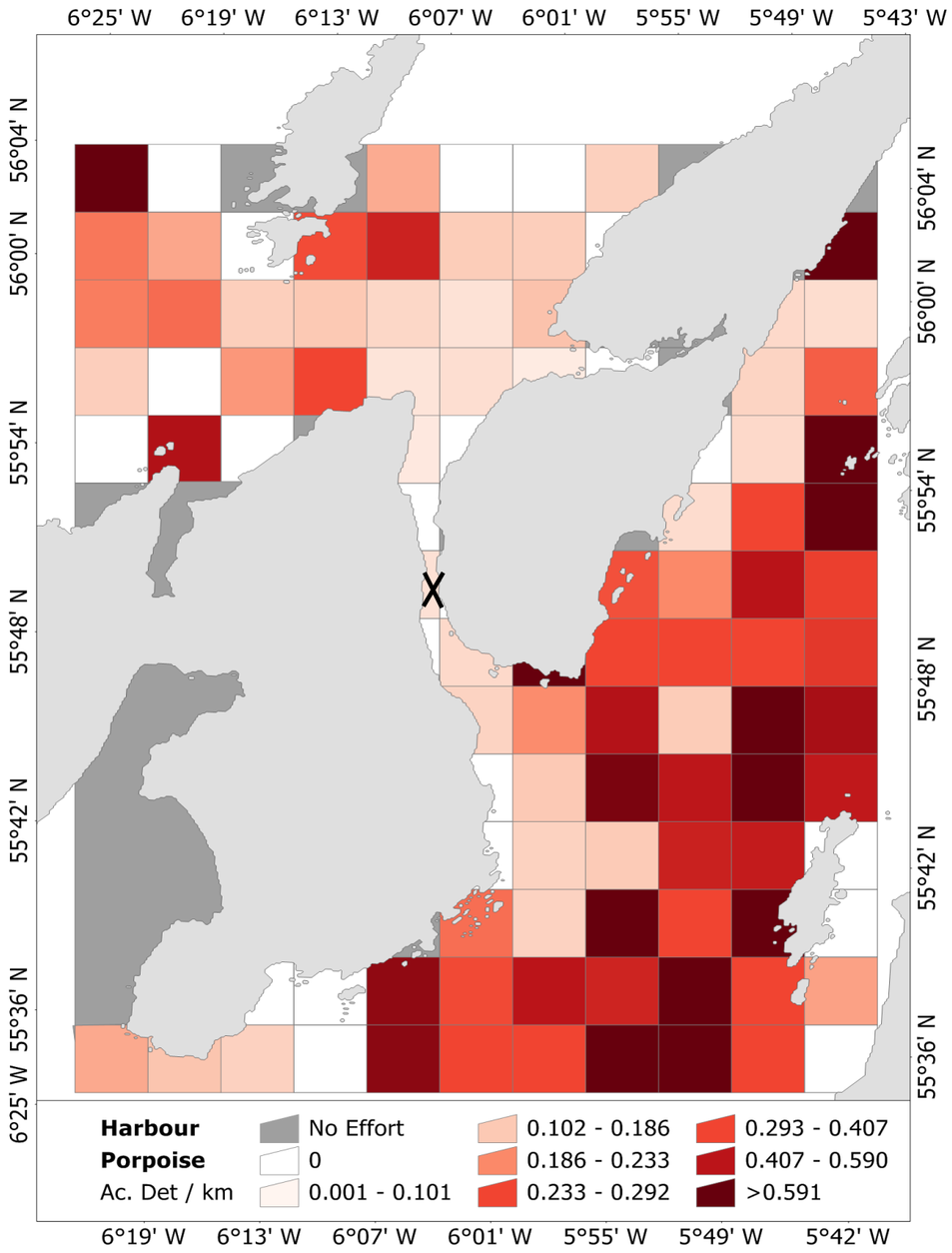

Figure 9.1: Harbour porpoise acoustic detections per unit effort in the Sound of Islay region (shown in shades of red – darker shades indicate higher detection rates). Grid cells not surveyed shown in dark grey. (Source, HWDT, 2009). Black cross shows the location of the Development.

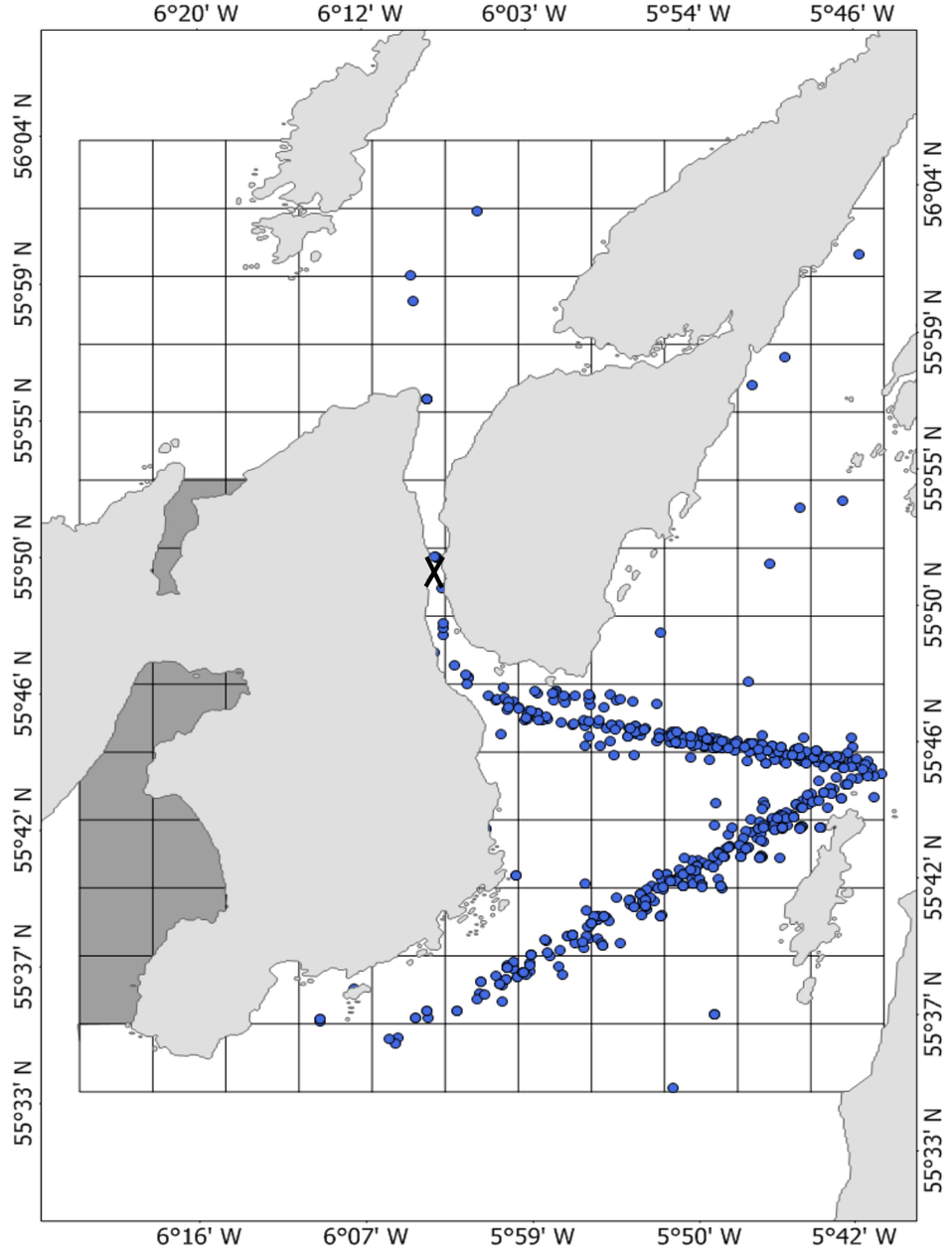

Figure 9.2: Harbour Porpoise public sightings (not effort corrected) 2000-2008 (blue dots) in the Sound of Islay region (Source: HWDT, 2009). Black cross shows the location of the Development.

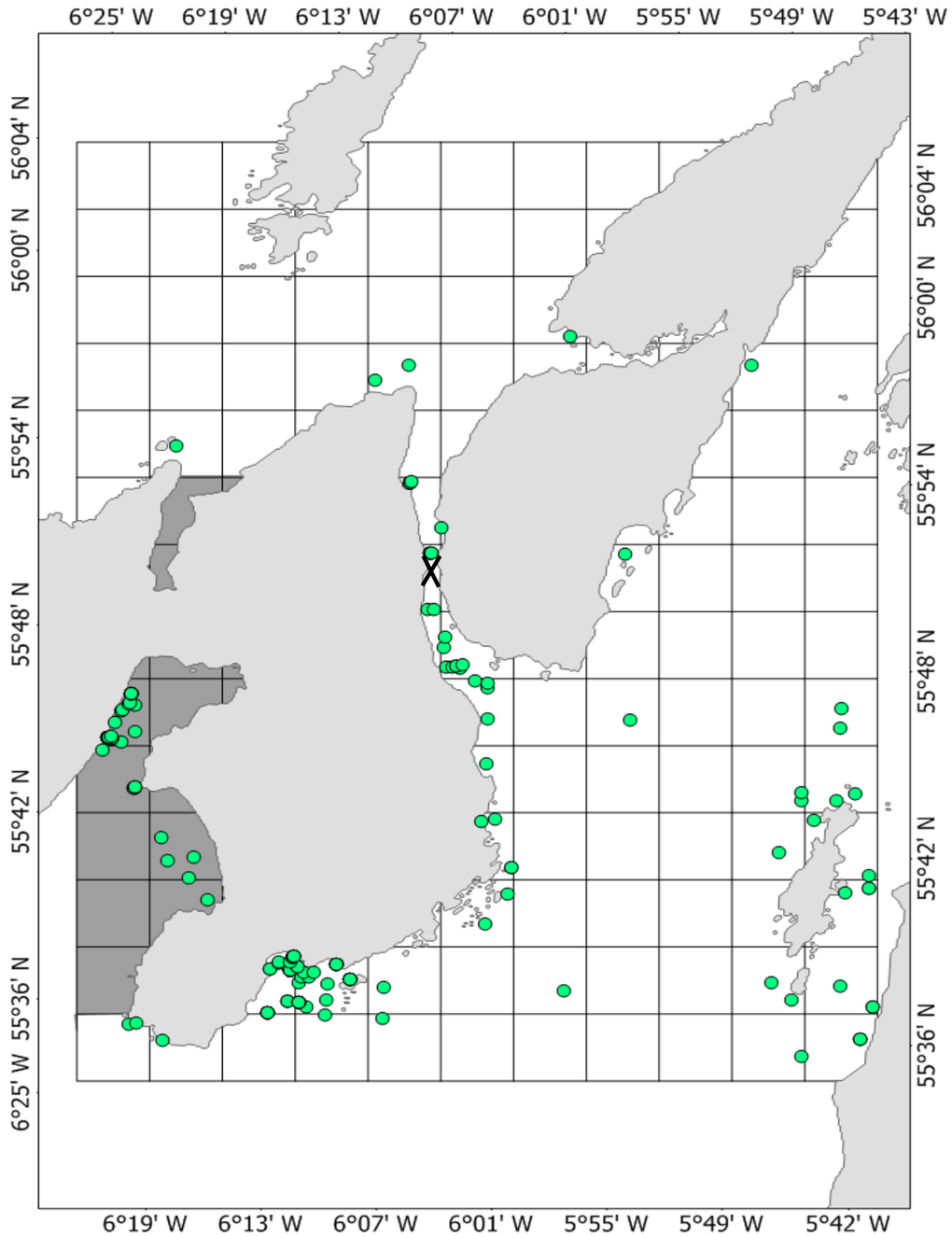

Figure 9.3: Bottlenose dolphin public sightings (not effort corrected) 2000-2008 (light green dots) in the Sound of Islay region (Source: HWDT, 2009). Black cross shows the location of the Development.

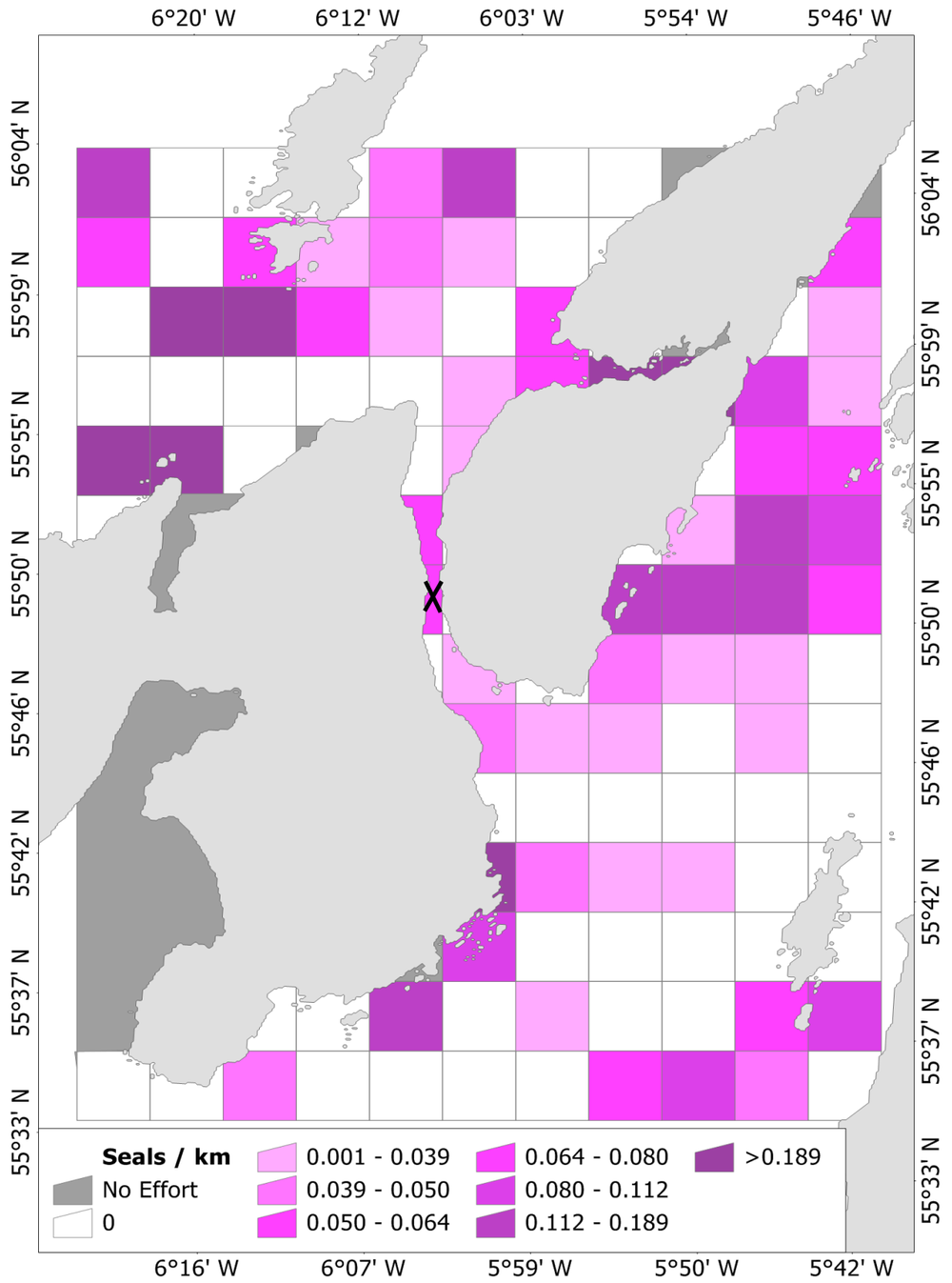

Figure 9.4: Combined sightings per unit effort of grey, harbour and unidentified seals in the Sound of Islay region (shown in shades of purple – darker shades indicate higher sighting rates). Grid cells not surveyed shown in dark grey (Source: HWDT, 2009). Black cross shows the location of the Development.

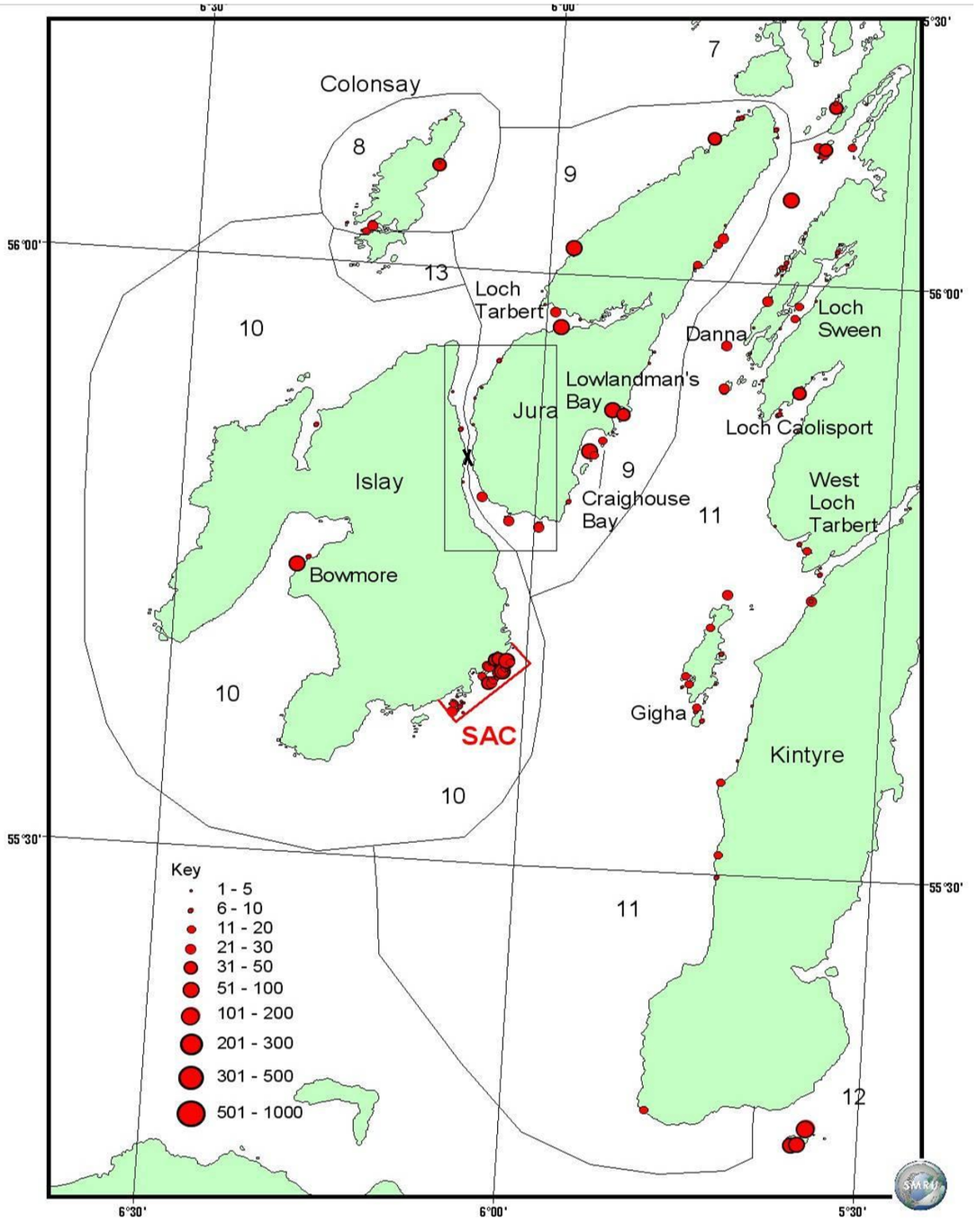

Figure 9.5: Harbour seal counts from an aerial survey around the Sound of Islay, August 2009 (Source: SMRU 2010). Red box shows the boundary of the South east Islay Skerries SAC and the black cross shows the location of the Development.

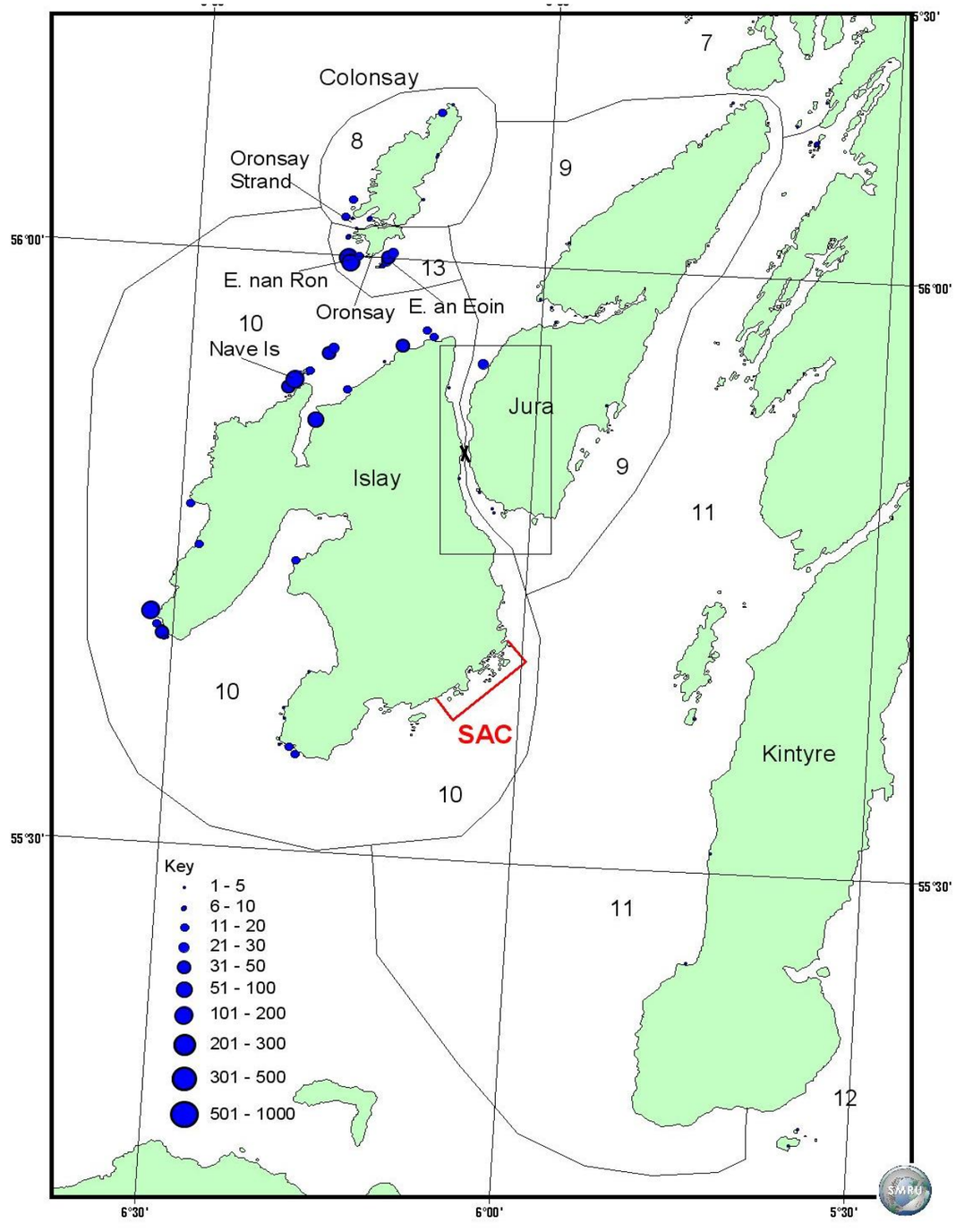

Figure 9.6: Grey seal counts from an aerial survey around the Sound of Islay, August 2009 (Source: SMRU 2010). Red box shows the boundary of the South east Islay Skerries SAC.

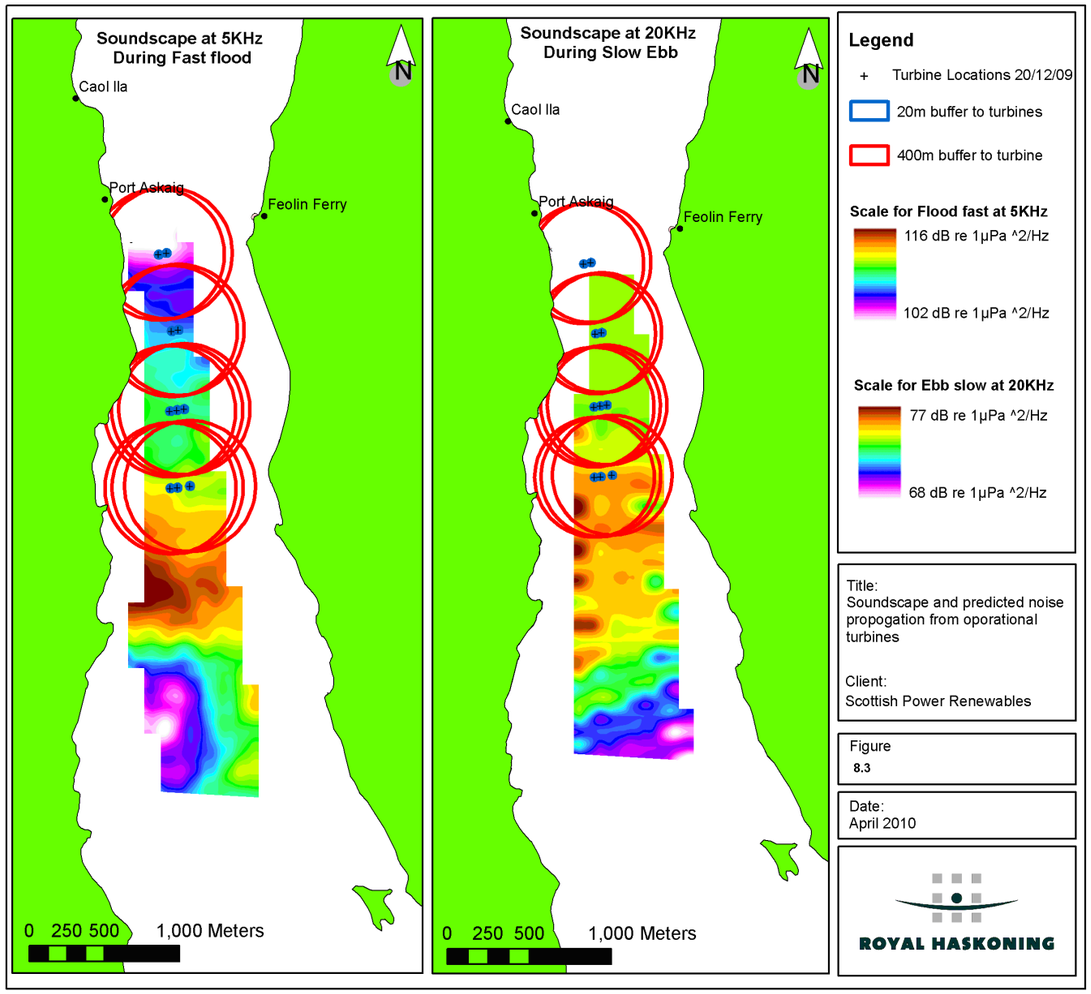

Figure 9.7: Illustration of the distance that noise within the Sound of Islay may travel from each turbine using two calculations for noise propagation, overlaid on Soundscape maps (produce by SAMS, 2010) of background noise levels within the Sound of Islay. Figure shows data for two states of tide (flood and slow ebb) and two frequencies (at 5KHz during full flood tide the highest recorded noise levels and at 20KHz during slow ebb, the lowest noise levels occurred).

9.9 References

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10.0 Noise and Vibration Affecting Human Receptors

10.1 Introduction

10.1 This Chapter of the Environmental Statement (ES) addresses potential noise and vibration impacts caused by the proposed Development (including the substation, cables and infrastructure) on human receptors only; noise and vibration effects on ecological receptors are addressed in other relevant Chapters within the ES. The assessment presents qualitative predictive assessment of noise and vibration levels.

10.2 The assessment addresses potential effects associated with the various marine and on-shore construction activities, the movements of marine construction vessels and the on-shore movement of construction-related vehicles and plant equipment. Impacts are considered during construction, operation (including maintenance) and decommissioning.

10.3 The significance of noise and vibration effects is presented along with suitable recommendations for minimisation or avoidance of adverse effects, where appropriate. Potential cumulative effects are also considered where appropriate.

10.2 Potential Effects

10.4 Noise and vibration effects on humans associated with the proposed Development are likely to arise as a result of the operation of work-boats and other marine construction equipment/vessels during the tidal turbine and cable installation. Additional impacts may arise as a result of the movement of construction-related vehicles at Port Askaig, en route to Jura, or on the A846 between Port Ellen and Port Askaig, should construction traffic be required to pass through Port Ellen.

10.5 Construction-related vehicle movements along the A846 on Jura will not pass close to any potentially noise sensitive premises (NSP) and there are no NSPs within approximately 1 mile of the cable landfall location at Daimh Sgeir and sub station site. Hence, it is reasonably inferred that these aspects of the Proposed Development will have no impact on human receptors and are not considered further in this Chapter.

10.6 Chapter 5, *Project Description*, indicates that operational constraints mean that only one marine work vessel would be able to operate within the Sound at any time. This vessel and any associated barges, used for the transportation of materials and equipment to the turbine installation sites, will berth in Caol Ila immediately to the north of Port Askaig, with no requirement to visit Port Askaig. It is, therefore, also reasonable to infer that daytime movement of the marine vessel would have no impact on potential residential receptors at Port Askaig. However, the working area for Turbine 1 is just over 200 m from Dunlossit House on, to the south of Port Askaig on Islay so noise from the movement of construction vessels and the construction operations at the turbine location, particularly if occurring at night, might give rise to a perceptible noise impact.

10.7 Therefore, potential construction-related noise impacts are likely to be limited to the movement of construction-related vehicles on the A846 on Islay, movements of construction-related vehicles within Port Askaig and the movement and operation of marine construction vessels in the vicinity of Turbines 1 and 2, particularly at night, potentially affecting Dunlossit House.

10.8 Vibration effects are only likely to occur as the result of the movement of additional construction-related vehicles on the A846 on Islay, or from the low speed movement of construction-related heavy goods vehicles within the port area at Port Askaig.

10.9 Vibration associated from the freely-flowing movement of construction-related vehicles on the A846 on Islay will principally comprise ground-borne vibration, caused by the interaction of the vehicle tyres with the road, with additional air-borne vibration caused by engine noise where vehicles are forced to accelerate or labour up-hill close to residential properties.

10.10 Vibration effects within Port Askaig will be air-borne vibration from heavy goods vehicle engines where the vehicles labour up-hill along the port exit road past the Hotel, before turning back into the port marshalling area. There is unlikely to be any significant ground-borne vibration form construction-related heavy vehicle movements within Port Askaig.

10.11 Airborne vibration generally manifests itself as short-duration vibration of loose fixtures and fittings attached to the outer fabric of buildings, namely door handles, window panes etc; the levels of noise/airborne vibration involved are unlikely to result in vibration of internal fixtures or fittings. Air-borne vibration does not give rise to levels sufficient to be a concern with regards to building damage and the effects are confined to disturbance to amenity.

10.12 Ground-borne vibration from the movement of vehicles on roads generally arises as a result of the interaction of the vehicles tyres with irregularities on the road surface. Such vibration may manifest itself as vibration of internal fixtures and fittings.

10.13 Heavy goods vehicles already travel along the A843 on Islay and through Port Askaig, so the actual levels of air-borne and ground-borne vibration will not increase, just the potential frequency of occurrence and duration.

10.14 There are unlikely to be significant operational impacts; low levels of noise may be emitted by the substation equipment which can be audible at distance of up to several hundred metres. However, the separation distance between the sub-station and potentially sensitive properties, combined with the proposed construction of a solid block-work building to house the equipment will be sufficient to suitably attenuate any noise emissions.

10.15 Decommissioning of the Turbines and sub-stations may give rise to similar effects as those described for the construction, but over a shorter time scale, and are likely to be restricted to the same aspects as for the construction operations.

10.16 The assessment is therefore limited to the day and night time movement of marine vessels in the Sound potentially affecting Dunlossit House, to the movement of heavy goods vehicles on the A846 on Islay or within the port area at Port Askaig and to the decommissioning activities.

10.17 With regard to the option of cable landfall at Daimh-Sgeir, the construction of a substation adjacent to the A846 to the south east of the landfall and the cabling operations between the two locations, it is evident that there are no residential receptors in close proximity to either the landfall location or substation construction area. The only noise and vibration effects associated with this option, therefore, relate to the movement of construction-related vehicles on the local road network close to noise sensitive premises.

10.3 Summary

The ambient noise levels close to the development site and associated on shore works will include natural noise from wind, waves and sea-birds along with intermittent anthropogenic noise such as low levels of cars traffic along the A846 and operation of ferries.

Key noise and vibration effects on humans associated with the proposed Development are likely to arise as a result of the operation of work-boats and other marine construction equipment/vessels during the array and cable installation. Low levels of noise may be omitted during construction of the substation. However, the separation distance between the sub-station and potentially sensitive properties will be sufficient to suitably attenuate any noise emissions.

10.4 Methodology

10.4.1 Legislative Background

10.18 There is a range of legislation in place to control noise levels at International, European Union (EU) and United Kingdom level.

10.19 The control of noise from construction activities, in Scotland, is achieved through the following Instruments:

10.20 Control of Pollution Act 1974 [COPA]; Section 60 the Act provides the local authority with powers to serve noise abatement notices on construction operations in order to minimise or prevent noise disturbance to local residents. Section 61 of the Act, provides a means whereby a contractor and local authority can reach agreement on suitable controls to minimise or prevent noise disturbance including such things as controlling hours of operation, the setting of specific noise limits or other appropriate controls. The written agreement is termed a 'prior consent' and it will be a defence against subsequent enforcement action for the contractor to show that he was working within the terms of the consent. The Act also defines the principles of best practice in construction operations, termed Best Practicable Means (BPM). The contractor will be expected to apply these principles to all construction operations. Failure to apply BPM or to work within the terms of a prior consent may leave a contractor open to local authority enforcement action and prosecution for causing noise disturbance.

10.21 Scottish Statutory Instrument (SSI) 2002/104 "The control of noise (Codes of practice for construction and open sites) (Scotland) Order 2002"; this Instrument approves the use of British Standard (BS) 5228 "the control of noise and vibration on construction and open sites" (Parts 1 – 5, 1992 – 1997) for the control of noise and vibration from such sites (these documents have been superseded by BS 5228-1&2: 2009 "Code of practice for noise and vibration control on construction and open sites". Part 1 deals with noise and Part 2 deals with vibration.

10.4.2 Guidelines

10.22 British Standard (BS) 5228-1: 2009 "Code of practice for noise and vibration control on construction and open sites"; this Standard is guidance and carries no legal enforceability but is regarded as best practice in respect of assessing and controlling noise from construction operations. It provides guidance on the causes of noise from construction operations, methods for calculating noise levels at potentially noise sensitive premises (NSPs) and suggests suitable methods for mitigating the adverse effects of noise. It does not specify permissible noise levels from construction activities, but does discuss the setting of suitable limits based on examples of controls applied to previous construction activities. The Annexes of the Standard also provide generic source noise levels for typical items of plant equipment used on construction sites.

10.23 The UK Department of Transport guidance "Calculation of road traffic noise" [CRTN] (Department of Transport, 1998) is generally used for calculating the noise arising from the movements of free-flowing traffic on roads, down to speeds of 20 $km.h^{-1}$ and 50 vehicles per hour (or 1000 vehicles per 18-hour day [06:00 – 00:00]). This guidance is of relevance to the noise from construction-related vehicle movements on the A846 on Islay. CRTN is applicable in Scotland and is widely used in the calculation of road traffic noise in Scotland.

10.24 The Highways Agency guidance "Design manual for roads and bridges", Volume 11, Section 3, Part 7 "Noise and vibration" provides guidance on the assessment of noise and vibration from road traffic, including assessment of air-borne noise. The guidance suggests that short-term changes in noise of 25% in total traffic, approximately equivalent to a 1dB change in noise, may be perceived by local residents whilst longer term gradual increases in noise of 3dB, approximately equivalent to a doubling of total traffic levels, may be required for audible effects to occur. For the purposes of this assessment, it was conservatively assumed that changes in traffic noise of 1dB would be used to define potentially significant changes in noise. The guidance also provides advice on the assessment of air-borne and ground-borne vibration but states that the percentage of people potentially 'bothered' by air-borne vibration form road traffic is 10% lower than for the equivalent noise exposure. With regard to ground-borne vibration, the guidance provides indicative vibration levels for perception by humans, described in terms of the peak particle velocity (PPV).

10.25 British Standard 6472-1:2008 "Guide to evaluation of human exposure to vibration in buildings. Part 1: vibration sources other than blasting". This document provides advice on the potential effects of vibration on humans within dwellings. It is referenced with regard to potential ground-borne vibration from construction-related traffic moving on the A846 on Islay.

10.26 British Standard 7385 "Evaluation and measurement for vibration in buildings. This document provides advice on the levels of vibration associated with building damage, including cosmetic damage. It is referenced with regard to potential ground-borne vibration construction-related traffic moving on the A846 on Islay.

10.4.3 Policy

10.27 Scottish Planning Advice Note (PAN) 56 “Planning and noise” (revised 2006); this document indicates how noise issues should be handled in development plans and development control, outlines ways of mitigating the adverse impact of noise, provides specific guidance on noisy and noise-sensitive development, introduces the use of noise exposure categories and gives guidance on the use of planning conditions relating to noise. Noise exposure categories are not relevant to this assessment, being concerned principally with the introduction of noise-sensitive development into noisy areas. PAN 56 recommends the use of the Control of Pollution Act 1974 and BS 5228 in assessing and controlling construction noise.

10.4.4 Consultation

10.28 A scoping opinion was sought from statutory consultees in August 2008; responses are detailed in *Chapter 3: Consultation*: a summary of the main points pertinent to issues regarding noise that were raised during this process and an explanation of how they were addressed are provided below.

10.29 Consultation with local residents has taken place throughout the development of the Environmental Statement through a range of methods. These include open days, public fairs and exhibitions, alongside regular updates in the Ileach (a local newsletter, courtesy of the Islay Energy Trust). There will also be further local consultation once the ES has been published. All consultation is outlined within *Chapter 3: Consultation.*

10.4.5 Data Collection

10.30 Due to the predicted low significance of the impact of noise and vibration on the local community a desk based study of predicted ambient noise levels within the development site, cable route, substation site and surrounding area was deemed sufficient.

10.5 Assessment of Significance

10.5.1 Construction Noise and Vibration Assessment Methodology

10.31 The assessments of noise and air-borne vibration from the slow speed movement of construction-related vehicles in Port Askaig and of noise from the operations of marine vessels in the Sound, were generally qualitative, as no detailed information was available regarding the numbers or types of vehicles or equipment involved. In undertaking this qualitative assessment it was accepted that construction activities can give rise to elevated noise levels sufficient to cause adverse reaction by local residents, even where the noise levels can not be accurately quantified.

10.32 It was assumed that the majority of construction activities in the Sound, and all vehicle movements in Port Askaig, will occur during the day time. However, there may be requirements, due to operational constraints, for night time construction operations in the Sound.

10.33 As part of this assessment, it was assumed that the volumes of construction traffic required, based upon data provided by SPR[1], would be as given in Table 10.1. This document and *Chapter 5: Project Description* state a preference for the delivery of the majority of materials for the scheme by sea, and that excavated material from the cable-trenches could be back-filled, in which case the construction traffic numbers would be greatly reduced from those given. However, in the interests of providing a conservative assessment, the noise assessment assumed that the full complement of construction traffic given in Table 10.1 would be used. It should be noted that this data relates only to the substation and cabling works; it was assumed that all materials and equipment associated with the turbine installations would be delivered directly to site or to the barges moored in Caol Ila Bay.

TABLE 10.1 HGV MOVEMENTS GENERATED DURING CONSTRUCTION

HGV Delivery of	Total HGV Movements*
Ready mixed concrete, *or…*	40, *or*
…aggregate and cement (for onsite batching)	10
Sand for cabling trenches	120
General Plant and Equipment	36
Sub Station components	6
Underground cabling	2

*Note: Some trips for the disposal of materials off site will be required; however these have not yet been quantified, these will be confirmed upon final construction methodology and controls will be put in place as part of site management.

[1] “Traffic movement for substation construction” notes from SPR, dated 18th June 2010.

10.34 The total cabling and substation construction period is anticipated to take approximately 3 months; however, the concrete for the sub-station hard-standing will need to be undertaken within a period of four days for technical reasons. The cabling duration is unknown but would be expected to take approximately six to eight weeks in total although it is probable that the sand would be delivered in bulk towards the beginning of the cabling phase and stock-piled on Jura, rather than delivered as needed.

10.35 The assessment of vibration from construction-related traffic movements on the A846 was qualitative as the generation and subsequent propagation of both air-borne and ground-borne vibration depend on a number of variables which are unknown at this stage.

10.36 The closest potentially sensitive receptor to vehicle movements at Port Askaig is the Hotel which is immediately adjacent to the ferry departure lane, approximately 20m from the ferry parking area and approximately 70m from the ferry loading ramp.

10.37 It is also expected that all site compounds and lay-down areas for materials and equipment will be located on Jura, close to the Feolin slipway.

10.38 With regard to the setting of potentially acceptable noise limits, there are no statutory or other defined criteria by which significance of relative changes in noise level might be assessed, as discussed previously. As the assessment of noise associated with construction vehicle movements in Port Askaig and marine vessel movements was qualitative, it is not meaningful to attempt to define noise criteria for the qualitative assessment. However, it may be useful to define criteria against which subsequent monitoring of noise generated by the construction activities might be assessed.

10.39 The setting of such noise limits is difficult, partly due to the subjectivity of noise level changes according to the perception of the listener, but also because the impact will depend on the nature of the existing noise situation.

10.40 PAN 56 states that "*For noise of a similar character, a change of 3dB is the minimum perceptible under normal conditions, and a change of 10dB corresponds roughly to halving or doubling the loudness of a sound*". This is based upon research which has shown that whilst in a laboratory situation a 1dB change in noise level might be perceptible to the average listener, in an outdoor situation a 3dB change in environmental noise levels is generally the least perceptible change, whilst a 5dB change in noise limits is clearly perceptible and a 10dB change in noise levels would be perceived as a doubling or halving of noise.

10.41 It is also generally accepted that construction activities are inherently noisy. Annex C of BS 5228-1 discusses possible approaches to setting noise controls; one of these is to set a 65dB LA_{eq} limit for construction noise, as measured at the noise sensitive premises, as being an acceptable limit, with relatively lower noise levels for evening, weekend and night time periods; the suggested levels are presented in Table 10.2.

TABLE 10.2 SUGGESTED ACCEPTABLE CONSTRUCTION NOISE LIMITS:

Assessment period	Acceptable noise level, in decibels (dB LA_{eq})		
	Category A[A]	Category B[B]	Category C[C]
Night-time (23.00−07.00)	45	50	55
Evenings, Weekends and Public/ Bank Holidays[B]	55	60	65
Daytime (07.00−19.00) and Saturdays (07.00−13.00)(D)	65	70	75
NOTE 1 *A significant effect has been deemed to occur if the total LA_{eq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level.*			
NOTE 2 *If the ambient noise level exceeds the threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a significant effect is deemed to occur if the total LA_{eq} noise level for the period increases by more than 3dB due to construction activity.*			
NOTE 3 *Applied to residential receptors only.*			
[A] The Sound of Islay ambient noise levels are predicted to be within the Category A levels and so, for the effect to be deemed significant the predicted noise levels during construction, operation or decommissioning will be greater than the Category A values. In the event that the noise levels are below these levels, there will be no significant noise impact.			
B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values.			
C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.			
D) 19.00–23.00 weekdays, 13.00–23.00 Saturdays and 07.00–23.00 Sundays.			

10.42 It has been estimated that, as a result of the low levels of traffic and activity at the development site, cable route and substation site, the existing ambient day time noise levels, even with the operation of the ferry and other marine vessels in the Sound, are similar to those in Category A of Table 10.2 and it is suggested that these are the acceptable values against which subsequent monitoring of construction noise should be assessed. It is worth noting that PAN 56 suggests that 66dB LA_{eq} is approximately equivalent to normal conversational speech at 1 metre, which provides a meaningful 'everyday' context against which predicted construction noise levels might be judged.

10.43 Assessment of the potential noise impact magnitude, in terms of exceedence of the suggested noise levels presented under Category A in Table 10.2, should be according to the significance criteria presented in Table 10.3 which accords with the assessment methodology outlined in *Chapter 2: Scoping and Assessment Methodology*.

TABLE 10.3 MAGNITUDE OF THE IMPACT

Magnitude of Impact	Description
High	Steady noise level changes greater than, or equal to, 10dB whereby the ambient noise may be perceived to have doubled. Changes in the range of 5 to 9.9dB may be of high magnitude if they contain particularly annoying characteristics, significant low-frequency or tonal noise, or if the noise impacts are long-lasting (greater than a few weeks for example).
Medium	Noise level change is potentially clearly audible, in the range of 5 to 9.9dB, but may be tolerable in the short-term. Changes in the range of 3 to 4.9dB may be of medium magnitude if they contain particularly annoying characteristics, significant low-frequency or tonal noise, or if the noise impacts are long-lasting (greater than a few weeks for example).
Low	Noise level change is potentially just audible, in the range of 3 to 4.9dB. Changes in the range of 1 to 2.9dB may be of low magnitude if they contain particularly annoying characteristics, significant low-frequency or tonal noise, or if the noise impacts are long-lasting (greater than a few weeks for example).

TABLE 10.3 MAGNITUDE OF THE IMPACT	
Magnitude of Impact	**Description**
Negligible/no impact*	Changes in steady noise of less than 3dB, or changes of less than 1dB if noise is particularly intrusive.

* For the purposes of the noise assessment, a negligible impact is additionally considered to give rise to no impact as it is potentially inaudible.

10.44 In addition to defining the magnitude of any impacts, it is necessary to consider the relative sensitivity of the human receptors potentially affected by changes in noise. These descriptors are presented in Table 10.4.

TABLE 10.4 SENSITIVITY OF THE RECEPTOR	
Receptor Sensitivity	**Description**
High	Existing ambient noise is particularly low or affected location is an area of particular tranquillity whereby external noise effects may be considered unacceptable.
Medium	Existing ambient noise is already affected by intermittent external noise, either natural or anthropogenic whereby short-term noise effects may be tolerable.
Low	Existing ambient noise is already affected by regular or elevated external noise, either natural or anthropogenic whereby medium- to long-term noise effects may be tolerable.
Negligible/no impact	Existing ambient noise is already affected by regular external noise, either natural or anthropogenic whereby noise effects may not be significantly perceived.

10.45 By combining the magnitude of impact with the receptor sensitivity it is then possible to arrive at the significance of effect of the impact on the receptor. The resulting significance of effect of the impact is presented in Table 10.5.

TABLE 10.5 IMPACT SIGNIFICANCE MATRIX				
Magnitude of Impact	**Receptor Sensitivity**			
	Negligible	**Low**	**Medium**	**High**
High	No significant effect	Moderate	Major	Major
Medium	No significant effect	Minor	Moderate	Major
Low	No significant effect	Negligible	Minor	Moderate
Negligible/No impact	No significant effect	No significant effect**	No significant effect**	No significant effect**

** As with Table 10.2, this table differs slightly from that presented in other chapters as the definition of “no noise impact” does not change according to the sensitivity of the receptor.

10.6 Baseline Description

10.6.1 Noise Sensitive Premises (NSP)

10.46 Noise sensitive premises (NSPs) are defined in British Standard 5228-1 as being 'any occupied premises outside a site used as a dwelling (including gardens), place of worship, educational establishment, hospital or similar institution, or any other property likely to be adversely affected by an increase in noise level'. In the case of this development, potential NSPs are all on Islay, namely:

- Dunlossit House;
- The hotel at Port Askaig;
- The two residential properties adjacent to Port Askaig (immediately north of the port and immediately south of the hotel); and
- All properties along the A846 between Port Ellen and Port Askaig.

10.47 There are no NSPs of any significance on Jura within close proximity to any construction or operational activities. There are no significant screening structures between marine construction operations and NSPs. See Figure 10.1.

10.6.2 Islay

10.48 The existing noise environment at Port Askaig is predicted to be highly variable, dependant upon activities occurring at any one time. Noise levels at Dunlossit House, to the south of Port Askaig will be less variable due to the relative separation distance from the port, but will none the less be affected by movements of ferries and other vessels within the Sound.

10.49 The Islay to Jura ferry service (discussed further in *Chapter 20: Traffic and Transport*) runs almost constantly from 07:35 until 20:00 (occasionally until 23:00 if pre booked) but there are no night time sailings of the ferry at this time.

10.50 Additional noise contributions may arise from the movement of CalMac ferries to and from Port Askaig. These larger ferries may, at times, give rise to significantly elevated levels of low frequency noise but examination of the current ferry timetable indicates that these events will not occur beyond the early evening. Table 10.6 presents the indicative number of sailings of the Kennacraig to Port Askaig CalMac ferry.

Table 10.6 Number of predicted sailing events to be executed by the Caledonian MacBryne ferries within the Sound of Islay in 2010		
	Summer	**Winter**
Monday	3	3
Tuesday	3	3
Wednesday	4	2
Thursday	2	2
Friday	3	3
Saturday	3	3
Sunday	2	2
Total	**20**	**18**

10.51 The existing noise for receptors adjacent to the A846 on Islay will also be highly variable, dominated on the whole by intermittent traffic noise during the day and, to a lesser extent, at

night. Table 20.6 of *Chapter 20: Traffic and Transport* indicates that existing traffic on the A846 (at Kilmeny, Islay) during the 12-hour daytime period, consists of 1054 vehicles of which 76 (7.2%) are heavy goods vehicles.

10.52 A proportion of the noise on Islay will be generated from natural sources, typical of rural-coastal areas e.g. birds and water movements. Existing noise levels are unlikely to be significant and are predicted to be similar to those presented as "Category A" in Table 10.2.

10.53 The receptors on Islay, close to the development site or transportation route along the A846 are assessed as being of medium sensitivity during the day but of high sensitivity at night.

10.6.3 Jura

10.54 The route from Feolin slipway to Daimh-sgeir and the substation site passes no properties. The ambient noise situation is likely to be typical of a rural-coastal environment, dominated on the whole by natural noise from wind, waves and sea-birds; however, intermittent anthropogenic contributions such as the movements of cars travelling along the A846, operation of ferries and other vessels in the Sound, are likely to occasionally dominate and 'drown out' the natural noise. There is predicted to be very little existing ambient ground-borne or airborne noise or vibration.

10.55 Existing ambient noise levels are likely to be similar to those presented as "Category A" in Table 10.2.

10.7 Assessment of Effects and Mitigation

10.7.1 Do nothing scenario

10.56 The do nothing scenario would result in no change to the ambient marine or on-shore noise and vibration situation.

10.7.2 Potential Impacts during Construction Phase

IMPACT 10.1: Noise and vibration associated with movement of vehicles on the A846 on Jura

10.57 The preferred transportation of construction materials and equipment is by boat directly to Jura.

10.58 As discussed previously there are no NSPs within or close to the route from Feolin slipway to the substation site. The sensitivity of the receptor is therefore **negligible**.

10.59 The magnitude of noise and vibration as a result of construction vehicles moving along the A846 between Feolin and the substation will be **negligible** hence, it is reasonably inferred that this aspect of the proposed Development will have **no significant effect** on human receptors.

MITIGATION IN RELATION TO IMPACT 10.1
• No mitigation required

Residual Impact

10.60 As no mitigation is required, the residual impact associated with this aspect of the noise and vibration assessment will be remain **no significant effect**.

IMPACT 10.2: Noise and vibration associated with movement of vehicles on the A846 on Islay

10.61 The preferred transport option of all construction vehicles is by sea directly to Jura; however plant hire may come from Islay and therefore the vehicles would travel on the A846 to Port Askaig. To provide a conservative impact assessment the effects of this are considered.

10.62 Noise and vibration effects may occur as a result of the movement of additional construction-related vehicles on the A846 on Islay. Vibration associated with the freely-flowing movement of construction-related vehicles on the A846 on Islay will principally comprise ground-borne vibration, caused by the interaction of the vehicle tyres with the road, with additional air-borne vibration caused by engine noise where vehicles are forced to accelerate or labour up-hill close to residential properties.

10.63 As discussed previously heavy goods vehicles already travel along the A846 on Islay and through Port Askaig, so the actual levels of air-borne and ground-borne vibration are not expected to increase, just the potential frequency of occurrence and duration. The magnitude of this is therefore expected to be **low**.

10.64 In accordance with the assessment methodology described Section 10.2.4, Chart 4 in CRTN was used to assess the change in heavy goods vehicle traffic on the A846 that would be required to produce a potentially significant 1dB change in noise levels. Based on existing total 12-hour traffic flows of 1054 vehicles of which 76 (or 7.2%) were heavy goods vehicles, it was calculated that the number of heavy goods vehicles would need to increase by 73, to a relative proportion of 13.2%, in order to give rise to a 1dB increase in noise levels.

10.65 Examination of the construction traffic figures presented in Table 10.1, in the context of a construction phase lasting many days and weeks, it is highly unlikely that this level of increase would occur. It would be more reasonable to expect that, at most, 10 to 20 additional heavy goods vehicles would travel on this road per day, conservatively assuming all construction traffic arrives through Port Ellen and that all such traffic movements would occur during the daytime only, and the works will only last for a short period of time.

10.66 As the data indicate that 76 heavy goods vehicles already travel on the A846, the few extra vehicles associated with construction traffic are predicted to give rise to a **low** magnitude. Receptors close to the A846 route on Islay are of **medium** sensitivity.

10.67 It was therefore predicted that the effect of the noise or vibration impact associated with additional construction-related vehicle movements on the A846 will be of **minor** significance.

MITIGATION IN RELATION TO IMPACT 10.2
• No mitigation required

Residual Impact

10.68 As no mitigation is required, the residual impact associated with this aspect of the noise and vibration assessment will be of **minor** significant effect.

IMPACT 10.3: Noise and vibration associated with slow-speed vehicle movement in Port Askaig

10.69 Vibration effects within Port Askaig will be air-borne vibration from heavy goods vehicle engines where the vehicles labour up-hill along the port exit road past the Hotel, before turning back into the port marshalling area. There is unlikely to be any significant ground-borne vibration from the low-speed movements of construction-related heavy vehicles within Port Askaig.

10.70 The number of commercial vehicles which travelled on the Kennacraig to Port Askaig ferry in 2009 was 9459. In addition 2478 commercial vehicles travelled on the Port Askaig to Feolin ferry. Since a number of the commercial vehicles on the ferry to Feolin may have also travelled on the Kennacraig ferry the annual number of commercial vehicles travelling through Port Askaig per year should lie between 9,459 and 11,937 (the Kennacraig to Port Askaig and Port Askaig to Feolin ferry numbers combined). Carrying statistics indicate that approximately 10 commercial vehicles per day arrive at Port Askaig on the Kennacraig to Islay ferry and approximately 7 per day travel on the Port Askaig to Feolin ferry. The approximate (average) number of commercial vehicles travelling through Port Askaig per day will therefore lie between 10 and 17.

10.71 The preference of SPR is that vehicles will be delivered directly to Jura; however this is dependant on whether the vehicles are contracted locally from Islay or are brought in from mainland Scotland. As a worst case scenario, this impact assessment assumes all construction vehicles are brought through Port Askaig. The peak levels of construction traffic flow will occur during the four days when concrete is delivered to Jura. This will require five HGV movements per day during this four day period. Throughout the remainder of the construction work vessel movements are predicted to be relatively sporadic, as required, and will therefore provide **low** magnitude of noise and vibration impact. The hotel and other nearby residential properties are all assessed as being of **medium** sensitivity during the day, it is anticipated that HGV's will not be moved through Port Askaig at night.

10.72 It was therefore predicted that the use of Port Askaig by additional construction-related heavy goods vehicles will give rise to noise and vibration impact of **minor** significant effect.

MITIGATION IN RELATION TO IMPACT 10.3
• No mitigation required

Residual Impact

10.73 As no mitigation is required the residual impact will remain of **minor** significant effect.

IMPACT 10.4: Noise associated with movement of marine vessels and on-site turbine installation activities

10.74 *Chapter 5: Project Description* states operational constraints mean that only one marine work vessel will be able to operate within the Sound at any time. This vessel and any associated barges, used for the transportation of materials and equipment to the turbine installation sites, will berth in Caol Ila immediately to the north of Port Askaig, with no requirement to visit Port Askaig. The working area for Turbine 1 is approximately 280m from the Port Askaig hotel and 220m from Dunlossit House and so noise from the movement of construction vessels and the construction operations at the turbine location might give rise to a perceptible noise impact. It is assumed that, where possible, work will be carried out during daytime. It is expected that the magnitude of this impact will be **low** and with a receptor of **medium** sensitivity the significance of effect of this impact is assessed as being **minor**. It might be that an element of this perceived disturbance may be associated with the visual intrusion of the activities into the views from the property across the Sound, as such contributory factors can often exacerbate perception of noise intrusion.

10.75 Additional elevated noise events associated with the development may include rough handling of equipment and materials, excessive revving of vessel engines, low frequency plant equipment noise and the noise created by construction operatives shouting. This is not predicted to increase above **medium** magnitude.

10.76 Of potentially greater significance will be any night time activities in this area, particularly during warm summer months when windows may be opened for ventilation and when noise might propagate particularly well over water and during which times Dunlossit House (and other properties in and around Port Askaig) would be considered to be a receptor of **medium** sensitivity. Night time elevated noise events might reasonably be expected to be of **medium** magnitude and therefore the perceived night time noise impact is predicted to be of **moderate** significant effect.

10.77 Mitigation against marine construction noise will, therefore be required to ensure that noise disturbance is minimised and that the suggested acceptable noise levels (presented in Category A shown in Table 10.2) are not exceeded at NSPs, particularly at night.

MITIGATION IN RELATION TO IMPACT 10.4
• Where feasible, night time operations will be avoided; • The control of construction noise from marine construction operations will be most effectively achieved through the application by the principal Contractor for a Section 61 'prior consent' in accordance with the guidance set out in the Control of Pollution Act 1974. • Additional generic mitigation against marine construction noise will be relatively generic, incorporating conventional best practice in construction operations. Mitigation measures may (not exclusively) include: — Education and awareness-raising of construction operatives with regard to the prevention of local community noise disturbance. — Minimising the idling of vessels in proximity to the residential properties. — Avoiding excessive revving of vessel or marine plant equipment engines. — Extra care taken in handling and placing materials within vessels. — Ensuring that the most modern plant equipment is used and fitted with appropriate noise attenuation. — Ensuring proper maintenance and operation of plant equipment and vessels.

Residual Impact

10.78 With the application of appropriate mitigation and control measures, it is expected that the impact of noise from marine construction activities would result in an effect of **minor** significance.

10.7.3 Potential Impacts during Operation Phase

IMPACT 10.5: Noise associated with movement of vehicles associated with substation maintenance

10.79 The onshore substation and cable network will need periodic inspection and maintenance resulting in an occasional addition of one to two vehicles of small size using the A846 and

therefore the noise associated with this impact is likely to be of **negligible** magnitude. With receptors of **low** sensitivity on Jura this impact will have **no significant effect** on human receptors.

MITIGATION IN RELATION TO IMPACT 10.5
• No mitigation required

Residual Impact

10.80 As no mitigation is required, the residual impact associated with this aspect of the noise and vibration assessment will remain of **no significant effect**.

IMPACT 10.6: Noise associated with turbine array and subsea cable maintenance activities

10.81 As discussed in *Chapter 5: Project Description* maintenance of the nacelles will occur every 5 years and will involve the removal of the nacelle from the substructure in a similar method to this part of the installation process, in reverse. Additional maintenance and repair outwith the 5 year schedule will be kept to a minimum and ROV will be used where possible to carryout out visual inspections.

10.82 The magnitude of this noise impact is predicted to be low and with medium receptor sensitivity the impact will be of **minor** significance.

MITIGATION IN RELATION TO IMPACT 10.6
No mitigation is required.

Residual Impact

10.83 As no mitigation is required, the impact of maintenance activities will remain of minor significant effect.

10.7.4 Potential Impacts during Decommissioning Phase

10.84 The decommissioning of the turbines and sub-stations is be expected to give rise to similar impact magnitudes as those described for the construction period, but over a shorter timescale, with no significant on-shore noise or vibration effects and minor to moderate adverse noise effects associated with marine activities during the day and moderate to major adverse noise impacts during the night.

10.85 The sensitivity of the receptor is likely to remain at the same level as during the construction phase; however this is dependant on any changes which may occur to ambient noise levels and NSPs in advance of the decommissioning phase and should be reassessed if necessary. However, no significant changes are anticipated, so we do not expect that the significance of effect of these impacts will differ from those of the construction phase.

10.7.5 Cumulative impacts

10.86 There are no known proposed developments within the Sound or on the islands of Jura or Islay which might give rise to a cumulative impact with this Development. Current activities that may have an overlap with the Sound of Islay project are:

- Argyll Array Wind farm;
- Kintyre territorial Wind farm; and
- Further port development at Port Askaig
- DP Energy Tidal Farm

10.87 Due to the timing of these projects or proposals there will be minimal overlap and cumulative impacts can be ruled out.

10.8 Summary of effects

10.88 Table 10.7 summarises the findings of significance of effect of the noise and vibration impact assessment.

TABLE 10.7 IMPACT ASSESSMENT SUMMARY

Impact	Construction/ Decommissioning				Operation/ Maintenance			
	Magnitude	Sensitivity	Significance level	Residual impact	Magnitude	Sensitivity	Significance level	Residual impact
Noise & vibration from vehicles on A846, Jura	Negligible	Negligible	No significant effect	No significant effect	N/A	N/A	N/A	N/A
Noise & vibration from vehicles on A846, Islay	Low	Medium	Minor	Minor	N/A	N/A	N/A	N/A
Noise & vibration from vehicle movements in Port Askaig	Low	Medium	Minor	Minor	N/A	N/A	N/A	N/A
Noise associated with movement of marine vessels and on-site turbine installation activities	Low	Medium	Minor to moderate	Minor	N/A	N/A	N/A	N/A
Noise associated with movement of vehicles associated with substation maintenance	N/A	N/A	N/A	N/A	Negligible	Low	No significant effect	No significant effect
Noise from array and subsea cable maintenance	N/A	N/A	N/A	N/A	Low	Medium	Minor	Minor

10.9 Statement of Significance

10.89 The assessment has shown that no on-shore noise or vibration impacts were predicted.

10.90 Off-shore movements of marine vessels and on-site turbine installation activities, particularly at the site of Turbines 1 and 2, was predicted to give rise to a potentially minor to moderate quantitative adverse noise impact at Dunlossit House, which might translate to a moderate to major 'perceived' adverse impact in this environment when combined with the visual intrusion of the construction operations into the views across the Sound from the property.

10.91 The control of noise disturbance through the application by the principal contractor for a Section 61 prior consent (Control of Pollution Act 1974) as well as the implementation of conventional best practice in construction operations, was predicted to result in no greater than an occasional **minor** impact.

10.92 Similar minor to moderate impacts were predicted for the decommissioning activities; the same mitigation measures will be applied to those measure being used for construction activity resulting in no greater than a predicted minor noise impact at Dunlossit House.

10.10 References

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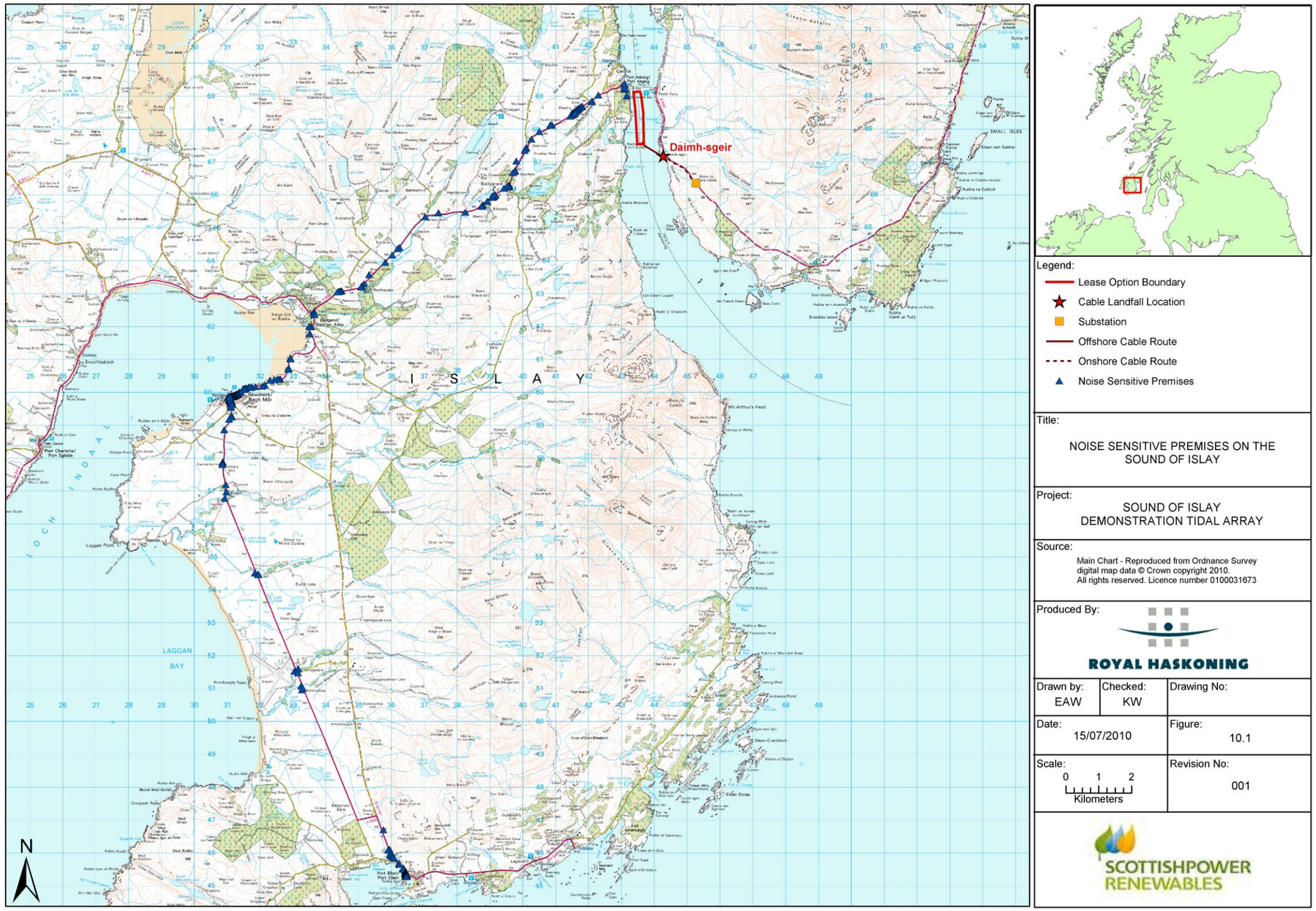

Figure 10.1: Noise Sensitive Premises on the Sound of Islay

11.0 Marine Fish and Shellfish Resources

11.1 Introduction

11.1. This Chapter evaluates the marine fish and shellfish resource present within the study area (as defined in paragraph 11.19). Baseline conditions with regard to fish and shellfish communities are presented and the potential impacts relating to the construction, operation/maintenance and decommissioning phases of the array are assessed. Mitigation measures are proposed where necessary and approaches to monitoring are discussed.

11.2. Marine fish and shellfish, benthic habitats, commercial fisheries, noise and ornithology are intrinsically linked and as such, this chapter should be read in conjunction with *Chapter 8: Benthic Ecology*, *Chapter 12: Anadromous Fish*, *Chapter 13: Elasmobranchs*, *Chapter 14: Ornithology*, and *Chapter 15: Commercial Fisheries* in order to gain a full overview of baseline conditions and potential impacts.

Summary of impacts on Fish and Shellfish Resources: The construction methodology aims to minimise the significance of smothering effects on marine fish and shellfish. It is anticipated that the proposed development will have at worst **minor** effects on marine fish and shellfish resources with the main impacts being noise and vibration during construction and operation, along with the risks of turbines acting as a physical barrier to the movement of fish along the Sound of Islay and those associated with potential collision. Effective mitigation is not possible and therefore the significance of these effects remain as (worst case scenario) **minor**.

11.2 Potential Effects

11.3. Fish and shellfish species can potentially be impacted in a number of ways by tidal array developments. These are outlined in the Scottish Marine Renewables SEA (Scottish Executive, 2007) and summarised below:

- During installation of the devices and cables, disturbance of species may occur as a result of seabed habitat loss or alteration;
- During installation, fish spawning habitat and filter feeding species may be affected as a result of increased turbidity and smothering as a result of disturbance to mobile seabed sediments;
- Disturbance may occur as the result of the presence of installation vessels and equipment, and associated noise. Depending upon noise levels and proximity of animals to the noise source, behavioural or physiological impacts may also result (a summary of the underwater noise background noise levels within the Sound and how the Development will impact upon these levels can be found in Section 8.4.3 in *Chapter 8: Benthic Ecology*);
- Noise generated by the devices during operation might potentially have an effect upon fish species;
- During operation of the array, there may be potential for the array to act as a barrier to fish movements;
- Some species may interact with the devices and there is a risk of collision resulting in physical trauma or death;
- Electromagnetic Fields (EMF)[1] generated by subsea cables may have effects on fish; and
- There may be effects on fish and shellfish resource associated with the creation of artificial reef structures on the seabed (e.g. fish aggregation around devices).

11.3 Methodology

11.3.1 Legislation, Guidelines and Policy Framework

EIA Guidance

11.4. The European Marine Energy Centre (EMEC) has developed EIA guidance for wave and tidal energy developers seeking consent within the EMEC test site on Orkney. These guidelines give an overview of the potential impacts of marine energy development on fish and shellfish resources, but do not discuss detailed EIA reporting requirements. The guidance suggests that the following potential effects on fish resources should be considered:

- Behavioural changes and altered well-being associated with noise, light and other disturbances;
- Changes in fish health resulting from release of contaminants; and
- Entrapment / collision with underwater devices.

11.5. There are no other specific EIA guidelines developed for tidal turbines; however the guidelines developed for undertaking EIA in support of licensing of offshore wind farm developments under the Food and Environment Protection Act 1985 (FEPA) and the Coast Protection Act 1949 (CPA) by Centre for Environment, Fisheries and Aquaculture Science (CEFAS) (2004) are largely applicable. As discussed in detail in *Chapter 6: Regulatory and Policy Context* the new Marine (Scotland) Act 2010 will allow for FEPA and CPA licenses to be consolidated into one Marine Licence, to be administered by Marine Scotland's Licensing and Policy Team. However this will not be implemented until April 2011 and will not directly relate to the proposed Development.

11.6. The CEFAS guidance states that there is potential for the "*construction, development and use of offshore wind farms (in this case tidal arrays) to adversely affect fish and shellfish resources*", and details what an EIA should take into account when assessing impacts on those resources.

[1] Power cables for transmitting electricity, such as those used to export electricity generated by tidal arrays, produce E and B fields when current passes through them. The B field is felt outside of the cable structure and this in turn induces a further E field (iE); studies have shown that EMF radiates beyond the cable into both seawater and the seabed.

11.7. The EIA should present information that describes fish and shellfish resources within the demonstration tidal array site and in the context of the wider area. The impact on 'Important' fish and shellfish resources are considered. Important fish and shellfish resources are considered to be those that are:

- Of significant importance to commercial and recreational fisheries;
- Of conservation importance;
- Sensitive to the potential effects of electromagnetic fields (EMF); and
- Of restricted geographical distribution and are locally abundant in the area.

11.8. For those resources identified as important, the following ecological aspects need to be considered:

- Spawning grounds;
- Nursery grounds;
- Migration routes;
- Feeding grounds; and
- Over wintering areas for crustaceans.

Appropriate Assessment Guidance

11.9. The principal aim of the European Habitats Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora is to sustain biodiversity through the conservation of natural habitats and wild flora and fauna in the territory of European Member States. These targets are principally being met through the establishment of nature conservation sites, Special Areas of Conservation (SACs). Designated SAC features include a number of fish species listed under Annex II of the Directive, namely: sea lamprey; Brook lamprey; River lamprey; Allis shad; Twaite shad; Atlantic salmon; Spined loach; and, Bullhead. An SAC may be designated on the basis of the presence of these species, and an objective of the designation will be to maintain or restore these species at a favourable conservation status.

11.10. The Directive requires that any plans or projects, whether inside or outside of the SAC, that are likely to have a significant effect on the conservation status of the site's features shall be subject to an Appropriate Assessment. Therefore where a proposed Development is located within, or would be likely to significantly affect, a designated, proposed or candidate[2] SAC, consenting authorities must ensure an Appropriate Assessment is carried out under the Directive. Where a proposed project does not fall within the boundaries of an SAC (as is the case for the proposed Sound of Islay Development) an Appropriate Assessment will only be required if it is considered (and fully justified) that a significant effect on an SAC site is likely. It is the responsibility of the competent authority (Marine Scotland), with advice from the conservation agencies, to determine whether a proposed project is likely to have a significant effect on an SAC.

11.3.2 Assessment Methods

Data Collection

11.11. The main sources of information used to establish baseline conditions are as follows:

- Marine Scotland: Compliance (formally Scottish Fisheries Protection Agency) landings statistics by species by ICES rectangle[3] for the period 2003 – 2008;
- Marine Scotland: Science (formally Fisheries Research Services)
- Centre for Environment, Fisheries and Aquaculture Science (CEFAS, 2004) and other current research publications;
- CEFAS fish and shellfish spawning and nursery ground maps;
- UK Offshore Operators Association (UKOOA, now UK Oil and Gas) Fish Sensitivity Charts;
- International Council for the Exploration of the Sea (ICES) Reports and Research Publications;
- Technical reports and reviews produced in support of Strategic Environmental Assessments for offshore renewable energy and oil and gas development in UK waters (e.g. Gordon, 2006).
- Stakeholder consultation (which is summarised in *Chapter 3: Consultation* and in Paragraphs 11.13 to 11.16) ;and
- Drop down camera survey reports of the study area produced by SeaStar Survey Ltd and Royal Haskoning for SPR.

11.12. The information sources listed above provide sufficient information to describe the fish and shellfish resources likely to be encountered in the study area. Site-specific fish surveys for the EIA have not been undertaken across the study area, partly for this reason, and partly because tidal conditions across the site do not support the deployment of suitable survey gears. As there is a lack of site specific data for the study area a precautionary approach is taken to this assessment using an extended species list that not only includes species which are known to be present within the study area but also species which are known to be present within the wider region.

[2] Candidate SACs are sites that have been submitted to the European Commission, but not yet formally adopted and Proposed SACs are sites that have been formally advised to UK Government, but not yet submitted to the European Commission.

[3] The International Council for the Exploration of the Sea (ICES) has developed a grid system derived from degrees latitude and longitude that divides the seas into rectangles.

Consultation

11.13. A scoping opinion was sought from statutory consultees (the details of which are set out in *Chapter 3: Consultation*) in August 2008. Responses are detailed in *Chapter 3: Consultation*, and a short summary of the main points pertinent to marine fish and shellfish raised during this process, along with an explanation of how they were addressed, is provided below.

11.14. A key concern of many respondents (including fisheries committees and fisheries boards) was that within the scoping report migratory fish such as salmon and sea trout were not considered in enough detail. As a result of this concern, an entire chapter (*Chapter 12: Anadromous Fish*) of this ES is dedicated to such species.

11.15. The effects that underwater noise could have on fish populations were also raised as a major concern, by many respondents including FRS and the Laggan and Sorn District Salmon Fishery Board. Therefore a study looking at the baseline noise of the Sound was undertaken and an assessment of the potential additional noise created by the proposed turbines (a summary of the findings of this report can be found in Section 8.4.3 of *Chapter 8: Benthic Ecology*) was conducted.

11.16. It was also highlighted during the scoping process that the possible effects of EMF created by cables and in particular their effects on elasmobranchs should be considered in detail. Consequently an entire chapter of this ES (*Chapter 13: Elasmobranchs*) has been dedicated to this group of fish species, and the issue of EMF is fully explored in that chapter. Impacts of EMF on other fish species are however considered in the current chapter.

11.4 Assessment of significance

11.17. The broad methodology used for determining impact significance is outlined in *Chapter 2: Scoping and Assessment Methodology*. The significance of the impact is assessed on the basis of both the magnitude of the impact (Table 11.1) and the sensitivity/value/importance of the receptor (Table 11.2). Also to be taken into account when making the assessment is the potential for impact occurring and the nature of the impact.

Table 11.1 Magnitude of the impact

Magnitude	Description
High	A fundamental change to the baseline condition of the marine fish or shell fish resource.
Medium	A detectible change in the baseline condition resulting in the non-fundamental temporary or permanent condition of marine fish and shellfish resources.
Low	A minor change to the baseline condition of marine fish and shellfish resources (or a change that is temporary in nature).
Negligible	An imperceptible and/or no change to the baseline condition of the receptor.

Table 11.2 Sensitivity/Value/Importance of the receptor

Sensitivity/Value/Importance	Description
High	Environment is subject to major change(s) due to impact. For example, study area contains species of international or national conservation importance/ value that will be permanently significantly altered by the Development.
Medium	Environment clearly responds to effect(s) in quantifiable and/or qualifiable manner. For example study area contains species of national or regional conservation importance/value which will be permanent significantly altered by the Development.
Low	Environment responds in minimal way to effects such that only minor change(s) are detectable. For example study area contains species of local conservation importance/ value which will be permanently significantly altered.
Negligible	Environment responds in minimal way to effect such that only minor change(s) are detectable. For example sites contain features of local conservation importance/ value.

11.18. By combining the magnitude of the impact and the sensitivity/value/importance of the receptor in a matrix (Table 11.3) the final significance of the effect (prior to the implementation of mitigation measures) can be obtained. The level of significance will then be described as either ‘major’, ‘moderate’, ‘minor’, ‘negligible' or 'no significant effect’’ based on the outcome of the impact matrix.

Table 11.3 Impact significance matrix

Magnitude of Impact	Receptor Sensitivity/Value/Importance			
	Negligible	**Low**	**Medium**	**High**
High	No significant effect	Moderate	Major	Major
Medium	No significant effect	Minor	Moderate	Major
Low	No significant effect	Negligible	Minor	Moderate
Negligible	No significant effect	Negligible	Negligible	Minor

11.5 Baseline description

11.5.1 Seabed habitats

11.19. For the purposes of the marine fish and shellfish resources assessment there are a number of geographical scales referred to in this chapter. The “Development site” is defined as the area within the lease boundary and the offshore cable route and is displayed in Figure 15.13 (*Chapter 15: Commercial Fisheries*). The “study area" is defined as the extent of the Sound of Islay and is displayed in Figure 15.12 (*Chapter 15: Commercial Fisheries*). As many fish species are highly mobile and as there has been no site specific fish survey (due to the hostile nature of the local environment) this assessment also extends beyond the study area and considers data from the “wider region” which includes the much of the coast of south west Scotland. As such the species list considered may include a greater range than regularly use the study area, but this approach was considered necessary due to the lack of site specific data.

11.20. The seabed environment within much of the study area is described in detail in *Chapter 8: Benthic Ecology* and *Chapter 7: Physical Environment and Coastal Processes*.

11.21. In summary, seabed habitats across the array site are characterised by a coarse sedimentary environment of sandy gravel, cobbles and small boulders along with areas of exposed bedrock.

The seabed is dominated by biological communities typical of sounds, narrows and tide-swept areas, with hydroids and bryozoans, anemones and sponges.

11.22. Shallower-water areas within the study area are dominated by either kelp communities with sparse red seaweeds on boulders and coarse sediments, or sandy sediments with little epifauna, depending upon location.

11.23. Maerl, which provides important nursery grounds for many commercial species (Barbera *et al*., 2003; UK Marine SACs Project website) including: scallops (Hall-Spencer, 2003), cod, saithe and pollock (Kamenos *et al.,* 2004) has been identified within the study area (Hiscock, 1983; Brodie *et al*., 2007). The closest indentified maerl bed is located approximately 300m from the Development site in depths of between 3 to 13m. The extent of and conservational interest of maerl is discussed in *Chapter 8: Benthic Ecology*.

11.5.2 Shellfish and Finfish Species

11.24. In order to identify the presence of, and obtain an indication of the abundance of fish and shellfish species in the study area, fisheries landings data for the period 2003 – 2008 have been analysed. Graphical representation and explanations of these analyses can be seen in *Chapter 15: Commercial Fisheries*. Landings data relating to ICES Statistical Rectangles 40E3 and 40E4, which include the study area and the wider region, indicate that shellfish species account for the majority (over 95%) of landings (scallops, velvet swimming crab, brown crab, lobster and Nephrops).

11.25. It is recognised that fishing methods and species targeted in a particular sea area are, to a large extent, market driven. In addition to landings data, other sources of information have been used to determine the presence of fish and shellfish species and to assess their relative importance. A primary reference point has been the list of finfish and shellfish species presented in the Scottish Marine Renewables Strategic Environmental Assessment (SEA) (Scottish Executive, 2007), which considers a wide study area that encompassed much of the west coast of Scotland, including the study area.

11.26. Table 11.4 lists those species known to occur throughout the wider region (West Coast of Scotland) on the basis of fisheries landings data and the findings of the Marine Renewables SEA (Scottish Executive, 2007).

Table 11.4 Shellfish and finfish species potentially present in the Sound of Islay and adjacent waters.

Shellfish	Fish
Crustaceans	Cod *Gadus morhua*
Lobster *Homarus gammarus**	Ling *Molva molva*
Nephrops *Nephrops norvegicus*	Whiting *Merlangius merlangus*
Squat lobster *Galathea squamifera*	Mackerel *Scomber scombrus*
Crawfish *Palinurus elephas*	Sandeels *Ammodytes spp.*
Edible crab *Cancer pagurus* *¤	Sprat *Sprattus sprattus*
Green crab *Carcinus maenas*	Pollack *Pollachius pollachius*
Velvet crab *Necora puber* *¤	Plaice *Pleuronectes platessa*
Spider crab *Maja verrucosa*	Saithe *Pollachius virens*
Brown shrimp *Crangon crangon*	Haddock *Melanogrammus aeglefinus*
Bivalves	Norway pout *Trisopterus esmarkii*
King scallop *Pecten maximus*¤	Flounder *Platichthys flesus*
Queen scallop *Aequipecten opercularis*	Monkfish (angler) *Lophius piscatorius*
Razor clam *Ensis ensis*	Witch *Glyptocephalus cynoglossus*
Horse mussel *Modiolus modiolus*	Striped red mullet *Mullus surmuletus*
Mussel *Mytilus edulis*¤	John dory *Zeus faber*
Cockle *Cerastoderma edule*	Sea bream *Spondyliosoma cantharus*
Native oyster *Ostrea edulis*	Bass *Dicentrarchus labrax*
Molluscs	Hake *Merluccius merluccius*
Squid *Loligo spp.*	Gurnards *Triglidae spp*
Whelk *Buccinum undatum*¤	Dab *Limanda limanda*
Common periwinkle *Littorina littorea*	Turbot *Psetta maxima*
	Dover sole *Solea solea*
	Lemon sole *Microstomus kitt*
	Megrim *Lepidorhombus whiffiagonis*
	Conger eel *Conger conger*
	Herring Clupea harengus
	Atlantic halibut *Hippoglossus hippoglossus*
	Red gurnard *Aspitrigla cuculus*
	Brill *Scophthalmus rhombus*
	Long rough dab *Hippoglossoides platessoides*

Note: Anadromous and Elasmobranch species are considered separately in Chapters 12 and 13 respectively

* indicates key species identified during consultation with fishermen within the Sound of Islay

¤ Indicates species identified during the benthic surveys (SeaStar Survey Ltd, 2009 and Royal Haskoning, 2010)

11.27. As part of the EIA process it is not considered necessary to assess potential impacts on each of the species listed in Table 11.4. In line with the EIA guidance (CEFAS, 2004) outlined in Section 11.3.1, only those resources considered to be important (see criteria in Paragraph 11.7) need be the subject of assessment. However it has been deemed practical to take a precautionary approach and therefore other species of potential importance to commercial fisheries have also been assessed.

11.28. Species are also deemed to be important or potentially important if they have spawning or nursery grounds within the study area.

11.29. Furthermore, given their behavioural characteristics and habitat preferences, it is not likely that all of the species listed in Table 11.4 will be encountered across the tidal array site or cable route. For example, although fisheries landing data indicates that Nephrops are a commercially important species in a regional context, it is unlikely that they would be encountered across the array site or cable route since the substrate in these locations (i.e. coarse and mobile sediments) would not allow the construction of suitable burrows. Also note native oyster (due to its conservation importance) as an example of a species whose habitat won't be present within the study area. Exclusions such as these are only possible as these species are benthic species (living on the seabed). It is not possible to exclude the more mobile fish species that inhabit the water column in such a way.

11.30. Taking Table 11.4 as a starting point, and based upon the criteria in Paragraph 11.7, species descriptions of "important species", "potentially important species" and groups of species are provided below.

11.5.3 Important Species: Shellfish

11.31. Landings from both ICES rectangles 40E3 and 40E4 combined, (and therefore the wider region), are shown in Appendix 15.1; Figure 3. These landings data show that Nephrops is the most important species for the wider region with scallop and crab species also forming a large part of the landings.

11.32. Shellfish species of greatest commercial interest when ICES rectangle 40E3 is taken in isolation, in order of value, are scallops, velvet swimming crab, brown crab, lobster and Nephrops (Appendix 15.1; Figure 1). Consultation with local fishermen and analysis of landings at Port Askaig (see *Chapter 15: Commercial Fisheries*) has confirmed that species of greatest commercial importance (in order of greatest value first) within the study area are velvet swimming crab, brown crab and lobster. Fishermen do occasionally target scallops within the study area; however these occasions are rare and therefore scallops within the study area do not form a commercially important natural resource. Common whelk are also known to be present within the study area (figure 15.13 *Chapter 15: Commercial Fisheries*) but are not currently targeted there.

Velvet swimming crab

11.33. The velvet swimming crab *Necora puber* (also known as the devil crab), is, along with edible crab and lobster, one of the three main species targeted by fishermen in the study area. They comprise the greatest percentage of landings at Port Askiag of any species and are therefore currently considered to be the most important commercial species within the study area (see *Chapter 15*: *Commercial Fisheries*). Velvet crabs are targeted using a type of static gear called a creel. This information was confirmed during the consultation process where interviews were conducted with local fishermen (Appendix 15.3).

11.34. Velvet swimming crabs are mostly found in rocky areas with reefs, boulders and large stones. After spawning (in late summer or autumn), eggs are carried by the female under the abdomen until they are ready to hatch. Hatching normally takes place in early summer, and the larvae are distributed by water movements before settling to the seabed as miniature adults. Velvet crabs are rarely thought to undertake any significant migrations (Fisheries Research Services, undated (b)). During the benthic surveys (SeaStar Survey Ltd, 2009 and Royal Haskoning, 2010) two velvet swimming crabs were identified close to the coastline, the closest of these was approximately 308m from the nearest potential tidal turbine site (Figure 15.13 *Chapter 15: Commercial Fisheries*).

Brown crab

11.35. Brown crab *Cancer pagurus* (also called the edible crab) are also one of the three main species that are targeted by fishermen in the study area (Appendix 15.3). Along with velvet swimming crab and lobster they are targeted using static gears. Similar size creels are used to target both species of crab.

11.36. Like velvet crabs, edible crabs are found in rocky areas, but they may also be found on sand, gravel and mud. Breeding takes place during winter months and spawning and hatching generally follows the same pattern as that described for velvet crabs. Tagging studies have shown that edible crabs may move up to a few kilometres a day, and hundreds of kilometres in the long term (Fisheries Research Services, undated, (b)).

11.37. Edible crabs inhabit the intertidal down to as deep as 100m (Niel and Wilson, 2008) and are therefore likely to exist throughout most of the study area. During the benthic surveys (SeaStar Survey Ltd, 2009 and Royal Haskoning, 2010) 21 individuals of this species were identified at locations throughout the survey area, many of which were within the Development site (Figure 15.13 *Chapter 15: Commercial Fisheries*).

Lobster

11.38. Lobsters are the third of the main species targeted by fishermen within the study area; they are landed using static gear; either creels of the same dimensions as those used for crabs or larger purpose built lobster pots (Appendix 15.3).

11.39. Lobsters have a preference for rocky reef habitats. Spawning and hatching generally follows the same pattern as that described for velvet crabs. They are rarely thought to undertake any significant migrations (Fisheries Research Services, undated (b)).

11.40. Lobsters inhabit water depths from the intertidal down to 60m, appearing to prefer mid to high energy environments (Galparsoro *et al*., 2009) so it is likely that they will occur on their preferred habitats throughout much of the study area. No lobsters were identified during the benthic surveys (SeaStar Survey Ltd, 2009 and Royal Haskoning, 2010), however lobster are highly mobile cryptic species that could easily avoid detection by a video sled.

Scallops

11.41. The great scallop *Pecten maximus* (also known as king and giant scallop) is the most-landed species in terms of live weight and value from ICES rectangle 40E3 (Appendix 15.1. Figure 1) Queen scallop (*Aquinopecten opercularis*) are also landed, though not in as great a number as they have less market value. Consultation with fishermen has revealed that scallops are targeted occasionally within the study area, with effort concentrated in the extreme north and extreme south of the study area due to local ground and tidal conditions. Diving for handpicked scallops is also known to have occurred in the past and may occur again in the future.

11.42. Scallops are not expected to occur abundantly across the Development site, though may be present in patches of softer sediments. During the benthic surveys (SeaStar Survey Ltd, 2009 and Royal Haskoning 2010) one single *P. maximus* specimen was recorded in shallow waters on the western side of the Sound (Figure 15.13 *Chapter 15: Commercial Fisheries*).

Nephrops

11.43. *Nephrops norvegicus* (also known as the Dublin Bay prawn, langoustine, scampi and Norway lobster) distribution is limited by the extent of suitable relatively soft stable sediment in which they construct burrows. Populations exist in depths as shallow as a few metres down to 500m in an area which includes much of the Hebrides. Nephrops spend most of their time in burrows, only coming out to feed and look for a mate, and the timing of emergence appears to be related to light level (Fisheries Research Services (d)).

11.44. Female Nephrops usually mature at three years of age and reproduce each year thereafter. They mate in early summer and spawn in September, carrying eggs under their tails until they hatch in April or May. The larvae develop in the plankton before settling to the seabed around eight weeks later. The study area lies within a wider region that is known to be a Nephrops spawning and nursery ground (Figure 11.1). The relative size of the Development site in relation to the area of the Nephrops spawning and nursery grounds and the minimum distance from the spawning and nursery grounds to the site are given in Table 11.5 and a summary of spawning times for this species is shown in Table 11.8.

Table 11.5 Distance to Nephrops spawning and nursery areas and relative area covered by the array site.

Species	Distance to nearest spawning area (km)	Nearest spawning area (km2)	% of nearest spawning area covered by site	Distance to nearest nursery area (km)	Nearest nursery area (km2)	% of nearest nursery area covered by site
Nephrops	0	54847	0.001	0	54531	0.001

11.45. As a result of their habitat requirements, Nephrops are not likely to be encountered in the Development site, but may be encountered in the study area. No Nephrops or Nephrops burrows were recorded during the benthic surveys of the study area (SeaStar Survey Ltd, 2009 and Royal Haskoning 2010) and it is very unlikely the Development site is used as spawning or nursery ground by this species.

Common whelk

11.46. The Common whelk *Buccinum undatum* is not landed in any great numbers from ICES rectangle 40E3 (which contains most of the study area) and they are not thought to be targeted at all within either the Development site or the study area.

11.47. Whelk were identified during the benthic surveys (SeaStar Survey Ltd, 2009 and Royal Haskoning 2010) and were found to be present within Development site (Figure 15.13, *Chapter 15: Commercial Fisheries*) the closest being within 100m of the nearest potential turbine location. Occasionally intertidal but more usually subtidal whelks are caught using purpose built pots and usually inhabit muddy sand gravel and rock habitats (Agar, 2008). The common whelk breeds in winter between November and January when the female produces large bundles of eggs which are normally stuck to stones or solid objects.

11.48. Discussions with local fishermen did not indicate that whelks are currently or could potentially be targeted within the study area.

Common mussel

11.49. The common mussel *Mytilus edulis* (also known as the blue mussel) is not landed in any great numbers from ICES rectangle 40E3 (see *Chapter 15: Commercial Fisheries*) and are not targeted within the study area as seabed topography and tidal conditions do not allow for harvesting.

11.50. Common mussels were identified in one sample during the benthic surveys (SeaStar Survey Ltd, 2009) in shallow waters in the north western part of the survey area (Figure 15.13, *: 15 Commercial Fisheries)* at approximately 281m from the nearest potential turbine location. Found in the intertidal through to the shallow subtidal (Tyler-Walters, 2008) mussels need a rocky substrate to attach to and are therefore unlikely to be found at the locations on which the turbines will be placed and were not recorded at any locations within the Development site.

11.5.4 Important Species: Fish

11.51. Fin fish species are not commercially targeted in the study area, where ground and tidal conditions mean that appropriate fishing gear types can not be safely deployed. As a result, it is difficult to assess the abundance of particular species within the study area. 'Important' species are therefore identified on the basis of their importance to commercial fisheries, their conservation importance, sensitivity to potential effects (including the presences of spawning or nursery grounds within the study area), of restricted geographical distribution (as per criteria outlined in Paragraph 11.7), and/or where they are known to be locally abundant representing a potentially valuable resource.

11.52. Fish can be divided into two main categories; pelagic and demersal. Pelagic fish are those that live in mid-water, often in shoals, such as herring and mackerel. Demersal fish are those that live at or close to the seabed. Some demersal fish, such as the flatfish and ray species, are more associated with the seabed while others such as the gadoid fishes, forage in a layer that can be tens of metres above the seabed (Scottish Executive, 2007). Both pelagic and demersal species can make extensive migrations between spawning and feeding grounds and are therefore likely to use the study area or transit through it.

Species of Conservation Importance

11.53. Table 11.6 shows species encountered on the west coast of Scotland, which are of conservation importance. 'Relevance' to marine renewable energy projects (and not to the specific assessment in this chapter) has been defined upon the basis of criteria provided by CEFAS guidance (2004).

11.54. The UK Biodiversity Action Plan (UK BAP) is the part of the UK Government's response to the Convention on Biological Diversity (UK Bap, 2010). It provides detailed plans for the protection of biological resources (species and habitats) of conservation importance. The IUCN Red List of Threatened Species identifies and provides information on plants and animals at risk of extinction.

Table 11.6 Species of conservation importance.

Species	Conservation status	Relevance
Cod	IUCN red list	Medium
Haddock	IUCN red list	Medium
High – Species present in the study area, which need to be considered in EIA Medium – Species that were historically present in the area but may not be present now, and species that may only occasionally occur in the area. These species may need to be considered in EIA but data are likely to be scant. N/A – Species not normally in the area.		

Note: Anadromous and Elasmobranch species of conservation importance are assessed in Chapters 12 and 13 respectively.

Spawning and Nursery Areas

11.55. The Development site and/or study area may currently act as a spawning and/or nursery ground during early stages of development for a number of species. The relative size of the Development site in relation to the area of the spawning and nursery grounds and the minimum distance from the spawning and nursery grounds to the site are given in Table 11.7.

Table 11.7 Distance to spawning and nursery areas and relative area covered by the array site.						
Species	**Distance to nearest spawning area (km)**	**Nearest spawning area (km2)**	**% of nearest spawning area covered by site**	**Distance to nearest nursery area (km)**	**Nearest nursery area (km2)**	**% of nearest nursery area covered by site**
Sprat	0	489399	0.0001	na	na	na
Cod	na	na	na	0	22277	0.003
Saithe	na	na	na	0	48140	0.001
Plaice	na	na	na	15	1.2	0

11.56. A summary of spawning times of the relevant species is shown in Table 11.8.

Table 11.8 Principal spawning times (by month) of fish species relevant to the array site (Fisheries Research Services, undated and ICES, undated).												
Species	J	F	M	A	M	J	J	A	S	O	N	D
Nephrops	Berried			Eggs hatch						Berried		
Sprat												

Sensitivity to Tidal Array Development

11.57. The Scottish Marine Renewables SEA (Scottish Executive, 2007) identifies the sensitivity of fish species to impacts associated with wave and tidal array developments. Table 11.9 below is adapted from the SEA and lists those species or species groups which may be considered sensitive to the proposed Development.

Table 11.9 Sensitivity of fish to impacts from tidal arrays. Source: Scottish Executive (2007).						
Species	**Smothering**	**Change in suspended sediment**	**Substratum loss**	**Decrease in water flow**	**EMF**	**Underwater noise**
Herring	High	Medium	High	High	Not sensitive	High
Sprat	Not sensitive	Medium	Not relevant	Not relevant	Not sensitive	Unknown
Cod	Not sensitive	Not relevant	Not relevant	Not relevant	Yes	High
Sandeels	High	Low	High	Medium	Not sensitive	Unknown
Lemon sole	Low	Low	Not relevant	Not relevant	Not sensitive	Low
Plaice	Low	Low	Not relevant	Not relevant	Yes	Low

Note: Anadromous and Elasmobranch species are considered in Chapters 12 and 13 respectively

Cod

11.58. Cod (*Gadus morhua*) is a widely distributed demersal species that occurs throughout UK waters. Tagging has revealed that cod migrate in late summer and early autumn from the west coast of Scotland to the north coast, and return in the late winter and early spring (Scottish Executive, 2007). The study area is however within a large nursery ground (Figure 11.1) that covers 22277 km^2 and therefore individuals may occur across the development site.

11.59. Spawning can occur from January to April, usually peaking in February, and there is a significant spawning area around the Outer Hebrides; however, the study area is not within this spawning area (Figure 11.1). The eggs, larvae and juvenile up to about 7cm in length are pelagic and there is no evidence of daily vertical migration through the water column. Demersal juvenile nursery areas are located in coastal waters from the Clyde northwards and they exhibit a preference for rocky substrates. The Sound of Islay is completely within a large cod nursery area (Figure 11.1)

11.60. Much of the prey of all sizes of cod consists of a variety of small fish and crustaceans. The remainder is made up of smaller quantities of molluscs and worms (Wheeler, 1978).

11.61. Although an important exploited fish species in the North Atlantic, cod is not targeted by fisheries in the study area and catches have declined across the wider region. Stocks are considered to be seriously depleted and outside of safe biological limits. The spawning stock biomass for west of Scotland cod has been estimated at an all time low and recruitment has been declining over the last decade (Fisheries Research Services (a)).

Haddock

11.62. Haddock (*Melanogrammus aeglefinus*) is a demersal species that shoals in colder waters and is usually found over rock, sand, gravel or shells (Barnes,2008). Haddock is widely distributed across western Scotland with adults found at depths from about 40 to 300m and is likely to occur within the study area. Spawning areas are in deeper water to the west of the Outer Hebrides. Spawning takes place from February to May (Scottish Executive, 2007).

11.63. The nursery grounds are widely distributed and are mostly offshore; therefore do not occur within the Sound of Islay. There is some evidence to supporting the theory that migration of Haddock between the North Sea and the northwest coast of Scotland occurs. Haddock is listed as vulnerable in the IUCN Red List (Table 11.6).

Sprat

11.64. Sprat (*Sprattus sprattus*) is a short-lived pelagic species that is widely distributed off western Scotland. They occur from the surface to about 100m depth but are generally found in shallower waters and are likely to occur across the study area. Sprat are batch spawners that spawn throughout the summer producing pelagic eggs. Nursery areas are in inshore waters along the west coast of Scotland. Mature fish often migrate inshore during the winter (September to March) and are sometimes commercially exploited.

11.65. The study area is within a wider area known to be a sprat spawning ground (Figure 11.1). However the Sound of Islay is not known to be used by sprat as a nursery ground (Figure 11.1).

Plaice

11.66. Plaice (*Pleuronectes platessa*) is widely distributed on sandy bottoms in the wider region from the intertidal to depths of around 80m.

11.67. Plaice spawn throughout their adult range and localised spawning concentrations occur in some areas. There are no spawning grounds within the study area and the nearest spawning sites are located to the west of Islay and south of the Kintyre peninsula. Plaice eggs are pelagic and metamorphosing larvae enter coastal areas. Sandy beaches are the nursery ground for plaice and four distinct nursery grounds are present around Islay (Loch Gruinart, Loch Indaal (Figure 11.1), Laggan Bay and Machir Bay), none of which fall within the study area and all of which are located more than 10km from the proposed Development site. After a year spent in nursery areas, plaice gradually disperse offshore. They can make extensive migrations between spawning and feeding grounds.

11.68. Plaice are benthic feeders, consuming polychaete worms, amphipods, mysids, molluscs and brittlestars. During the benthic survey no habitats that are likely to support plaice were identified; however the benthic survey only covered the area of interest and not the entire study area.

Saithe

11.69. Adult saithe (*Pollachius virens*) are found in deep waters (approximately 100 – 200m) at the edge of the continental shelf. Spawning takes place from January to April to the west of the Outer Hebrides. Juveniles are located in coastal waters that cover the entire west coast of Scotland and do not migrate into offshore waters until they reach 2 – 3 years old. The migration takes place in spring.

11.70. The pelagic eggs and larvae are widely distributed and nursery areas are in the inshore waters of the west of Scotland and around Orkney and Shetland. The study area is included in a large saithe nursery ground (Figure 11.1 and Table 11.7) and therefore this species may be sensitive to the effects of the proposed development.

11.71. The diet of juvenile saithe comprises both pelagic and demersal organisms, with copepods, amphipods, decapods and polychaetes being the dominant taxa taken. Adult saithe feed mostly on euphausiids and fish. During the benthic survey no habitats that are likely to support saithe were identified; however the benthic survey only covered the Development site and not the entire study area.

Herring

11.72. Herring (*Clupea harengus*) is a pelagic species that is widely distributed off the west coast of Scotland and are likely to be present across the study area and Development site. During the daytime they remain close to the seabed or in deep water, and they undertake diurnal feeding migrations into surface waters.

11.73. Although a pelagic species, they are demersal spawners, depositing sticky eggs on stone and gravel in waters down to 200m. For this reason, herring are considered particularly sensitive to seabed developments that affect their spawning grounds. The major northwest Scotland spawning area (with spawning occurring in both spring and autumn) lies to the west of the Outer Hebrides and extends north along the north coast of mainland Scotland. Other spawning events include autumn spawning around the Inner Hebrides and a spring spawning period within the Firth of Clyde. After hatching the larvae are pelagic and drift with the currents and the juvenile nursery grounds tend to be close inshore from the Clyde along the entire west coast of Scotland and both the inner and outer Hebrides. Herring are not thought to spawn in, or use the study area as a nursery ground.

11.74. Generally, crustaceans (shrimps and copepods) and juvenile sandeels are the main components of the diet of herring (Fisheries Research Services (b)). There are no marked differences between the diets of juvenile or adult herring; only the proportions of different food items change with the size of the herring (DTI, 2007). During the benthic surveys no habitats that are likely to support herring were identified; however the benthic survey only covered the development site and not the entire study area.

11.75. Based on the most recent estimates of the spawning stock biomass and fishing mortality, it is considered that the herring stock is currently fluctuating at a low level (Fisheries Research Services (c)).

Sandeels

11.76. Although there are five species of sandeel in Scottish waters about 90% of the commercial catch consists of one species, *Ammodytes marinus*. Sandeels are a shoaling species that lie buried in sand during the night and emerge during the day to feed in midwater. During the winter they remain in the seabed sediment only emerging to spawn. Given the coarse nature of the seabed sediments in the study area, it is unlikely that this species would be encountered across the array site.

11.77. Spawning takes place from November to February and is widespread. Eggs are demersal and are laid in sticky clumps on sandy substrates. Larvae are pelagic and after about 2 to 5 months they adopt the demersal habit. All known sand eel spawning and nursery grounds lie over 25km from the proposed array site.

Lemon Sole

11.78. Lemon sole (*Microstomus kitt*) is a deeper living (40 – 200m) demersal species that occurs throughout waters off the west coast of Scotland, though is in greater abundance around the Outer Hebrides and off Orkney and Shetland (Scottish Executive, 2007).

11.79. Spawning runs from April to July in deep water and the pelagic eggs and larvae occupy progressively deeper water as they develop.

11.6 Impact Assessment

11.6.1 Do nothing scenario

11.80. Apart from creeling on a small scale, there has been very little direct anthropogenic influence on the natural fish and shellfish resources within the study area. It is anticipated that this practice will continue regardless of whether the Development is constructed or not. Therefore, if the proposed tidal array is not deployed the existing environment discussed above is likely to remain in its current status. However, it is recognised that commercial fishing within the area is very much driven by demand which can fluctuate. So if demand for the three main species (velvet crab, brown crab and lobster) targeted within the study area were to increase significantly then fishing effort is likely to increase as a response. Demand for these species is currently believed to be relatively stable.

11.6.2 Potential Impacts during Construction Phase

11.81. *Chapter 8: Benthic Ecology* presents the assessment of habitat disturbance upon the benthic assemblage within the development site. It is estimated that the total loss of seabed within the footprint of the devices will be a maximum of 329.7m^2; the footprint for the inter-array cables will be approximately 3506m^2, and the maximum export cable route, will be 1946m^2 (with a 200cm buffer). This equates to a total loss of 0.02% of the total seabed within the area of interest and 0.002 % of the study area. The seabed upon which it is proposed that the array will be placed is comprised of coarse seabed sediments. Due to the strong tidal currents in the Sound of Islay, the area is deemed to be unsuitable as feeding ground for demersal species and this impact is not assessed.

Impact 11.1: Habitat disturbance of mollusc species

11.82. Direct impacts caused by habitat disturbance during the construction phase are expected to be greater on sessile (immobile bottom dwelling) organisms and species whose limited mobility will inhibit avoidance reactions. The great scallop *Pecten maximus*, the mussel *Mytilus edulis* and the whelk *Buccinium undatum* were all identified as present within the study area during the benthic survey (SeaStar Survey Ltd, 2009 and Royal Haskoning, 2010); and it is these species that are most likely to be affected by habitat disturbance.

11.83. These species were not found to be common within the study area or to inhabit the preferred sites for turbine location and therefore the magnitude of the impact can be considered to be low. None of these species are considered to be of national or international conservation importance and although these species are of local value it is unlikely that anything other than very minor changes in their abundance would be detectable post Development. Consequently the sensitivity of the receptor can be considered to be low.

11.84. As both the magnitude of the impact and the sensitivity of the receptor (in this case mollusc species) are low the direct impact due to habitat disturbance of these species is considered to be of **negligible** significant effect.

MITIGATION IN RELATION TO IMPACT 11.1
• No mitigation is required

Residual impact:

11.85. As no mitigation is required the impact of habitat disturbance of mollusc species will remain of **negligible** significant effect.

Impact 11.2: Habitat disturbance of crustaceans

11.86. Crustaceans, such as velvet crab, brown crab and lobster, have a greater mobility than mollusc species allowing them to exhibit avoidance responses to disturbance. They also have a preference for rocky, cryptic habitats, which will not be preferred substrates for turbine placement.

11.87. However, these species, in particular the edible crabs, were either found to be relatively abundant within the study area and Development site during the benthic surveys (SeaStar Survey Ltd, 2009 and Royal Haskoning 2010) or were identified as present by local fishermen (Appendix 15.1). It is likely that only a minor change to the baseline condition of these species will be detected by the fishermen and as such the magnitude can be considered to be low. None of these species are of national or international conservation importance, but due to the commercial importance of these species this receptor is locally valuable, therefore the sensitivity can be considered to be low.

11.88. As both the magnitude of the impact and the sensitivity of the receptor (crustacean species) are considered to be low the impacts of habitat disturbance on crustaceans are likely to be of **negligible** significant effect.

MITIGATION IN RELATION TO IMPACT 11.2
• Micro-siting to avoid any known sensitive habitats such as rocky reefs

Residual impact

11.89. If the above mitigation is implemented then there is likely to be **no significant** effect of the development upon crustaceans.

Impact 11.3: Loss of spawning grounds

11.90. The study area has been identified (using the CEFAS data) as being part of wider spawning grounds for two commercially exploited species which are sprat and Nephrops (Figure 11.1).

11.91. The wider spawning ground for sprat covers an area of 489,399km^2 and the construction phase of the project will impact upon 0.1×10^5% of this total spawning area; this coupled with the fact that sprat produce pelagic eggs which are unlikely to be affected by the development mean that the magnitude of impacts of the development on sprat spawning grounds are likely to be imperceptible giving a negligible impact magnitude and a negligible sensitivity.

11.92. Due to the unavailability of suitable habitats, Nephrops are unlikely to be present within the study area and therefore the development is likely to cause **no significant effect** to this species.

11.93. Therefore even with uncertainties it is not unreasonable to predict that with a negligible magnitude of impact and the negligible sensitivity of the receptor (Nephrops and sprat) that there would be **no significant effect** of the Development on spawning grounds.

MITIGATION IN RELATION TO IMPACT 11.3
• No mitigation is required

Residual Impact:

11.94. As no mitigation is required the impact of the Development on spawning grounds will remain **no significant effect**.

Impact 11.4: Loss of Nursery grounds

11.95. The study area has been identified (using CEFAS data) as being part of wider nursery areas for cod, saithe and Nephrops (Figure 11.1). Construction of the development will affect less than: 0.003% of cod, 0.001% of saithe and 0.001% of Nephrops nursery grounds. As juveniles cod and saithe are highly mobile, any individuals within the site at the time of construction are likely to vacate the area once construction begins. Also due to their habitat requirements,

juvenile Nephrops are not likely to be encountered in the area of interest (see Impact 11.3). Therefore it is unlikely that any change to the baseline condition of these species caused by the Development will be imperceptible making the magnitude of the impact and the sensitivity of the receptor negligible.

11.96. Although not within the study area itself plaice are known to use the inshore waters of the both Islay and Jura as nursery areas (Figure 11.1). The closest of these to the Development site is located 15km to the north east, on the west coast of Jura. Due to its distance from the site the impacts of the development on plaice nursery grounds are likely to be negligible.

11.97. As both the magnitude of the impact and the sensitivity of the receptors (fish nursery grounds) are negligible it is considered that there will be **no significant effect** to nursery grounds caused by the Development.

MITIGATION IN RELATION TO IMPACT 11.4
• No mitigation is required

Residual impact

11.98. As no mitigation is required, the impact on nursery grounds will remain of **no significant effect**.

Impact 11.5 Noise and vibration on fin fish species

11.99. The main activities related to the construction of the tidal array with the potential to cause an impact to natural fish resources are cable laying and burial, and rock placement (and associated vessel movements). These activities are discussed in more detail in *Chapter 5: Project Description*.

11.100. An assessment of underwater noise within the study area (SAMS, 2009) concluded that high levels of background noise currently exist with there. A summary of this report can be found in *Chapter 9: Marine Mammals*. Therefore any additional noise sources within the study area would have to be at a very high level to be detected by fish species.

11.101. According to Vella *et al*. (2001) the sensitivity of species to noise and vibration is dependent on:

- The audible threshold;
- The presence of a swim bladder and its size and physical coupling to the ear;
- The resonance frequency of the otolith system; and
- Behavioural factors, such as aggregation or shoaling behaviour.

11.102. Hearing sensitivities of important or potentially important species are included in Table 11.10.

Table 11.10 Hearing specialisation of Important fish species. Source: Nedwell *et al* (2004).

Species	Family	Swim Bladder Connection	Sensitivity
Herring	Clupeoidea	Prootic auditory bullae	High
Sprat	Clupeoidea	Prootic auditory bullae	High
Cod	Gadidae	None	Medium
Plaice	Pleuronectidae	No swim bladder	Low

Note: sensitivity to noise of anadromous and elasmobrach species are discussed in Chapters 12 and 13 respectively

11.103. The effects of noise on fish can be divided into the following categories (Hastings and Popper, 2005):

- Lethality and physical injury;
- Traumatic hearing damage (i.e. temporary and permanent hearing loss); and
- Behavioural responses and masking of biologically relevant sounds.

11.104. Most of the fish species likely to be encountered within the Development site have a relatively low sensitivity to noise. Within this impact assessment, herring has been used as the example against which all impacts are assessed, as it is considered to be the most sensitive species present and believed to be present within the region.

11.105. It is likely that as herring are sensitive to noise disturbance they will show a minor detectable change in behaviour if present within study area. The magnitude of this impact can therefore be considered to be low.

11.106. Herring is a UK BAP species meaning it is of national importance, this together with the high sensitivity of this species to noise (Table 11.10) means that the sensitivity of this receptor must be considered to be medium. It is not considered to be of high sensitivity as the definition in Table 11.2 states that for high sensitivity a species will be “permanently significantly altered by the Development”. This is not likely to be the case for the herring population within the study area or within the wider region.

11.107. Taking account for the fact that the magnitude of the impact is low and the sensitivity of the receptor medium, which is in fact a precautionary approach, and given that pile driving is not an activity expected to take place during construction, it is likely that the impact of noise and vibration on fish species can be considered to be of **minor** significant effect.

MITIGATION IN RELATION TO IMPACT 11.5
• Use of soft start (gradual ramping up) to any operations that will emit noise and vibrations into the Sound • Adherence to best practice outlined in BS5228-2 (2009) British Standards Code of practice for noise and vibration control on construction and open sites during all construction activities • Adherence to best practice guidance in CIRIA C584 (2003) Coastal and Marine Environmental Site Guide during all construction activities

11.108. With best practice mitigation in place, the impact of noise and vibration on fish species can be considered to be of **negligible to minor** significant effect.

Impact 11.6 noise and vibration on shellfish species

11.109. In the case of shellfish, there is limited research on the effect of noise upon these species. Due to the absence of swim bladders, it is generally assumed that shellfish are relatively insensitive to noise. The effect of noise is expected to cause some localised avoidance behaviour at worst. Therefore the magnitude of this impact can be considered low and the sensitivity of the receptor low.

11.110. As both the magnitude of the impact and the sensitivity of the receptor are low it can be considered likely that the impact of construction noise on shellfish will be of **negligible** significance.

MITIGATION IN RELATION TO IMPACT 11.6
• Use of soft start (gradual ramping up) to any operations that will emit noise and vibrations into the Sound • Adherence to best practice outlined in BS5228-2 (2009) British Standards Code of practice for noise and vibration control on construction and open sites during all construction activities • Adherence to best practice guidance in CIRIA C584 (2003) Coastal and Marine Environmental Site Guide during all construction activities

Residual impact

11.111. If the mitigation above is implemented during construction the residual impact of noise and vibration on shellfish species is likely to be of **negligible** significance.

Impact 11.7: Increased turbidity affecting fin fish

11.112. Activities related to the construction of the tidal array, such as cable laying and device placement can result in a temporary increase in turbidity through sediment re-suspension (OSPAR, 2004). However, these effects will be short term and will only affect localised areas during construction, with suspended sediment re-settling soon after works stop in a given place. Coarser sediment fractions are likely to be re-deposited on the seabed within approximately 50m of the works (Scottish Executive, 2007). The sediment within the study area is mainly coarse grained and it is thought that fine grained sediments are rare. Therefore, the majority or re-suspended material will fall out of suspension within 50m of the works and the effect on turbidity will be localised and minimal.

11.113. Increases in suspended sediment concentrations and turbidity can have effects on foraging, social and predator/prey interactions (Scottish Executive, 2007) of many species. A summary of risks to fish and their habitat associated with increased concentrations of suspended sediments are given in Table 11.11.

Table 11.11 Risks to fish and their habitat by sediment concentration. Source: Department of Fisheries and Oceans, Canada (2000).

Sediment Increase (mg/l)	Risk to fish and their habitat
0	No risk
<25	Very low risk
25-100	Low risk
100-200	Moderate risk
200-400	High risk
>400	Unacceptable risk

11.114. Herring and sprat have “medium sensitivity” to increases in suspended sediment concentrations (Scottish Executive, 2007). The SEA states that all other fish and shellfish species (relevant to this chapter), for which sensitivity is known, have “low” or “no sensitivity” to this impact.

11.115. *Chapter 7: Physical Environment and Coastal Processes* provides an assessment of the impact of increases in suspended sediment (Impact 7.2). Reference is made in that section to the fact that, due to the strong currents within the study area, any increase in suspended sediments and therefore turbidity will be small and short lived. Consequently the magnitude of this impact can be considered to be low.

11.116. As is stated above the maximum sensitivity of any species likely to be within the study area is said to be medium, and therefore taking a precautionary approach it is this level of sensitivity which is used in the significance matrix. Therefore the overall impact of increased turbidity on fin fish is likely to have a **minor** significant effect.

MITIGATION IN RELATION TO IMPACT 11.7
• Carry out works at or close to slack tide when any suspended sediment will re-settle more rapidly and in the vicinity of the work site

Residual impact

11.117. If the mitigation suggested above is implemented than the residual impact of increased turbidity upon fin fish is likely to be of **negligible** significant effect.

Impact 11.8: Increased turbidity effecting bivalves

11.118. Filter feeding species are considered to be most at risk from potential effects associated with increased suspended sediments and turbidity. The Scottish Marine Renewables SEA (Scottish Executive, 2007) concludes that scallops and mussels both have medium sensitivity to increases in suspended sediment concentrations. The SEA states that all other shellfish species (relevant to this chapter), for which sensitivity is known, have low or no sensitivity to this impact.

11.119. Scallops and mussels are both commercial bivalve species that were found to be present within the study area during the benthic surveys (SeaStar Survey Ltd, 2009 and Royal Haskoning, 2010). These species are filter feeding organisms, which collect algae, detritus and organic material for food. The systems for achieving this are delicate and have the potential to become blocked if a substantial increase in suspended sediment and turbidity occurs. It is therefore likely that a small change in turbidity as predicted in *Chapter 7: Physical Environment and Coastal Processes* will result in a minor detectable change in the baseline condition of these species. Taking the above into account the magnitude of this impact can be regarded as low.

11.120. Although neither of these species are considered to be of National importance (neither are a UK BAP species), they are both considered to be of local value and importance, therefore the sensitivity of must be considered to be low.

11.121. Low magnitude and low sensitivity mean that the impact of increased turbidity on bivalves is likely to be of **negligible** significant effect.

MITIGATION IN RELATION TO IMPACT 11.8
• Use cable and device installation methods that minimise sediment re-suspension

Residual impact

11.122. With the above mitigation implemented the residual impact of increased turbidity on commercially important bivalves is likely to remain of **negligible** significant effect.

Impact 11.9: Smothering marine fish and shellfish

11.123. There is no evidence to suggest that elevated suspended sediment levels would significantly impact the larval stages or eggs of species that are likely to be present within the study area such as cod, saithe, Nephrops sprat and plaice, all species that use the study area or its vicinity as spawning or nursery grounds.

11.124. There is limited information available on the effect of increased suspended sediment on crustacean species. However, the Marine Life Information Network (MarLIN) provides sensitivity assessments for the brown crab (*Cancer pagurus*), for both its larval and adult stages. A summary of the sensitivity of adult edible crab to increased suspended sediment concentration and turbidity is given in Table 11.12. Neal and Wilson (2008) suggest that the larval stages of the edible crab, as they are pelagic, are unlikely to be affected by increased sediment concentrations.

Table 11.12 Sensitivity of adult brown crab (Cancer pagurus). Source: Neal and Wilson (2008).

Physical Impact Factor	Intolerance	Recoverability	Sensitivity	Evidence / Confidence
Smothering	Low	Very high	Very low	High
Increased suspended sediment	Low	High	Low	Very low
Increased turbidity	Tolerant	Not relevant	Not sensitive	Very low

11.125. MarLIN also provides sensitivity assessments for a number of filter-feeding shellfish species. Tables 11.13 and 11.14 summarise the results of the MarLIN assessments for great scallop and common mussel (two commercially important species) occurring within the Sound of Islay (and therefore of potential local value), albeit in low abundances. The assessments indicate that scallops are tolerant of smothering and that mussels show intermediate tolerance, with both species having high recoverability where effects have occurred.

Table 11.13 Sensitivity of adult great scallop. Source: Marshall and Wilson (2008).

Physical Impact Factor	Intolerance	Recoverability	Sensitivity	Evidence / Confidence
Smothering	Low	High	Low	Low
Increased suspended sediment	Low	High	Low	Moderate
Increased turbidity	Tolerant	Not relevant	Not Sensitive	Not relevant

11.126. Smothering associated with the deposition of sediments disturbed by installation of the turbines and associated cables is expected to be a temporary impact, as excess material deposited will be re-suspended and distributed by natural hydrodynamic processes (Scottish Executive, 2007).

11.127. On this basis, and taking account that pile driving is not part of construction methodology, it has not been considered necessary to undertake a modelling exercise to predict the levels of sediment that could be put into suspension.

Table 11.14 Sensitivity of adult common mussel. Source: Tyler-Walters (2008).

Physical Impact Factor	Intolerance	Recoverability	Sensitivity	Evidence / Confidence
Smothering	Intermediate	High	Low	Low
Increased suspended sediment	Low	Intermediate	Not sensitive	High
Increased turbidity	Tolerant	Not relevant	Not sensitive	Not relevant

11.128. While increased sediment concentrations could trigger some short-term avoidance behaviour in adult crabs and lobsters, both the magnitude of this impact (smothering) and sensitivity of the receptor (marine fish and shellfish) can be considered to be low. Therefore by using the significance matrix (Table 11.3) it is predicted that the impact of smothering on marine fish and shellfish species is likely to be of **negligible** significant effect.

MITIGATION IN RELATION TO IMPACT 11.9

- Use cable and device installation methods that minimise sediment re-suspension.

Residual impact:

11.129. With the above mitigation implemented the residual impact of smothering of marine fish or shellfish is likely to remain of **negligible** significant effect.

Impact 11.10: Release of sediment bound contaminants

11.130. Disturbance of contaminated sediments during device and cable installation may cause potentially detrimental impacts on species that are sensitive to contamination. However, there is no indication that seabed sediments present across the array site or cable route have been contaminated. The impacts of sediment quality have been discussed in further detail in *Chapter 22: Water and Sediment Quality* and *Chapter 8: Benthic Ecology*.

11.131. As it is not thought that there is any significant degree of contamination of sediments within the study area, both the magnitude and sensitivity of this impact are considered **low** and therefore by using these criteria in the significance matrix, the impact of sediment bound contaminants being released is likely to be of **negligible** significant effect.

MITIGATION IN RELATION TO IMPACT 11.10

- Use cable and device installation methods that minimise sediment re-suspension

Residual impact:

11.132. The residual impact of sediment bound contaminants being released is likely to remain of **negligible** significant effect.

11.6.3 Potential Impacts during Operational Phase

Impact 11.11 Increase of available habitat

11.133. The device foundations and any associated scour protection are likely to be colonised by numerous marine organisms. On the basis of evidence from offshore wind farms, the array structure may also act as a refuge for some species (Linley *et al*., 2007). The establishment of epifauna and flora on the new substrates may also increase food availability (OSPAR, 2004). However, this may not necessarily result in increased productivity, but a spatial shift in the fish resource (i.e. the array could act as a fish aggregation device) (CEFAS, 2004).

11.134. Surveys conducted in 2004 on the operational Horns Rev offshore wind farm found that the wind farm had become a nursery ground for various species, particularly in the case of edible crab, with juveniles found in large numbers on the monopiles and larger individuals observed in scour protection crevices (Leonhard and Pedersen, 2005). Horns Rev also appeared to be an important nursery ground of masked crab and possibly for sea urchin. In addition, egg masses of species such as whelk and sea slug were commonly found (Leonhard and Pedersen, 2005). Monitoring also revealed marked increases in fish fauna diversity, with shoals of cod, bib and whiting observed around the turbine bases (Leonhard and Pedersen, 2004).

11.135. Post-construction monitoring at other offshore wind farm sites around the UK have not identified any short term negative environmental impacts on fish and shellfish populations caused by wind farm construction (npower renewables, 2007; BOWind, 2008).

11.136. Benthic post-installation monitoring around the SeaGen tidal turbine in Strangford Lough has concluded to date that installation has not resulted in any significant changes to the benthic environment, and all observed changes are natural and seasonal (SeaGen project presentation, undated).

11.137. In view of the above, the magnitude of the impact is likely to be low, as was found at Horns Rev or negligible as was found in the other studies mentioned above. It is difficult to judge the sensitivity of the fauna in the study area to an increase in available habitat but, it is considered likely that the environment will respond in a minimal way and therefore the sensitivity of the receptor is low.

11.138. Therefore it is likely that increased habitat availability during the operational phase of the Development will lead to a effect of **negligible** significance.

MITIGATION IN RELATION TO IMPACT 11.11
• No mitigation is required

Residual impact:

11.139. As no mitigation is required for this impact the residual effect will remain **negligible.**

Impact 11.12: Noise on fish and shellfish.

11.140. During the operational phase of the Development the main source of underwater noise will be rotating turbine blades and mechanically generated vibration, which will be transmitted into the sea.

11.141. Martec Limited (2004) found that acoustic outputs from operational pipelines included sound at frequencies ranging from 34 to 100 Hz, well within the sound detection frequency range of crustaceans. Pipeline sounds were detected on either side of the pipeline at a maximum distance of 200m. The maximum measured SPLs (sound pressure levels) were approximately 10dB above the ambient sound level. Using a 'catch and release' program, the study did not detect any behavioural impacts on crustaceans, indicating these species are not adversely affected by substantial increases in noise and therefore the sensitivity of shell fish can be considered to be low.

11.142. It is possible that some avoidance behaviour may be detected in some finfish species that are particularly sensitive to noise such as herring and sprat (Table 11.10). However these changes will not be major and therefore according to the Table 11.2 a medium sensitivity is likely.

11.143. An assessment of underwater noise within the study area (SAMS, 2009) concluded that high levels of background noise currently exist there. It was also concluded that it was "*unlikely that the turbine devices would represent a significant source of sound pollution within the area*". A summary of this report can be found in *Chapter 9: Marine Mammals*. The magnitude of this impact can therefore be considered to be low.

11.144. With a low impact magnitude and medium sensitivity (using the "worst case scenario") of the receptor the overall operational impact of noise on fish and shellfish is likely to be of **minor** significant effect.

MITIGATION IN RELATION TO IMPACT 11.12
For maintenance activities the following best practice should be adhered to: • Use of soft start (gradual ramping up) to any operations that will omit noise and vibrations into the Sound • Adherence to best practice outlined in BS5228-2 (2009) British Standards Code of practice for noise and vibration control on construction and open sites during all construction activities • Adherence to best practice guidance in CIRIA C584 (2003) Coastal and Marine Environmental Site Guide during all construction activities

Residual impact:

11.145. It is likely that if the mitigation suggested is implemented the residual magnitude of the impact will be negligible, therefore reducing the significance of the effect to **negligible**.

Impact 11.13: Electromagnetic fields on Fish and shellfish species

11.146. Elasmobranchs are a group of fish that contain sharks skates and rays, and are particularly sensitive to electromagnetic fields (Gill *et al*.,2008). Impacts of EMF on elasmobranchs are discussed in detail in *Chapter 13: Elasmobranches*.

11.147. A COWRIE funded report (Gill *et al*., 2008) concluded that, of the non elasmobranch species observed that could detect EMF, it was not possible to ascertain if the effects are adverse or

beneficial. I was found that general patterns in the response of any species to EMF were difficult to predict and were specific to the individual specimen and not to the species or group of species. The cable armouring, designed to protect the underwater cables (both inter array and export cable) as part of the project design, will dampen effects of EMF.

11.148. Therefore even taking a precautionary approach it is likely that the magnitude and sensitivity of the important species to this impact is low and that the overall impact of EMF on fish and shellfish species is of **negligible** significant effect.

MITIGATION IN RELATION TO IMPACT 11.13
• No mitigation is required

Residual impact:

11.149. As no mitigation is required, the residual impact of EMF on fish and shell fish will remain of **negligible significant effect**.

Impact 11.14: Physical barriers to movement

11.150. There is a potential for the Development to form a barrier to usual migration and transit patterns of marine finfish, either because of collision risk, aversive reactions to underwater noise, or perceptions of devices and associated infrastructure. This is particularly relevant in 'constrained' areas (such as the mouths of sea lochs or in this case a narrow Sound).

11.151. Any barrier effect is most likely to be felt by mobile fish species which frequently transit through the study area. The Sound of Islay is not known to support any particular fish transit or migratory movements (relevant to this chapter), whereby fish are known to specifically use this stretch of water.

11.152. All ten turbines will be located in water that is deeper then 48m thus leaving a minimum of 14.5m of the water column above the device for movement of fish. The turbines will be positioned in 4 rows either 2 or 3 wide (Figure 1.1). Table 11.15 gives the width in meters that each row could potentially occupy as physical barrier to movement of fish in relation to the width of the Sound at that point.

Table 11.15 Linear distance of the Sound of Islay that is occupied by each row of the turbine array

Turbine row	Number of turbines	Width of row (m) (total width between eastern and western turbine)	Width of Sound at that point (m)	% width of the Sound influenced by the development
Most northern	2	49	720	6.81
2nd most northern	2	42	825	5.09
2nd most southern	3	88	1,085	8.11
Most southern	3	120	1,055	11.37

11.153. The maximum width of the study area that will be taken up by the array is 120m which is occurs at the southern most row of turbines (Figure 1.1). This equates to the maximum percentage of the Sound occupied which is 11.37%. In this row of the array there will also be a large gap between the turbines of approximately 76m which will allow fish to pass through; however this is not included within the barrier calculations as they have been calculated based on a worst case scenario.

11.154. Due to there being no evidence that the study area is important for the movement of any particular fish or shellfish species, and that a minimum of 88.63% of the width of the Sound will be unaffected by the development, the impact of the array as a physical barrier is likely to be at most, of low magnitude.

11.155. The species likely to respond to the impact of a physical barrier imposed by the Development will not be impacted upon at a national or international level and are only considered important at a local level. Therefore the sensitivity of the receptor is considered to be low.

11.156. As this impact (a physical barrier to movement) can be considered to be of medium magnitude and the receptor (marine fish) to be of low sensitivity these criteria result in the anticipated impact being of **minor** significant effect (as a worst case scenario).

MITIGATION IN RELATION TO IMPACT 11.14
• No mitigation is required

Residual impact:

11.157. Given mitigation of this impact is unlikely to be effective, the significance of the array causing a physical barrier to movement of fish species through the sound is likely to remain of **minor** significant effect.

Impact 11.15: Collision risk

11.158. Collision risk with rotating turbines is considered to be a key potential effect during device operation (Scottish Executive, 2007). A collision in the context is understood to be an interaction between a marine vertebrate and a marine renewable energy device that may result in a physical injury (however slight) to the organism. A collision may therefore involve actual physical contact between the organism and device or an interaction with its pressure field.

11.159. Of the important species identified it is the pelagic species, sprat and herring that are most likely to be involved in a collision with the tidal array as these species occupy the same level in the water column as the turbine blades. Cod may also be affected as although they are classified as a demersal species they are known to also travel through the water column.

11.160. The Scottish Executive commissioned a study which investigated collision risk between marine renewable energy devices and fish to support the Scottish Marine Renewables SEA (Wilson *et al*., 2007). The study identified the following:

- Collision risks are not well understood for any marine vertebrates;
- Man-made collision risks are more diverse and common than generally supposed;
- Underwater collision risks typically become well studied after they have become a conservation concern;
- Animals may appear to behave illogically when faced with novel situations;
- Subtleties of gear design (e.g. shape, colour, etc.) as well as environmental conditions (e.g. turbidity, flow rate, etc.) can markedly change collision rates;

- Objects in the water column will naturally attract fish and their predators;
- Stationary objects in flowing water can herd fish upstream until they become exhausted limiting their behavioural options;
- The proximity and relative orientation to other objects will impact escape options and the combined collision risk while topography will impact escape options and animal approach angles;
- Collision risk will vary with age of organisms, with juveniles likely to be more at risk than adults because of reduced abilities or experience;
- The potential for animals to escape collisions with marine renewable devices will depend on their body size, social behaviour (especially schooling), foraging tactics, curiosity, habitat use, underwater agility and sensory capabilities; and
- A variety of warning devices and gear adaptations have been developed for fish in recognition of underwater collision issues.

11.161. Whilst the study presents a useful overview of the factors likely to influence collision risks posed by marine renewable energy devices, given the lack of empirical knowledge it is still not possible to quantify the risk posed by the Development.

11.162. It is generally considered that pelagic fish (in this case herring, sprat) will be the most likely to be impacted by collisions with devices as their diurnal vertical migration behaviour forces them to occupy all depths of the water column at some time during the day (Scottish Executive, 2007), though demersal species making vertical migrations (e.g. plaice and cod) could also be potentially impacted. Demersal fish spending all their time near the seabed are unlikely to be affected by the moving parts of each turbine.

11.163. The study conducted by Wilson *et al*. (2007), using herring as an example of a species that may be at risk of collision, modelled potential encounter rates between 100 horizontal axis 8m radius turbines operating off the Scottish coast and existing populations of herring. The model incorporated a number of assumptions about the vertical distribution of herring, their swimming speeds and distribution. As escape (avoidance and evasion) behaviours by the fish to this type of device are currently unknown it was also assumed that the animals were neither attracted to nor avoided the immediate area around the turbine. While these assumptions could be further refined, the intent was to derive an estimate for the number of potential physical encounters between rotors and animals. The model predicted that in a year of operation, 2% of the herring population would encounter a rotating blade. The calculated encounter rates between herring and turbines are of relatively low significance compared to losses from fisheries. Furthermore it must be stressed that encounters are not collisions. An encounter may lead to a collision but only if the animal in question does not take appropriate avoidance or evasive action. At this point in time, there is no information on the degree to which marine animals will make appropriate manoeuvres. However, many species occupying the same part of the water column as the turbines are predatory animals that are also preyed upon; therefore they are manoeuvrable and aware of their environment. The turbine is relatively slow moving compared to predators.

11.164. The Wilson *et al*. (2007) study also ran the model for harbour porpoise populations (discussed further in *Chapter 9: Marine Mammals*), which showed a higher (3.6%) encounter rate. A comparison of findings for herring and harbour porpoise indicated that the difference between the proportion of herring and the proportion of porpoises encountering the turbines in the model is attributable to the greater swimming speeds and body size of the porpoises. It is apparent that collision risk increases with increasing organism size.

11.165. The Wilson *et al*. (2007) model does not allow for laminar flow effects which may carry smaller animals (such as fish) around the rotors, thus minimising the effects of collision.

11.166. Based on the information available, it is assumed that any effect of herring, sprat or cod, fish associated with collision risk would not result in an impact magnitude greater than at a medium level. It is unlikely that effects of this impact would be felt at anything greater than a local scale and therefore the receptor can be said to be of low sensitivity to this impact.

11.167. As the magnitude of the impact is medium and the sensitivity of the receptor (marine fish) is low and by using the significance matrix in Table 11.3 it can be predicted that the impact of collision with turbines will be no more than of **minor** significant effect.

MITIGATION IN RELATION TO IMPACT 11.15
• No mitigation is required.

Residual impact:

11.168. No mitigation is required and therefore the significance of effect of the impact of collision risk of fish with the turbines is deemed to remain **minor** significant effect.

Impact 11.16: Changes in water flow

11.169. The changes in water flow resulting from extraction of tidal energy will potentially impact on habitats and species which are sensitive to changes to tidal flows and wave exposure. This impact mainly applies to shellfish species (identified in Section 11.5.3) which have low – medium sensitivity to changes in tidal flows, and to herring spawning grounds (Scottish Executive, 2007), of which there are none in the vicinity of the study area.

11.170. The total extraction of energy by the Development from the existing high energy environment will be minimal (*Chapter 7: Physical Environment and Coastal Processes*) and it is likely that any changes in flow will be extremely localised. Also, the hydrodynamic design of the tripod devices offers little resistance and creates minimal downstream turbulence. Therefore, the impact of changes in water flow will be at worst of medium magnitude to shellfish species (as they are less mobile) and of low magnitude to fish species (which are more mobile).

11.171. The effects of this impact will only be realised at a very local level and consequently the sensitivity of the receptor can be considered to be low.

11.172. Based on the above magnitude of the impact and the sensitivity of the receptor it is predicted that the impact of changes in water flow is likely to be of **minor** significance for shellfish species, and **negligible** for herring spawning grounds.

MITIGATION IN RELATION TO IMPACT 11.16
• No mitigation is required

Residual impact:

11.173. With implementation of the above mitigation the residual impact of changes in flow to fish and shellfish is likely to remain of **minor** significant effect for shellfish species and of **negligible** significant effect for herring spawning grounds.

11.6.4 Potential Impacts during Decommissioning Phase

11.174. The impacts produced during decommissioning are expected to be of the same nature and magnitude as those on the construction phase. In addition, if there has been any habitat creation on the structures there may be potential for this to be lost, reversing any beneficial impact created.

11.7 Cumulative Impacts

11.175. The principal offshore activities which could result in in-combination effects with the Sound of Islay tidal array are commercial fisheries and marine traffic, both of which create noise in the marine environment.

11.176. The Navigation Risk and Safety Assessment that has been completed for this for this Development (Appendix 19.1) recommends that an application be made by SPR to the Scottish Government to designate the Development site an area of “No Fishing” and “No Diving”. This would displace current commercial fishing which is exclusively creeling (*Chapter 15: Commercial fisheries*) from the Development site. However, there is no evidence to suggest that the level of fishing displaced from the Development site will be displaced on a scale that would have any significant cumulative impact.

11.177. Current activities that may have an overlap with the Sound of Islay project are:

- Islay offshore Windfarm
- Argyll Array Wind farm;
- Kintyre territorial Wind farm; and
- Further port development at Port Askaig
- DP Energy proposed tidal turbine of west coast of Islay.

However it is unlikely that the construction phase of any of these projects will overlap with the construction phase of the current Development.

11.178. In the high energy, dispersive environment of the Sound, any temporary effects on the release of sediments into the water column associated with the tidal array are not expected to act in combination with these existing activities to result in cumulative impacts. Each of these activities is located at considerable distance from the study area and is therefore considered to be of **negligible** significance.

11.8 Summary

11.179. Table 11.16 summarises the findings of the impact assessment of Marine fish and shellfish resources

Table 11.16 Impact assessment summary

Impact	Construction				Operation and maintenance			
	Magnitude	Sensitivity/Value/ significance	impact	Residual impact	Magnitude	Sensitivity/Value/ significance	impact	Residual impact
Habitat disturbance of mollusc species	Low	Low	Negligible	Negligible				
Habitat disturbance of crustaceans	Low	Low	Negligible	No significant effect				
Loss of spawning grounds	Negligible	Negligible	No significant effect	No significant effect				
Loss of nursery grounds	Negligible	Negligible	No significant effect	No significant effect				
Noise and vibration on fin fish species	Low	Medium	Minor	Negligible/Minor				
Noise and vibration on shellfish species	Low	Low	Negligible	Negligible				
Increased turbidity effecting bivalves	Low	Low	Minor	Negligible				
Smothering of marine fish or shellfish	Low	Low	Negligible	Negligible				
Release of sediment bound contaminants	Low	Low	Negligible	Negligible				
Increase of available habitat					Low	Low	Negligible	Negligible
Noise impacts on fish and shellfish					Low	Medium	Minor	Negligible
Electromagnetic fields on fish and shellfish					Low	Low	Negligible	Negligible
Physical barriers to movement					Medium	Low	Minor	Minor
Collision risk					Medium	Low	Minor	Minor
Changes in water flow					Medium	Low	Minor (shellfish species) & Negligible (fish species)	Minor (shellfish species) & Negligible (fish species)

11.9 Conclusions

11.180. The construction methodology aims to minimise the significance of smothering effects on marine fish and shellfish. It is anticipated that the proposed development will have at worst **minor** effects on marine fish and shellfish resources with the main impacts being noise and vibration during construction and operation, along with the risks of turbines acting as a physical barrier to the movement of fish along the Sound of Islay and those associated with potential collision. Effective mitigation is not possible and so the significance of these effects remains as **minor** (when taking the "worst case scenario").

11.10 References

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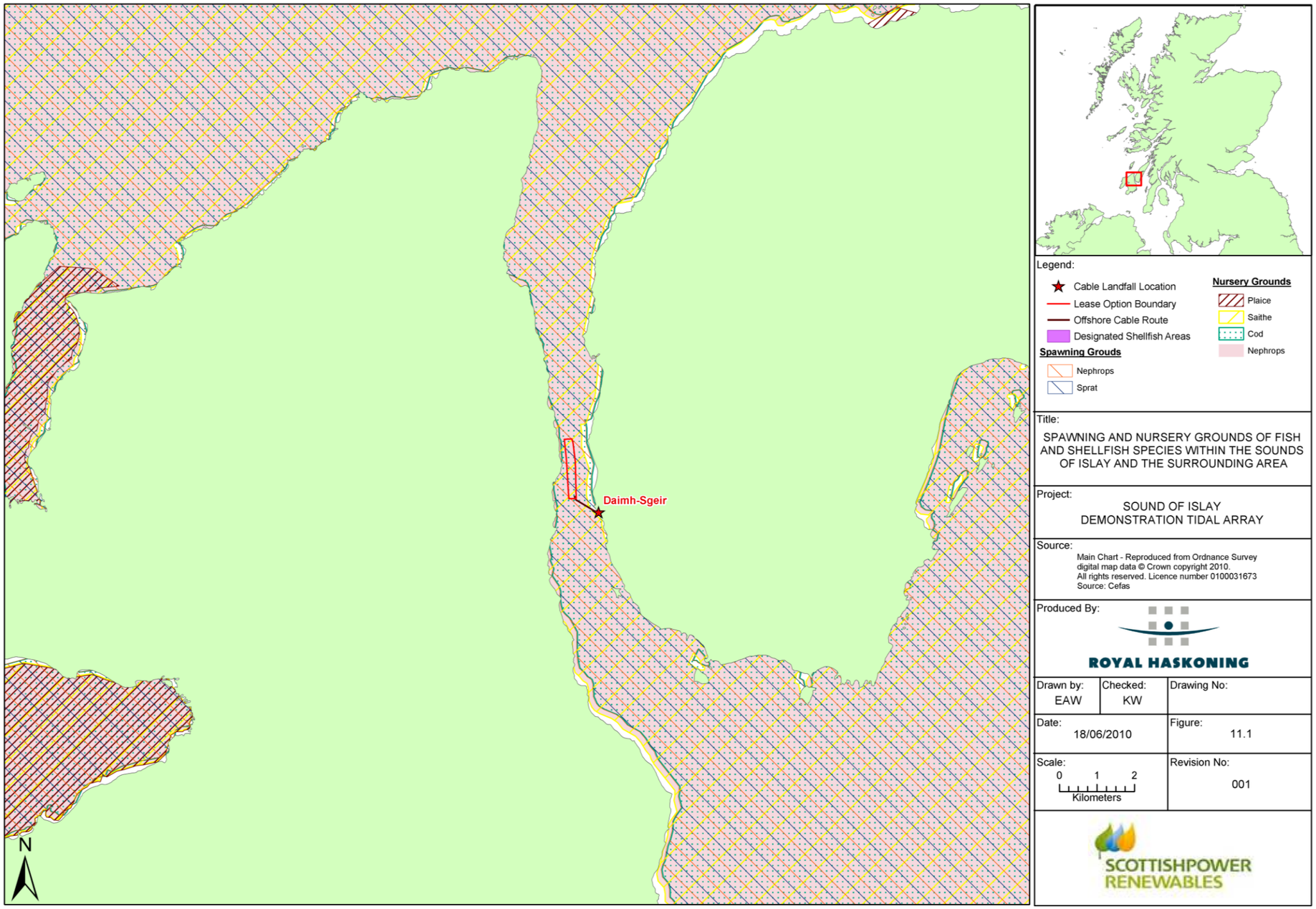

Figure 11.1 Spawning and Nursery grounds in the vicinity of the study area. Data Source: CEFAS

12.0 Anadromous Fish

12.1 Introduction

12.1 This Chapter of the Environmental Statement evaluates anadromous fish (also known as migratory fish), which are fish species that spend part of their life at sea, but migrate up rivers in order to breed. Baseline conditions with regard to migratory fish communities within the study area (as defined in Paragraph 12.12) are presented and the potential impacts relating to the construction, operational (including maintenance) and decommissioning phases of the Development are assessed. Mitigation measures are proposed where necessary and approaches to monitoring are discussed.

12.2 Several species of fish living in Scottish rivers migrate between the sea and the upper reaches of rivers during their life cycle. This chapter focuses on two of these species: the Atlantic salmon (*Salmo salar)* and sea trout (*Salmo trutta*) together being salmonids [1],which are known to occur in waters off the west coast of Scotland, and which are of commercial and recreational importance to the Argyll region. Throughout this chapter where the term salmonid is mentioned, it refers to these two species.

Summary of Anadromous Fish Chapter: There is little evidence suggesting that migratory fish use the Sound of Islay regularly or in any great numbers, and watercourses within the Sound show limited potential to support anadromous fish populations. All available information relevant to potential impacts of offshore renewables on migratory fish suggests that effects on such species are likely to be **negligible**.

12.2 Potential Effects

12.3 Migratory fish species can potentially be impacted in a number of ways by tidal array developments. These are outlined in the Scottish Marine Renewables SEA (Scottish Executive, 2007) and summarised below. Effects may result in behavioural changes or physiological impacts.

12.4 The main concern expressed by consultees during scoping and additional consultation (detailed later in this chapter) is any potential there might be for the Development to deter or delay salmonid migration of either returning adults or of smolts[2] leaving their natal river[3].

12.5 During installation, maintenance and decommissioning of the devices and cables, disturbance of species may occur as the result of the presence of installation vessels and equipment, and associated noise.

12.6 One of the most significant sources of noise during offshore wind farm installation is piling activity during construction (CEFAS, 2004). The tidal devices used within the Development will have gravity based foundations and neither pile driving nor pin piling will be required.

12.7 During operation of the Development, there may be potential for the array to act as a barrier to fish movements and migrations. Additionally, some species may also interact with the devices and there may be some risk of collision.

12.8 Other effects of primary concern are those associated with underwater noise and vibration generated by the devices and Electromagnetic Fields (EMF) generated by subsea cables.

12.3 Methodology

12.3.1. Legislation, Guidelines and Policy Framework

EIA Guidance

12.9 The European Marine Energy Centre (EMEC) has developed EIA guidance for wave and tidal energy developers seeking consent within the EMEC test site on Orkney. These guidelines give an overview of the potential impacts of marine energy development on fish resources, but do not discuss detailed EIA reporting requirements. The guidance suggests that the following potential effects on fish resources should be considered:

- Behavioural changes and altered well-being associated with noise, light and other disturbances;
- Changes in fish health resulting from release of contaminants; and
- Entrapment / collision with underwater devices.

12.10 There are no other specific EIA guidelines developed for tidal turbines. However, the guidelines developed for undertaking EIA in support of licensing of offshore wind farm developments under the Food and Environment Protection Act 1985 (FEPA) and the Coast Protection Act 1949 (CPA) by CEFAS (2004) are largely applicable.

12.11 The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) guidance states that there is potential for the construction, development and use of offshore wind farms (in this case tidal arrays) to adversely affect fish resources, and it details a number of factors an EIA should take into account when assessing impacts on those resources. This is considered further below.

12.12 The EIA should present information that describes fish resources within the "Development site" (which in this case is the lease boundary and cable route displayed in Figure 1.1) and in the context of the "wider area" (which in this case includes the Islands of both Islay and Jura and the waters that surround them). Only migratory fish species that are considered to be important to the "study area" (which for the purpose of this assessment is defined as the Sound of Islay and is displayed in Figure 15.12 *Chapter 15: Commercial Fisheries*) and the wider area are subject to an impact assessment. Important migratory fish and shellfish resources are considered to be those that are:

- Of significant importance to commercial and recreational fisheries;
- Of conservation importance;
- Sensitive to the potential effects of EMF; and / or
- Of restricted geographical distribution and are locally abundant in the area.

12.13 Migratory fish including salmonids would be considered important as a result of their conservation value.

[1] Of, belonging to, or characteristic of the family Salmonidae, which includes the salmon, trout, and whitefish.
[2] Juvenile salmonids at the stage intermediate between the parr and the grilse, when it becomes covered with silvery scales and first migrates from fresh water to the sea.
[3] When the adult fish are ready to spawn, they return to the river in which they were born (natal river).

12.14 For those resources identified as important, the following ecological aspects need to be considered:

- Spawning grounds;
- Nursery grounds;
- Migration routes; and
- Feeding grounds.

12.15 For migratory fish, such as salmonid species, it is anticipated that the key aspects to be considered for inshore waters in Scotland are potential impacts on migration routes and access to spawning grounds.

12.16 The CEFAS guidance acknowledges that where wind farm sites (in this case the Development) are in inshore waters, there may be the possibility of negative impacts on the migration routes of diadromous [4] fishes and other migratory species, particularly during construction, and that these impacts may need to be considered in EIA to address local concerns.

12.3.2. Appropriate Assessment Guidance

12.17 The principal aim of the European Habitats Directive 92/43/EEC (Habitats Directive) on the conservation of natural habitats and of wild fauna and flora is to sustain biodiversity through the conservation of natural habitats and wild flora and fauna in the territory of European Member States. These targets are principally being met through the establishment of nature conservation sites: Special Areas of Conservation (SACs). Designated SAC features include a number of fish species listed under Annex II of the Directive, namely sea lamprey; brook lamprey; river lamprey; allis shad; twaite shad; Atlantic salmon; spined loach; and, bullhead. An SAC may be designated on the basis of the presence of these species, and an objective of the designation will be to maintain or restore these species at a favourable conservation status.

12.18 The Habitats Directive requires that any plans or projects, whether inside or outside of the SAC, that are likely to have a significant effect on the conservation status of the site's features, shall be subject to Appropriate Assessment. Therefore, where a proposed tidal array is located within, or would be likely to significantly affect, a designated, proposed or candidate SAC, consenting authorities must ensure an Appropriate Assessment is carried out under the Habitats Directive. Where a proposed project does not fall within the boundaries of an SAC (as is the case for the Sound of Islay array) an Appropriate Assessment will only be required if it is considered (and fully justified) that a significant effect on the site is likely. It is the responsibility of the competent authority (Marine Scotland), with advice from the conservation agency (Scottish Natural Heritage), to determine whether a proposed project is likely to have a significant effect on an SAC. There are no SACs designated for migratory fish adjacent to, or in the wider area of, the proposed site.

12.3.3. Assessment Methods

Data Collection

12.19 The main sources of information used to establish baseline conditions were:

- Reports and information from the Argyll Fisheries Trust (Argyll Fisheries Trust, 2009);
- Technical reports and reviews produced in support of Strategic Environmental Assessments for offshore renewable energy in Scottish waters (Faber Maunsell, 2007);
- Results of a salmonid habitat survey undertaken in January 2010 (Appendix 12.1); and
- Stakeholder consultation (discussed below).

12.20 While the data sources listed above provide some information on the presence of salmon and sea trout in rivers in the wider region, there are no existing data relating to the use or importance of the study area as a migratory route for salmonids, or on the origin of any salmonids that may use the Sound.

12.21 No site-specific fish surveys have been undertaken across the Development site. The collection of such data is considered impractical in the extreme tidal conditions encountered in the Sound of Islay.

12.22 A precautionary approach has been taken for the purposes of this EIA, and it has accordingly been assumed that migratory fish species do make use of the waters in the Sound of Islay.

Consultation

12.23 Consultation with statutory bodies and key stakeholders was undertaken by ScottishPower Renewables (SPR) on the following scoping document: 'Proposed Demonstration Tidal Site, Sound of Islay, "Request for a Scoping Opinion" (ScottishPower Renewables, 2008).

12.24 Further consultation has been undertaken by SPR throughout the EIA process with the following stakeholders:

- Marine Scotland: Science (Freshwater Laboratory);
- Argyll Fisheries Trust;
- Argyll District Salmon Fisheries Board;
- Association of Rivers and Fisheries Trusts of Scotland; and
- Laggan and Sorn District Salmon Fisheries Board.

12.25 Concerns were raised by the above fisheries boards and trusts in relation to potential impacts of the proposed array on fish behaviour. In particular they queried the effects of noise, vibration and EMF[5] on salmonids. They also queried the extent to which the Development might act as a barrier to migration. The boards and trusts agreed that primary (fatalities) and secondary (injury) effects associated with the Development were not likely.

Impact Assessment

12.26 The broad methodology used for determining impact significance is outlined in *Chapter 2: Scoping and Assessment Methodology*. The significance of the impact is assessed on the basis of both the likelihood of a potential impact occurring, importance of the species, the magnitude of impact and the sensitivity of the receptor (in this case a fish resource) to that impact.

[4] Migratory between fresh and salt waters. Note: anadromous are also diadromous fish but anadromous refers to the fish migrating from the sea to fresh water to breed (e.g. salmon and sea trout).

[5] Power cables for transmitting electricity, such as those used to export electricity generated by tidal arrays, produce E and B fields when current passes through them. The B field is felt outside of the cable structure and this in turn induces a further E field (iE); studies have shown that EMF radiates beyond the cable into both seawater and the seabed.

12.27 Impact assessment is based on an assessment of the magnitude of the impact and the sensitivity of the receptor. The criteria used to determine the magnitude of likely impacts and sensitivity/importance/value are described below in Tables 12.1 and 12.2 respectively, while impacts have been assigned a level of significance of effect (from major to no significant effect) as defined in Table 12.3.

12.28 The definitions used for magnitude, and in the assignment of significance have drawn on detailed criteria for significance developed for the Scottish Marine Renewables SEA (Scottish Executive, 2007)

Table 12.1: Magnitude of impact on anadromous fish

Magnitude of Impact	Description of Magnitude
High	▪ Prolonged / widespread disturbance to anadromous fish species, with long term or permanent effects on any or all of the following: spawning grounds; nursery grounds; migration routes; and / or feeding grounds.
Medium	▪ Short-term and localised disturbance to anadromous fish species, with temporary affects on : spawning grounds; nursery grounds; migration routes; and / or feeding grounds.
Low	▪ Detectable disturbance to: spawning grounds; nursery grounds; migration routes; and / or feeding grounds.
Negligible	▪ Imperceptible or no changes to: spawning grounds; nursery grounds; migration routes; and / or feeding grounds.

12.29 Table 12.2 provides a framework for assessing the sensitivity/value/importance of the receptor.

Table 12.2: Sensitivity/value/importance of anadromous fish

Receptor Sensitivity/value/importance	Description
High	• Area designated for its ecological importance for anadromous fish species designated under Annex II of Habitats Directive or UK Biodiversity Action Plan (BAP) species within zone of influence of impact; and • Species is highly sensitive to impact under consideration;
Medium	• Area designated for its ecological importance for anadromous fish species designated under Annex II of Habitats Directive or UK Biodiversity Action Plan (BAP) species, within zone of influence of impact, and • Species has low to moderate sensitivity to impact under consideration; or • Area inhabited by anadromous fish species which are nationally rare; and • Species highly sensitive to impact considered;
Minor	• Non designated spawning grounds; nursery grounds; migration routes; and / or feeding grounds of common or widespread anadromous species are within the predicted zone of influence of impact; and

Table 12.2: Sensitivity/value/importance of anadromous fish

Receptor Sensitivity/value/importance	Description
	• Species shows low to moderate sensitivity to impact considered.
Negligible	• No spawning grounds; nursery grounds; migration routes; and / or feeding grounds are within the predicted zone of influence of the impact.

12.30 Table 12.3 combines the assessment for the sensitivity/importance/value of the receptor (Table 12.1) with the potential impact magnitude (Table 12.2) to give an overall assessment of the environmental impact significance of effect. Further detail is provided within *Chapter 2: Scoping and Assessment Methodology*.

Table 12.3 Impact Prediction Matrix.

Magnitude of Impact	Receptor Sensitivity/value/importance			
	Negligible	**Low**	**Medium**	**High**
High	No significant effect	Moderate	Major	Major
Medium	No significant effect	Minor	Moderate	Major
Low	No significant effect	Negligible	Minor	Moderate
Negligible	No significant effect	Negligible	Negligible	Minor

12.4 Existing Environment

12.4.1 Regional Fish Resource

12.31 The diverse freshwater resource of mainland Argyll and the Islands sustain a variety of fish species and habitats that are an important part of the region's biodiversity. Fish resources also offer a range of fishery opportunities that have the potential to be a significant contributor to the local economy and recreational amenity (Argyll Fisheries Trust, 2009).

12.32 There are over 100 rivers in the Argyll region supporting migratory fish populations such as Atlantic salmon and/or sea trout. On the west coast of Scotland main rivers are located from the Awe northwards to Laxford, with a few on the Isle of Skye and some to the south on the Ayrshire and Dumfriesshire coasts (Faber Maunsell, 2007).

12.33 Migratory salmonid fish have formed the basis of the net as well as the rod and line fisheries resources in Argyll and the Islands. Historically these fisheries have been an important source of food and more recently employment and tourist related income for local communities. However, fishery catches of salmon and sea trout have decreased substantially over recent times, although cause(s) for this are unclear and contentious (Webb *et al*, 2009). Data collected by Marine Scotland (formerly Fisheries Research Services) indicate that the recorded numbers of Atlantic salmon landed in Argyll have declined from a peak of 12,000 fish in the

early 1960s to less than 2,000 in recent years and this may reflect a wider decline in stocks reported for western Scotland (Webb et al, 2009). Similarly, the reported number of sea trout landed in Argyll has also declined significantly since the 1960s, although the decline in catches appeared to begin earlier in the 1970s compared to that of salmon.

12.34 Data also show that catches from rivers around the study area have historically accounted for a minimal proportion of overall catch volumes. Figures 12.1 and 12.2 provide an overview of catches, for salmon and sea trout respectively, for the Argyll area, with catches for Islay shown (Argyll Fisheries Trust, 2009).

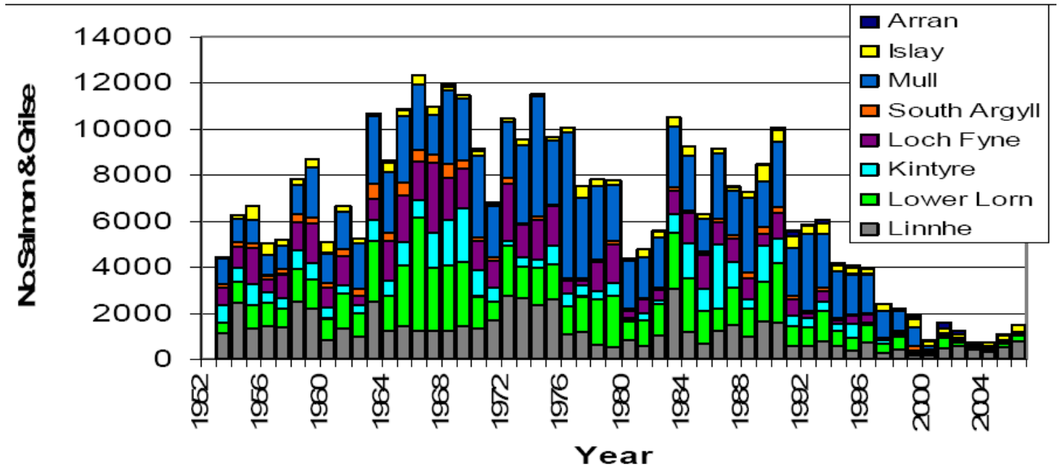

Figure 12.1 Trend in reported catches of Atlantic salmon (all methods). Source: Argyll Fisheries Trust, 2009.

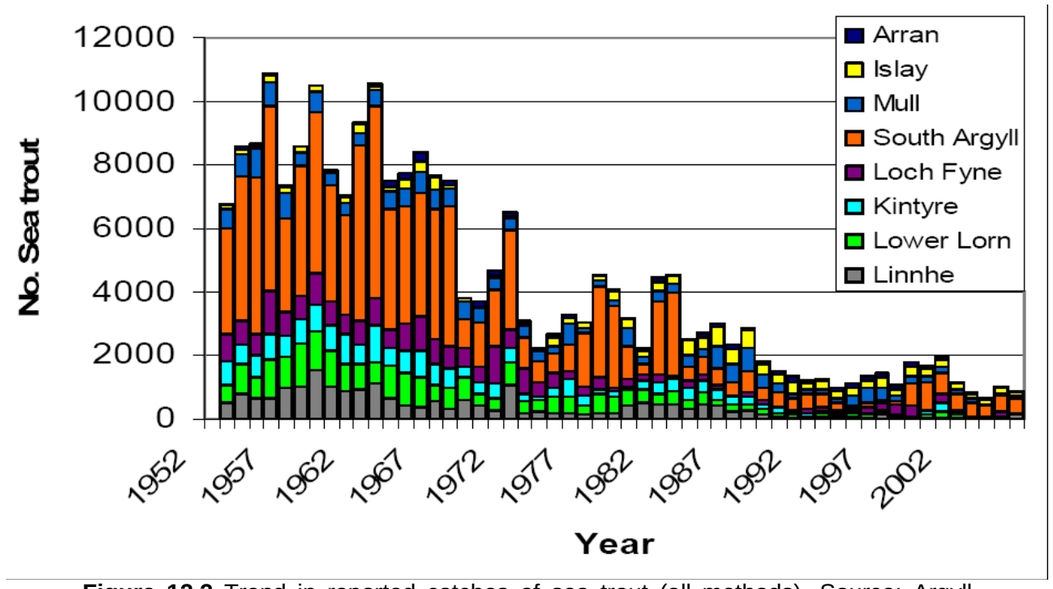

Figure 12.2 Trend in reported catches of sea trout (all methods). Source: Argyll Fisheries Trust, 2009.

12.35 There are no coastal salmonid net fisheries in the Study area. Locally fished catchments are shown in Figure 12.3. The primary catchments are the Laggan and Sorn on Islay (Laggan District) and the Lussa on Jura (Inner District). The Laggan and Sorn Rivers are the main salmon and sea trout fishing rivers proximate to the Development site, and are located on the west coast of Islay 56 and 66 km distant from the potential array, respectively. Catch data provided by Marine Scotland indicate that in 2008 156 salmon and 119 sea trout were caught by rod in the Laggan District, while in 2007 catch numbers were 74 and 147 respectively. Over the same period in the Inner District, 4 salmon and 41 sea trout were caught in 2008 and 1 salmon and 16 sea trout in 2007.

12.36 The Kintour River, on the east coast of Islay, 16km south of the Development site, is also fished although catch numbers are reported to be low (pers. comm. Malcolm Younger, Laggan and Sorn DSFB, July 2009).

12.37 No catch data are available for the smaller rivers and burns that run into the Sound of Islay. In support of this EIA, a salmonid habitat survey was carried out in January 2010 to examine the potential for the presence of salmonid species in the smaller rivers and burns adjacent to the Sound of Islay (four sites on the west coast of Jura and one on the east coast of Islay). The survey report is provided in Appendix 12.1. Salmonids have not previously been recorded in any of the five targeted rivers and the survey showed that impassable barriers (for example, waterfalls or other barriers where vertical sections are too high to allow passage) prevented the watercourses from being suitable for salmonid spawning. It is unlikely that any of the surveyed watercourses are accessible by salmonids.

12.38 There is no evidence, anecdotal or otherwise, available to suggest that salmonid fish migrate through the Sound of Islay.

12.5 Species Characteristics

12.5.1 Atlantic salmon

12.39 The Atlantic salmon is widespread throughout Scotland. The amount of time they spend in the coastal zone is limited and their distribution is dependent on the location of rivers suitable for spawning.

12.40 The adult fish may spawn in quite small headwater streams as well as in suitable areas in larger watercourses. The adult fish enter rivers from the sea at almost any time of year, but they migrate into smaller spawning streams on elevated flows following rainfall in the autumn (September – November). After spawning in October – December the adult fish return seawards over a period of up to several months.

12.41 The eggs are laid in areas of gravel where there is an adequate flow of water. After hatching, the young fish (known as fry) remain within the gravel for several weeks, eventually emerging in March to May. The fry disperse for distances of up to several hundred metres downstream. As the fish grow (known as parr at this stage) they redistribute themselves, generally downstream in direction. After 2 to 4 years the parr develop a silver colour and migrate seawards, usually in April to June. At this stage they are termed smolts. The survivors return to spawn after 1 to 3 years of feeding and growing in the sea (Scottish Executive, undated).

12.42 There is no information available which would indicate whether salmon pass through the Sound of Islay. Therefore, a precautionary approach has been taken and, for the purposes of impact assessment, it has been assumed that salmon do pass through the Sound during their migration. Therefore, although we have no direct evidence, based on migration timings, salmon might therefore be present in the Sound of Islay from April to June/July.

12.43 There is limited information pertaining to the at-sea migration of salmon. Smolts are believed to move offshore in schools to deep-sea feeding areas. While the best-known feeding locations are in the Norwegian Sea and the waters off Southwest Greenland, there are known to be many other sub-arctic feeding areas (Atlantic Salmon Trust website). The routes by which they depart from and return to natal rivers in the Argyll region is not known, but it is assumed that on their return they swim along the coast seeking olfactory cues that help identify the correct river (Lockwood, 2005).

12.44 Salmon tagging studies suggest that whilst at sea, salmon may travel throughout the water column, from near surface down to 600m depth (e.g. Sturlaugsson, undated). The complex near-shore directional patterns in the salmon movements remain poorly understood, and behaviour may be linked to a range of local environmental conditions such as tidal movements, diurnal rhythms, home river discharge, etc.

12.5.2 Sea Trout

12.45 The sea trout, the migratory form of the brown trout, has a life history very similar to that of the salmon. The main differences are that the sea trout may return to fresh water after only a few months at sea, and the adults are generally smaller than salmon (typically 25 to 60cm). The adults may also enter smaller spawning tributaries earlier than salmon, often penetrating to the upper headwaters during the summer. A higher proportion survive to spawn again than is the case for salmon (Scottish Executive, undated).

12.46 There is no information available which would indicate whether sea trout pass through the Sound of Islay. A precautionary approach has therefore been taken for the purposes of this impact assessment, and it has been assumed that sea trout do pass through the Sound during their migration.

12.47 As with salmon, little is known about the behaviour of sea trout whilst undertaking migration at sea although they are thought to generally remain in coastal areas, staying at sea for anything from a few weeks to more than two years (SNH, 2010).

12.5.3 Other Migratory Species

12.48 A number of other migratory species may occur in the waters off the west coast of Scotland, including lamprey species and eels. However, given their behavioural characteristics and ecological preferences, it is not likely that they would interact with the Development. Furthermore, these species have not been identified as being of local commercial importance during consultation. They are accordingly not considered further here, only salmonids are.

12.5.4 Fisheries Management

12.49 The fisheries of Argyll are managed by a mixture of fishery interests, ranging from angling clubs, individual and organised groups of owners in River & Loch Improvement Associations, to District Salmon Fishery Boards (DSFBs), which have statutory powers and responsibilities. Along with these local fishery interests, other parties with an interest in fisheries also contribute to the management process through representation on Argyll District Salmon Fishery Board and the Argyll Fisheries Trust.

12.50 Management of the Laggan and Sorn on Islay is overseen by the Laggan and Sorn DSFB. There is currently no DSFB overseeing management of the Lussa on Jura.

12.51 The Argyll Fisheries Trust has developed the "*Argyll & The Islands Strategic Fishery Management Plan"* (Argyll Fisheries Trust, 2009). This plan seeks to provide a framework for the strategic approach to improving management and regeneration of the local fish resource. The plan is to engage all stakeholders into the on-going process of management with an aim to conserve and restore all native fish populations and their habitats in Argyll and the Islands for the benefit of local biodiversity and the fisheries resource.

12.6 Impact Assessment

Do Nothing Scenario

12.52 It is not possible to accurately predict the future status of anadromous fish populations under a 'do nothing scenario'. Aside from the fact that we cannot be certain to what extent Atlantic salmon and sea trout use the study area, if at all, there are other considerations. For example, Scottish Atlantic salmon do not constitute a single population whose fortunes can be summarised in a single trend line. Neighbouring tributaries may vary independently due to a wide range of pressures that differ among locations and with time. Such pressures include habitat change, predation and targeted fisheries. In addition, tributaries may contain genetically distinct populations, which may respond differently to some or all of these pressures (Eatherley *et. al.*, 2005).

12.53 However, there is currently no reason to expect a dramatic change in status of migratory fish populations under a 'do nothing scenario'. However, as the reasons for the apparent decline in populations of salmonids on the west coast of Scotland is uncertain, there is clearly potential for this reduction to continue. However there is potential for the decline to cease or for the trend to be reversed and populations increase

12.3.4. Potential Impacts during Construction phase

Impact 12.1: Impacts due to noise and vibration

12.54 An assessment of underwater noise within the study area (SAMS, 2009) concluded that high levels of background noise currently exist there. It was also concluded that it was "*unlikely that the turbine devices would represent a significant source of sound pollution within the area*". A summary of this report can be found in *Chapter 9: Marine Mammals*.

12.55 The main activities related to the construction of the Development with the potential to cause an impact are cable laying and placement of the turbines, as well as associated vessel movements. These activities are discussed in more detail in *Chapter 5: Project Description*.

12.56 In terms of offshore renewable energy development, pile driving of turbine foundations is typically considered to be the main cause for concern due to the high sound pressure levels and broad band noise generated (Nedwell and Howell, 2004). Studies investigating the effects of noise and vibration on fish have accordingly focused on the effects of piling-associated noise and vibration. There will not be any requirement for piling during installation of the tidal array.

12.57 Studies relating to the effects of noise and vibration on fish have focused on hearing-sensitive species. The hearing ability of fish varies greatly across species types, though both Atlantic salmon and sea trout are considered to have insensitive hearing and are adapted to living in coastal, shallow water environments in which background noise levels are relatively high (Parvin *et al*, 2005; Nedwell *et al*, 2004). To place their hearing ability in some context, a number of marine fish species that may be encountered in the Sound of Islay, including herring, cod and mackerel, are considered to have a greater hearing sensitivity than salmon or trout (Nedwell *et al.*, 2004). Cod and herring have typically been the fish species referenced in studies examining noise effects on fish, and are considered in *Chapter 11: Marine Fish and Shellfish Resources*, as they are not anadromous fish.

12.58 According to Vella *et al.* (2001) the sensitivity of species to noise and vibration is dependent on:

- The audible threshold;
- The presence of a swim bladder and its size and physical coupling to the ear;
- The resonance frequency of the otolith system; and
- Behavioural factors, such as aggregation or shoaling behaviour.

12.59 The effects of noise on fish can be divided into the following categories (Hastings and Popper, 2005):

- Lethality and physical injury;
- Traumatic hearing damage (i.e. temporary and permanent hearing loss); and
- Behavioural responses and masking of biologically relevant sounds.

12.60 Studies and data relating to the effects of non-piling offshore wind farm construction noise on fish are reviewed by Nedwell *et al.* (2004). Available information is limited; a summary of relevant findings is presented below.

Vessel Activity

12.61 During construction, small and large vessel support will be required. Vessels which are likely to be present during the installation of the Development include a small Rigid Inflatable Boat (RIB) to transfer crew from one vessel to another, large construction support Barges (Dumb Barges) and a heavy lift dynamic positioning vessel. All these will create underwater noise in the vicinity of the Development adding to the general level of vessel and machinery noise from existing shipping. Boat noise is predominantly propeller noise, except when operating at very low speeds where hull radiated noise dominates. During the Development construction, both propeller noise from small boats or ships underway and hull radiated noise from stationary vessels conducting works may be significant sources.

12.62 A set of noise measurements were taken of major construction works at a large ferry terminal in Southampton docks during September 2003. The objective of the measurements was to monitor pile driving, but during construction down time they gave an insight into sound levels in a busy port. The study also involved the monitoring of caged brown trout (a salmonid species), observed to detect any behavioural changes associated with noise levels. The result of double blind analysis of the caged fish video recordings showed no significant behavioural reactions during the course of the survey. Thus, for brown trout (and therefore for sea trout, which is the same species), these measurements show that an increase in vessel traffic is unlikely to create significant behavioural changes (Nedwell *et al.*, 2003).

Gravity Based Support Sub-Structure Installation

12.63 The turbines within the Development site each consist of a pre-fabricated tripod foundation that is either floated out to the array location or carried on a heavy lift vessel. The structure will be filled with either sand or a fluid so that it sinks to the seafloor where it is secured using additional weights (approximately 150t per foot). The turbine nacelle is then fixed to the structure.

12.64 No known underwater noise measurements have been made of gravity support structure installation, and no behavioural observations have been made.

Armouring

12.65 A large amount of cable (approximately 5km) will be installed as part of the Development both, as interconnections between the individual devices and cables to the shore based substation. To protect the cables from damage they will be armoured.

12.66 No measurements of shallow water armoured cable laying noise have been published; however, they are not thought to be likely to be significant.

12.67 There is limited available information concerning the potential effects of noise and vibration on salmonid fish species during the installation of gravity based structures. However, on the basis of impact assessments and literature relating to offshore wind farms, it is clear that the main concern in terms of effects on fish relates to noise and vibration associated with piling, which will not be required at the Development site.

12.68 Salmonids are not considered to be particularly sensitive to the effects of noise and vibration given that they are not a hearing-sensitive fish species. In addition, no known migratory routes or spawning grounds are known to exist within the study area, suggesting that sensitivity can be categorised as minor. There is no evidence of significant salmonid presence in the Sound; however, if these are assumed to be present, construction-related noise and vibration will be temporary and short-lived. If present, salmonids will only encounter noise impacts between April and July and not during the full period of possible migratory movement. It is assumed that some detectable disturbance may occur; however, the magnitude of this will be low. On the basis of minor sensitivity and low magnitude, any impact is assessed as being of **negligible** significant effect for noise and vibration on salmonids.

MITIGATION IN RELATION TO IMPACT 12.1
• No mitigation required.

Residual Impact

12.69 As no mitigation is required, any impact is predicted to remain of **negligible** significant effect.

Impact 12.2: Impacts due to increased suspended sediment concentration, turbidity and smothering

12.70 Activities related to the construction of the Development, such as cable laying, may result in a temporary increase in turbidity through sediment re-suspension (OSPAR, 2004). However, these effects will be short-term and affect localised areas during construction with suspended sediment re-settling soon after works stop in a given place. Coarser sediment fractions (which are the dominant fractions in the area of the proposed array) are likely to be re-deposited on the seabed within about 50m of the works (Scottish Executive, 2007).

12.71 Increases in suspended sediment and turbidity are unlikely to be significant across the Development site (*Chapter 7: Physical Environment and Coastal Processes*). Given the coarse nature of the seabed substrate and the high energy tidal conditions, it is expected that little material will be put into suspension during construction works, and what does enter suspension will be rapidly dispersed.

12.72 Increases in suspended sediment concentrations and turbidity can have effects on foraging, social and predator/prey interactions (Faber Maunsell, 2007). However, sensitivity assessments presented in the Scottish Marine Renewables SEA indicate that salmonids are not considered to be sensitive to the impacts of increased suspended sediment concentrations or smothering (Scottish Executive, 2007).

12.73 There are no known migratory routes or spawning grounds which could potentially be affected by the limited potential for disturbed sediment. In addition, salmonids are not thought to be particularly sensitive to increased sediment, suggesting a minor or negligible sensitivity to this impact. The localised nature of any potential sediment suspension suggests that the magnitude of impact from suspended sediment will be low or negligible. Minor or low sensitivity combined with low or negligible magnitude leads to an assessment of **negligible** significance or **no significant** effect.

MITIGATION IN RELATION TO IMPACT 12.2
• No mitigation required; however, contractors will adhere to good construction practice guidance (e.g. CIRIA guidance, SEPA Pollution Prevention Guidelines).

Residual Impact

12.74 As no mitigation is required, and in light of the seabed conditions in the study area (i.e. coarse sediments, fast currents), the significance of effect is expected to remain **no significant** effect in relation to changes in suspended sediments.

Impact 12.3: Impacts due to the release of sediment bound contaminants

12.75 Disturbance of contaminated sediments during device and cable installation could cause potentially detrimental impacts on species that are sensitive to contamination. However, there is no reason to expect seabed sediments present across the Development site or cable route to be contaminated. The coarse nature of the sediment present, lack of significant historic or ongoing industrial activity, absence of fine sediments which could contain such contaminants and the highly dispersive nature of the site all contribute to this conclusion.

12.76 There is no evidence to suggest that sediments within the study area are contaminated and consequentially magnitude of impact from this source is considered to be negligible. Sensitivity is considered to be minor or negligible as a result of the limited presence of salmonid species in the Sound and the absence of evidence of effects on migratory or spawning routes. Consequently **no significant** effect or **negligible** significance is predicted. The impacts of sediment quality are discussed in further detail in *Chapter 21: Water and Sediment Quality*.

MITIGATION IN RELATION TO IMPACT 12.3
• No mitigation required; however, contractors will adhere to good construction practice guidance (e.g. CIRIA guidance, SEPA Pollution Prevention Guidelines).

Residual Impact

12.77 As no mitigation is required, **no significant** effect or **negligible** significance is predicted to remain the case.

12.6 2. Potential impacts during Operation phase

Impact 12.4 Impacts due to noise and vibration

12.78 During the operational phase of the Development the main source of underwater noise will be from the rotation of the turbine rotors and vibration mechanically generated from the turbines, which will be transmitted into the sea.

12.79 No existing studies have considered the noise and vibration effects of an operational tidal array on fish species and the most relevant data comes from assessments of the noise effects of offshore wind farm turbines. Table 12.4 summarises existing information relating to the effects of operational noise (from offshore wind farm turbines and other marine renewable devices) on fish.

Table 12.4: Information regarding operational noise effects on fish.

Location / Project	Species Present / Considered	Research Approach	Key Findings	Any significant effect on salmonids?
Scottish Marine Renewables SEA, Chapter 17 (Faber Maunsell and Metoc, 2007)	Atlantic salmon	Desk-based literature review and specialist study (QinetiQ, 2007)	Assesses the potential noise impacts of operational tidal and wave arrays (based on available field noise measurements from MCT and Pelamis and assumptions regarding array layout). For assessment detail please refer to the document, but in summary, fish would need to be in close proximity to the devices over a long period of time (several hours) for a significant impact to occur.	**NEGLIGIBLE**
Effects of offshore wind farm noise on marine mammals and fish (Thomsen *et.al.*, 2006)	Atlantic salmon	Field noise measurement (of a single 1.5MW wind turbine) and desk-based literature review	The operational noise of wind turbines will 'probably' be detectable up to a distance of 1km for salmon. Within this zone, masking of communication and behavioural and/or physiological (stress) effects are possible – however, they should be restricted to very close range. Based on present knowledge, it is 'highly unlikely' that sound levels during wind turbine operation will cause physical damage to fish fauna.	**NEGLIGIBLE** (tertiary only)
Gwynt y Mor Offshore Wind Farm Environmental Statement (npower Renewables, 2005)	Salmonids and eels	Desk-based literature review and modelling	Effects of turbine operational noise on fish were considered. The distance at which turbine noise falls below background noise levels (and therefore undetectable by fish) is predicted to be 4m for hearing specialist fish, including salmon. Levels of predicted operational noise were found to be insufficient to cause avoidance reactions (including changes in migratory routes), permanent hearing damage, or impairment of prey detection in fish species (including salmon, sea trout and eels). Evidence of fish aggregation around current operational offshore wind farms (e.g. Horns Rev, Svante, North Hoyle) indicates that structures can act as fish attraction devices.	**NEGLIGIBLE**
Beatrice Offshore Wind Farm Environmental Statement (Talisman Energy, 2005)	Atlantic salmon	Desk-based literature review and modelling	The EIA focused on those activities which may produce noises loud enough to result in an animal displaying a 'strong avoidance reaction' or cause a temporary change in hearing ability. Noise above 90 dB taken as threshold. Potential effects of turbine operation are considered based on published data on source noise levels from operating wind farms (reviewed by Nedwell & Howell, 2004). The ES states that 'If the underwater noise from the operating Wind Turbine Generators is of a low frequency range, it would essentially not be detectable by bottlenose dolphin, harbour porpoise, common seal or salmon.'	**NO SIGNIFICANT EFFECT**

12.80 There is no evidence to suggest that operational noise associated with individual tidal turbines would cause any long-term effect on salmonids.

12.81 A technical underwater noise assessment commissioned by SPR for the Sound of Islay (SAMS, 2010 – Appendix 9.4) concluded that natural sound levels within the study area are substantially higher than would be encountered in open ocean environments for equivalent weather conditions. As such, the acoustic footprint of the Development is likely to be small in the context of a 'noisy' background. If placed in areas of high acoustic intensity then their outputs will not exceed the ambient background noise levels. If placed in quieter regions then their sphere of acoustic impact will be in the order of tens to the low hundreds of meters.

12.82 Studies detailed earlier in this chapter considered the effects of noise from piling and from vessel traffic (Nedwell *et al.*, 2003) and concluded that the brown trout (and by definition sea trout, which is the same species) are not sensitive to significant noise impacts. The hearing of salmon is also poor with narrow frequency span, poor power to discriminate signals from noise, and low overall sensitivity (Hawkins and Johnstone 1978; referenced in Thomsen *et al*, 2006).

12.83 Although there is no evidence of salmonid use of the study area, they have been assumed to be present for the purposes of this assessment. In the context of the natural background noise within the Sound, the noise generated by the Development is unlikely to be detectable to salmonids and the potential magnitude of impact is considered to be low. The absence of designated areas of importance for salmonids and the low sensitivity of salmonids to noise suggest a minor or low sensitivity. Minor or low sensitivity and low magnitude leads to an assessment of potential impact significance of **negligible** significant effect.

MITIGATION IN RELATION TO IMPACT 12.4
• No mitigation required

Residual Impact

12.84 Any impact is predicted to remain of **negligible** significance.

Impact 12.5: Impacts of electromagnetic fields (EMFs)

12.85 The University of Liverpool Centre for Marine and Coastal Studies and Cranfield University (CMACS, 2003; Gill *et al.*, 2005) have undertaken studies, funded through COWRIE, to investigate electromagnetic field (EMF) emission from typical offshore subsea cables, in the context of the electric (E) and magnetic (B) fields. Studies have been largely been driven by the need to consider the effects of EMF resulting from offshore wind farm subsea cabling.

12.86 Desk-based, laboratory and field studies have been undertaken in the course of this research. However, it is still generally considered that the current state of knowledge regarding the EMF emitted by subsea power cables is too variable and inconclusive to make and informed assessment of any possible environmental impact of EMF (CMACS, 2003).

12.87 The first report of the COWRIE EMF study (Gill *et al*, 2005) made the following findings:

- There is no direct generation of an E-field outside of the cable;
- B-fields generated by the cable created 'induced' E-fields (iE) outside of the cable, irrespective of shielding;
- B-fields are present in close proximity to the cable and the sediment type in which a cable is buried has no effect on the magnitude of the B-field generated;
- The magnitude of the B-field within millimeters of the cable, referred to as its 'skin', is approximately 1.6µT, which will be superimposed on any other B-fields in the surrounding area (e.g. the Earth's geomagnetic field of 50 µT); and
- The magnitude of the B-field associated with the cable falls to background levels within 20m.

12.88 The major group of organisms that are known to detect EMF are the elasmobranchs (sharks, skates and rays), although diadromous species have also been found to respond to iE and B fields (COWRIE, 2005), as summarised in Table 12. 5. Open water species, including salmonids, are not considered to be as reliant on this sense, and are therefore considered to be significantly less sensitive than elasmobranchs to EMF (Faber Maunsell, 2007).

12.89 Encounters with a B-field may cause behavioural changes such as a change in swimming direction. However, the type of cable likely to be used at the array will reduce B-field emissions to well below the magnitude of the Earth's geomagnetic field.

12.90 Table 12. 5 summarises the findings of available research relating to migratory fish species and EMF. Reference is made to a number of offshore wind farm sites, where subsea cable specifications are likely to be similar to those associated with the Sound of Islay tidal development. A much wider body of research is available relating to elasmobranch species, but this is not considered here (see *Chapter 13: Elasmobranchs*).

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Table 12.5: Evidence of EMF effects on fish.

Location / Project	Species Present / Considered	Research Approach	Key Findings	Any significant effect on salmonids?
COWRIE research (primarily COWRIE, 2005)	Atlantic salmon Sea trout European eel Sea lamprey European river lamprey	Desk-based literature review (later mesocosm studies didn't include teleost fish)	The Collaborative Offshore Wind Research into the Environment (COWRIE) programme has sponsored a significant volume of EMF research. A particularly useful study was published in 2005, which reviewed the findings of all available Round 1 and Round 2 offshore wind farm data relating to EMF effects. In total 10 offshore wind farm Environmental Statements and 6 scoping reports were reviewed. None of the reviewed documents considered that EMF would adversely affect salmonids or eels (because the species were not present across the site / because EMF emissions were not significant – due to cable design or burial / because species were not considered sensitive to EMF). The study reports on ongoing or planned environmental monitoring at operational wind farms (North Hoyle, Robin Rigg and Lynn & Inner Dowsing). Monitoring of EMF is focused on effects on elasmobranchs and does not make specific reference to salmonids or eels. The study draws no firm conclusion regarding the effects of EMF on salmonids or eels. It acknowledges that information available on magnetosensitive species is limited, though points out that potential interaction with B fields could occur.	**NO SIGNIFICANT EFFECT**
Scottish Marine SEA (Faber Maunsell & Metoc, 2007)	Atlantic salmon Sea trout European eel	Desk-based literature review	Whilst they are at sea, salmon and trout are likely to be present in the main water column and therefore would be unlikely to come into close contact with the magnetic field of any cable. 'Atlantic salmon, eels and sea trout are believed to be sensitive to magnetic fields. However, evidence from existing cables indicates that navigation and migration in these species is unlikely to be affected by the magnetic field produced by the operation of wave and tidal devices.' 'Marine teleost fishes do not react to electric field strengths of less than 6 V/m (several orders of magnitude greater than the estimated field strength from the inter array and export cables for the proposed Development. No impacts are expected.'	**NO SIGNIFICANT EFFECT**
Burbo Offshore Wind Farm – Electromagnetic Fields and Marine Ecology (2007)	Migratory teleosts and eels	Desk-based literature review (prepared as response to FEPA licence conditions)	Reports that on the basis of available information, a negligible impact due to magnetic field effects on magnetically sensitive species such as migratory teleosts and eels was predicted in the Burbo Offshore Wind Farm EIA because of the localised and low-level magnetic field (very much smaller than the background geomagnetic field) and over-riding importance of olfaction (smell) for salmonids navigating coastal waters'. However, the environmental monitoring programme to be implemented during and post-construction will include monitoring of all potentially impacted species, should this be required.	**NO SIGNIFICANT EFFECT**
Beatrice Offshore Wind Farm Environmental Statement (Talisman Energy, 2005)	Atlantic salmon	Desk-based literature review	The ES reviews factors considered to be relevant to salmon migratory movements (e.g. water salinity and temperature, the olfactory senses of salmon, etc. as well as E and B fields). The degree to which migrating salmon rely on E and B fields compared to other olfactory and physical stimuli is not known. On the basis of a review of other UK offshore wind farm ESs, it is concluded that 'there is a general consensus that the EMF likely to be present around a wind farm development will not have a significant environmental impact'.	**NO SIGNIFICANT EFFECT**
Gwynt y Mor Offshore Wind Farm Environmental Statement (npower Renewables, 2005)	Salmonids and eels	Desk-based literature review	'The potential impacts on migratory species and other teleost fish species are considered to be of negligible to low significance. This is due to the low significance of magnetic cues in their behaviour in coastal waters and the limited spatial extent of the predicted EMF arising from the Gwynt y Mor cabling'. Note that cable burial was assumed to play a role in significantly reducing EMF. Emissions from unburied cables were not considered.	**NO SIGNIFICANT EFFECT**

12.91 On the basis of available evidence (i.e. the known EMF emissions from cables and the known responses of marine teleost fish to electric field strengths) there is no reason to expect significant impacts of EMF on migratory fish species in the study area.

12.92 The magnitude of the potential impact due to EMF is considered to be low as a result of the limited evidence for use of the study area by salmonids and the localised scale of the potential impact. The sensitivity of salmonids is considered to be minor due to the absence of areas of importance to salmonids and no evidence of effects of EMF on salmonids. Based on these criteria the impact significance due to EMF, on salmonid species, is currently considered to be of **negligible** significant effect.

MITIGATION IN RELATION TO IMPACT 12.5
• No mitigation is required.

Residual Impact

12.93 As no mitigation is required, impacts are expected to remain of **negligible** significant effect.

Impact 12.6 Impacts of barriers to movement

12.94 Any barrier effect would be most likely to be felt by mobile fish species which frequently transit through the study area. The Sound of Islay is not known to support any particular fish transit or migratory movements.

12.95 As detailed in previous sections, salmonid species are not believed to be sensitive to noise and vibration, or EMF, the two main mechanisms via which the array could be perceived as a barrier.

12.96 The tidal devices will be placed in deep water (~50>48 m) on the seabed. With a blade diameter of 23 m there will be at least 14.5 m between the tip of the blade and the surface of the water at Lowest Astronomical Tide. It is estimated that the maximum cross section of device rotors will amount to less than 1% of the estimated cross section of the Sound. This assumes a worse case scenario of devices deployed side by side across the Sound presenting the maximum theoretical cross section to the movement of water, while approximating the cross section of the Sound based on an average depth of 45m and width of 1km. It is also assumed that each rotor presents a solid circular barrier – rather than a slow moving obstacle, occupying only a fraction of its theoretical cross section at any time.

12.97 There is no evidence to indicate that salmonids use the study area as a migration route; however, it is assumed that some use of the Sound for this purpose does occur. Additionally, it is not anticipated that the array will be perceived by salmonid species as a barrier. If this assumption were to prove to be incorrect, the array will occupy only a small fraction of the potential area of the Sound, leaving the majority of the Sound available for migration.

12.98 The magnitude of impact is assessed as low to negligible based on the limited evidence of use of the Sound and limited potential scale of effect. Sensitivity is considered to be minor because of the absence of known areas of importance to salmonid species and lack of evidence of potential for barrier effects. Based upon this assessment significance of this potential effect is considered to be **negligible** to **no significant effect**.

MITIGATION IN RELATION TO IMPACT 12.6
• No mitigation required.

Residual Impact

12.99 As no mitigation is required, impacts will remain **negligible** or **no significant effect**.

Impact 12.7: Impacts of collision risk

12.100 Collision risk with rotating turbines is considered to be a key potential effect during device operation (Faber Maunsell, 2007). A collision in this context is understood to be an interaction between a marine vertebrate and a marine renewable energy device that may result in a physical injury (however slight) to the organism. A collision may therefore involve actual physical contact between the organism and device or an interaction with its pressure field.

12.101 The Scottish Executive commissioned a study which investigated collision risk between marine renewable energy devices and fish to support the Scottish Marine Renewables SEA (Wilson *et al*., 2007). The study identified the following:

- Collision risks are not well understood for any marine vertebrates;
- Underwater collision risks typically become well studied only after they have become a conservation concern;
- Animals may appear to behave illogically when faced with novel situations;
- Subtleties of gear design (shape, colour, etc.) as well as environmental conditions (turbidity, flow rate, etc.) can markedly change collision rates;
- Objects in the water column will naturally attract fish and their predators;
- The proximity and relative orientation to other objects will impact escape options and the combined collision risk while topography will impact escape options and animal approach angles;
- Collision risk will vary with age of organisms, with juveniles likely to be more at risk than adults because of reduced abilities or experience; and
- The potential for animals to escape collisions with marine renewable devices will depend on their body size, social behaviour (especially schooling), foraging tactics, curiosity, habitat use, underwater agility and sensory capabilities.

12.102 The study conducted by Wilson *et al*. (2007), using herring as an example of a species that may be at risk of collision, and simplistically modelled potential encounter rates between 100 horizontal axis 8m radius turbines operating off the Scottish coast and existing populations of herring. The model predicted that in a year of operation, 2% of the herring population could encounter a rotating blade. It is important to note that encounters are not collisions and no account was taken of the potential for fish species to actively avoid obstacles. In addition, the movement of species throughout the full water column is also assumed by Wilson's model, when in reality many species will have preferences for discrete parts of the water column.

12.103 Based on the small and limited cross section of the Sound potentially occupied by the turbine array, the slow moving nature of the turbine rotors, the ability of salmonid fish to both actively avoid predators and hunt prey, as well as limited evidence of salmonid species using the Sound as a migration route, the magnitude of the potential impact on migratory fish is considered low. No areas of sensitivity for salmonids are present and their sensitivity to collision is considered to be minor. Based on this assessment, significance of potential effects due to collision are considered **negligible.**

MITIGATION IN RELATION TO IMPACT 12.6
• No mitigation is required

Residual Impact

12.104 As no mitigation is required, impacts are expected to remain of **negligible** significant effect.

12.3.5. Potential Impacts during decommissioning phase

12.105 The impacts produced during decommissioning are expected to be, at worst, of the same nature, magnitude and significance as those during the construction phase.

12.7 Cumulative Impacts

12.106 The principal offshore activities which could result in in-combination effects with the Sound of Islay Development are commercial fisheries and marine traffic, both of which create noise in the marine environment. The natural background noise within the Sound is considerable (Appendix 9.4) and during periods of peak flow the noise generated by the devices is not predicted to rise above background levels.

12.8 Summary

12.107 Table 12.6 below summarises the findings of significance of effect of the impact assessment of anadromous fish

Table 12.6: Impact assessment summary

Impact	Construction/Decommissioning				Operation and maintenance			
	Magnitude of Impact	**Sensitivity/Value/ Importance of Receptor**	**Significance of effect**	**Residual impact**	**Magnitude of impact**	**Sensitivity/Value/ Importance of Receptor**	**Significance of effect**	**Residual impact**
Noise and vibration	Low	Minor	Negligible	Negligible	Low	Minor / Low	Negligible	Negligible
Suspended sediment	Low/Negligible	Minor/Low	Negligible / No Significant effect	Negligible / No Significant Effect				
Sediment Contamination	Negligible	Minor / Negligible	Negligible / No Significant effect	Negligible/No Significant Effect				
EMF					Low	Minor	Negligible	Negligible
Barrier					Low / Negligible	Minor	Negligible / No Significant Effect	Negligible / No Significant Effect
Collision					Low	Minor	Negligible	Negligible

12.9 Conclusions

12.108 There is no evidence to suggest that anadromous fish use or transit the waters of the Sound of Islay. Furthermore, a recent survey has shown that watercourses on Islay and Jura adjacent to the array site show very limited potential to support anadromous fish populations.

12.109 In the absence of data for the Development site, a precautionary approach to assessment has been taken, and it has been assumed that migratory fish species do make use of the Sound. However, the Sound is not considered to be a site of particular importance for anadromous fish.

12.110 Few studies have considered specifically the effects of offshore renewables installations on anadromous fish species. Available information has been reviewed and indicates that any effects on such species would be of **negligible** significant effect.

12.10 References

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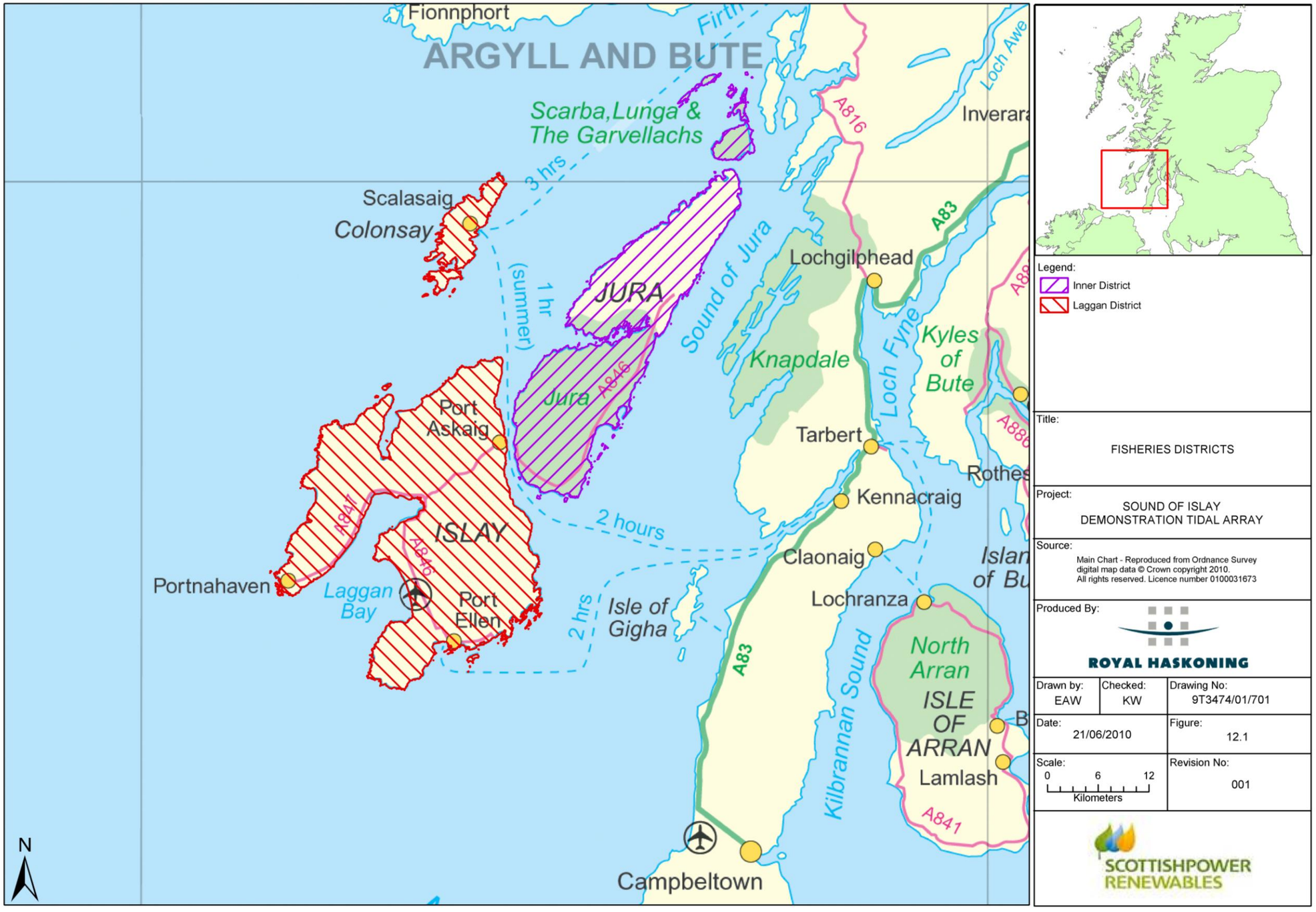

Figure 12.3 Relevant fisheries districts. Source: Argyll Fisheries Trust, 2009.

13.0 Elasmobranchs

13.1 Introduction

13.1. This section of the Environmental Statement considers the likely presence of elasmobranch species (sharks, rays and skates) within the Development. Baseline conditions with regard to elasmobranch communities are presented and the potential impacts relating to the construction, operational and decommissioning phases of the array are assessed. Mitigation measures are proposed where necessary and approaches to monitoring are discussed.

13.2. Elasmobranchs are considered separately here as they have unique characteristics, with different levels of sensitivity to the potential impacts compared to fish and other receptors. Fish resource, benthic habitats, commercial fisheries and ornithology are intrinsically linked and section should be read in conjunction with *Chapter 8: Benthic Ecology*, *Chapter 11: Marine Fish and Shellfish Resources*, *Chapter 14: Ornithology* and *Chapter 15: Commercial Fisheries* in order to gain a full overview of baseline conditions and potential impacts.

13.3. Elasmobranch species which have been recorded or are expected to be found in and around the Sound of Islay include:

- *Cetorhinus maximus* basking shark;
- *Lamna nasus* porbeagle shark;
- *Galeorhinus galeus* tope;
- *Squalus acanthias* spurdog;
- *Scyliorhinus canicula* lesser spotted dogfish;
- *Isurus oxyrinchus* shortfin mako;
- *Prionace glauca* blue shark;
- *Scyliorhinus stellaris* nurse hound;
- *Raja naevus* cuckoo ray;
- *Raja montagui* spotted ray;
- *Raja clavata* thornback ray; and
- *Dipturus batis* common skate.

Summary of Impact on Elasmobranchs:

The Sound of Islay is not believed to be an important area for elasmobranchs; however, with the surrounding waters supporting a number of elasmobranch species, there is potential for these to occur in, or travel through, the Sound of Islay. The impacts of the proposed Development on elasmobranchs are expected to be of low magnitude and unlikely to occur. Where the development may impact upon species of high importance the significance of the impact is assessed as **moderate**, but this is reduced to **minor** after mitigation. This applies to collision risk, whereas all other impacts have been assessed as being of **negligible** significance.

13.2 Potential Effects

13.4. Elasmobranch species (as well as other fish species) can potentially be impacted in a number of ways by tidal array development. These are outlined in the Scottish Marine Renewables SEA (Scottish Executive, 2007) and summarised below.

13.5. Sediment suspended, particularly during construction works and decommissioning may cause smothering of spawning habitats and egg cases.

13.6. The temporary footprint from construction vessels and permanent footprint from the arrays gravity bases and cabling (for a full description of the installation process see *Chapter 5: Project Description*) will result in the loss of seabed habitat used by most elasmobranch species for spawning and nursery areas, as well as feeding.

13.7. Changes to presence and distribution of prey species such as teleost fish (*Chapter 11: Marine Fish and Shellfish Resources*) and invertebrates (*Chapter 8: Benthic Ecology*) as a result of the Development may in turn influence the presence and distribution of elasmobranchs in the Sound of Islay.

13.8. Accidental pollution such as spillage of oils during construction, operation, maintenance and decommissioning has been considered within the *Chapter 22: Water and Sediment Quality*. Any use and discharge of chemicals during construction will be subject to controls as part of consent requirements and so it is expected that, should a spill occur, its scale and the nature of the contaminant will result in negligible impacts on elasmobranchs. In a high energy marine environment such as the Sound of Islay contaminants are expected to rapidly disperse.

13.9. Noise produced during construction, operation, maintenance and decommissioning (discussed further in *Chapter 9: Marine Mammals*) can impact upon elasmobranchs, which can both produce and hear marine noise. Although not fully understood, noise is thought to be associated with alarm calls and social behaviour in elasmobranchs. Studies have found that noise such as is generated by shipping activity can cause avoidance or attraction reactions in fish species (Thomsen *et al.,* 2006). Thomsen *et al.* (2006) did not cover elasmobranchs specifically; however, this finding may well be applicable to elasmobranchs.

13.10. Vessel movement during installation, operation, maintenance and decommissioning has an associated potential for collision with some species of elasmobranch. The greatest collision risk due to species size, limited ability to manoeuvre and feeding habits is thought to be basking shark. High current speeds added to swimming speeds produce potentially high approach velocities, with consequently reduced avoidance or evasion response times (Scottish Executive, 2007).

13.11. Electromagnetic frequency (EMF) emissions caused by electricity cables can potentially affect migration and prey detection in elasmobranchs, which have specialised electro-receptors that detect bioelectric emissions from prey, predators and competitors. This 'E-sense' is used to support navigation, foraging activity and interaction with other species/individuals. Research indicates that the E-sense is used when in close proximity to their source of interest (e.g. a prey item) and that other senses (such as hearing or smell) are used at distances of more than 30cm (CMACS, 2005). EMF has the potential to interfere with the electro-reception in some elasmobranch species, and thus affect species behaviour.

13.12. The presence of an array in the Sound of Islay, as well as associated activities to install or decommission it, could act as a barrier to possible elasmobranch movements, through a number of potential effects, either singly or in combination.

13.3 Methodology

13.3.1 Legislation, Guidelines and Policy Framework

13.13. Basking shark is included in Appendix II (strictly protected species) of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention, 1979). Short fin mako, porbeagle and blue shark are included in Annex III (protected species) of the Bern Convention.

13.14. The Bern convention was implemented in the UK by the Wildlife and Countryside Act in 1981 and basking sharks are protected under Schedule 5 of the Act which prohibits the killing, injuring or taking by any method of those wild animals listed on Schedule 5 of the Act.

13.15. The Nature Conservation (Scotland) Act 2004, Part 3 and Schedule 6 make amendments to the Wildlife and Countryside Act 1981, strengthening the legal protection for threatened species to include 'reckless' acts. The Act makes it an offence to intentionally or recklessly disturb basking sharks.

13.16. The OSPAR Convention outlines species and habitats which require further protection. Of the species expected within the Sound of Islay basking shark and common skate are included on the list of threatened or endangered species.

13.17. IUCN red lists of threatened species include the following species:

- Basking shark is 'globally vulnerable';
- Common skate is 'critically endangered'; and
- Spurdog is 'vulnerable'.

13.18. Basking shark is listed under Appendix II (not currently threatened with extinction but will become so if their trade or any products made from them, are not subjected to strong regulations) of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

13.19. The UK Biodiversity Action Plan (UKBAP) identifies a list of Species of Conservation Concern in response to the Convention on Biological Diversity, from which elasmobranch priority species which have potential to be present in the Sound of Islay include: blue shark; porbeagle shark; common skate; shortfin mako; tope; basking shark; and spurdog.

13.3.2. EIA Guidance

13.20. The European Marine Energy Centre (EMEC) has developed EIA guidance for wave and tidal energy developers seeking consent within the EMEC test site at Orkney. These guidelines give an overview of the potential impacts of marine energy development on fish, but do not discuss elasmobranchs specifically or EIA reporting requirements.

13.21. There are no other specific EIA guidelines developed for tidal turbines; however, the guidelines developed for undertaking EIA in support of licensing of offshore wind farm development under the Food and Environmental Protection Act 1985 (FEPA) and the Coast Protection Act 1949 (CPA) by CEFAS (2004) are largely applicable.

13.22. Much of the CEFAS guidance for offshore windfarms (CEFAS, 2004) is considered to be applicable to tidal arrays. Little mention is made for elasmobranchs separately; however in relation to fish in general the guidance states that there is potential for the construction, development and use of offshore wind farms (in this case tidal arrays) to adversely affect fish, and details what an EIA should take into account when assessing impacts on those resources.

13.23. In relation to elasmobranchs the CEFAS guidance states that the EIA should make special mention of elasmobranchs, which may be susceptible to the effects of EMF, and which may also be of commercial and recreational importance. Aspects of the guidance referring to fish and shellfish which are relevant to elasmobranchs state that the EIA should:

- Identify which fish species are present at the site and in the surrounding area and if there are any of commercial, recreational or conservation importance;
- Identify possible spawning, nursery and feeding grounds;
- Examine possible migration routes through the Sound of Islay;
- Identify when the relevant species spawn;
- Assess whether construction will affect the physical habitat used by egg-laying species;
- Suggest mitigation which will enable construction activities to least impact on spawning behaviour;
- Assess the relative importance of the habitat for the region as a whole.

13.3.3. Data Collection

13.24. The main sources of information used to establish baseline conditions were:

- Department for Environment, Food and Rural Affairs (Defra) landings statistics by species by ICES rectangle for the period 2003 – 2008;
- Technical reports and reviews produced in support of Strategic Environmental Assessments for offshore renewable energy and oil and gas development in UK waters;
- Marine Conservation Society basking shark sightings reports;
- Marine Life Information Network (MarLIN) and National Biodiversity Network (NBN) websites; and
- Hebridean Whale and Dolphin Trust (HWDT) (Appendix 9.2) and Sea Mammal Research Unit (SMRU Ltd) (Appendix 9.1) report on basking sharks (and marine mammals) in the Sound of Islay.

13.25. The information sources listed above provide sufficient information to describe the elasmobranch resource potentially encountered in the Sound of Islay. No site-specific fish surveys have been undertaken across the array site for this reason, and also because tidal conditions across the site do not support the deployment of suitable survey gear.

13.3.4. Consultation

13.26. A scoping opinion was sought from statutory consultees in August 2008 and the responses are detailed in *Chapter 3: Consultation*. The key points raised during this process, which apply to elasmobranchs, along with an explanation of how they were addressed, are provided below.

13.27. Concerns were raised by many respondents (including SNH, Laggan and Sorn (Islay) DSFB and SMRU) with regard to the effects of noise on elasmobranchs. In response to these concerns two studies were commissioned by ScottishPower Renewables (SPR): The Scottish Association of Marine Science (SAMS) were commissioned to measure underwater noise levels within the Sound of Islay (SAMS, 2010) and Akvaplan-niva were commissioned to investigate noise emissions of a Hammerfest Strøm HS 1000 device (Akvaplan-niva, 2010). The findings of these have been applied, where possible, to the impact assessment outlined for Impact 13.5.

13.28. It was also highlighted during the scoping process that the possible effects of Electromagnetic Fields (EMF) on elasmobranchs should be considered in detail. These effects are discussed below under Impact 13.8.

13.4 Existing Environment

13.29. Shark species expected in the area around the Sound of Islay include basking shark, porbeagle shark, tope, spurdog and lesser spotted dogfish (Scottish Executive, 2007); shortfin mako, blue shark and nurse hound may also be present around Islay (MarLIN, undated).

13.30. The main species of skate and ray on the west coast of Scotland are cuckoo ray, spotted ray, thornback ray and common skate (Scottish Executive, 2007). The thornback ray is expected to be the most often encountered ray species in west coast waters (Scottish Executive, 2007).

13.31. There are no known records of elasmobranchs within the Sound of Islay; however given the reef habitat demersal species such as the lesser spotted dogfish would be the most likely to be encountered. The characteristics of those species that are expected within the area surrounding the Sound of Islay are described below.

Basking shark (Cetorhinus maximus)

13.32. The basking shark is a widely distributed pelagic species, and is the largest fish in British waters (second largest in the world) growing up to approximately 10m in length. Basking sharks generally live in open waters but migrate towards the shore in summer, when they can be seen 'basking', or swimming slowly, at the surface with the mouth wide open. Basking sharks are viviparous, producing live pelagic young.

13.33. UK-wide basking shark sightings data are collated by the Marine Conservation Society (2008), producing annual sightings reports. Sightings distribution maps show large concentrations of shark sightings in the Inner Hebrides, where sightings have always remained high. Looking at the annual variability in sightings numbers, sightings in Scottish waters have decreased in recent years and in 2008 were down by almost a third since 2007 (from 345 to 108 – a 69% decrease in sightings). Reasons for the decrease in sightings are not explored in the Marine Conservation Society 2008 Annual Report (Marine Conservation Society, 2008), but should be considered with caution as they may be an artefact of reduced sightings effort or poor sightings conditions.

13.34. On the west coast of Scotland, sightings data gathered and collated by the Hebridean Whale and Dolphin Trust (HWDT) show basking sharks are encountered frequently in the Hebrides between May and October and are seen in highest numbers around the islands of Coll, Tiree and Mull (though this pattern of distribution may be an artefact of sightings effort). Recent tagging work has shown that they make extensive horizontal and vertical migrations to locate feeding hotspots, often associated with frontal systems (Scottish Executive, 2007).

13.35. A study by HWDT collating visual and acoustic survey data between 2003 and 2009 as well as public sightings data between 2000 and 2008 concluded that there was a low number of basking sharks sighted in the area, 56.04^{o}N 6.41^{o}W to 55.58^{o}N and 5.70^{o}W, around Islay and the Sound of Jura. Basking sharks have previously been recorded at the mouth of the Sound of Islay to the north and south but not within the Sound (Appendix 9.2). SMRU land based visual observations, carried out between April and November 2009 recorded two basking sharks in August and again in September within the Sound of Islay (Appendix 9.1).

Porbeagle (Lamna nasus)

13.36. The porbeagle is a pelagic, viviparous species of up to 3.5m in length and is widely distributed off the west coast of Scotland from the surface to approximately 145m depth. It is mainly an offshore species but does also occur closer inshore, and appears to migrate northwards in the summer. Occasional porbeagle fisheries have developed off the west coast of Scotland. It is reportedly often found around man-made structures, such as North Sea oil platforms (Scottish Executive, 2007).

Tope (Galeorhinus galeus)

13.37. The tope is a pelagic species with a widespread distribution at depths down to about 50m. They are viviparous growing up to around 1.9m in length. They tend to be solitary, migrating offshore in winter to deep water and arriving in coastal waters in September/October/November (Scottish Executive, 2007). Tope are active, strong swimmers (The Shark Trust, undated) and they are a popular fish with anglers, with hotspots from the Mull of Galloway to the Shetland Islands.

Spurdog (Squalus acanthias)

13.38. The spurdog is a small pelagic dogfish (up to 1.6m in length), widely distributed, including off the west coast of Scotland, mainly at depths between 10 and 100m. They tend to aggregate in shoals of the same size or sex. There is some evidence that they may undertake extensive migrations. They are viviparous and mature females migrate inshore to give birth to live young. ICES has estimated that the Northeast Atlantic stock is severely depleted and advised a zero TAC (Total Allowable Catch) in recent years (Scottish Executive, 2007).

Lesser spotted dogfish (Scyliorhinus canicula)

13.39. The lesser spotted dogfish is small shark, reaching up to around 75cm in length. It is commonly encountered off the west coast of Scotland, living at depths down to about 60m (Scottish Executive, 2007). It is a bottom living species with a preference for sandy, gravely or muddy bottoms, and it feeds on molluscs, crustaceans and slow-moving benthic species. Spawning takes place in shallow waters and egg purses are found close inshore where they are attached to the substrate.

Shortfin mako (Isurus oxyrinchus)

13.40. The shortfin mako is a pelagic shark found throughout the UK from surface waters to depths of around 700m, as well as venturing into close inshore waters. It is thought to be one of the fastest shark species reaching speeds of up to 80mph. The shortfin mako is viviparous and has a rapid growth rate compared to other pelagic sharks reaching up to 4m in length. The shortfin mako feeds mostly on bony fish (MarLIN, undated).

Blue shark (Prionace glauca)

13.41. The blue shark is a pelagic species, though bottom-living fish and invertebrates can be included in its diet. The shark feeds mostly on relatively small prey, including squid and teleost fish. The blue shark is often found in surface waters although it can descend to depths of around 400m. It is a migratory species, undertaking north-south migrations in the north east Atlantic, visiting western Britain and Ireland in the summer months. This shark species is viviparous with a gestation period of around 9 to 12 months, producing between 4 and 135 young per litter. They survive around 20 years and reach up to 3.8m in length (MarLIN, undated).

Nurse hound (Scyliorhinus stellaris)

13.42. The nurse hound inhabits inshore and offshore waters to a maximum depth of around 100m. It is a bottom dwelling species, usually found on rugged rocky substrates or coralline and seaweed beds. This is a small dogfish reaching up to 1.6m in length. It feeds on a variety of benthic organisms including teleost fish, crustaceans and cephalopods. The nurse hound is oviparous, producing eggs in shallow waters.

Cuckoo ray (Raja naevus)

13.43. The cuckoo ray is a benthic species inhabiting coastal waters between 20 and 250m, found throughout the west coast of Britain and feeding on a wide range of benthic organisms. Egg cases are laid on the seabed throughout the year with up to 100 eggs produced by each female (Marine Species Identification Portal, undated).

Spotted ray (Raja montagui)

13.44. The spotted ray inhabits sandy and muddy substrates between 25 and 120m depth and is found widespread throughout the coasts of Britain and Ireland. Adult spotted rays feed mostly on crabs while the juveniles feed on amphipods, isopods and shrimp (National Museums of Northern Ireland, 2009).

Thornback ray (Raja clavata)

13.45. The thornback ray, which occurs at depths between 2 and 60m, is likely to be the ray species most often encountered across the tidal array site. It is a demersal species that frequents a wide variety of grounds from mud, sand, shingle and gravel. Although mainly a non-migratory, oviparous species, the fish often moves close inshore during the winter and spring. Egg placement is thought to occur during the summer, with hatching occurring towards winter.

Common skate (Dipturus batis)

13.46. Common skate is oviparous, breeding every other year and producing between 11 and 100 eggs. Populations only tend to survive where there is no commercial fishing. The known population distribution in the UK is limited to the Isles of Scilly, western British channel, west and north Ireland and west Scotland. Findings of skate tagging of the Sound of Mull and Firth of Lorne population indicate that the species does not undertake extensive migration. Egg placement is thought to occur during the summer, on sandy or muddy flats; however, the location of important breeding grounds is poorly understood (MarLIN, undated).

13.5 Assessment Methods

13.47. The significance of the impact is assessed on the basis of both the importance/sensitivity/value of the receptor (in this case the elasmobranch resource) and the magnitude of effect should it occur. This provides a worst case scenario and does not take into consideration the likelihood of occurrence.

13.48. The level of significance will be described as either 'major', 'moderate', 'minor' or 'negligible' on the basis of detailed criteria provided by the Scottish Marine Renewables SEA (Scottish Executive, 2007) developed for fish and shellfish as well as taking into account some elements of the marine mammal criteria, where applicable. Tables 13.1 and 13.2 below have been adapted for elasmobranchs.

Table 13.1: Definitions of Magnitude

Magnitude of Impact	Description of Magnitude
High	Affect an entire population causing a decline in abundance and / or change in distribution beyond which natural recruitment would not return that population / habitat, or any population / habitat dependent upon it, to its former level within several generations of the species being affected.
Medium	Damage or disturbance to populations above those experienced under natural conditions, over one or more generation, but which does not threaten the integrity of that population or any population dependent on it. Impact on a known spawning or nursery area where an elasmobranch species that has a low to moderate sensitivity to the impact in question is within the zone of influence of that impact.
Low	Small-scale or short-term disturbance to species, with rapid recovery rates, and no long-term noticeable effects above the levels of natural variation experienced in the area. The impacts are not sufficient to be observed at the population level.

Table 13.2: Sensitivity/Importance/value of elasmobranchs.

Receptor Sensitivity/Importance/ Value	Importance value of Marine flora and fauna	Site designations
High	International/National	Species listed under National or International legislation and policies e.g. UK Biodiversity Action Plan (BAP) priority species.
Medium	Regional	Species that have been designated for their regional importance (Local BAP species). Impact on a known area inhabited by an elasmobranch species that is nationally rare or scarce which has a high to very high sensitivity to the impact in question
Low	Local	Impact on an elasmobranch species not designated under national or international legislation and that has a low to high sensitivity to the impact in question is within the zone of influence of that impact
Negligible	Lesser	Other species with little or no local importance or sensitivity to the impacts in question

13.49. Following the criteria laid out in Table 13.2 the elasmobranch species expected to be present within the Sound of Islay are either covered by national / international legislation and so will be of high value (e.g. basking shark) or are covered by no legislation and are predicted to have little or no sensitivity to the array and so negligible value (e.g. cuckoo ray).

13.50. Table 13.3 combines the definitions of magnitude with the level of conservation importance, to give a prediction of overall impact.

Table 13.3: Significance Prediction Matrix

Magnitude of Impact	Receptor Sensitivity/Importance/Value			
	Negligible	Low	Medium	High
High	Minor	Moderate	Major	Major
Medium	Negligible	Minor	Moderate	Major
Low	Negligible	Negligible	Minor	Moderate

13.51. The Scottish Marine Renewables SEA (Scottish Executive, 2007) identifies the 'sensitivity' of fish species to impacts associated with wave and tidal array developments. Table 13.4 is adapted from the SEA and lists those elasmobranch species which may be considered sensitive to tidal array development. Available data indicate that, of the potential effects caused by tidal array development, the possible effects of EMF on elasmobranch behaviour are of greatest concern. While this detailed species sensitivity is not used directly during the impact assessment it provides an important component of the appraisal.

Table 0.4: Sensitivity of certain elasmobranch species to impacts from tidal arrays. Source: Scottish Executive (2007).

Species	Smothering	Change in suspended sediment	Substratum loss	Decrease in water flow	EMF	Underwater noise
Spurdog	Not sensitive	Not relevant	Not relevant	Not relevant	Yes	Unknown
Lesser spotted dogfish	Low	Not relevant	Not relevant	Not relevant	Yes	Unknown

Table 0.4: Sensitivity of certain elasmobranch species to impacts from tidal arrays. Source: Scottish Executive (2007).						
Species	**Smothering**	**Change in suspended sediment**	**Substratum loss**	**Decrease in water flow**	**EMF**	**Underwater noise**
Basking shark	Not sensitive	Low	Not relevant	Not relevant	Yes	Unknown
Porbeagle	Not sensitive	Not relevant	Not relevant	Not relevant	Yes	Unknown
Tope	Not sensitive	Not relevant	Not relevant	Not relevant	Yes	Unknown
Thornback ray	Low	Not relevant	Not relevant	Not relevant	Yes	Low
Common skate	Low	Not relevant	Low	Not relevant	Yes	Not sensitive

13.52. It should be noted that any residual effect (the effect after the implementation of mitigation) which remains at the level of 'Moderate' or 'Major' is still regarded by the EIA Regulations as being of significant effect.

13.6 Impact Assessment

13.6.1. Do Nothing Scenario

13.53. There are currently few direct anthropogenic influences on elasmobranchs in and around the Sound of Islay. Therefore if the proposed tidal array is not deployed the existing environment is likely to remain in its current status. Natural variation in elasmobranch species is expected to be relatively high, particularly with pelagic species which are influenced by the presence of prey species and for basking sharks where planktonic species are susceptible to high variability.

13.6.2. Potential Impacts during Construction Phase

Impact 13.1 Smothering of spawning habitat

13.54. Smothering due to suspended sediments from construction activities, such as placement of foundations or cable on seabed is expected to have no direct impact on adult elasmobranchs which are expected to move away from the limited area of smothering. Egg cases may be more sensitive (MarLIN, undated). However, the Sound is not a known breeding habitat for any elasmobranch species and sensitivity is therefore considered to be low. Of the species expected in or around the Sound of Islay the ray and skate species as well as the lesser spotted dogfish and nurse hound are oviparous, and would be expected to move away from any disturbance before giving birth

13.55. Due to the relatively coarse nature of the substrates in the Sound of Islay (mainly sand and gravel) suspended sediments are likely to be limited in quantity and to be dispersed rapidly in the energetic tidal environment, suggesting a low magnitude of effect. Any smothering is expected to be temporary as excess sediment deposit may be resuspended by natural hydrodynamic processes (Scottish Executive, 2007) and dispersed. The significance of effect of any smothering on elasmobranch spawning habitat is therefore expected to be **negligible.**

MITIGATION IN RELATION TO IMPACT 13.1
• No mitigation required

Residual impact

13.56. As no mitigation is required, the residual impact of smothering of any spawning habitats during construction is likely to remain of **negligible** significant effect**.**

Impact 13.2 Loss of seabed

13.57. Seabed within the footprint of the devices once in their final position will be lost for the duration of their installation.

13.58. The footprint of ten devices is predicted to be 329.7m^2. With a 25m buffer width for cabling impact, the footprint for the inter-array cables will be approximately 43,825m^2 (assuming a cable running the length of the array, north – south with four perpendicular rows joining the turbines). The maximum export cable route, to the southern most cable landing option at Daimh-sgeir gives a footprint of approximately 24,325m^2 (with a 25m buffer). The Sound of Islay is approximately 40km^2 and therefore the area impacted by the turbine bases and cable route is small by comparison and magnitude of potential impact is considered to be low. The sensitivity of elasmobranch species to this low magnitude impact is considered to also be low and as a result any habitat loss is considered to be of **negligible** significant effect to elasmobranchs.

MITIGATION IN RELATION TO IMPACT 13.2
• No mitigation required

Residual impact

13.59. As no mitigation is required, the residual impact of seabed loss during construction will remain of **negligible** significant effect**.**

Impact 13.3 Changes to prey species

13.60. The potential for the Development to cause changes to prey species such as benthic invertebrates and bony fish is limited (see *Chapter 8: Benthic Ecology* and *Chapter 11: Fish and Shellfish Resources*). The magnitude of any potential effect is assessed as low and the potential mechanism for interaction and resulting sensitivity of elasmobranchs is negligible. The significance of any effect is considered to be **negligible**.

MITIGATION IN RELATION TO IMPACT 13.3
• No mitigation required

Residual impact

13.61. As no mitigation is required, the residual impact of changes to prey species during construction will remain of **negligible** significant effect**.**

Impact 13.4 Accidental pollution

13.62. Use, management and discharge of chemicals during construction will be subject to controls as part of consent requirements, with best practice being followed. Should a spill occur, its scale and the nature of the contaminant will have a low magnitude. In a high energy marine environment, contaminants can be expected to rapidly disperse and the pathway for potential exposure for elasmobranchs is limited both spatially and temporally.

13.63. The sensitivity of elasmobranchs to such a low magnitude impact in a highly dispersive environment is considered to be low, resulting in **negligible** significant effect to elasmobranchs.

MITIGATION IN RELATION TO IMPACT 13.4
• No mitigation required

Residual impact

13.64. As no mitigation is required, the residual impact of accidental pollution during construction will remain of **negligible** significant effect**.**

Impact 13.5 Noise

13.65. Baseline noise levels are discussed in *Chapter 9: Marine Mammals*. The impact of underwater noise on the elasmobranch species which may occur within the Sound of Islay is largely unknown; however, common skate and thornback ray are expected to be 'not sensitive' and have 'low sensitivity' respectively (Scottish Executive, 2007).

13.66. The level of noise during construction of the tidal array is expected to be relatively low in comparison to data for windfarm construction (Nedwell and Howell, 2004) as drilling or piling methods are not being used for the Development. There will be some noise generated from vessel activity and placement of the devices on the seabed

13.67. Noise studies in the Sound (SAMS, 2010; Appendix 9.4) demonstrated that normal, natural background noise levels in the Sound are high, even when anthropogenic noise, such as that generated by ferries, is excluded (see *Chapter 9: Marine Mammals*). The potential input from ferries and shipping is a considerable addition to the existing background noise levels.

13.68. The magnitude of noise impacts in the already noisy environment of the Sound is considered to be low, as is the potential sensitivity of elasmobranch species to noise. The significance of effect of noise impacts on elasmobranchs during construction is expected to be **negligible**.

MITIGATION IN RELATION TO IMPACT 13.5
• No mitigation required

Residual impact

13.69. As no mitigation is required, the residual impact of noise on elasmobranchs during construction will remain of **negligible** significant effect**.**

Impact 13.6 Collision

13.70. Basking sharks are relatively slow moving, particularly when feeding and, therefore, the potential does exist for collisions to occur with vessels. Therefore, they are considered to be the most at risk of the elasmobranch species from collision. However, in modification of this assessment, it is important to note that there are no data suggesting any history of collision with the vessels currently using the Sound, suggesting that the potential for such interaction is low.

13.71. Due to the number of vessels already using the Sound of Islay and the relatively limited duration over which vessel activity will increase as a result of the development, and the relatively low frequency of basking shark occurrence in the Sound, it is considered that the potential for a collision and the magnitude of such an impact is low. However given the conservation status of basking sharks the sensitivity of the species is high and the subsequent significance of effect of a collision is considered to be **moderate**.

MITIGATION IN RELATION TO IMPACT 13.6
• The use of vessel and / or shore based visual observers would allow teams undertaking installation works to be alerted to the presence of basking sharks in the Sound. On receiving such an alert, appropriate mitigation would be put in place, potentially including avoidance of areas where sharks are feeding and modification (e.g. slowing of vessels) or cessation of installation activity until the sharks have moved on from the installation area. Appropriate procedures would be agreed with Marine Scotland.
• SPR accepts that there is some uncertainty about some potential impacts from the Development and is committed to undertaking a post installation monitoring programme in order to determine the nature of those impacts.
• To the extent further mitigation is required over and above the first two mitigations proposed for Impact 13.6, SPR is committed to working with the regulator to identify reasonable measures to mitigate against this impact..

Residual impact

13.72. The residual impact of collision during construction could be reduced by mitigation to **minor** significance of effect**.**

13.6.3. Operational Phase

Impact 13.7 Barrier effect

13.73. The noise and physical presence of the array has been suggested as potentially causing a barrier to the movement of elasmobranchs through the Sound of Islay. However, the limited cross sectional and seabed area of the sound occupied by the array, combined with a lack of evidence of importance of the Sound of Islay as a passage way or feeding / breeding area for elasmobranchs suggest that the magnitude of such an impact should be considered to be low.

13.74. Based upon the low magnitude of impact, in combination with the low sensitivity of elasmobranchs to noise, it is proposed that the significance of effect of any barrier effect will be **negligible**.

MITIGATION IN RELATION TO IMPACT 13.7
• No mitigation required

Residual impact

13.75. As no mitigation is required, the residual impact of barrier effects during operation is likely to remain of **negligible** significant effect**.**

Impact 13.8 Impacts of electromagnetic fields

13.76. Ambient electric (E) and magnetic (B) fields detected within the marine environment are generated by either natural (e.g. Earth's magnetic field) or anthropogenic (e.g. subsea power cables) sources.

13.77. Power cables for transmitting electricity, such as those used to export electricity generated by tidal arrays, produce E and B fields when current passes through them. The B field is felt outside of the cable structure and this in turn induces a further E field (iE); studies have shown that EMF radiates beyond the cable into both seawater and the seabed.

13.78. Figure 13.1 provides a simplified overview of the fields associated with industry-standard submarine power cables, highlighting the magnetic and induced electrical fields that are of interest in terms of potential effects on elasmobranch species.

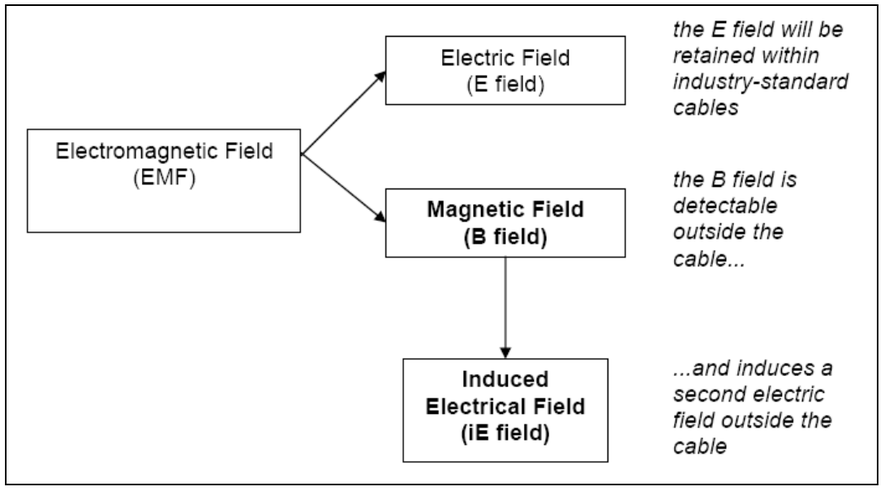

Figure 13.1: Overview of fields associated with subsea power cables, such as those that will link the tidal array to the onshore grid network. Source: Gill *et al* (2005).

13.79. The University of Liverpool Centre for Marine and Coastal Studies and Cranfield University (CMACS, 2003; Gill *et al*, 2005) have undertaken studies, funded through COWRIE, to investigate EMF emission from typical offshore subsea cables, in the context of the E and B fields. Studies have been largely driven by the need to consider the effects of EMF resulting from offshore wind farm subsea cabling.

13.80. Desk-based, laboratory and field studies have been undertaken in the course of this research. However, it is still generally considered that the current state of knowledge regarding the EMF emitted by subsea power cables is too variable and inconclusive to make and informed assessment of any possible environmental impact of EMF (CMACS, 2003).

13.81. The first report of the COWRIE EMF study made the following findings:

- There is no direct generation of an E-field outside of the cable;
- B-fields generated by the cable created 'induced' E-fields (iE) outside of the cable, irrespective of shielding;
- B-fields are present in close proximity to the cable and the sediment type in which a cable is buried has no effect on the magnitude of the B-field generated;
- The magnitude of the B-field within millimetres of the cable, referred to as its 'skin', is approximately 1.6µT, which will be superimposed on any other B-fields in the surrounding area (e.g. the Earth's geomagnetic field of 50 µT); and
- The magnitude of the B-field associated with the cable falls to background levels within 20m.

13.82. Considering the results of the modelling in respect of its significance to electro-sensitive fish, the report found the following:

- That the EMF emitted by an industry standard subsea cable will induce E-fields;
- Cables will produce an E-field of approximately 91µV/m at the seabed adjacent to a cable buried to 1m. An E-field of this magnitude is at the lower limit of emissions that are expected to attract and repel the most sensitive species (i.e. elasmobranchs);
- The iE-fields calculated from the B-field were also within the range of detection by elasmobranchs;
- Changing the permeability of conductivity of the cable may effectively reduce the magnitude of the iE-field;
- To reduce the iE-field such that it is below the level of detection of elasmobranchs will require a material of very high permeability, hence, any reduction in iE-field emission will minimize the potential for avoidance reaction but may still result in an attraction response; and
- The relationship between the amount of cabling present, producing iE-fields, and the available habitat of electro-sensitive species is an important consideration.

13.83. In addition, further research funded by COWRIE conducted by Gill *et al* (2009) in which the impact of controlled EMF (with the magnitude and characteristics associated with offshore wind farms) on electro-sensitive fish was studied, found the following:

- There is evidence that benthic elasmobranch species studied did respond to the presence of EMF emitted by a subsea cable. The responses were, however, found to be highly variable between species and during times of cable switch on and off, day and night;
- The overall spatial distribution was found to be non-random. Dogfish appeared to be more likely found within the zone of EMF emission and moving faster during times when the cable was switched on; and
- No differences between fish response by day or night or over time were found.

13.84. The array cabling will include 1.5km of subsea cable to the Daimh-Sgeir landfall location.

13.85. It is currently not known what extent the exact magnitude of the B and iE-field emissions will be from the cables used for the array, but it is considered likely to be in line with the predictions made in the COWRIE reports. This implies that the B-field will potentially be detectable to magnetically sensitive fish species and that the iE-field would be within the range that could either attract or repel electro-sensitive fish species (Gill *et al*, 2009).

13.86. Species potentially occurring in the local area for which there is evidence of response to B-fields include elasmobranch species (Gill *et al*, 2005). Encounters with a B-field may cause behavioural changes such as a change in swimming direction. The type of cable likely to be used at the array will reduce B-field emissions to well below the magnitude of the Earth's geomagnetic field.

13.87. Species potentially occurring in the local area for which there is evidence of response to iE-fields also include elasmobranch species (Gill *et al*, 2005). Electro-sensitive species will be expected to detect the iE-field emitted by a shielded cable up to a distance of 20m from the cable. The magnitude of the iE-field falls at the boundary between the likely attraction and repulsion of elasmobranch species. There is currently no evidence to show whether either attraction or repulsion will have a detrimental impact upon an elasmobranch species.

13.88. There are insufficient data available with which a judgment can be made about the potential for EMF to impact on a particular elasmobranch species. However, it is thought that effects will be influenced to some extent by their habitat preferences. For example, bottom dwellers such as skates/rays and dogfish use electroreception as their principal sense for locating food. More open water species, such as tope, may encounter EMF near the seabed but spend significant time hunting in the water column. The potential for impact is considered highest for species that depend on electric cues to detect benthic prey (CMACS, 2005).

13.89. There is no evidence to suggest any particular importance of the Sound for benthic elasmobranchs. This combined with the limited spatial potential for EMF effects suggests that the magnitude of potential impacts can be considered low. Species such as basking shark are not benthic feeders and are therefore unlikely to be affected.

13.90. There is no evidence from studies undertaken to suggest any negative impacts on magnetically and electrically sensitive species as a result of EMF and sensitivity is also considered to be low. As a result the significance of effect of impacts due to EMF is considered to be **negligible**.

MITIGATION IN RELATION TO IMPACT 13.8
• No mitigation required

Residual impact

13.91. As no mitigation is required, the residual impact of EMF during operation is likely to remain of **negligible** significant effect**.**

Impact 13.9 Collision

13.92. The significance of potential collisions between elasmobranchs and the Development is not fully known and may vary with changes in seasonal behaviour and species. Each device will have clearance of 10.5m from the seabed and therefore it could be expected that demersal and benthic elasmobranchs will pass under the device without collision.

13.93. Basking sharks are typically recorded close to the surface and will therefore pass over the turbines, the tips of which will be at a minimum depth of 14.5m.

13.94. Other pelagic species may be within the depth range of the turbine rotors; however with smaller body size and faster swimming speeds these species may be able to avoid the turbine rotors which will rotate at a maximum tip speed of 12m/s.

13.95. The number of vessels during maintenance and operation will be significantly lower than during construction and should be minor in the context of the existing vessel movements within the Sound representing no significant increase in risk of collision. There are no known instances of vessels colliding with elasmobranchs, including basking sharks.

13.96. Excluding basking sharks and benthic species from assessment of collision risk as result of their occupying surface waters away from turbine operation, the sensitivity and importance of other elasmobranch species is considered to be low. It is not clear that there will be any impacts due to collision and there is no interaction with breeding areas; however, a precautionary approach, because interactions with pelagic species is unknown, suggests a medium magnitude and subsequently **minor** significance of effect**.**

MITIGATION IN RELATION TO IMPACT 13.9
• SPR accepts that there is some uncertainty about some potential impacts from the Development and is committed to undertaking a post installation monitoring programme in order to determine the nature of those impacts. • To the extent further mitigation is required over and above the first two mitigations proposed for Impact 13.9, SPR is committed to working with the regulator to identify reasonable measures to mitigate against this impact.

Residual impact

13.97. The residual significance of collision during operation is likely to remain of **minor** significance of effect**.**

Impact 13.10 Noise

13.98. Baseline noise levels and predicted operational noise levels are discussed further in *Chapter 9: Marine Mammals*. As discussed previously, the impact of underwater noise on elasmobranchs is largely unknown, although common skate and thornback ray are expected to be 'not sensitive' and have 'low sensitivity' respectively (Scottish Executive, 2007).

13.99. Due to the shielding effect caused by the islands of Islay and Jura (Scottish executive, 2007) noise generated by the turbines will be modified and is therefore not likely to travel out of the Sound.

13.100. *Chapter 9: Marine Mammals* details the area of the Sound within which sound generated by the Development may propagate and considers this in the context of high levels of background (natural) noise. Noise from the Development may not be detectable above background.

13.101. Marine turbines by their nature can (currently) only operate in areas where high ambient sea noise levels already exist (Subacoustech, 2005; Akvaplan, 2010) due to the high energy environment. Additionally, tidal turbines typically produce noise at low frequencies (between 50 and 1000 Hz). Coincidentally, noise produced by shipping and natural noise associated with high energy coastal environments is also generally centred around the lower frequencies; therefore, the operational noise of the turbine will be masked by the background noise of shipping and the natural environment.

13.102. The significance of effect of noise on elasmobranchs is therefore expected to be **negligible** based on the anticipated low sensitivity of elasmobranch species to noise, as well as the limited area of the Sound within which low magnitude noise might be propagated and the high levels of background noise present within the Sound.

MITIGATION IN RELATION TO IMPACT 13.10
• No mitigation required

Residual impact

13.103. As no mitigation is required, the residual impact of noise during operation is likely to remain of **negligible** significant effect**.**

13.6.4. Potential Impacts during Decommissioning Phase

13.104. The potential impacts during decommissioning are expected to be of the same nature and magnitude as the construction impacts:

- Smothering of spawning habitat;
- Loss of seabed
- Changes to prey species;
- Accidental pollution;
- Noise disturbance;
- Collision.

13.105. The significance of all impacts during decommissioning has been assessed as **negligible** except collision which is predicted to be **minor / negligible**.

13.7 Cumulative Impacts

13.106. Principal offshore activities which could result in in-combination effects with the Sound of Islay tidal array include:

- Commercial fisheries;
- Marine traffic;

- A proposed array of tidal devices by DP Energy, for which exact location is currently unknown, however will be off the West coast of Islay; and
- Scottish Territorial Waters windfarms, which are proposed for 40km west of the Sound of Islay and at Kintyre, 50km south of the Sound of Islay.

13.107. The likely impacts of these projects include smothering of spawning habitat; loss of seabed; changes to prey species; accidental pollution; noise disturbance; and collision. It is expected that the cumulative significance of these impacts would be of similar significance to the Sound of Islay development i.e. collision could be of **moderate** significance (prior to mitigation) while the other impacts would be expected to be of **negligible** significance.

13.8 Summary

Impact	Construction/ Decommissioning				Operation/ Maintenance			
	Magnitude of Impact	Receptor Value/ Sensitivity/ Importance	Significance of effect	Residual impact	Magnitude of Impact	Receptor Value/ Sensitivity/ Importance	Significance of effect	Residual impact
Smothering	Low	Low	Negligible	Negligible	Low	Low	N/A	N/A
Loss of Seabed	Low	Low	Negligible	Negligible	Low	Low	N/A	N/A
Changes to prey species	Low	Low	Negligible	Negligible				
Accidental pollution	Low	Low	Negligible	Negligible	N/A	N/A	N/A	N/A
Noise	Low	Low	Negligible	Negligible	N/A	N/A	N/A	N/A
Collision	Low	High	Moderate	Minor	Medium	Low	Minor	Minor
Barrier Effect	N/A	N/A	N/A	N/A	Low	Low	Negligible	Negligible
EMF	N/A	N/A	N/A	N/A	Low	Low	Negligible	Negligible

13.9 Conclusions

13.108. It is expected that the Development is unlikely to significantly impact elasmobranchs. The magnitude of the impacts is predicted to be low, and elasmobranchs in many cases with either not directly interact with the impact, or have low sensitivity to it. Collision could have an impact on basking sharks; therefore given the high importance of this species, the significance of this effect has been assessed as **minor –** after mitigation. All other impacts have been assessed as being of **negligible** significance.

13.109. Post installation monitoring for elasmobranchs, specifically basking sharks, may be combined with data collection for marine mammal monitoring (*Chapter 9: Marine Mammals*).

13.110. Some mitigation of vessel collision risk is proposed at the construction phase (due to the large increase in vessel activity); however, it is not anticipated that any further mitigation will be required.

13.111. There is not considered to be any significant potential for collision as a result of increased vessel activity during operation, given that the numbers of vessel movements will be small in relation to existing activity.

13.112. It is anticipated that the feeding and behavioural ecology of basking sharks means that their potential for direct interaction with turbines within the Development is very low. However, there continues to be uncertainty regarding collision risk and monitoring may be appropriate.

13.113. Monitoring would allow the significance of collision risk to be continually assessed and if required collision mitigation will be implemented. Key post installation monitoring relevant to collision risk could include monitoring of impact sensors on each device and collection of basking shark activity data through shore based observers.

13.10 References

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14.0 Ornithology

14.1 Introduction

14.1. This Chapter of the Environmental Statement (ES) evaluates the potential effects on birds of the proposed Sound of Islay Tidal Demonstration Array (hereafter referred to as "the proposed Development"). This Chapter compliments the separate evaluation of potential ecological effects in *Chapter 8: Benthic Ecology* and *Chapter 16: Terrestrial and Intertidal Ecology* and has been completed by Natural Research Projects Limited (NRP).

14.2. This Chapter is supported by the following Technical Appendix provided in Volume 2 of this ES:

- Appendix 14.1 Birds Technical Report.

14.3. In addition, there is one Confidential Appendix:

- Appendix 14.2 Peregrine nest site and White-tailed eagle locations.

14.4. The Chapter describes the methods used to establish the bird interest within the Development and its hinterland, together with the process used to determine the Nature Conservation Importance (as discussed at paragraph 14.3.2.5 of this Chapter) of the bird populations/species present. The ways in which birds might be affected by the construction, operation, decommissioning of the Development are explained, the magnitude of any probable effects of the scheme considered, and the significance of any likely effects is assessed.

14.2 Potential Effects

14.5. Ornithological interests have the potential to be affected (directly or indirectly) by the following key elements of the Development:

- Construction activities;
- Operational activities, including turbine function and maintenance vessels;
- Decommissioning of the proposed Development; and
- Cumulative effects of the proposed Development when taken alongside other tidal power developments in the area whether operational or in application.

14.6. The types of potential effect of the proposed Development on birds that have been evaluated within this Chapter, include:

- The effects of direct sea-bed habitat loss due to the placement of submerged turbines;
- The effects of indirect habitat loss due to the displacement of birds as a result of Development activities, in particular disturbance from vessels and operational turbines;
- The effects of habitat modification due to the placement of marine turbines in the Development site; the Development site is defined as the sea bed lease area (including the subsea cable footprint) together with the proposed terrestrial cable route and substation site on Jura (see Figure 1.1 in *Chapter 1: Introduction* and *Chapter 5: Project Description*);
- The effects of bird collision with marine turbine rotors, and other structures such as vessel mooring lines;
- The effects of pollution and contamination, in particular from vessel discharges, anti-foulants and accidental leakage of turbine lubricants, and;
- The effects of disturbance and habitat change on land birds along the terrestrial cable route and vicinity of the proposed sub-station on Jura; and
- The beneficial contribution made by the Development towards countering climate change. Uncertainties regarding climate change predictions mean that it is not possible at present to carry out a quantitative assessment of these effects on birds. However, climate change is widely perceived to be the single most important long-term threat to the global environment, particularly to biodiversity and to birds. Thus, the continued rise in mean global temperatures is predicted to affect the size, distribution, survival and breeding productivity of many British bird species (Leech 2010).

14.7. A detailed description of the proposed Development, turbine layout and construction and operational procedures is presented in *Chapter 1: Introduction* and *Chapter 5: Project Description* of this ES.

14.3 Methodology

14.3.1 Legislation, Guidelines and Policy Framework

14.8. The following guidance and legislation was taken into account during this assessment:

- Directive 2009/147/EC on the Conservation of Wild Birds (Birds Directive);
- Directive on Conservation of Natural Habitats and of Wild Flora and Fauna 92/43/EEC (Habitats Directive);
- The Wildlife and Countryside Act 1981 (as amended) (WCA);
- The Conservation (Natural Habitats &c.) Regulations 1994 (as amended); (The Habitats Regulations);
- The Nature Conservation (Scotland) Act 2004 (as amended); and
- The Environmental Impact Assessment (Scotland) Regulations 1999 (as amended) (Scotland Executive 1999);
- UK Biodiversity Action Plan (BAP); and
- Birds of Conservation Concern (BoCC 3) 'Red list'.

14.9. At present there are no ornithological survey guidelines for tidal power developments. However, there is guidance for onshore and offshore windfarms and this was taken into account where appropriate (SNH, 2005, Camphuysen *et al.,* 2004).

14.10. The Planning Policy context is summarised in *Chapter 6: Regulatory and Policy Context* of this ES.

14.11. With regard to The Habitats Regulations, the following is of note:

a. The Development site is not statutorily designated at international or national level for ornithological interests;

b. The Jura, Scarba and Garvellachs proposed Special Protection Area (pSPA) for golden eagle covers almost all of Jura including the coast and hinterland adjacent to the Development site;

c. The North Colonsay and Western Cliffs SPA, classified for its internationally important breeding seabird assemblage (notably common guillemot and kittiwake), is over 25 km away from the Development site. This site is made up of two SSSIs, namely West Colonsay Seabird Cliffs and North Colonsay;

d. Although breeding seabirds are not a qualifying interest of the Rinns of Islay SPA, this SPA includes the Glac na Criche SSSI (22 km west of the Development site) for which breeding seabirds, including auks, are a noted feature; and

e. All SPAs within 25 km of the Development site are designated for non-seabird species, in particular wintering geese, breeding corncrake and chough. These comprise: The Rinns of Islay; Gruinart Flats; Bridgend Flats; Laggan Peninsula and Bay; and The Oa and Eilean na Muice Duibhe. All of these sites are located on Islay and are also designated SSSIs.

14.12. Given the different Regulations governing assessment of potential effects of proposed developments on Natura 2000 sites, these are considered separately in this Chapter (Section 14.11).

14.3.2 Assessment Methods

14.3.2.1 Consultation

14.13. Scoping responses were received from SNH (SNH, 2008) and RSPB (RSPB, 2008) and these are summarised in Table 14.1.

14.14. SNH highlighted that some seabirds using the Sound of Islay could originate from SPA breeding colonies, in particular common guillemots, kittiwakes and razorbills. However they point out that the closest seabird SPA, North Colonsay and Western Cliffs SPA, is over 25 km away; therefore the Sound (and thereby the Development site) is unlikely to be regularly used by foraging seabirds from this colony. The SNH response states that '*SNH does not consider that the proposed development is likely to have any effect on seabird populations within any sites designated for nationally or internationally important colonies of seabirds*.'

14.15. Despite this SNH advised that the EIA for the Development should consider potential impacts on seabirds.

14.16. RSPB identified black guillemot, common guillemot, razorbill, cormorant, shag, eider, common scoter, great northern diver and red-throated diver as species that are potentially affected at a local scale by displacement and collision.

14.17. RSPB suggested that the provision of artificial nest sites located away from the Development could help mitigate effects on black guillemots.

TABLE 14.1 SUMMARY OF CONSULTEE RESPONSES

Consultee	Response
SNH	Do not consider that the Development is likely to have any effects on seabird populations at designated SPA seabird colonies. It would be helpful for the EIA to consider potential impacts on seabirds.
RSPB	Suggest that the EIA should consider the placement of suitable nest structures for black guillemot away from the development area as a potential mitigation measure.

14.3.2.2 Desk Study

14.18. NRP identified the following key field survey requirements:

- year-round vantage point (VP) surveys to assess the use of the sea and shorelines in the vicinity of the Development by seabirds, waterfowl and waders;
- walkover surveys of terrestrial habitats within 1 km of the Development site;
- surveys of scarce breeding raptors and breeding black guillemot within 2 km of the marine habitats and adjacent shore of the Development site;
- surveys of birds of conservation concern present during the non-breeding period at the within 1 km of the Development Site; and
- surveys of seabirds using the outer Sound of Islay from CalMac passenger ferries, subject to any ferry timetable constraints.

14.3.2.3 Field Survey

14.19. Due to the novelty of the Development and the geography of the site (a narrow sea channel), a survey method had to be developed for the Development that enabled accurate mapping of the locations of birds seen on the sea from elevated VPs. The method was developed and trialled during visits in February and April 2009 (Technical Appendix 14.1). Regular VP observations were made from May 2009 to November 2009. Certain changes were made to the VP programme in August 2009 following a review of fieldwork in which it was decided that greater survey effort was required in the close vicinity of the proposed Development site. The main change was to limit observations to the four VPs overlooking the Development site and other marine areas within approximately 1 km (Figure 2. in Technical Appendix 14.1). Initially observations were also made from three additional VPs overlooking the northern part of the inner sound.

14.20. Approximately 48 hours of VP observations were conducted monthly and as far as possible this was evenly spread between VPs and across the day light hours and tidal conditions (Technical Appendix 14.1). The VP survey programme was designed to collect data on the distribution, abundance and behaviour of marine mammals as well as birds. The assessment of the marine mammal results is covered in *Chapter 9: Marine Mammals*. VP surveys consisted of repeated alternating short bouts of three activities, 15 minute snap-shot scans of marine mammals, 10-15 minute snap-scans for sea birds; timed; and timed flying bird watches (five minutes). Separate scans were undertaken for marine mammals and birds to minimise observer bias.

14.21. The snap-shot scans were designed to give instantaneous samples of the distribution, abundance and behaviour of all birds using the sea and coastlines within approximately 1 km of a VP, with the exception of flying birds passing through the sound. The precise position of birds was recorded in terms of a compass bearing and angle of declination. Full details of the VP method, sampling design, timing of surveys and system of calculating bird positions are given in the Birds Technical Report (Technical Appendix 14.1).

14.22. The timed 5-minute flying bird watches were designed to systematically quantify the numbers of birds flying through the sound. Full details of the flying-bird watch method and timing of watches are given in the Birds Technical Report. (Technical Appendix 14.1)

14.23. A pre-breeding survey of black guillemots covering the whole of the inner sound was made in early April 2009 (Figure 2 in Technical Appendix 14.1).

14.24. The shorelines and adjacent habitat along the inner sound were surveyed for scarce breeding birds, non-breeding birds of conservation concern and waders by walkover surveys (Figure 2 in Technical Appendix 14.1). These surveys also included all terrestrial habitat within 1 km of the Development site (Figure 2 in Technical Appendix 14.1). Walkover surveys were conducted in February, April, May, July, and September 2009. All incidental records of scarce species seen at other times were also recorded.

14.25. The proposed terrestrial route for the underground cable and proposed location of the substation (both close to the main road on Jura) were not decided in time for 2009 breeding season surveys. As a consequence the 2009 surveys did not fully cover all areas within 1 km of these proposed features. They did however receive incidental coverage throughout 2009 as they are highly visible from the main road. To ensure comprehensive baseline data were available these areas were fully surveyed for scarce breeding birds in the 2010 breeding season (April – June).

14.26. Data on seabird distribution and abundance from the outer parts of the Sound of Islay were also collected by conducting surveys from CalMac ferries (Figure 1 in Technical Appendix 14.1) using the European Seabirds at Sea method (Camphuysen *et al.*, 2004). Surveys from Port Askaig to West Loch Tarbert on the Scottish mainland (i.e. including the south outer sound) were made at least once a month from April to November 2009. Surveys from Port Askaig to Colonsay (i.e. including the north outer sound) were made from May to October 2009 only due to this ferry service not being operational through the winter months. Full details of timing and methods used for the ferry surveys are given in Technical Appendix 14.1.

14.27. Data on vessel activity were systematically collected during baseline surveys of birds and marine mammals to provide a source of reference for any subsequent monitoring.

14.28. The collection of baseline data is ongoing and is planned to continue until a full year of data has been collected.

14.3.2.4 Assessment of Significance

14.29. The evaluation follows the process set out in the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 1999 ("the EIA Regulations") and guidance on the implementation of the Birds and Habitats Directives (SERAD, 2000). Owing to the distance of the Development from two internationally designated sites (see Section 14.3.1) regard has been had to the Birds and Habitats Directives as transposed by the Conservation (Natural Habitats &c.) Regulations 1994 (as amended). For the purposes of assessing the effect of the proposed Development on the SPAs, the process undertaken within this assessment has ensured that the appropriate authority has sufficient information to determine whether the proposal (either alone or in combination with other plans or projects) is likely to have a significant effect on the integrity of the SPAs and, accordingly, whether or not an appropriate assessment should be undertaken (see Section 14.11).

14.30. Where there is a potential effect on a bird population that forms part of the qualifying interest of an internationally or nationally designated site (or where such designation is proposed) i.e. Ramsar sites, SPAs, SSSIs, pSPAs or a site that would meet the criteria for international or national designation, so far as possible, effects are judged against whether the Development could significantly affect the site population and its distribution. Where bird populations (the population does not meet the criteria for national/international designation) are not protected by designated sites, judgement is made against a more general expectation that the Development would not have a significant adverse effect on the overall population, range or distribution; and that it would not interfere significantly with the flight paths of migratory birds. In assessing the effects consideration is given to the relevant populations of the species. Trivial or inconsequential effects are excluded.

14.31. The assessment determines the potential effects of the Development and the likelihood of their occurrence. In judging whether a potential effect is significant or not, two factors are taken into account:

- The magnitude of the likely effect; and
- The Nature Conservation Importance (NCI) of the species involved.

14.32. The significance of potential effects is determined by integrating the assessments of Nature Conservation Importance and magnitude of effects in a reasoned way. In making judgements on significance, consideration is given to the population status and trend of the potentially affected species. If a potential effect is determined to be significant, measures to avoid, reduce or remedy the effect are suggested wherever possible.

14.3.2.5 Methods Used to Evaluate Nature Conservation Importance

14.33. The Nature Conservation Importance (NCI) of the bird species potentially affected by the proposed Development is defined according to Table 14.2.

14.34. Species listed in Local Biodiversity Action Plans (LBAPs) would be considered moderately important only if the Development supported at least 1% of the regional population.

TABLE 14.2 DETERMINING FACTORS FOR NATURE CONSERVATION IMPORTANCE

Importance	Definition
High NCI	Species listed in Annex 1 of the EU Birds Directive. Breeding species listed on Schedule 1 of the Wildlife and Countryside Act (WCA).
Moderate NCI	• Other Species listed in the UK Biodiversity Action Plan (BAP) • Other Species listed on the Birds of Conservation Concern (BOCC) 'Red' list • Regularly occurring migratory species, which are either rare or vulnerable, or warrant special consideration on account of the proximity of migration routes, or breeding, moulting, wintering or staging areas in relation to the proposed Development. • Species present in regionally important numbers (>1% regional population).
Low NCI	All other species not covered above.

14.3.2.6 Methods Used to Evaluate the Magnitude of Effects

14.35. Effect is defined as a change in the assemblage of bird species present as a result of the Development. Change can occur either during or beyond the life of the Development. Where the response of a population has varying degrees of likelihood, the probability of these differing outcomes is considered. Note that effects can be adverse, neutral or favourable.

14.36. In determining the magnitude of effects, the behavioural sensitivity and ability to recover from temporary adverse conditions is considered in respect of each potentially affected population. Behavioural sensitivity is determined according to each species' ecological function and behaviour, using the broad criteria set out in Table 14.3. The judgement takes account of information available on the responses of birds to various stimuli (e.g. predators, noise and disturbance by humans). Note that behavioural sensitivity can differ even between similar species (Schueck *et al.,* 2001; Garthe and Hüppop, 2004) and that, within a particular species, some populations and individuals may be more sensitive than others, and sensitivity may change over time, for example due to habituation. Thus the behavioural responses of birds are likely to vary with both the nature and context of the stimulus and the experience and 'personality' of the bird. Sensitivity also depends on the activity of the bird. For example, a species is likely to be less tolerant of disturbance whilst breeding than at other times; however tolerance is likely to increase as breeding progresses (Holthuijzen, 1985).

TABLE 14.3 DETERMINING FACTORS FOR BEHAVIOURAL SENSITIVITY

Sensitivity	Definition
High	Species or populations occupying habitats remote from human activities, or that exhibit strong and long-lasting reactions to disturbance events.
Moderate	Species or populations that appear to be warily tolerant of human activities, or exhibit short-term reactions to disturbance events.
Low	Species or populations occupying areas subject to frequent human activity and exhibiting mild and brief reaction (including flushing behaviour) to disturbance events.

14.37. Effects are judged in terms of magnitude in space and time (Regini, 2000). There are five levels of spatial effects and four levels of temporal effects (Tables 14.4 and 14.5).

TABLE 14.4 SCALES OF SPATIAL MAGNITUDE	
Magnitude	**Definition**
Very High	Total/near total loss of a bird population due to mortality or displacement. Total/near total loss of productivity in a bird population due to disturbance. *Guide: >80% of population affected*.
High	Major reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. *Guide: 21-80% of population affected*.
Moderate	Partial reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. *Guide: 6-20% of population affected*.
Low	Small but discernable reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. *Guide: 1-5% of population affected*.
Negligible	Very slight reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Reduction barely discernible, approximating to the "no change" situation. *Guide: < 1% population affected*.

Table 14.5 SCALES OF TEMPORAL MAGNITUDE	
Magnitude	**Definition**
Permanent	Effects continuing indefinitely beyond the span of one human generation (taken as approximately 25 years), except where there is likely to be substantial improvement after this period.
Long term	Approximately 15 - 25 years or longer (refer to above).
Medium term	Approximately 5 - 15 years.
Short term	Up to approximately 5 years.

14.38. In the case of non-designated sites, magnitude of effect is assessed in respect of an appropriate ecological unit. In the present case the appropriate regional unit is taken to be Natural Heritage Zone (NHZ) 14 'Argyll West and Islands' for terrestrial species of bird. For most seabirds, the appropriate unit is considered to be 'Argyll and Bute', which covers a similar area to NHZ 14, because this corresponds to one of the areas used to summarise data from national seabird censuses reported in 'Seabird Populations of Britain and Ireland' (Mitchell *et al.,* 2004). For gannet the regional population is taken to include birds breeding on Ailsa Craig. This island lies just inside the boundary of NHZ 14 but outwith 'Argyll and Bute' and is the only breeding colony in the region. For Manx shearwater the regional population is taken to include the Copeland Islands, Northern Ireland, the largest colony in the region. The Copeland Islands lie outwith 'Argyll and Bute' and close to the border of NHZ 14.

14.39. Where the available data allows, the conservation status of each potentially affected terrestrial bird species is evaluated within NHZ 14 or, for breeding seabirds, within Argyll and Bute or the defined regional population. For these purposes conservation status is taken to mean the sum of the influences acting on a population which may affect its long-term distribution and abundance.

14.4 Existing Environment

14.40. The inner Sound of Islay comprises an approximately 1 km wide marine channel between the islands of Islay and Jura. The channel varies in depth; the deepest parts exceed 60 m and the proposed Development is to be located below the 48m bathymetric contour. The great majority is shallower than 48m. A strong tidal current flows through the sound. The coastlines comprise a mix of rocky-shore, low sea cliffs, shingle beaches, and the outlets of several small rivers. On the Jura side the adjacent land is blanket moorland whereas on the Islay side there is a mix of native woodland, extensive grazed grassland, conifer plantation and moorland (see *Chapter 16: Terrestrial and Intertidal Ecology*). The small village and ferry port of Port Askaig is located on the Islay side approximately half way along the inner sound and just north of the proposed Development site. The Jura ferry operates between Port Askaig and Feolin Pier, which is situated directly opposite on the Jura side.

14.41. A significant number of medium sized vessels use the Sound of Islay (see Appendix 19.1) with relatively high numbers of vessel movements (approx. 3.4 per day - see Appendix 19.1). These include large CalMac vehicle ferries that operate between the Scottish mainland, Islay and Colonsay; the small vehicle ferry that operates between Port Askaig and Jura; numerous small fishing vessels mainly operating out of Port Askaig; commercial shipping passing through the sound; and various recreational craft.

14.42. The following summary of the ornithological observations is based on baseline studies of the proposed Development site and adjacent areas of the inner Sound of Islay made from February 2009 to November 2009. Details of spatial extent, timing and methods used in field surveys are given in Technical Appendix 14.1. As will be explained later on in this Chapter, in view of the low likelihood that the additional surveys will identify additional bird sensitivities or elevate existing sensitivities, the current information is considered sufficient for the purpose of evaluating effects of the proposed Development site.

14.43. The areas surveyed in the inner Sound of Islay covered a larger area than that of the proposed Development (as described in *Chapter 1: Introduction*). The location and coverage of the four VPs overlooking the Development site, the coastal walkover survey routes and the areas searched for scarce birds are illustrated in Figure 2 in Technical Appendix 14.1.

14.44. The Nature Conservation Importance (NCI) is indicated for each recorded species: this is explained in the Section 14.3.2 'Assessment Methods'. While all bird species rely on terrestrial habitats in order to breed and to varying degrees at other stages of their life cycle, to ease interpretation, species have been placed into three categories depending on the extent and form of their exploitation of the marine environment to obtain food:

- Terrestrial: species which rely entirely, or predominantly, on terrestrial habitats (i.e. raptors, geese, waders, passerines);
- Surface diving seabirds: seabirds which feed by diving, typically relatively deeply, from the surface of the sea (i.e. divers, auks, sea-ducks, shags/cormorants); and
- Plunge diving and surface active seabirds: seabirds which dive from above the surface of the sea to feed in the upper reaches of the sea column or at/above the sea surface (i.e. gulls, gannet, skuas, Manx shearwater).

14.45. In summarising the observations of species collected during baseline surveys (documented by subsequent sub-sections of Section 14.4) descriptions are thorough regarding the assemblage recorded. Reference has been made, nevertheless, to the potential effects of the Development (Section 14.2) in evaluating whether the observation records constitute evidence for the species to be considered as being potentially affected by the Development (under basic criteria described by Section 14.3). If species are not considered to be remotely affected under these criteria then this is noted; obviating any further consideration under the subsequent assessment process.

14.4.1 Terrestrial Species

14.46. A pair of immature white-tailed eagles (high NCI) bearing yellow wing tags with the letters 'P' and 'L' respectively was regularly seen in the autumn and winter months. Both birds hatched in 2006 from nests on Mull (D Sexton RSPB, email to NRP). They were seen hunting in the inner sound and in the autumn and winter sometimes roosted within 2 km of the proposed Development site (Figure 1 in Confidential Technical Appendix 14.2). At times during the winter months they were joined by a third, apparently untagged bird, probably a one-year-old based on its plumage.

14.47. The white-tailed eagles using the sound are part of a Scottish population which currently numbers about 46 established pairs. The immature pair is likely to start breeding in the next few years and it is possible that their regular occurrence in the inner Sound of Islay indicates that they may be establishing a territory there. Because of the current rarity of this species even a single pair is regarded as nationally important (>1% of the national population), although strictly speaking an immature non-breeding pair should not be considered as part of the breeding population.

14.48. Single hen harriers (high NCI) were noted on six occasions through the year hunting over the coastal moorland of Jura. Although there was no evidence of breeding within 1 km of the proposed Development site (including proposed cable route and sub-station) a pair was suspected to be breeding locally somewhere on the Jura moors. A single pair is well below 1% of the regional population. It is highly unlikely that any form of the Development process (section 14.2) could potentially affect hen harrier, therefore this species is not considered further.

14.49. Merlins (high NCI) were seen on two occasions (maximum 2 birds) both in the autumn or winter. There was no evidence that merlin bred within 1 km of the proposed Development site (including proposed cable route and sub station) but they are reported as breeding in small numbers on Jura and Islay. It is highly unlikely that any form of the Development process (section 14.2) could potentially affect merlin, therefore this species is not considered further.

14.50. During reconnaissance for VP locations a pair of peregrines (high NCI) was incidentally discovered breeding over 2 km from the proposed Development site. One pair is > 1% of the regional population. However, as the nest site was well away from any likely source of effect from the proposed Development (Whitfield *et al.,* 2008) and no peregrines were seen during any other surveys, therefore this species is not considered further.

14.51. The only feeding barnacle geese (high NCI) seen were a winter flock of 350 feeding on the island of Glas Eilean (approximately 3 km south-west of the proposed Development site). Several small flocks (maximum 20) were seen flying over the inner sound in the autumn.

14.52. Flocks of up to 90 Greenland white-fronted geese (high NCI) were recorded flying over the inner sound on several occasions in the autumn and winter. Some of these flocks appeared to be travelling between feeding grounds on Islay to a probable roost site somewhere on Jura. No Greenland white-fronted geese were seen feeding on the coastal lands within 1 km of the Development site.

14.53. Whilst both species of geese which were recorded are high NCI, their observation during baseline surveys is not unexpected given their regional abundance. Based on these observations, however, it is highly unlikely that any key elements of the Development (section 14.2) could potentially affect geese under any process. Barnacle goose and Greenland white-fronted goose are therefore not considered further in this Chapter.

14.54. A few pairs of oystercatcher, ringed plover and common sandpiper (all low NCI) bred along the coasts of the inner sound especially on the Jura side. In all cases the numbers present were well below 1% of the regional population. Given these species' conservation status and their local abundance in relation to regional populations, they are not considered further in this Chapter.

14.55. A small flock (maximum 10) of twite (moderate NCI) was occasionally seen in the summer feeding on the Jura coast opposite the proposed Development site. These were probably of local breeding origin. Twite breed in moderate numbers across the region; a single pair is likely to represent well below 1% of the regional population. It is highly unlikely that any form of the Development process (section 14.2) could potentially affect twite, therefore, this species is not considered further in this Chapter.

14.4.2 Surface Diving Seabird Species

14.56. Seventeen species of seabird were recorded using the inner sound both in the breeding season and at other times of year. This involved nine species classed as surface diving species: red-throated diver, great northern diver, black guillemot, common guillemot, razorbill, shag, cormorant, eider and common scoter.

14.57. Red-throated divers (high NCI) occurred in small numbers in the inner sound throughout the year but mostly in summer. The birds present in the summer were probably local breeding birds that visit the sound to feed. These birds were seen flying from central Jura where it was presumed they were nesting. The estimated population size for Argyll is about 80 pairs (Forrester and Andrews, 2007) and therefore it is likely that a single pair represents >1% of the NHZ 14 regional population.

14.58. The few red-throated divers recorded outside the breeding season were likely to be birds from breeding sites outwith the region; either passing through on migration or visiting for the winter. The winter population for the Argyll and Clyde coasts is estimated to be 232 birds (approximating to NHZ 14 and NHZ 17 combined) (O'Brien *et al.,* 2008). Therefore, the few birds intermittently present in the Sound of Islay outside the breeding season are unlikely to exceed 1% of the regional population.

14.59. The sightings of red-throated diver were not evenly distributed over the inner sound, because there was a tendency for the shallower areas to be favoured and the proposed Development site to be avoided.

14.60. Approximately 2-4 great northern divers (high NCI) were typically present in the inner sound survey area during the winter months. These birds were also commonly seen flying through the sound, probably on migration. There were proportionally few records of great northern diver from the deepest areas of the inner sound that coincide with the proposed Development site (Figure 6 in Technical Appendix 14.1).

14.61. The over-wintering population of great northern diver in Scotland is estimated at approximately 2000-3000 (Forrester and Andrews, 2007). No population estimate is available specifically for the NHZ 14 region; however, Argyll alone is known to support up to a few hundred individuals (Craik 2002). Therefore, 2-4 birds typically present in winter are unlikely to exceed 1% of the regional population, therefore the inner sound (and consequently the Development site) is not considered to be of regional importance.

14.62. Black guillemot (moderate NCI) is a resident auk species that breeds in small colonies on sea cliffs and rock outcrops along the Islay side of the inner sound (Figure 3 in Technical Appendix 14.1). A total of 66 individuals were counted in a pre-breeding survey in April 2009 suggesting a breeding population of around 35 pairs. This estimate represents about 2.3% of the regional (Argyll and Bute) population of 3046 individuals (Mitchell *et al*., 2004) and is thus considered to be of regional importance. Approximately four pairs apparently bred on low cliffs adjacent (within 200 m) to the western edge of the proposed Development site. Approximately 5 further pairs apparently bred within

300 m of Port Askaig, approximately 100 - 500 m north of the proposed Development site (Figure 3 in Technical Appendix 14.1).

14.63. Black guillemot were seen on the sea of the inner sound throughout the year and commonly foraged. They showed a strong tendency to avoid the deep water areas including the proposed Development site (Figure 4 in Technical Appendix 14.1.) Black guillemots usually make feeding dives to the sea bed to hunt for small fish and it is likely that it is unprofitable for them to hunt in depths greater than about 40m.

14.64. Two other auk species, razorbill and common guillemot, do not breed within the sound but can range far from their breeding colony (up to 50 km or more) to feed and both have relatively large populations breeding within the region. Numbers recorded in the inner sound, however, were well below 1% of the regional populations and for this reason these species are rated as low NCI (see Table 14.2). Razorbill and common guillemot make deep dives to catch small fish prey. The distributions of these species on the sea in the inner sound showed that the birds generally avoided the deepest areas including the proposed Development site (Figure 5 in Technical Appendix 14.1). In most cases it is impossible to know whether seabirds seen during the breeding season were breeding or non-breeding individuals and, if the former, which colonies they originate from. In the case of razorbill, some of the birds seen in late summer had attendant dependent young and so were definitely breeding birds.

14.65. Shags (low NCI) occurred commonly in the inner Sound of Islay throughout the year. On average there were approximately 15-20 individuals present in the spring and summer, 20-25 in the autumn and 40 in the winter. These numbers are well below 1% of the regional population size (approximately 3341 pairs) and are therefore not considered to be of regional importance. No shags were noted breeding in the inner sound but there were small breeding colonies in the outer sound. Shags make deep dives to hunt fish on or close to the sea-bed. The distribution of shags recorded on the sea indicates that they tended to avoid areas greater than 40m depth, including the proposed Development site (Figure 7 in Technical Appendix 14.1).

14.66. Cormorants (low NCI) were present in the inner sound in very small numbers (maximum 3) throughout the year. This is well below 1% of the regional population. As a result of the very low abundance of cormorants, the species is not considered further in this Chapter.

14.67. Eider (moderate NCI) occurred in the inner sound in moderate numbers in the late summer and autumn. The maximum count was 156 individuals but on average there were less than 100 individuals present. The peak numbers using the inner sound are of regional importance representing approximately 3% of the wintering population in Argyll (Forrester and Andrews, 2007). Eider feed by diving to the seabed to catch mainly bivalve molluscs. The records of eider were not evenly distributed in the inner sound: they showed a strong preference for the shallower areas and almost completely avoided the deep waters of the proposed Development site (Figure 9 in Technical Appendix 14.1).

14.68. Common scoter (high NCI) was recorded on passage in very small numbers in autumn and winter flying through the sound. There was no evidence that inner sound regularly supported any wintering or moulting common scoter or that there was suitable feeding habitat present. The numbers seen were below 1% of the regional winter population (up to approximately 500 individuals, though numbers are highly variable between years). Although common scoter is a high NCI species, the low numbers observed and the apparent lack of any dependence on the sound as a feeding site indicate that potential effects of the proposed Development (Section 14.2) will be unlikely to be relevant. This species, therefore, is not considered further in this Chapter.

14.4.3 Plunge Diving and Surface Active Seabird Species

14.69. Of the seventeen species of seabird recorded using the inner sound eight species were classed as plunge diving and surface active species: Arctic tern, gannet, Manx shearwater, Arctic skua, kittiwake, herring gull, great black-backed gull and common gull.

14.70. A pair of Arctic skua (moderate NCI) probably breed locally on moorland habitat on Jura (the exact location was not determined but was >1 km from the Development) and regularly fed in the inner sound. Arctic skua is a scarce breeding bird in the region with a population of only 21 pairs, so a single pair is of regional importance. Arctic skuas were also recorded flying through the sound on several occasions in August although these were likely to be passage birds.

14.71. Small numbers (maximum 4) of arctic tern (high NCI) were seen feeding in the inner sound regularly from May to July. This represents well below 1% of the regional population (1823 pairs). The birds seen were probably from the small arctic tern colony located on the Jura coast approximately 3km north of the proposed Development site.

14.72. Small numbers of herring gull (moderate NCI), common gull, and great black-backed gull (both low NCI) were recorded in the inner sound throughout the year. In all cases the numbers are well below 1% of the regional breeding population totals (herring gull 15,370 pairs, common gull 2,683 pairs, great black-backed gull 1736 pairs). Several pairs of common gull bred locally along the shores.

14.73. Three other seabird species, none of which nest locally, used the inner sound for feeding, especially in the late summer. These are gannet, Manx shearwater, and kittiwake (all low NCI). All these species typically range far (up to 50 km or more) from breeding colonies to feed and all have relatively large populations within the region (kittiwake 8976 pairs, gannet 35,825 pairs all at Ailsa Craig, Manx shearwater approximately 3249 pairs) and elsewhere in western Scotland. In all cases the numbers present at any one time in the inner sound were well below 1% of the regional populations. Nonetheless although of low NCI, these three species were regularly present and sometimes common in the inner sound.

14.5 Impact Assessment

14.74. Potential effects are evaluated in respect of all species of high or moderate Nature Conservation Importance (Table 14.6). Emphasis is given to species identified as sensitive receptors. In considering the NCI of potentially affected species, consideration has been given to the criteria in Table 14.2. Given the novelty of tidal power developments and, therefore, the desire to address the full breadth of potential ornithological concerns in this ES (and satisfy SNH's scoping request concerning assessment of seabirds: see Section 14.3.2.1), potential effects are also evaluated for certain seabird species that are rated as low NCI but that were regularly present in the inner Sound of Islay (Table 14.6).

TABLE 14.6 NATURE CONSERVATION IMPORTANCE OF POTENTIALLY AFFECTED SPECIES

Importance	Species
High	Red-throated Diver, Great Northern Diver, White-tailed Eagle, Arctic Tern
Moderate	Eider, Black Guillemot, Arctic Skua, Herring Gull
Low	All other species, including Shag, Gannet, Razorbill, Common Guillemot, Manx Shearwater and Kittiwake

14.75. To reiterate Section 14.2 of this Chapter, the types of potential effects on birds which can be quantitatively assessed, resulting from the proposed Development, are likely to be:

- displacement of birds as a result of construction and decommissioning disturbance activities;
- displacement due to operational maintenance activities (especially from vessel movements and, perhaps, loud noise), and/or due to the presence of the operating tidal turbines close to feeding sites;
- collision with rotating turbine blades during operation;
- the effects of pollutant contamination during operation; and
- direct loss of sea-bed habitat due to turbine bases.

14.76. Due to the differing biology of the three classes of species described earlier (Section 14.4) it is apparent that not all of the potential effects are relevant to each class. Notably, for terrestrial species the only potential effect will be increased land-based disturbance during construction and decommissioning e.g. activities close to and on shore related to cable landfall activities, construction compound, substation location and underground cables.

14.77. All electrical cabling between the proposed turbines and the onshore substation would be either sub-sea cables or buried underground. Electrical connection to the national grid would be the subject of a separate planning application.

14.78. The relevant regulations and codes of best practice covering the safe use of oil, lubricants, chemicals and antifouling paints in the marine environment will be fully complied with. Contingency plans for dealing with any accidental release of these pollutants will be drawn up as part of the site construction plans. As well as being made a matter of high priority operational policy.

14.79. The land take caused by the proposed Development will result in negligible loss of terrestrial habitat, being restricted to a small area (likely to be <0.1 ha) of rough moorland coinciding with the proposed footprint of the sub-station on Jura.

14.80. The loss of sea-bed habitat caused by the deployment of turbine bases will be <33m^2 for each turbine, and so for 10 turbines would amount to approx. 330m^2 in total. With respect to the proposed site boundary this represents approximately 0.3% of the proposed Development site. Although this loss will, based on the duration of any granted consent – initially 7 years - and possible extension – likely 8 years, be Medium to Long Term temporally (Table 14.5) it will be Negligible spatially (Table 14.4). Therefore the effects of direct habitat loss due to sea-bed take and land take are deemed not significant for all species under the terms of the EIA Regulations.

14.5.1 Potential Impacts during Construction Phase

14.81. Surveys to locate the nests of birds listed in Schedule 1 of the WCA will be undertaken prior to construction (and prior to decommissioning) works during the period March-August. In the event that an active nest of a Schedule 1 species is discovered within distances (of construction activities) given by Whitfield *et al*. 2008 (or a 500 m radius of the nest for species not listed by Whitfield *et al*., 2008) then activities within the specified distance, including vessel movements, would be halted immediately. A disturbance risk assessment (prepared under a Breeding Bird Protection Plan for the site) would be undertaken and any measures considered necessary to safeguard the breeding attempt (e.g. exclusion zones or restrictions on timing of works) would be submitted to SNH for agreement before recommencing work.

14.82. Construction activities close to the active nest sites of specially protected species (those on Schedule 1 of the WCA) would be avoided (see above) and therefore disruption of active breeding attempts is highly unlikely. On the basis of the breeding distribution of specially protected species in 2009 (including the prospective pair of white-tailed eagle) it is unlikely that any of these species will nest within 1 km of the Development during construction and so the Breeding Bird Protection Plan is unlikely to be required. It is likely that noise and disturbance from vessels associated with construction activities would temporarily displace some foraging or resting birds, particularly seabird species. Potential effects are likely to be greatest during the period when birds breed, though some birds, like those that migrate through or are winter visitors, may encounter potential effects at other times. Birds that are disturbed at breeding sites are vulnerable to a variety of potential effects that may lead to a reduction in the productivity and survival rates of bird populations, including:

- the chilling or predation of exposed eggs / chicks;
- damage or loss of eggs / chicks caused by panicked adults;
- the premature fledging of young; and
- disturbed birds may also feed less efficiently and breed less successfully.

14.83. Disturbance effects on birds during construction would be confined to areas close to shore activities, such as piers, construction compounds, the cable route and sub-station, the routes travelled by construction, maintenance and survey vessels, and the vicinity of turbines. Construction is anticipated to last approximately 3 months, including approximately 1 breeding season.

14.5.1.1 Terrestrial Species

14.84. No nest sites of terrestrial species (or potential nest sites for white-tailed eagle) were recorded at distances at which disturbance of breeding birds should occur (Whitfield *et al*., 2008). Therefore, it is unlikely that there will be any direct effects on breeding terrestrial birds during construction.

14.85. As noted earlier, construction disturbance may also potentially have an adverse effect through displacement of foraging birds. For species which forage in terrestrial habitats the terrestrial area which will be affected during construction is small relative to foraging ranges of the species concerned. Moreover, observations suggested that no 'terrestrial' species made frequent use of the areas liable to be affected during construction. In addition, since construction will be short-term it is unlikely that there will be any measurable effect on populations of terrestrial species (i.e. merlin, hen harrier, white-tailed eagle) and so disturbance effects during construction will not be significant for these species under the terms of the EIA Regulations.

14.5.1.2 Surface Diving, Plunge Diving and Surface Active Seabird Species

14.86. Due to the distance of onshore construction activities from recorded nests sites, relative to known distances at which breeding birds may be disturbed (e.g. Whitfield *et al*., 2008), the only breeding seabird species of conservation concern which may be affected at breeding sites during construction is the black guillemot (moderate NCI). This species nests on the coastline of the inner sound including those parts closest to the proposed Development site. Frequent disturbance during construction close to black guillemot nest sites could lead to reduced breeding success. There are no published observations of disturbance distances of this species at the nest. Nevertheless, 250 m is probably reasonable and precautionary as a distance at which direct disturbance should not occur, based on other species and the anecdotal observations of black guillemots breeding in the Sound of Islay during baseline surveys. It is estimated that there were four pairs of black guillemots nesting within a distance at which direct disturbance of nesting birds may be affected by construction activities within the proposed Development site. Additional pairs may be affected by movements of construction vessels outwith the proposed Development site boundary; this will depend on the routes taken by vessels. Some, perhaps all, of the birds which may be affected will already be subject to a relatively high level of background disturbance and the species can apparently readily habituate to such disturbance, judging by the locations which can be used as nest sites (e.g. holes in quay walls of busy harbours) (Greenwood 2010). Given these observations and that, at worst, breeding success will probably be only slightly depressed short-term, and only in a negligible proportion of the population, it is

reasonable to conclude that the effect of construction disturbance on black guillemots will be negligible and not significant under the terms of the EIA Regulations. While not necessary under the EIA Regulations, measures are described in the Breeding Bird Protection Plan that, in the interests of best practice, will mitigate against potential adverse effects on black guillemots.

14.87. None of the other seabird species of high or moderate NCI breed in or close to the areas that will be potentially affected by construction disturbance. Therefore the effects at breeding sites due to construction are likely to be nil and, therefore, not significant under the terms of the EIA Regulations.

14.88. All seabird species that feed in the inner sound would be potentially affected by displacement due to disturbance from construction vessels and construction noise (*Chapter 10: Noise and Vibration Affecting Human Receptors*). However, this disturbance is expected to be only moderate in comparisons to the baseline activity of vessels using the sound and the associated noise this creates. Although the baseline levels of vessel activity inevitably causes some localised temporary disturbances of seabirds there is no evidence that this has any adverse effects on the seabird populations using the sound. Furthermore, the additional disturbance from construction vessels will be concentrated within the proposed Development site, an area that is generally avoided by surface-diving seabird species (e.g. diver and auk species, shag and eider) (Technical Appendix 14.1) which suggests that it is unimportant, even locally, as a foraging area. This is probably because of the relatively large sea depth within the proposed Development site. Therefore, most of the additional disturbance will be away from the area preferred locally by surface-diving seabirds. Any construction disturbance of seabirds would be temporary and of short duration. Based on observations of the response of seabirds disturbed by vessels during baseline survey work, the most likely effect of any additional disturbance from construction vessels would be for birds to be temporarily inconvenienced as they relocate to a nearby (up to a few hundred meters away) location.

14.89. Furthermore, in all cases the numbers of individuals of each seabird species using the inner sound represent at most a small proportion of the regional populations. Therefore, the short-term displacement effects on seabirds are deemed not significant under the EIA Regulations.

14.90. Overall, therefore, although construction disturbance could potentially affect almost all bird species using the inner sound, it is predicted that the effects of any disturbance will be **negligible**. It is unlikely that the effects would have a measurable effect on abundance, survival or productivity at the regional scale. Therefore, the predicted effects are not significant under the terms of the EIA Regulations.

14.5.2 Potential Impacts during Operational Phase

14.5.2.1 Terrestrial Species

14.91. For all terrestrial species of high or moderate nature conservation importance, operational effects of the proposed Development will be neutral or barely discernible and will therefore not be significant under the terms of the EIA Regulations.

14.5.2.2 Surface Diving Seabird Species

14.92. For surface diving seabirds, a potential effect during the operational phase of the proposed Development is disturbance by displacement from foraging areas, principally from maintenance and survey vessels. Although essentially similar in nature to vessel disturbance caused during the construction phase, the frequency and duration of any disturbance caused during the operational phase is likely to be much less and against a background of substantial vessel activity in the absence of the proposed Development. Therefore, following the additional reasoning outlined in Section 14.5.1, it is predicted that the likely effects of vessel disturbance on surface diving seabird species during the operational phase will be negligible and not significant under the terms of the EIA Regulations.

14.93. The tidal turbines themselves could plausibly directly affect only those species that potentially occupy the same location, i.e. the sea bed and water depths where turbines are sited. The turbine rotors would occupy depths between approximately 16.5-40 m below the sea surface. Therefore, the surface diving seabird species could be directly affected by turbines through avoidance of the vicinity of the turbines (i.e. displacement) and by collision with rotors possibly causing injury or death (i.e. in a similar fashion to the familiar issue of flying birds colliding with wind turbine rotors). Due to the novelty of the technology and the lack of studies there is no information on how diving birds are actually affected by operational tidal turbines. This information gap requires investigation (Shields, 2009).

14.94. Nevertheless, the numbers of surface diving seabirds listed above that regularly use the inner sound are in all cases small in a regional context; numbers of only two species recorded by the bird surveys of the inner sound (black guillemot and eider) exceeded 1% of the regional population and then only marginally. The proposed Development site occupies approximately 10% of the area of the inner sound (i.e. the area covered by bird surveys). Furthermore, all surface diving seabird species showed a tendency to avoid the propose Development site (Technical Appendix 14.1). Therefore, even under the worst case scenario where all surface diving seabirds would be permanently displaced from the proposed Development site (which is unlikely), the effects of displacement by operational turbines would result in a negligible loss of foraging habitat to these species at a regional level. This effect is not considered to be significant under the terms of the EIA Regulations.

14.95. The issue of the potential collision threat to surface diving seabirds is more difficult to predict. Studies are required to establish how diving seabirds, and their fish prey, respond to submerged turbines and to quantify the extent to which they are able to avoid collision (Shields, 2009). The indications from studies at the SeaGen installation in Strangford Lough have so far provided no evidence of collisions with diving seabirds.

14.96. The baseline bird surveys provide strong evidence that the assemblage of surface diving seabirds generally avoided the areas of deepest water for feeding (Technical Appendix 14.1). Although these species sometimes occurred on the sea surface within the proposed Development site they were seldom observed to dive in the deep water areas where the proposed Development will be located. This is not surprising as it is likely that most of these species are usually diving to the seabed (or close to it) to forage and diving to depths greater than about 30m is likely to be increasingly energetically less profitable than foraging in nearby shallower areas (Wanless *et al*., 1997). If, as seems likely, the spatial distribution of foraging activity by surface diving seabirds during the operational phase will be similar to that observed during baseline surveys then these species will seldom dive into the space occupied by turbine rotors; therefore, there will be a **negligible** risk of collision. Thus, to a large extent, diving birds are predicted not to occupy the same water space as turbine rotors; therefore, they are predicted to be exposed to **negligible** collision risk. Furthermore, if operational turbines have a displacement effect on diving seabirds then the potential for collision will be reduced correspondingly. However, given the uncertainties of the underwater behaviour of diving birds and how they might respond to submerged turbines a precautionary approach to the assessment of risk is warranted. Paying heed to the likely limits of such uncertainties, the magnitude of the risk of collision to diving seabirds is assessed as being low in a local context: in a worst case scenario a small number of individuals could be killed (or injured) over the lifetime of the project. It is not possible to quantify the actual numbers due to the limitations of the current information on how diving birds respond to turbines. Nevertheless, given that for each species the numbers of individuals that could plausibly be killed or injured are at most a small proportion of the birds that use the inner sound and these in turn constitute only a small proportion of the regional populations, it is predicted that collision mortality would have negligible effects on the regional populations of surface diving seabird species.

14.97. It is possible that the submerged turbines, the upper parts of which would be in water depths regularly visited by feeding surface diving seabirds (i.e. <30 m), might attract fish prey which in turn could attract diving birds. If this happened then surface-diving seabirds might be at a slightly greater risk of collision than the above reasoning suggests. It is not possible to quantify this risk due to the lack of understanding of how fish and birds respond to submerged turbines. Recognising these uncertainties but also applying knowledge that the numbers of surface diving seabirds using the inner sound comprise only small proportions of the regional populations, it is likely that, at worst, the overall effect of this theoretical collision risk on regional populations will be **low**.

14.98. Therefore, the effects of collision on all species are not considered to be significant under the terms of the EIA Regulations.

14.99. The release of oil and other marine pollutants and the toxic effects of anti-fouling chemicals could have lethal and sub-lethal effects on seabirds and their prey. For example it is well known that oil slicks can kill seabirds. As the various regulations and codes of practice covering the safe use of oil, lubricants, chemicals and antifouling paints in the marine environment will be fully complied with, the risks of such contamination occurring would be limited to accidental release. Even so, the Development will also adopt an explicit policy to deal rapidly and effectively with any accidental release of pollutants.

14.100. Given such a contingency policy, and: a) that the quantities of any oil or chemicals accidentally released are likely to be relatively small; b) that the strong tidal currents would quickly disperse and dilute any contaminants and, c) that the numbers of all seabird species using the inner sound are small in a regional context, then the likely effects on regional seabird populations (for both classes of species) are assessed as **negligible**. These effects are not considered to be significant under the terms of the EIA Regulations.

14.5.2.3 Plunge Diving and Surface Active Seabird Species

14.101. Plunge diving and surface active seabirds could potentially be affected by the operational phase of the proposed Development due to displacement from foraging areas, principally from maintenance and survey vessels. However, as reasoned for surface diving seabirds, it is unlikely that the operational displacement by vessels connected to the proposed Development will have a material influence on plunge diving and surface active seabirds and will not be significant under the terms of the EIA Regulations.

14.102. As noted in the previous section, the tidal turbines themselves could plausibly directly affect only those species that potentially occupy the same location. The turbine rotors would occupy depths between approximately 16.5-40 m below the sea surface in areas of the Sound that exceed at least 48m water depth (below chart datum). Plunge diving and surface active species such as Arctic skua, gannet, kittiwake, Arctic tern and Manx shearwater do not regularly attain such depths and so are unlikely to be directly affected by the turbines. Gannets can sometimes attain depths >15m (Brierley, 2001) when targeting large prey but their dives are typically <5 m when targeting small prey (Garthe, 2007). Consequently it is considered unlikely that any displacement or collision risk due to the submerged turbines will influence this group of seabirds (and whose abundance within the whole inner sound, moreover, was relatively low). Displacement and collision effects due to the sub-sea turbines are therefore not deemed significant under the terms of the EIA Regulations.

14.5.3 Potential Impacts during Decommissioning Phase

14.103. Habitat reinstatement requirements would be set out in consultation with the statutory authorities at the time of decommissioning. It is anticipated that turbines would be removed at the end of the operational phase (approx. 15 years). Disturbance effects due to decommissioning are anticipated to last approximately three months and be of lower intensity than during construction, and so effects would be similar in nature but of lower magnitude than during installation.

14.104. The magnitude of decommissioning effects on all species is considered to be **negligible**. Even in the case of species of highest NCI (refer to Table 14.6) these effects are judged unlikely to be significant under the terms of the EIA Regulations.

14.6 Mitigation and Management

14.105. No effects were identified as significant under the terms of the EIA Regulations. Nevertheless, it is considered good practice to implement appropriate measures to mitigate any local effects and thereby minimise potential (albeit assessed as negligible) adverse impacts.

14.106. As noted earlier (Section 14.5.1) surveys to locate the nests of birds listed in Schedule 1 of the WCA will be undertaken prior to construction (and decommissioning) works during the period March-August. These surveys will be undertaken to inform measures to safeguard any breeding attempts from disturbance.

14.107. The risks to seabirds of accidental release of marine contaminants will be minimised by adopting safe working practices and having contingency plans for dealing with incidents

14.108. Good practice would aim to minimise disturbance by vessels associated with the proposed Development to seabirds using the inner sound during all phases of the proposed development by avoiding where possible preferred feeding areas and adopting voluntary speed restrictions whenever possible. Studies elsewhere indicate the severity of disturbance by boats is related to speed (Ronconi and Cassady St. Clair, 2002). Vessel speed limits are commonly used to limit disturbance to seabirds in the vicinity of colonies and feeding sites; however there is no accepted maximum permissible speed.

14.109. Artificial nest sites for black guillemots located away from the immediate vicinity of the proposed Development site should help reduce disturbance effects on the breeding population of this species (see also Section 14.3.2.1). It could also lead to an increase in the local population size (though this is likely to be limited by food supply) and breeding success, thereby helping offset any adverse effects on this species. Artificial nest sites should take the form of specially designed nest boxes or providing suitable cavities in stone walls or quays next to the sea. It is anticipated that approximately ten such sites should be constructed given the numbers of existing nest sites that may be affected by the proposed Development and that not all artificial sites may be occupied.

14.7 Residual Effects

14.110. Any construction and decommissioning effects leading to direct disturbance of nesting Schedule 1 species will be avoided due to the Breeding Bird Protection Plan (BBPP) (Section 14.5.1).

14.111. The risks to seabirds of accidental release of marine contaminants will be minimised by adopting safe working practices and having contingency plans for dealing with incidents.

14.112. Adoption of voluntary speed limits to minimise disturbance whenever possible and avoiding preferred seabird feeding areas should reduce any disturbance effects due to vessel traffic.

14.113. Provision of artificial nest sites for black guillemots away from regularly disturbed areas should help reduce potential disturbance effects on this species (primarily during construction) and may well create a net beneficial effect.

14.114. Other regional effects assessed in Section 14.5 would remain unaffected by the proposed mitigation.

14.8 Cumulative Impacts

14.115. The EIA Regulations require that the proposed Development be assessed cumulatively along with other projects or plans. In doing so, SNH guidance (2005) on assessing cumulative effects has been followed. In considering cumulative effects it is necessary to identify any effects that are minor in isolation but which may be major additively.

14.116. 'Target' species were taken to be those species of high and medium Nature Conservation Importance (Table 14.2) and for which there was some indication of a potential impact as a result of the proposed Development which may be exacerbated cumulatively. In assessing cumulative impacts of development projects only tidal power developments were considered; whilst terrestrial species may be affected by other forms of development (e.g. onshore wind energy schemes) the predicted impacts of the proposed Development described herein on these species were so small that they could not conceivably contribute measurably to any cumulative regional effects.

14.117. The only other tidal power development within the regions considered by the assessment of the proposed Development is a planned tidal array off the west coast of Islay, approximately 40km away from the proposed Development site. This project is currently in the early stages of collecting baseline survey data (i.e. it has not reached a planning application stage) and so no information on predicted effects is available. It has an offshore location and is therefore not likely to have any effects on the various species of terrestrial bird species (raptors, geese, waders, passerines) nor the inshore coastal seabird species (divers, eider, black guillemot, Arctic tern) that form the bulk of species plausibly affected by the Sound of Islay Demonstration Tidal Array.

14.118. In conclusion, the cumulative combined effects of the proposed Development and other projects are likely to be **negligible** and so not deemed to be significant under the terms of the EIA Regulations.

14.9 Summary

14.119. Effects are summarised in Table 14.7.

TABLE 14.7 : SUMMARY OF EFFECTS

Potential effect	Mitigation	Residual Effect
Sea-bed take (all phases)		
All species	None	**Negligible**
Disturbance (construction and decommissioning))		
Breeding Schedule 1 species	Breeding Bird Protection Plan	**Nil/Negligible**
Disturbance (all phases)		
Seabird species	Limit marine vessels to speeds that allow seabirds time to move away. Choose vessel routes that avoid preferred feeding areas.*	**Negligible**
Black Guillemot	Provide nest boxes away from places subject to regular disturbance*	**Nil/Negligible**
Other species	None	**Negligible**
Collision (operational phase)		
All species	None	**Negligible/Low**
Pollutant contamination (all phases)		
Seabird species	Adopt safe working practices, draw up contingency plans for accidents and have equipment available for dealing with incidents	**Negligible**
Cumulative		
All species	None	**Negligible**

* N.B. Under best practice recommendations only

14.10 Proposed Monitoring

14.120. None of the proposed Development's potential effects on birds are deemed to be significant. Even so, best practice dictates that an appropriately detailed monitoring programme should be agreed and implemented. The value of monitoring the Sound of Islay Demonstration Tidal Array to the wider tidal renewables industry is likely to be particularly high given that this would be one of the first tidal renewable projects, the geography of the site facilitates survey work (as much can be done from the land) and there is a relatively high level of pre-construction baseline survey data for comparison.

14.121. Under the BBPP surveys to locate the nests of birds listed in Schedule 1 of the WCA will be undertaken prior to construction (and decommissioning) works during the period March-August. These surveys will be undertaken to inform measures to safeguard any breeding attempts from disturbance.

14.122. Monitoring studies of greatest value include:

- Pre-breeding surveys of black guillemot in the Sound of Islay, including the monitoring of any nest boxes provided;
- Surveys to quantify the distribution, abundance and behaviour of diving seabirds using the Development site and other parts of the Sound of Islay. The behavioural surveys should collect evidence of changes in behaviour in response to the proposed Development including disturbance, displacement, attraction and habituation; and
- Surveys to quantify the level of human activity, in particular vessel movements, associated with the construction and operation phases of the proposed Development.

14.123. The surveys noted above should be conducted during construction and in years 1 – 3, 5 and 10 of the proposed Development's 15-year operation period. However, flexibility will be retained to cancel this monitoring programme if it is clear that beneficial information is not being collected.

14.124. Given the Development's novelty, an appropriately detailed bird monitoring programme should be agreed, with an Ornithological Steering Group for the Sound of Islay Demonstration Tidal Array to

establish protocols and review results on a suitably frequent basis. If distribution and abundance surveys indicate a high likelihood of interaction it would be beneficial to attempt to monitor any mortality which results from collision with the turbines. The need for and methods used to monitor collisions would be considered by the Ornithological Steering Group.

14.11 Potential Effects on SPA Interests

14.125. Whilst the Conservation (Natural Habitats &c.) Regulations 1994 ('the Habitats Regulations') provide that an assessment of the possible effects of a proposed Development on a SPA is the responsibility of the competent authority, this section of the ES Chapter provides a summary examination of the relevant issues pertaining to the potential effect of the proposed Development.

14.126. The proposed Development is in a location where (although the Development is not a statutorily designated site either at international or national level) there is a possibility that it may potentially influence the qualifying interest of two SPAs: the Jura, Scarba and Garvellachs pSPA with golden eagles as the qualifying interest, and the North Colonsay and Western Cliffs SPA, classified for its internationally important breeding seabird assemblage.

14.127. Therefore, there are two European Directives that are relevant, namely the Birds Directive and the Habitats Directive (SERAD 2000, and materials therein). The WCA transposed many parts of the Birds Directive into domestic legislation. The Habitats Directive was transposed in the UK through The Habitats Regulations. Guidance for the implementation of the Directives in Scotland is provided in Scottish Executive Circular No. 6/1995 (revised June 2000) (SERAD, 2000).

14.128. Article 6 of the Habitats Directive refers to conservation measures and assessment procedures for plans or projects affecting Natura 2000 sites (including SPAs), and the steps for assessment are outlined in Article 6 (3) and (4). Part IV of the Habitats Regulations transposes these steps into domestic legislation, with Regulations 48 and 49 being relevant.

14.129. Regulation 48 of the Habitats Regulations refers to three assessment steps: the outcome of the first two steps determining whether or not the third needs to be implemented. The three steps, set out below as questions, are:

- Step 1: Is the proposal directly connected with or necessary to the management of the site?;
- Step 2: Is the proposal, alone or in combination, likely to have a significant effect on the site? If a significant effect is likely, then an appropriate assessment is necessary; and, hence, if so
- Step 3: Can it be demonstrated in light of the conservation objectives that the proposal will not adversely affect the integrity of the site?

14.130. It is important to note that step 2 only applies to the qualifying species of the SPA and the decision is informed by the SPA's conservation objectives. The European Court of Justice (ECJ) ruling of 7 September 2004 (C-127/02) on the Waddenzee mechanical cockle fishery clarified that Article 6 (3) of the Habitats Directive should be interpreted as meaning that any plan or project (other than those directly concerned with the management of the SPA) should be subject to step 3 if under step 2 "*it can not be excluded, on the basis of objective information, that it will not have a significant effect on that site, either individually or in combination with other plans or projects*". Further, if a plan or project "*is likely to undermine the site's conservation objectives it must be considered likely to have a significant effect. The assessment of risk must be made in light of, amongst others, the characteristics and specific environmental conditions of the site concerned*." Under step 3 there is an onus on demonstrating that there will be no adverse effect on integrity, in light of best scientific knowledge, and the 2004 ECJ ruling has clarified that the consenting authority can only consent a plan or project if it is confident that a plan or project will not adversely affect site integrity, that is, when there is no reasonable scientific doubt as to the absence of such effects.

14.131. With respect to the Development, which does not lie within the boundary of a SPA, the revised Scottish Executive Circular (SERAD, 2000) advises that in order to determine the implications for the interest protected *within* the Natura 2000 site, the need for considering the assessment steps referred to by Regulation 48 of the Habitats Regulations also potentially extends to plans or projects *outside* the boundary of the site. Hence, it is a proposal's potential effect on the SPA's interest which is relevant, rather than its location with respect to the SPA boundary *per se*. Thus, the assessment steps need to be considered for the proposed Development.

14.132. **Step 1.** The construction of marine turbines and ancillary developments and activities under the proposed Development are clearly not directly connected with or necessary to conservation management of the SPAs, and therefore the next step needs to be considered.

14.133. **Step 2.** The sites' conservation objectives (relevant to both Steps 2 and 3 of an assessment) are designed to achieve the obligations set out in Article 6.2 of the Habitats Directive (which applies to SPAs) by using the components of favourable conservation status for species as set out within Article 1(i) of the Habitats Directive. This approach is recommended by the EC in their Guidance on Managing Natura 2000 Sites, Section 2.3. (European Commission, 2000). The conservation objectives for SPAs are the same as for other Natura sites in Scotland in having an overarching conservation objective to avoid deterioration of the habitats of the qualifying interest, or significant disturbance to the qualifying interest, thus ensuring that the integrity of the site (SPA) is maintained. The component conservation objectives which encapsulate the maintenance of site (SPA) integrity in the long-term, are as follows:

- ensure for the qualifying species that there is no significant disturbance;
- ensure for the qualifying species that the structure, function and supporting processes of habitats supporting the species are maintained in the long term;
- ensure for the qualifying species that the distribution and extent of habitats supporting the species are maintained in the long term;
- ensure for the qualifying species that the distribution of the species within the site is maintained in the long term; and
- ensure for the qualifying species that the population of the species is maintained as a viable component of the site.

14.134. Almost the whole of Jura, including the coast along the inner Sound of Islay, forms part of the proposed Jura, Scarba and Garvellachs pSPA (Natura, 2009). The only qualifying species for this pSPA is the golden eagle. The proposed Development lies several kilometres from the nearest golden eagle territory centre and no golden eagles were seen in the vicinity of the proposed Development site during baseline survey work in 2009 or 2010, suggesting that the area is of negligible or no importance to the species. The only part of the Development that directly impinges on the pSPA is approximately 50 m of the underground cable route and part of the sub-station compound (likely to be an area <0.04 ha) adjacent to the main road on Jura. These will result in only very minor (and in the case of the cable route, temporary) changes to the terrestrial habitats on Jura. Furthermore the proposed Development will not result in any disturbance or habitat loss that could plausibly adversely affect golden eagles under any of the site's conservation objectives. Therefore, it is unlikely that the proposed Development would have a significant effect on the ornithological interest for which the pSPA qualifies. For these reasons the proposed Development is considered not to present any plausible risk to the pSPA's interest and therefore an Appropriate Assessment under the Habitat Regulations is not required.

14.135. SNH indicated in their scoping response (SNH, 2008) that they do not consider it likely that the proposed Development would have any effects on breeding seabird SPAs because all these are located over 25km from the proposed Development site. Specifically, the closest seabird SPA, North Colonsay and Western Cliffs SPA, is over 25 km away and therefore the Sound is unlikely to be

regularly used by foraging seabirds from this colony. Observations collected during the baseline surveys do not provide a reasonable basis for a contradiction of this opinion. While some razorbills apparently had dependent young (and so were from a breeding colony) numbers were small and overall numbers of all seabird species were relatively small, in keeping with SNH's opinion. Moreover, as described in previous sections the risk posed by the proposed Development to seabirds would not constitute a violation of SPA conservation objectives. Therefore, it is unlikely that the proposed Development would have a significant effect on the ornithological interest for which the SPA qualifies. For these reasons the proposed Development is considered not to present a plausible risk to the SPA's interest and therefore an Appropriate Assessment under the Habitat Regulations is not required.

14.136. **Step 3**. As recorded under Step 2, it is unlikely under the scrutiny of reasonable scientific evidence that the Development would give rise to a significant effect on the ornithological interest of the (p)SPAs. Accordingly, it is considered that no appropriate assessment is required under Step 3 to be undertaken by a competent authority under the Conservation (Natural Habitats &c.) Regulations 1994. The quantity of evidence obtained in the course of identifying and assessing the ornithological effects of the proposed Development together with the level of scientific scrutiny and assessment undertaken corroborate the finding that no appropriate assessment is required (and, hence, for the North Colonsay and Western Cliffs SPA, corroborate SNH's scoping response). Rather than omit this material from this ES on the basis that it is not considered necessary for an appropriate assessment to be undertaken, the relevant material has been presented above as it would be considered in a three-stage assessment under the Habitat Regulations.

14.137. Potential cumulative (in combination) effects have been described in Section 14.8 and it is apparent that the proposed Development will not have a significant effect on (p)SPA interests in combination with other projects.

14.138. Overall, therefore, it is reasonable to conclude that the Development will not have a significant effect on the integrity of (p)SPAs, either alone or in combination with other developments.

14.139. It follows that there will be no detrimental effects on the respective SSSI designations which spatially overlap those of the (p)SPAs.

14.12 Conclusions

14.140. The likely effects of the proposed Development were evaluated in accordance with Section 14.3 and the significance of each potential effect stated under Section 14.3.

14.141. It is concluded that the likely effects of the proposed Development on all bird species are **not significant** under the terms of the EIA Regulations.

14.142. The available information indicates, beyond reasonable scientific doubt, that the Development will not, either alone or in combination, have a significant effect on any classified or proposed SPAs.

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15.0 Commercial fisheries

15.1 Introduction

15.1. This chapter presents the existing environment within the study area (as defined at Paragraph 15.26) and assesses the impact of the proposed Development and export cables on commercial fisheries within this area.

15.2. The fishery resource within and around the Development site and those directly dependent upon this resource are considered. The catching sector supports a range of associated upstream activities such as vessel and gear suppliers, and downstream activities such as marketing, processing and distribution.

15.3. This chapter should be read in conjunction with *Chapter 11: Marine Fish and Shellfish Resources*, *Chapter 12: Anadromous Fish*, *Chapter 19 Transport and Traffic* and *Chapter 13: Elasmobranchs*. Also accompanying this chapter is Appendices 15.1 to 15.4 which contains:

- Additional statistics;
- The Fisheries Liaison Officers (FLO) notes on discussions with fishermen;
- Fishermen Questionnaire; and
- A summary of fishermen's responses

Summary of Commercial Fisheries and impacts: Due to the nature of the local physical environment, commercial fishing within the Sound of Islay is limited to the use of static gears and occasional diving for scallops. Fishing for crustacean species such as velvet swimming crab, brown crab, and lobster is practiced by approximately 10 fishing vessels, with concentrated effort in the Sound of Islay occurring during the winter and spring months. Impacts of the proposed Development are deemed to range between **minor adverse** and **minor beneficial** levels providing the appropriate mitigation measures are implemented.

15.2 Potential Effects

15.4. Commercial fisheries could potentially be impacted in a number of ways by tidal arrays. The three main effects are likely to be: disturbance of fishing grounds, displacement of fishing vessels, (as outlined in the Scottish Marine Renewables SEA (Scottish Executive, 2007)) and safety implications for the fishermen. Also identified in the SEA as potential impacts are: marine noise, electromagnetic fields (EMF), changes in suspended sediment, contamination, smothering, increased turbidity and changes in hydrodynamic regime.

15.3 Methodology

15.3.1 Legislative Background and Guidance

15.5. There is no specific legislation or statutory guidelines which inform management of impacts on commercial fisheries from tidal turbines, other than through protection of the natural resources on which they depend. These are detailed in *Chapter 11: Natural Fish and Shellfish Resources*.

15.6. The European Marine Energy Centre (EMEC) has developed EIA guidance for developers seeking consent within the EMEC site on Orkney. These guidelines are very useful particularly in relation to detailing the information required for describing the project. The guidelines also give an overview of potential impacts highlighting that the loss of any substantial fishery should be considered a major impact, but do not discuss baseline reporting requirements

15.3.2 Consultation

15.7. A dedicated Fisheries Liaison Officer (FLO) was appointed by SPR at the start of the EIA process. The FLO also acted as a Community Liaison Officer (CLO) and was based full-time on Islay.

15.8. A number of group meetings were held with the fishermen, as outlined below in Table 15.1.

Table 15.1 Record of meetings regarding commercial fisheries

Date	Activity	Location	Organiser	Attendance
05/1/2009	Preliminary Hazard Assessment meeting	Port Askaig Hotel	David Cantello	7 Fishermen, Local CFA Secretary,
04/2/2009	Tidal Project Open Day	Columba Centre, Islay	Andrew Macdonald	1 Fisherman, CFA Secretary, Local CFA Secretary
04/2/2009	Islay Energy Trust (IET) AGM, Presentation on Tidal Project	Columba Centre, Islay	Andrew Macdonald	50 General Public
05/3/2009	Clyde Fishermen's Association	IET Office	Andrew Macdonald	CFA Secretary
16/4/2009	Tidal Project Update	Local CFA Secretary's Office	Andrew Macdonald	Local CFA Secretary
01/5/2009	Informal Interviews with fishermen	Various	Andrew Macdonald, Stephen Appleby	5 Fishermen
13/5/2009	Clyde Fishermen's Association	IET Office	Andrew Macdonald, Stephen Appleby	CFA Secretary
13/8/2009	Islay Show (IET Stand with Project Information)	Bridgend	Andrew Macdonald	1 Fisherman, 100 General Public
16/9/2009	Sample Fishing Trip	At sea	Andrew Macdonald	1 Fisherman
21/10/2009	Tidal Project Update	Local CFA Secretary's Office	Andrew Macdonald	Local CFA Secretary
29/10/2009	Letter to Fishermen with invite to NSRA	Royal Mail	Andrew Macdonald	21 Islay Fishermen
03/11/2009	Navigational Safety Risk Assessment meeting	ServicePoint, Bowmore	David Cantello	5 Fishermen
09/11/2009	Navigational Safety Risk Assessment meeting	Glasgow	David Cantello	CFA Secretary
09/11/2009	NSRA Minutes and Questionnaire posted	Royal Mail	Andrew Macdonald	8 Port Askaig Fishermen
07/04/2010	Update letter to Fishermen	Royal Mail	Andrew Macdonald	21 Islay Fishermen
12/4/2010	Clyde Fishermen's	IET Office	Andrew Macdonald	CFA Secretary

Table 15.1 Record of meetings regarding commercial fisheries				
Date	**Activity**	**Location**	**Organiser**	**Attendance**
	Association – review of draft EIA			

Interviews and observer trips

15.9. Local fishermen have been consulted about the project in a variety of ways including:

- Open Day event and information stands at local events;
- Meetings with the Clyde Fishermen's Association representatives;
- Formal group meetings in January and November 2009;
- Informal discussions with individual fishermen throughout the year;
- Questionnaires sent direct to fishermen across Islay (Appendix 15.3);
- An observer trip on a crabbing vessel in September 2009; and
- Project updates in the local press and IET website.

Scoping opinion

15.10. A scoping opinion was sought from statutory consultees in August 2008; responses are detailed in *Chapter 3: Consultation*, and a short summary of the main point's pertinent to commercial fisheries that were raised during this process, along with an explanation of how they were addressed, is provided below.

15.11. A key concern raised by many of the respondents such as the Scottish Environment Protection Agency (SEPA) and the Laggan and Sorn District Salmon Fishery Board was that not enough consideration had been given to the possible impacts to migratory fish such salmon and trout. In response to this an entire chapter of this ES (*Chapter 12: Anadromous Fish*) has been dedicated to anadromous fish (fish that travel between salt and fresh water) and the possible impacts to this group has been assessed there. A second concern raised by fishermen during both the scoping stage and in further consultation was the risk that the Development may pose to the health and safety. This concern has been addressed by SPR by commissioning Abbot Risk Consulting (arc) to complete a Navigational Risk and Safety Assessment (NRSA) of the Development. This documented is contained in Appendix 19.1 and addresses key issues associated with health and safety of fishermen.

15.3.3 Data collection

15.12. Information was collated from a number of sources including Marine Scotland: Compliance (formally Scottish Fisheries Protection Agency), Marine Scotland: Science (formally Fisheries Research Services), Cefas, Marine Fisheries Agency (MFA), FLO appointed for the project by SPR, local fishermen and an observation trip.

15.13. Several data sets were obtained from Marine Scotland: Compliance Marine Monitoring Centre, including:

- Annual landings by all vessels detailing live weight, value and species landed by vessel length category and port of landing from ICES Statistical Rectangles 40E3 and 40E4 (see Figure 15.12 for ICES rectangle boundaries) for 2003 to 2008;
- Monthly landings from ICES rectangles 40E3 and 40E4 for 2008, by species, live weight and value;
- MFA UK fishing vessel list for vessels under and over 10m (DEFRA, 2008);
- Air surveillance data detailing vessel gear type, activity and number of sightings by year, month and day for ICES Statistical Rectangles 40E3 and 40E4 for 2003 to 2008; and
- Vessel Monitoring System (VMS) data for vessels over 15m within the Sound of Islay and surrounding area detailing vessel gear type, activity, directional course and number of VMS logs recorded by year, month and day.

15.14. Other reports have provided important background reading, including:

- A report on the perceptions of the fishing industry into the potential socio-economic impacts of offshore wind energy developments on their work patterns and income (Mackinson *et al.*, 2006);
- Scottish Marine Renewables Strategic Environmental Assessment: Chapter C10 Commercial Fisheries and Mariculture (Scottish Executive, 2007);
- Environmental Statements for other tidal sites including SeaGen, Strangford Lough (Royal Haskoning, 2005) and Fall of Warness (Aurora Environmental, 2005); and
- Strategic Research Assessment for Wet Renewables (Davies, 2008).

Risks and uncertainty

15.15. The Registration of Fish Buyers and Sellers and Designation of Fish Auction Sites Regulations 2005 have had a significant impact on the recording of first hand sales in the fish trade. Under these regulations buyers and sellers must be registered and therefore all landings are captured in official statistics that provide an accurate representation of the commercial fishing industry.

15.16. Landing statistics are reported by ICES rectangles which are 30 minutes latitude and 1° longitude in size, and are thus approximately 30 nautical miles square. Therefore, it is not possible to report landings from a smaller specific area. However, other factors can be considered when assessing landing statistics to provide a better picture of the local fleet's activity, including vessel length category, gear type and landing port.

15.17. The overflight data used to asses fishing grounds is only a snapshot in time as the spotter plane that records this data will only fly in suitable conditions and therefore only represents a small amount of the fishing activity that occurs in the area. VMS data is now widely accepted to be a more accurate method of assessing the locations and intensity of fishing effort. However, VMS data from the Sound of Islay area could also provide a misleading indication of fishing effort levels for the following reasons: Firstly it is not a legal requirement for vessels under 15m (which includes all vessels that are known to fish within the Sound) to carry VMS equipment (therefore VMS will not pick up local fishing activity) and secondly VMS data is generally speed filtered to indicate when a vessel is fishing. However, in areas with strong currents, such as the Sound of Islay vessels in transit (not fishing) that are travelling against the tide can be slowed and will artificially appear to be fishing. As vessels slow down to enter ports such as Port Askaig (located within the Sound (Figure 15.13) they will also appear from VMS data, as though they are fishing.

15.3.4 Assessment of Significance

15.18. This section describes the methodology behind how the impacts of the construction, operation, maintenance and decommissioning of the Development on commercial fisheries have been assessed.

15.19. Impacts have been assigned a level of likely significance (from major to negligible), according to the definitions described in *Chapter 2: Scoping and Assessment Methodology*.

15.20. The impact assessment is based on an assessment of the magnitude of the impact and the sensitivity/value and/or the importance of the receptor (which in this case is commercial fisheries).

15.21. Table 15.2 provides a description of the criteria used to assess impact magnitude. Levels of magnitude are shown with a general description of the meaning of each 'level' applied within the context of commercial fisheries.

Table 15.2 Magnitude of the impact

Magnitude	Description
High	A fundamental change to the baseline condition of the commercial fisheries.
Medium	A detectible change in the baseline condition resulting in the non-fundamental temporary or permanent effect on commercial fisheries.
Low	A minor change to the baseline condition of commercial fisheries (or a change that is short lived in nature).
Negligible	An imperceptible and/or no change to the baseline condition of commercial fisheries.

15.22. The assessment of significance is based upon the magnitude and features of the impact and the sensitivity or value of the receptor. The sensitivity/value and/or importance of the receptor are determined from a set of accepted criteria (Defined within Scottish Executive SEA 2007). A detailed description of the criteria used to assess sensitivity/value and/or importance for the receptor of each impact to commercial fisheries is provided in Table 15.3 below.

Table 15.3 Description of Sensitivity or Importance/Value of Receptor.

Sensitivity / value and/or importance of receptor	Description
High	Environment is subject to major change(s) due to impact. For example, Impact on commercial fishing causing a long term (for the life of the device array) significant reduction in landings, or a permanent reduction of the fishing fleet (i.e. number of vessels) that operate within the study area.
Medium	Impact on commercial fishing activities that may cause; fishing fleets to permanently modify their fishing activities (e.g. modification of methods or gear), or, long term (for the life of the array) reduced access to traditional fishing grounds or greater transit times to grounds, or, temporary total loss of access to grounds. The total quantity of landings from the study area or the number of vessels in the fishing fleet would not be significantly reduced.
Low	Environment responds in minimal way to effects such that only minor change(s) are detectable. For example commercial fishing activities that may cause; fishing fleets to temporarily modify their fishing activities (e.g. modification of methods or gear), or temporary reduced access to traditional fishing grounds. The total quantity of landings from the area or the number of vessels in the fishing fleet may not show a reduction that can be attributed to the Development.
Negligible	An imperceptible and/or no change to commercial fisheries.

Note: This table has been adapted from the Scottish Executive SEA (2007) significance criteria table for the purposes of this assessment. .

15.23. Table 15.4 combines the assessment for the sensitivity of a receptor with the potential impact magnitude to give an overall assessment of the environmental impact significance.

Table 15.4 IMPACT SIGNIFICANCE MATRIX

Magnitude of Impact	Receptor Sensitivity			
	Negligible	**Low**	**Medium**	**High**
High	No significant effect	Moderate	Major	Major
Medium	No significant effect	Minor	Moderate	Major
Low	No significant effect	Negligible	Minor	Moderate
Negligible	No significant effect	Negligible	Negligible	Minor

15.24. It should be noted that any residual effect (the effect after the implementation of mitigation) which remains at the level of 'Moderate' or 'Major' is still regarded by the EIA Regulations as being a significant effect.

15.4 Baseline Description

15.4.1 Study area

15.25. The location of the proposed Sound of Islay Demonstration Tidal Array, along with associated onshore and marine infrastructure, is shown in Figure 1.1 (*Chapter 1: Introduction*).

15.26. A number of different terms are used to describe various spatial scales considered in this Chapter. The "wider region" is a term used to describe The Sound of Islay and surrounding waters. The "study area" is, for the purposes of this assessment, the term used to describe the Sound of Islay (the extent of which is displayed in Figure 15.12) and the "development site" is defined as the lease boundary option and is displayed in Figure 15.13.

15.27. The study area is predominantly within ICES rectangle 40E3 (with a very small section falling within rectangle 40E4), and therefore quantitative analysis is concentrated on this rectangle. Due regard, is also given to ICES rectangle 40E4 in relation to describing other fishing activities in the "wider region"

15.28. The main landing port within the study area is Port Askaig, and this is where the vast majority of the catch within the study area will be landed. Alternatively, Port Ellen can be used to land catches in bad weather. Other landing ports of significant importance to 40E3 and 40E4 are presented in Table 15.5 and their locations are displayed in Figure 15.12.

Table 15.5 Local ports with significant landings (£'000) during 2003-2008 from ICES rectangles 40E3 and 40E4

Port	Landings from ICES rectangle 40E3 and 40E4 combined (value £'000)	Landings from ICES rectangle 40E3 (value £'000)
Port Ellen	3379	3230
Port Askaig	2306	2245
Bowmore	1262	1186
Oban	1621	559
Troon and Saltcoats	3681	351
Campbeltown	2795	176

Table 15.5 Local ports with significant landings (£'000) during 2003-2008 from ICES rectangles 40E3 and 40E4		
Port	**Landings from ICES rectangle 40E3 and 40E4 combined (value £'000)**	**Landings from ICES rectangle 40E3 (value £'000)**
Tayinloan	3188	154
West Loch Tarbert	3932	106
Bruichladdich	46	46
Jura	130	40
Crinin	828	30

15.29. The study area covers approximately 40km^2 and contains water depths of up to 65m which occur in deep channels within the centre of the Sound. The Development site is located in water greater than 48m deep, where the seabed habitat is predominately gravel with large boulders and rocky ground. Further information on the seabed habitat, ground conditions and water conditions are presented in *Chapter 7: Physical Conditions and Coastal Processes and Chapter 8: Benthic Ecology*.

15.30. The local conditions and current speed within much of the study area render the site unsuitable for fishing practices using mobile gears, such as dredging or trawling. The main fishing activity within the study area is therefore carried out using static gears, mainly creeling for crab and lobsters. However, consultation with local fishermen has revealed that scallop dredging does occasionally occur in the most northern and most southern parts of the study area and some diving for scallops has occurred in the past (this may resume in the near future). Scallop diving is generally only conducted in water depths of less than 25m.

15.4.2 Fisheries management

15.31. Management of marine fish and shellfish stocks varies with species and is largely dependant on the scale, distribution and value of the fisheries. National and international bodies carry responsibilities for fisheries management and within Scotland this is delivered by Marine Scotland: Sea Fisheries Division and enforced by Marine Scotland: Compliance (formally Scottish Fisheries Protection Agency).

15.32. As a member of the EU and with important stocks widely distributed across other European countries, the UK is subject to the Common Fisheries Policy (CFP). Under the CFP, the EU Fisheries Commission is responsible for making recommendations/proposals, from which the Council of Ministers base management decisions for specific species.

15.33. One of the principle management tools used by the EU is the Total Allowable Catch (TAC) which is implemented through the allocation of quotas. However, the CFP is currently being reviewed and control is focusing more on effort management including days/hours at sea and technical conservation measures (TCM) such as mesh and size restrictions.

15.34. Quotas and days at sea restrictions are enforced for specific important stocks and are allocated by ICES Division. The West of Scotland is located within ICES Division VI which itself is split into VIa (West Scotland – Clyde stock) and VIb (Rockall). The area VI has quotas for the following species: spiny dogfish, anglerfish, tusk, cod, megrims, horse mackerel, haddock, greenland halibut, roundnose grenadier, herring, norway lobster (Nephrops), pollack, saithe, ling, blue ling, mackerel, whiting, blue whiting, hake, plaice, skate and ray, sole and porbeagle.

15.35. The Inshore Fishing (Scotland) Act 1984 (as amended by the Inshore Fishing (Scotland) Act 1994) gives Marine Scotland: Sea Fisheries Division managers the powers to open and close inshore areas and control the activities of certain fishing gears. Non quota species such as lobster, crab species and scallops are therefore managed at a national and/or local level through restrictions such as minimum landing sizes and number of dredges per side (for scallops) and voluntary measures such as returning berried lobster and/or crab and v-notching lobster.

15.36. The inshore fleet is due to have another means of management through the forthcoming Inshore Fishery Groups (IFGs). There are to be twelve IFGs which span the coast of Scotland out to 6 nautical miles offshore. Once established the South west IFG will be responsible for an area which includes the study area. The role of the South West IFG will be expected to include the following:

- Formulation and implementation of management plans;
- Preparation of spatial management initiatives;
- Setting up of voluntary agreements to improve working relationships amongst different types of fisheries; and
- Assessing proposals for funding priorities for an area's fisheries and communities.

15.4.3 Species of Commercial Interest in the Study Area

Overall landings

15.37. Species of greatest commercial interest landed from ICES rectangle 40E3 during the period 2003 to 2008, in order of highest value first are as follows: great scallop, velvet swimming crab, brown crab and lobster (Figure 15.1). The main species of commercial interest in the wider region (ICES rectangles 40E3 and 40E4), in order of the highest value first, are as follows: great scallop, brown crab, velvet swimming crab and lobster.

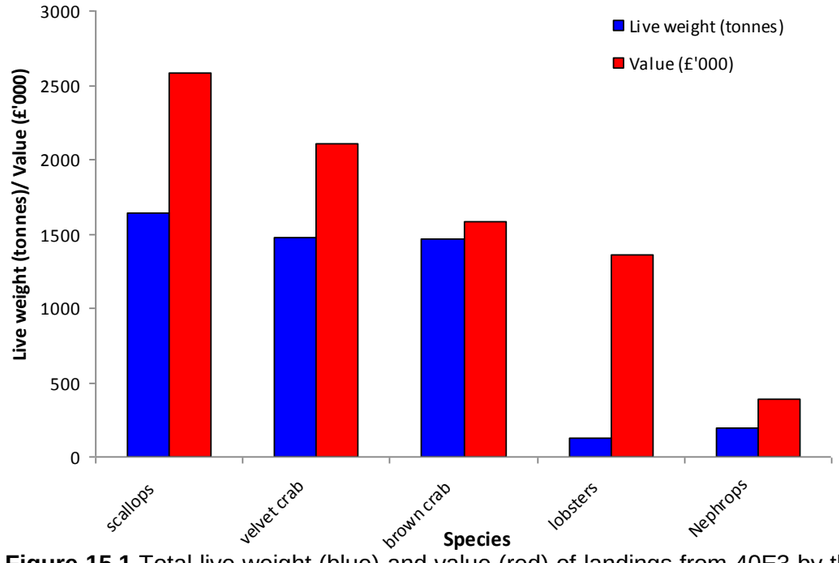

Figure 15.1 Total live weight (blue) and value (red) of landings from 40E3 by the most valuable species between 2003 and 2008.

15.38. Between 2003 and 2008 the overall value of landings from rectangle 40E3 has increased, while the live weight landed has fluctuated but overall has decreased, with the most dramatic decrease occurring from 2004 to 2005 (Figure 15.2). The total live weight landed from 40E3 in 2008 was 900 tonnes with a value of approximately £1.8 million.

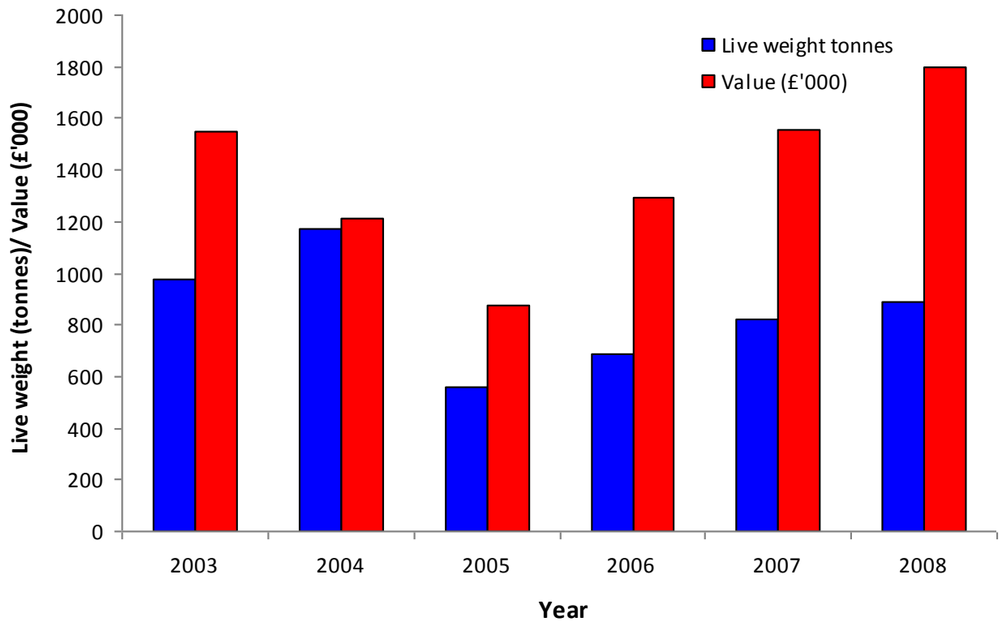

Figure 15.2 Total live weight (blue) and value (red) of landings from 40E3 by Year species.

Seasonality and distribution

15.39. Calculations of the average landing by live weight and by value per month from ICES rectangle 40E3 were conducted to highlight any general patterns with season over the time period 2003 to 2008. In terms of the live weight landed (tonnes) fishing shows clear seasonality with the highest amount of fishing being done in the summer (July to October) and the least in the winter (December to March). However, in terms of value (£'000), there is a less clearly defined trend with a high value for fish in April, May, June, August and December distorting the pattern that is seen in landings by live weight (Figure 15.3).

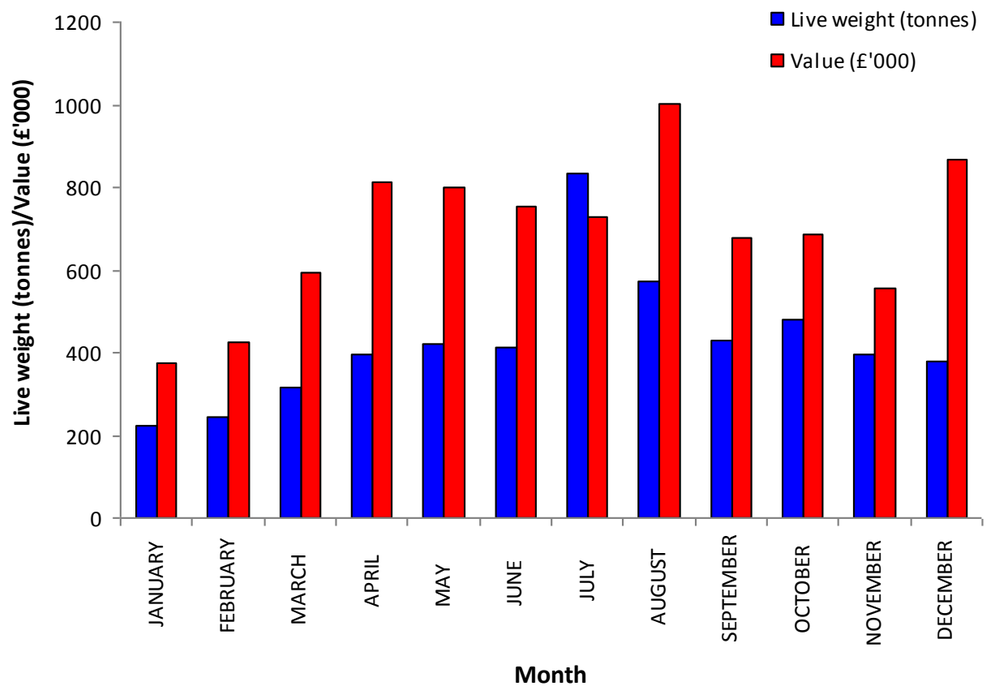

Figure 15.3 Total live weight (blue) and value (red) of landings from 40E3 by month. (Data source: Marine Scotland Compliance, 2009).

15.40. Landings at Port Askaig, which is likely to represent the majority of commercial fishing within the study area, are mostly comprised of velvet swimming crab, edible crab and lobster (Figure 15.4). These species are clearly important to commercial fisheries with the study area and have therfore been identified as "Key species".

15.4.4 Key Species

Velvet swimming crab

15.41. Between 2003 and 2008 the velvet swimming crab *Necora puber* comprised 26% of the value of landings from ICES rectangle 40E3 and 24% of the total live weight. At Port Askaig velvet swimming crabs comprised 48% of the value of landings and 59% of the live weight.

15.42. Velvet crabs are targeted by vessels operating static gear (creelers) and interviews with local fishermen have confirmed that they are fished within the study area by up to ten vessels with the majority of activity occurring during the winter months (Appendix 15.2). Landings data confirms this seasonal trend, showing that landings of velvet swimming crab are approximately double during the latter part of the year (Figure 15.5). This increase in landings is driven by the increase in sale value over this period (by £1.81 per kg) which is likely to be due to the increased demand at Christmas from European markets.

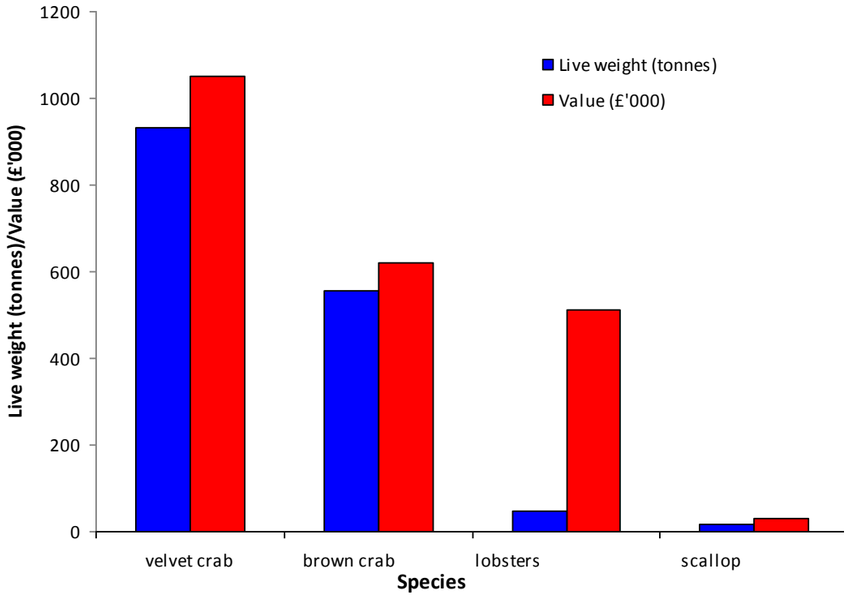

Figure 15.4 landings at Port Askaig from 2003-2008 in live weight (blue) and value (red) (Data source: Marine Scotland Compliance, 2009)

15.43. Construction activities are unlikely to be conducted during winter months due to the increased chance of bad weather during this period.

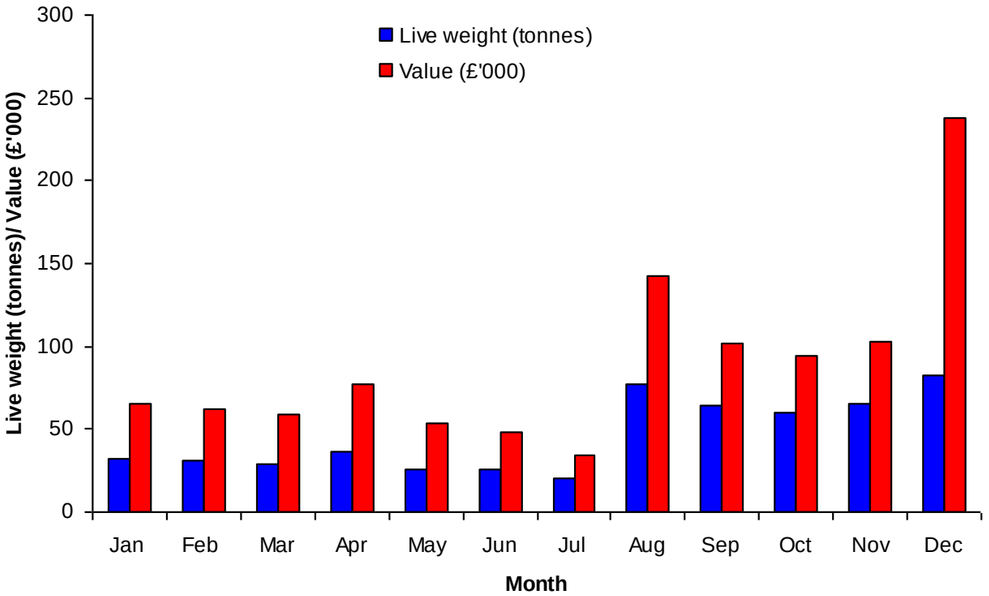

Figure 15.5 Seasonal trends for live weight (blue) and value (red) of landings of velvet swimming crab at Port Askaig from 2003 to 2008 (Data source: Marine Scotland Compliance,2009).

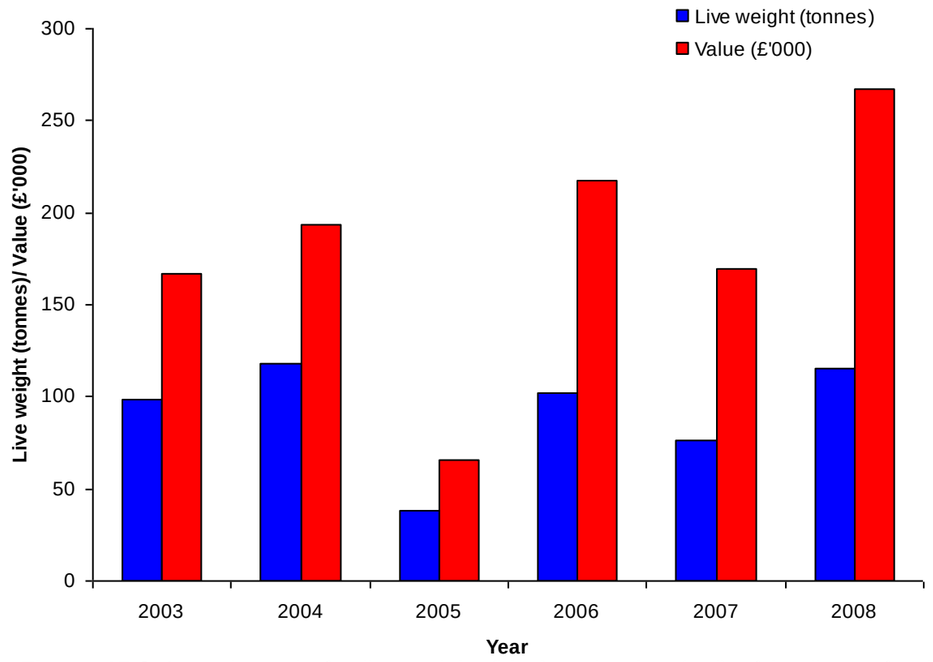

Figure 15.6 Annual trends for live weight (blue) and value (red) of landings of velvet swimming crab landed at Port Askaig from 2003 to 2008 (Data source: Marine Scotland Compliance, 2009)

15.44. The trend in annual landings of velvet crab at Port Askaig is shown in Figure 15.6. Live weight and value have remained relatively consistent since 2003, with the exception of 2005 which saw a marked decrease in landings. While the landed weight has remained similar across 2003 to 2008, the value has increased over this period giving a sales value of £2.28 per kg in 2008, compared to £1.69 per kg in 2003.

15.45. Velvet crabs are mostly found in the intertidal and shallow water on stony and rocky substrata, being most abundant on moderately sheltered shores (Wilson, 2008a). Therefore the preferred habitat for these crabs will not overlap with the development site, but will overlap with the cable landfall route (see *Chapter 5: Project description*). Also vessels targeting these species are likely to transit through the development site whilst travelling to sites or hauling pots. During the benthic surveys (SeaStar Survey Ltd, 2009 and Royal Haskoning 2010) there were two sighting of a velvet swimming crab, both were in shallow near-shore waters (Figure 15.13) and the closest was approximately 150m from the development site and 308m from the nearest potential turbine location.

Brown crab

15.46. Brown crabs are targeted by vessels operating static gear (creelers) and are known to be landed from within the study area. Consultation with local fishermen has also confirmed that this species is targeted within the development site.

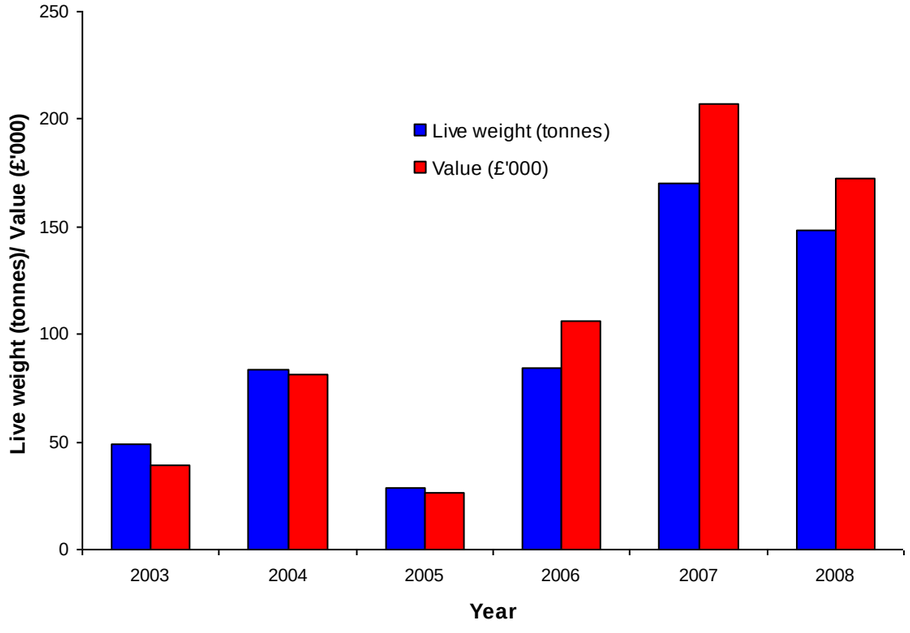

Figure 15.7 Annual trends for live weight (blue) and value (red) of brown crab landed at Port Askaig from 2003 to 2008 (Data source: Marine Scotland Compliance, 2009).

15.47. The brown crab *Cancer pagurus* (also known as the edible crab) comprise 29% of the overall weight and 19% of the overall value of landings of all species from ICES rectangle 40E3 between 2003 and 2008 making it the third most important species in terms of weight landed (Appendix 15.1, Figure 1). However, the value of brown crab is relatively small per unit weight when compared to other "key species" which explains why it comprises much less of the percentage value landed from this rectangle.

15.48. Between 2003 and 2008 brown crab landings at Port Askaig comprised 35% of the live weight landed and 28% of the total value. Overall both value and weight of brown crab landings at Port Askaig increased between 2003 and 2007, before falling in 2008 (Figure 15.7). After a dip in landings in 2005 a rapid increase was seen in the years 2006 to 2008. The seasonality of brown crab landings at Port Askaig from years 2003 to 2008 show a similar trend to that of velvet swimming crab with landings increasing during autumn and then dropping of at the beginning of the year(Figure 15.8). This appears to be driven by an increase in value over this period.

15.49. The favoured habitats of brown crab are bedrock including under boulders, mixed coarse grounds, and offshore in muddy sand. Lower shore, shallow sublittoral and offshore to about 100m (Neil & Wilson, 2008). During the benthic surveys (SeaStar Survey Ltd, 2009 and Royal Haskoning 2010) brown crabs were sighted at many locations within the development site and in close proximity to proposed turbine locations (Figure 15.13).

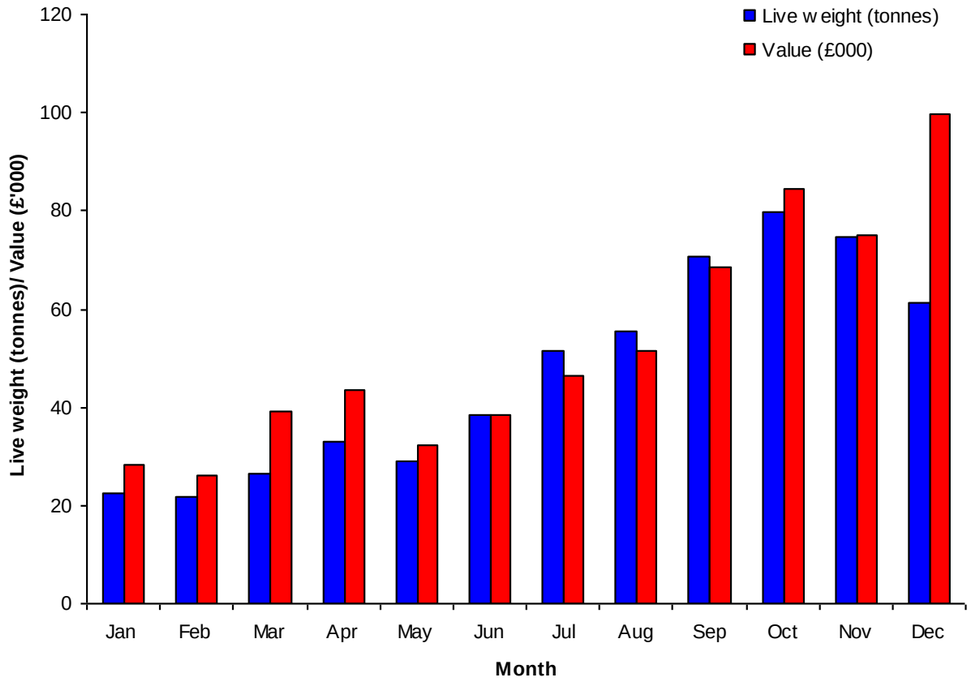

Figure 15.8 Seasonal trends for live weight (blue) and value (red) of landings of brown crab landed at Port Askaig from 2003 to 2008 (Data source: Marine Scotland Compliance, 2009).

Lobster

15.50. Lobster which are currently targeted within the study area comprise only 2.4% of the live weight landed from rectangle 40E3 during the period 2003 to 2008, but due to the high value of lobster this constituted 16% of the value of landings. Landings of lobster from this rectangle fell constantly between 2003 and 2005 but then increased rapidly between 2005 and 2008 (Appendix 15.1, Figure 2 (d)). A clear trend in seasonality was seen in all years for lobster landings with an increase in spring leading to the highest landings occurring in the summer months, reducing in late autumn and winter (Figure 15.9).

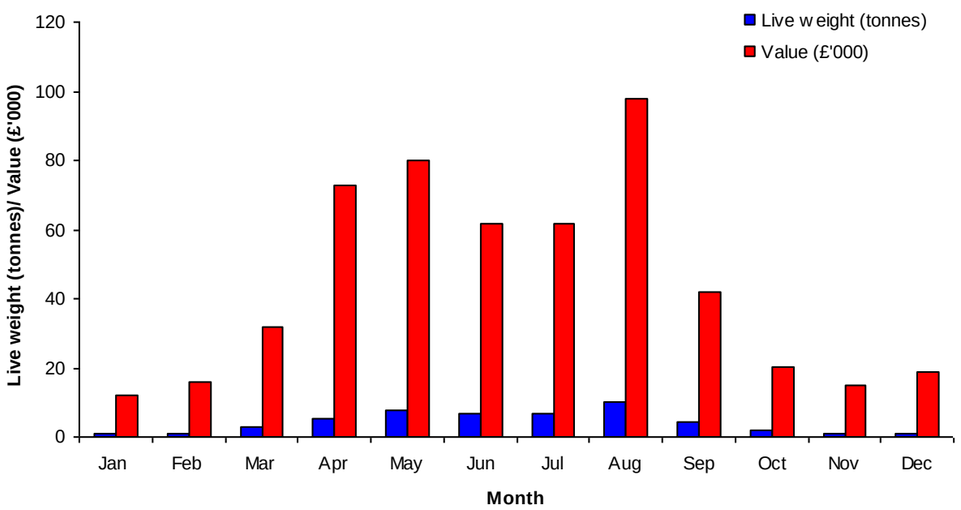

Figure 15.9 Seasonal trends for live weight (blue) and value (red) of landings of lobster landed at Port Askaig from 2003 to 2008 (Data source: Marine Scotland Compliance, 2009).

15.51. At Port Askaig Lobster comprised 2.9% of the live weight landed and 22.7% of the value landing during the years 2003 to 2008. In contrast to landings from the ICES rectangle 40E3 landings at Port Askaig increased from 2003 to 2004 and then dropped sharply in 2005. Since 2005 lobster landings at Port Askaig have seen an overall increase (Figure 15.10). Landings at Port Askaig mirrored the landings from ICES rectangle 40E3 in terms of seasonality (Figure 15.9).

15.52. Lobsters prefer rocky substrata, living in holes and excavated tunnels from the lower shore to about 60m depth (Wilson, 2008b). Consultation with local fishermen has revealed that during certain periods lobster are also present in mixed substrata habitats. During the benthic surveys (SeaStar Survey Ltd 2009 and Royal Haskoning, 2010) lobsters were not sighted. However, they are a generally cryptic species, not often observed via remote video methods.

15.53. Lobsters are targeted by vessels operating static gear. Creelers are known to operate within the Sound and consultation with fisherman operating within study area revealed that one vessel specifically targets lobster within the development site.

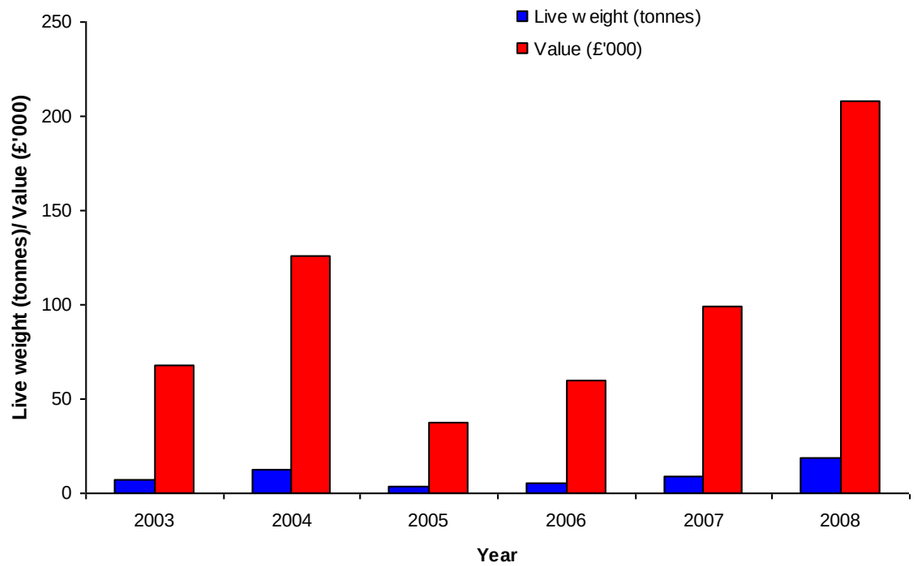

Figure 15.10 Annual trends for live weight (blue) and value (red) of lobster landed at Port Askaig from 2003 to 2008 (Data source: Marine Scotland Compliance, 2009)

Great Scallop

15.54. The great scallop *Pecten maximus* (also know as the king scallop) comprised 32% of the total live weight and 31% of the value of landings from ICES rectangle 40E3 for the period 2003-2008 making them consistently the most landed species from this ICES rectangle. However, at Port Askaig scallops only comprised 1.1% of landings in terms of weight and 1.3% of landings in terms of value between 2003 and 2008 (Figure 15.4).

15.55. Although scallops are not an important species in terms of volume landed from within the study area, they are an important species for the wider region. It is possible that the scallops within the study area are helping to populate the wider region from which scallops are fished.

15.56. Scallops were found to be present within the study area during the benthic surveys (SeaStar Survey Ltd, 2009 and Royal Haskoning, 2010) but not within the development site (Figure 15.13). Scallops are not expected to occur abundantly across the Development site, though they may be present in patches of softer sediments. Consultation with local fishermen indicated that scallops have been targeted using divers in the past but this does not currently occur on a large scale. Scallop diving usually only occurs in water less than 25m deep and so would not occur within the development site.

Other species.

15.57. Although only crab, lobster, and to a far lesser extent, scallops, are targeted within the study area other species which have not been defined as “Key species” in this assessment are landed from ICES rectangle 40E3. For calculations of the live weight and value of other species landed from ICES rectangle 40E3 see Appendix 15.1 (Figure 1).

15.4.5 Fishing Activity in the Area (Local Fleet)

Overview of the local fleet

15.58. Fishing activities within the study area currently consist almost entirely of creeling with the exception of occasional scallop dredging at the very far north and south of the Sound. No evidence has been acquired during consultation with fishermen that trawling, net or line fishing occurs on a regular basis, or has occurred on a commercial scale in the recent past within the study area (Appendix 15.4). Creeling in the study area is conducted by small, locally based, day-fishing vessels. These vessels range between 5.6m single handed vessels and vessels up to 11.8m (Table 15.6) manned by 3-4 people. The number of creel boats operating in the study area is approximately 10 with roughly 8 using the area on a regular full-time basis (Appendix 15.2).

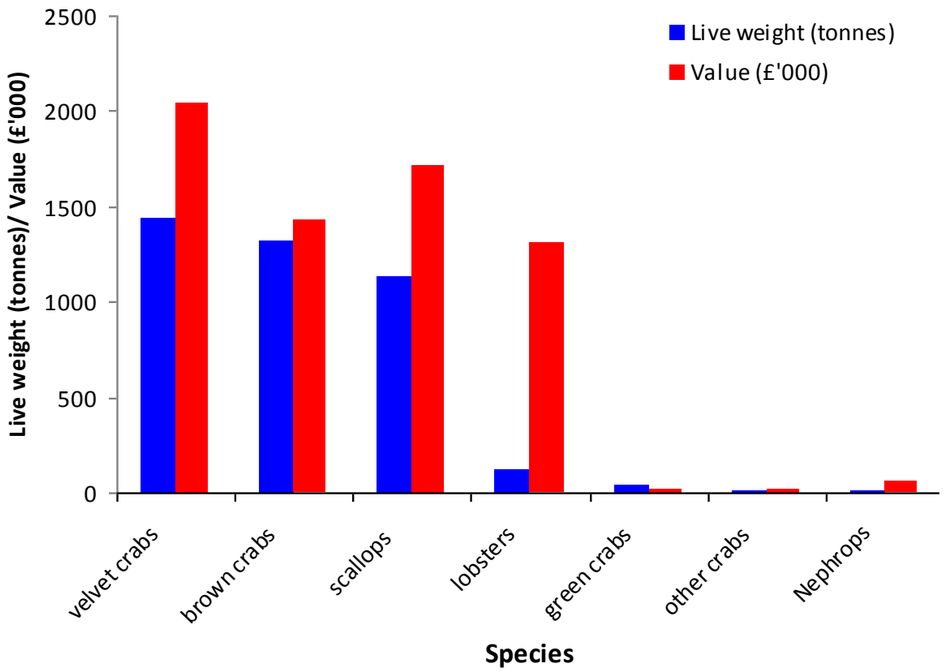

Figure 15.11 landings at all ports on Islay from 2003 to 2008 live weight (blue) and value (red). (Data source: Marine Scotland Compliance, 2009)

15.59. Comparing the overall landings for Islay (Figure 15.11) with those of Port Askaig (Figure 15.4) highlights the significant scallop dredging activity that occurs elsewhere around Islay. In particular, 60% of all scallops harvested from ICES rectangle 40E3 were landed at Port Ellen (located on the southern side of Islay) between 2003 and 2008.

Vessels

15.60. Both the DEFRA vessel list (which was collated by the MFA) and consultation with local fishermen was used to identify which vessels are active within the study area. A list of these vessels is displayed in Table 15.6. All but two of these vessels are less than 10m in length and all are less than 12m. The entire fleet of vessels identified in Table 15.6 are registered with Campbeltown as their administrative port.

Table 15.6: List of vessels that fish within the study area.

Vessel name	Overall length	Registered tonnage	Engine Output
Speedwell of Glenariffe	8.2	4.76	164
Hazel Ann	9.94	7.85	261
Cynosure	6.45	1.44	53
Lynn Louise	5.62	1.16	22.38
Sapphire	6.2	1.5	32
Paulanda	11.28	12.14	132
Exuberant	6.4	2.41	23
Jacamar	8.57	3.07	180
Calon Mor	11.8	11.64	134.2
Golden Opportunity	9.7	10.03	89

Gears used

15.61. Landings data for Port Askaig was used to calculate what type of fishing gear was responsible for the majority of landings from within the study area. During 2003 to 2008, 1555 tonnes (with a value of £2,215,184) was landed using pots and 17 tonnes (with a value of £30,000) was landed using dredges. This is to be expected as crab lobster and scallop constitute the vast majority of the landings from ICES rectangle 40E3 (Figure 15.1) and all of these species are landed by pots and dredges.

15.62. Creels or pots are usually set in 5-30m of water for crabs and as deep as 60m for lobster, although this is dependent on the location being fished, the size of the vessel and the equipment on board (e.g. the size of the hauler). During the consultation process it was revealed that some local fishermen target brown crab below 30m within the study area. The baited pots are normally strung together on a lead line of up to 20 pots, but can also be set singularly. The pots set within the development site are used to target brown crab and lobster (Appendix 15.2 and 15.4).

Fishing effort of the local fleet

15.63. There are a number of small harbours and ports within the wider region, with the main administrative ports in the being Oban and Campbeltown. According to the DEFRA vessel list, (DEFRA, 2009) there are 186 vessels less than 10m registered to Campbeltown and Oban (18 of which have their home port in Islay) and 88 vessels over 10m (2 of which have their home port in Islay). These vessels have an average registered tonnage of 14.64 and power of 107.77 kW. The average vessel age is 24 years, with 30% being built after 1990.

15.64. During consultation with local fishermen it was identified that 10 vessels are active within the study area. These vessels are detailed in Table 15.6 and approximately eight of them are known to use the study area on a regular basis with the majority of their effort occurring in winter and early spring when the Sound offers shelter that is not found in the surrounding waters.

Defined fishing grounds

15.65. Consultation with local fishermen has not enabled pin pointing of exact fishing locations within the Sound; however, of the three primary species targeted within the study area (velvet swimming crab, brown crab and lobster) only brown crab and lobster are targeted in water depths greater than 30m. As turbines are to be located in water depths greater than 48m it is only lobster and brown crab that can be targeted within the development site (Figure 15.13).

15.66. The VMS data illustrated in Figure 15.14 indicates that the study area is subjected to low or moderate levels of fishing by vessels that are over 15m in length. This appears to contradict the outcomes of the consultation process in which many local fishermen confirmed that it is only small vessels, under 15m in length that fish in the study area. The reason for this discrepancy can be explained by the fact that there is a landing facility at Port Askaig which larger vessels (over 15 m) occasionally use. The VMS data is speed filtered so that only vessels travelling between 3 and 10km per hour are included in Figure 15.14; therefore as the vessels slow down on approach to Port Askaig they register in the data as apparently fishing when actually vessels are in transit to or from Port Askaig.

15.67. Also as a result of the speed filtering process fishing vessels that are travelling through the study area against the tidal flow and vessels that take shelter within the study area will appear in the data as if they are fishing when in fact they are not.

Socio-economics

15.68. The 2006 economic survey of the UK fishing fleet (Seafish, 2008) calculated that the average income of a potting/creeling vessel between 10 and 12m in length was £84,200 in 2004 £99,000 in 2005 and £88,000 in 2006. This equated to an average crew member aboard these vessels generating an income of £42,100, £49,500 and £37,843 in the years 2004, 2005 and 2006 respectively. These figures are calculated for vessels between 10-12m which only represents the two largest vessels that regularly fish within the study area, so income for the majority of local vessels is assumed to be lower. Although this survey is the most recent it was conducted four years ago and therefore earnings are likely to have increased in line with inflation and higher demand for seafood. During consultation with the local fishing industry it was suggested that the gross income per boat would need to be in the region of £120,000 to £150,000 to make the boat economically viable.

15.4.6 Other EU and UK fishing vessels

Other UK vessels and EU Member States vessels

15.69. All vessels that landed fish from ICES rectangle 40E3 (which contains the study area) between 2003 and 2008 were registered within the UK. The majority of landings were from vessels that are registered in Scotland. Although vessels from outside of Scotland were travelling to ICES rectangle 40E3 during this period, it is unlikely that they were targeting the study area itself as creels (the only practical method of fishing within the Sound) are usually left for 12-40 hours and then recovered, making this method of fishing viable only to local vessels. Also, strong currents and variable substrate make it a very difficult place to fish.

15.5 Assessment of Effects and Mitigation

15.5.1 Do nothing scenario

15.70. If the proposed development is not realised, commercial fisheries within the study area are likely to continue much as described in the base line condition (Section 15.4). Consultation with fishermen that use the study area has determined that there are no current plans to increase fishing pressure within the Sound either by increasing the number of vessels or the number of creels used. It is recognised that fishing pressure within the study area would respond to the market forces, however such forces are difficult to predict.

15.5.2 Potential Impacts during Construction Phase

Impact 15.1: Temporary exclusion from fishing grounds

15.71. Commercial fishing within the study area is almost exclusively carried out by small vessels that use creels to catch crab and lobster. Ten boats use the Sound for creeling with approximately eight vessels using it regularly. Most of the fishing is conducted in winter and early spring when other grounds can't be accessed due to seasonal bad weather; however some vessels do use the study area all year round.

15.72. Installation of the proposed development is likely to take place during the summer months in order to avoid any potential bad weather.

15.73. The Navigation Safety Risk Assessment (NSRA) commissioned by SPR (Appendix 19.1) concluded that it would be inappropriate to implement safety zones, which encircle installation vessels or turbine structures. However in reality, during construction, fishermen will be unable to fish within the immediate vicinity of the construction vessels due to safety considerations of both the installation vessels and the fishing vessels. The NSRA (Appendix 19.1) also recommends that an application be made by SPR to the Scottish Government to designate the Development site an area of "No Fishing" and "No Diving". It is likely that this application will be made prior to construction and therefore if granted will prevent fishing within the development site during the construction phase.

15.74. In addition fishermen will also be unable to safely fish in Caol Ila Bay where temporary moorings are to be installed affecting an area of approximately 0.041km^2 (Figure 15.13) for the duration of the construction period (predicted to be between 60 and 80 days). Taking a precautionary approach, it is possible that a detectable change in the baseline condition may consequently occur due to the exclusion of fishing from these areas and therefore the magnitude of this impact can be considered to be medium.

15.75. Additionally, a temporary modification of fishing activities is likely to occur due to the impact and therefore the sensitivity of the receptor (local commercial fisheries) can be considered low.

15.76. As the impact of temporarily restricting access to fishing grounds is of a medium magnitude and the sensitivity of the receptor (local commercial fisheries) is low the overall effect is likely to be of **minor** significance during the short duration of the installation period.

MITIGATION IN RELATION TO IMPACT 15.1
• Install turbines and cables during periods of least fishing activity within the Sound (creeling activity is at its lowest in the summer). • Close consultation with local fishermen to identify methods of installation which minimise the area and the time period for any restriction.

Residual impact

15.77. If the mitigation suggested above is implemented then the significance of the impact will be reduced slightly but the effect overall is likely to remain of **minor** significance.

Impact 15.2: Change in abundance of targeted species

15.78. *Chapter 8: Benthic Ecology* and *Chapter 11: Marine Fish and Shellfish Resources* present an assessment of habitat disturbance upon the benthic assemblage and the impact to commercially important species within the tidal array site. It is estimated that the total loss of seabed within the footprint of the devices will cover a very small percentage of the Sound (see *Chapter 11: Marine*

and Shellfish Resources and *Chapter 8: Benthic Ecology* for detailed calculations) and therefore the magnitude of the impact will be low.

15.79. Furthermore, velvet swimming crabs, which provide the greatest value of landings on Islay and in particular at Port Askaig (Figure 15.4), are usually found intertidally or in shallow water and therefore are not likely to inhabit the deep waters (deeper than 48m) of the study area such as the Development site. However, the cable route will be taken through the intertidal and will result in maximum habitat loss of approximately 1946m^2 which is less than 0.01% of the available habitat for velvet swimming crabs within the study area.

15.80. The only flat areas of seabed upon which the turbines will be placed are comprised of coarse sediments. Of the target species within the study area (velvet swimming crabs, lobster and brown crabs), only brown crab and lobster are likely to use such habitats. According to Neal and Wilson (2008) and Jackson *et. al.* (2008) both crab and lobster have intermediate or very little sensitivity to smothering or habitat loss (which may potentially be caused by construction of the proposed Development); therefore these species can be considered to have a medium or low sensitivity to the impacts of the Development.

15.81. As the magnitude of the impact is low and the sensitivity of the receptor (crab and lobster) is, at worst, medium, the loss of available habitat and possible decrease in abundance of targeted species is likely to have an effect of **minor** significance**.**

MITIGATION IN RELATION TO IMPACT 15.2
• Micro-siting to avoid reef areas which may potentially be used by lobster.

Residual impact

15.82. If the above mitigation is implemented then the effect of the Development upon the abundance of targeted species is likely to be of **negligible** significance.

Impact 15.3: Displaced fishing effort targeting new or other existing fishing grounds

15.83. Vessels that currently fish in the study area mainly do so during the winter and early spring when other fishing grounds are not accessible due to bad weather (Appendix 15.2 and 15.4); however, some smaller vessels utilise the study area year-round. Alternative fishing grounds for creeling are located to the north of the study area (Appendix 15.2) and to the south. During construction the majority of the study area will be accessible to fishermen for creeling (Appendix 19.1) and therefore the magnitude of this impact will be low.

15.84. The local fishing fleet may need to temporarily modify their fishing activities during the construction period in order prevent collision with construction vessels and avoid interactions with installed infrastructure. However, as the displaced effort would be small (approximately 10 vessels, many of which only operate within the Sound over winter and spring months) and much of study area will still be accessible to the fleet the sensitivity of local commercial fisheries can be considered to be medium or low. Therefore (using the significance matrix) the effect of displaced fishing effort targeting new or other fishing grounds is likely to be at worst, of **minor** significance.

MITIGATION IN RELATION TO IMPACT 15.3
• Where practicable timing of installation should coincide with times when the least fishing is being conducted within the study area. This will be agreed after further consultation with the local fishermen.

Residual impact

15.85. If the above mitigation is implemented the effect of the proposed development on other new or existing fishing grounds is likely to be of **negligible** significance.

Impact 15.4: Loss of fishing gear due to entanglement

15.86. The consultation process identified that there are occasions when singly operated fishing vessels drift whilst untangling fouled fleets of creels. If this situation were to arise whilst the fishing vessel were upstream of the construction area there is potential for the fishing gear to become entangled in either installed infrastructure or vessels and machinery associated with construction process.

15.87. The likelihood of this situation occurring and therefore the magnitude of the impact is low due to the fact that close consultation has and will continue to inform all fishermen of how and when development of the array is progressing.

15.88. The costs incurred to a fisherman (and therefore the sensitivity of this impact) if an entire fleet of creels was lost would be in the region of £1500 (Appendix 15.2) which would be significant for that individual when compared to their earnings (see Paragraph 15.68). Therefore the sensitivity to the individual involved could be considered to be high/medium; however when this is considered across the whole fleet (10 vessels) the sensitivity is only likely to be medium or low.

15.89. Therefore with a low magnitude of impact and medium/low sensitivity of the receptor, the loss of fishing gear due to entanglement is likely to be result in an effect of **minor** significance.

MITIGATION IN RELATION TO IMPACT 15.4
• Consultation with fishermen to ensure that they are fully aware of the locations and timings of installation. • Fishing vessels to be provided with accurate information on the position of the individual devices immediately after they are installed. • All crews operating installation vessels and any shore based workers to remain vigilant at all times, and alerting such fisherman to the potential danger. • Dedicated safety boat to safely manage any unpowered vessels that come within the vicinity during installation.

Residual impact

15.90. If some or all of the above mitigation is implemented then the likelihood of fishing gear being lost due to entanglement with turbines and associated infrastructure will be reduced still further resulting in an effect of **negligible** significance**.**

15.5.3 Potential impacts during operational (and maintenance) phase

Impact 15.5: Long term exclusion from fishing grounds

15.91. During operation of the Development a small area of the study area will become unsafe to fish. An application will be made by SPR to the Scottish Government to designate the development site a “No Fishing” (Int. Symbol N21) and “No Diving” area. This area will be in existence for the life time of the development which is currently believed to be approximately 15 years and is likely to be similar in area to the lease option boundary displayed in Figure 15.13, which is 0.35km^2.

15.92. This “No Fishing” area, if granted is likely to cause the greatest impact to fishermen targeting lobster and brown crab (as these are the only species in the study area that are commercially

targeted below 30m and the turbines will be located in water depths greater than 48m). Furthermore consultation with local fishermen has revealed that of the three key species (velvet swimming crab, brown crab and lobster) it is only lobster that will favour the substrates upon which the turbines will be located and even lobster only use these substrates for short time periods; therefore the magnitude of this impact can be considered to be low.

15.93. The amount of lobster landed (live weight) at Port Askaig and on Islay as a whole is far less than that of other key species targeted within the study area (Figures 15.4 and 15.11). However the value per unit weight of lobster greatly increases its importance to the commercial fisheries within the study area, therefore the sensitivity can be considered to be medium to low.

15.94. Taking this into account and allowing for the fact that only a small number of vessels fish the study area (and for discrete parts of the year), the effect of long term displacement from fishing grounds is likely to be of **minor** significance.

MITIGATION IN RELATION TO IMPACT 15.5
• No mitigation required

Residual impact

15.95. As no mitigation has been suggested the long term displacement of fishermen from fishing grounds is likely to continue to have an effect of **minor** significance.

Impact 15.6: Displaced fishing effort targeting new or other existing fishing grounds

15.96. During operation the impacts caused by displacement of fishing effort are likely to be similar to those outlined during the construction phase (Impact 15.3). However, impacts during the operation phase will differ slightly in that the duration of the impact will be longer. As the expected life span of the development is 15 years it is likely that there will be slightly increased pressure on other existing fishing grounds over the winter season during this period. However, the magnitude of this impact is considered to be low.

15.97. Small scale modification of the local fishing fleet's activities may occur due to operation of the proposed Development, and these activities will occur over the long term (the life span of the project). Consequently the sensitivity of the receptor (commercial fisheries) can be considered to be medium.

15.98. As a result of the low magnitude and medium sensitivity, there is likely to be an overall effect of **minor** significance caused by displacement of fishing effort.

MITIGATION IN RELATION TO IMPACT 15.6
• No mitigation suggested

Residual impact

15.99. As no mitigation is suggested this effect is likely to remain of **minor** significance.

Impact 15.7: Loss of fishing gear due to entanglement with turbines and associated infrastructure

15.100. The consultation process identified concerns that fishermen have in regards to loss or damage of fishing gear. It is conceivable that a situation may arise where a fishing vessel is trying to haul a tangled fleet of creels whilst drifting toward the Development site. In this situation pots may have to be cut free by the fisherman as safety measures to ensure against vessel capsize.

15.101. The replacement cost of a creel is £50 and the ropes used in a fleet of creels cost £80 per 220 metre coil (Appendix 15.2). A fleet on average contains approximately 25 creels (see Appendix 15.2) and can be up to half a mile long. Therefore if an entire fleet was lost the cost would be in the region of £1500 and could potentially be a lot more, if marker buoys and other associated equipment were also lost.

15.102. As all local fishermen have, and will continue to be updated with regards the progress of the proposed Development the magnitude of this impact is considered to be medium.

15.103. The costs incurred to the individual fisherman (and therefore the sensitivity of the receptor) if an entire fleet of creels was lost would be significant when compared to their earnings (see paragraph 15.68). Therefore the sensitivity to the single fishermen could be considered to be high, however when this is considered across the whole fleet (10 vessels) the sensitivity is only likely to be low.

15.104. With a medium magnitude and a low sensitivity, it is likely that the loss of fishing gear will result in an effect of **minor** significance to commercial fisheries.

MITIGATION IN RELATION TO IMPACT 15.7
• Consultation with fishermen to ensure that they are fully aware of the locations of the turbines. • Provision of device positional data to Kingfisher Information Services and to local fishermen (so they can input into their plotters). • Designate the array area a "No Fishing" (Int. Symbol N21) and "No Diving" area. • That an explanatory note be included in navigational charts explaining the nature of the hazards caused by the turbines. • The reporting of any accidents or near misses should occur in a clear and concise manor. A procedure for achieving this should be decided upon which should clearly outline who is responsible for reporting and how it should occur.

Residual impact

15.105. If the above mitigation is implemented then the likelihood of fishing gear being lost due to entanglement with turbines and associated infrastructure will be reduced still further resulting in an effect of **negligible** significance.

Impact 15.8: Change in abundance of targeted species

15.106. The exclusion of fishermen from the immediate area around the turbines may have the effect of providing a refuge for targeted species. Lobster and brown crab are the only species that are currently targeted within the development site from which fishing will be excluded. Furthermore it is possible that the turbine support structures may act as "artificial reefs" increasing productivity and growth of invertebrates (this point is discussed further in *Chapter 8: Benthic ecology*) upon which crab and lobster may feed. The possible increase in food availability and the cessation of fishing pressure may have the effect of increasing lobster and brown crab populations locally within the turbine array (this point is discussed in more detail and the impacts are assessed in detail in *Chapter 11: Marine fish and shellfish resource*).

15.107. This potential increase in population may then spill over into areas that fishermen can target, increasing their catch. The magnitude of this impact is likely to be low to medium and the sensitivity can be considered beneficial leading to an overall effect that is of **negligible** or **minor** significance.

MITIGATION IN RELATION TO IMPACT 15.6
• No mitigation suggested

Residual impact

15.108. As no mitigation is suggested this effect is likely to remain at **negligible** or **minor** significance.

15.5.4 Potential Impacts during decommissioning Phase

15.109. The impacts caused during decommissioning are expected to be, at worst, of the same nature and magnitude as those during the construction phase. A decommissioning plan will be completed when the array nears the end of the operational phase to assess the impacts that will occur during array decommissioning.

15.5.5 Cumulative Impacts

15.110. Exclusive development rights were awarded in 2009 for an offshore windfarm site located to the west of the study area (Royal Haskoning, 2009). Fishermen are likely to be excluded from this site during construction and possibly during operation as well. However it is unlikely those construction periods will overlap and there is no evidence to suggest that the level of fishing displaced from the study area will be displaced on a scale that would have any significant cumulative impact.

15.111. The Irish renewable energy company DP Energy has announced their intention to develop a 400MW tidal turbine near Islay. No details of the proposed development are currently available and it is not possible to assess cumulative potential without details of location and technology.

15.6 Summary of effects

15.112. Table 15.7 summarises the findings of the commercial fisheries impact assessment.

15.7 Conclusion

15.113. There is likely to be some restriction of area open to the fishermen during construction operation maintenance and decommissioning; however seasonal management of timing works and constant and clear consultation with local fishermen should minimise any impacts that may result. After installation the area of the seabed used will have a minimal direct affect on fishing within the study area (based on current information), so only impacts of **minor** or **negligible** significance are anticipated.

Table 15.7 Significance of effect of Impact: summary table									
		Construction/ Decommissioning				Operation/Maintenance			
Impact	Impact number	Magnitude	Sensitivity / value of receptor	Impact	Residual significance of impact after mitigation	Magnitude	Sensitivity / value of receptor	Impact	Residual significance of impact after mitigation
Exclusion from fishing grounds	15.1 and 15.5	Medium	Low	Minor	Minor	Low	Medium to low	Minor	Minor
Change in abundance of targeted species	15.2 and 15.8	low	Medium/ low	Minor	Negligible	Medium to low	Medium to low	Beneficial	Beneficial
Displaced fishing effort targeting new or other existing fishing grounds	15.3 and 15.6	Low	Medium/low	Minor	Negligible	Low	Beneficial	Minor	Minor
Loss of fishing gear due to entanglement	15.4 and 15.7	Low	Medium/ low	Minor	Negligible	Medium	Low	Minor	Negligible

15.8 References

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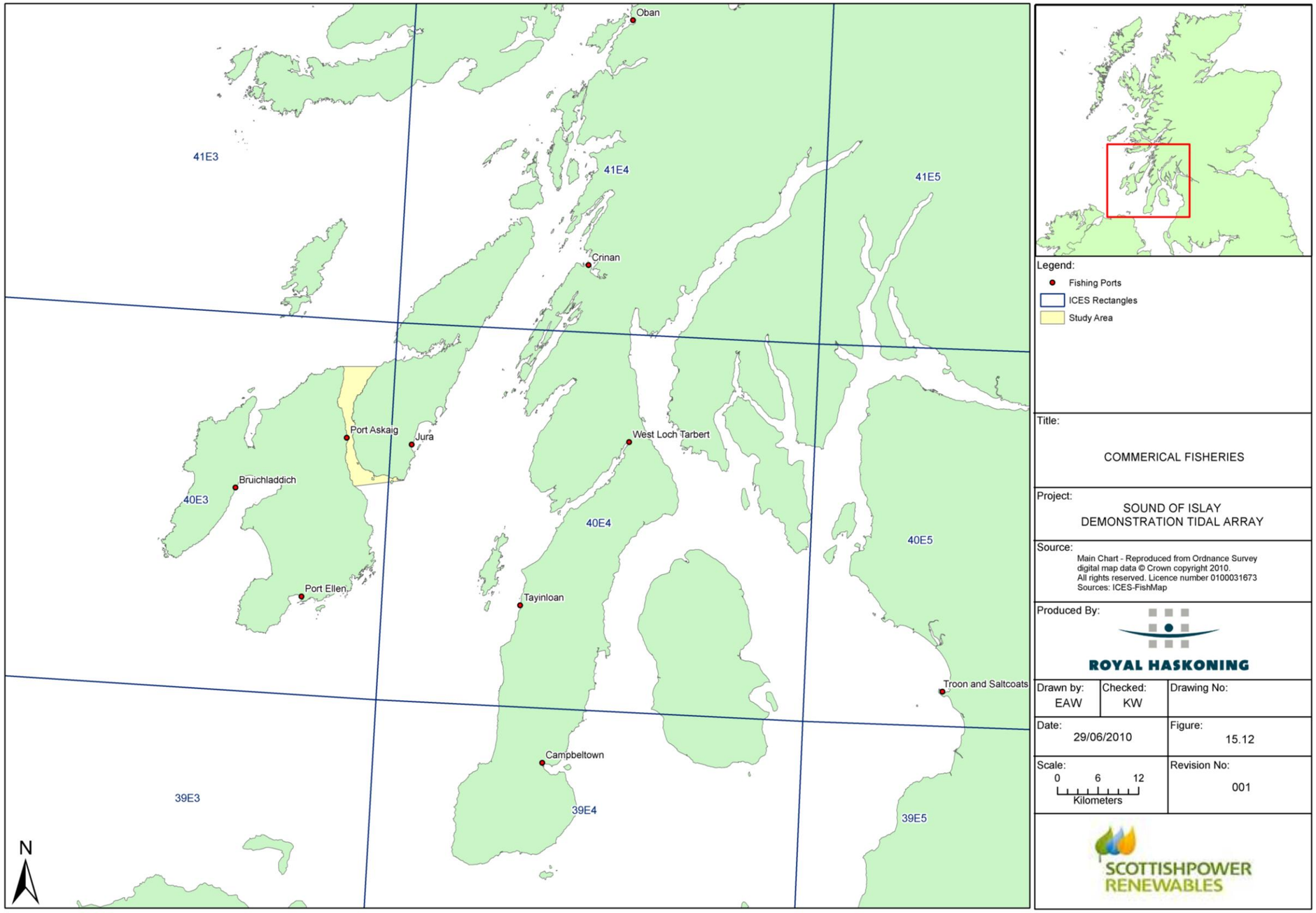

Figure 15.12 Showing the Fish landing ports, the study area and ICES rectangles in the wider region.

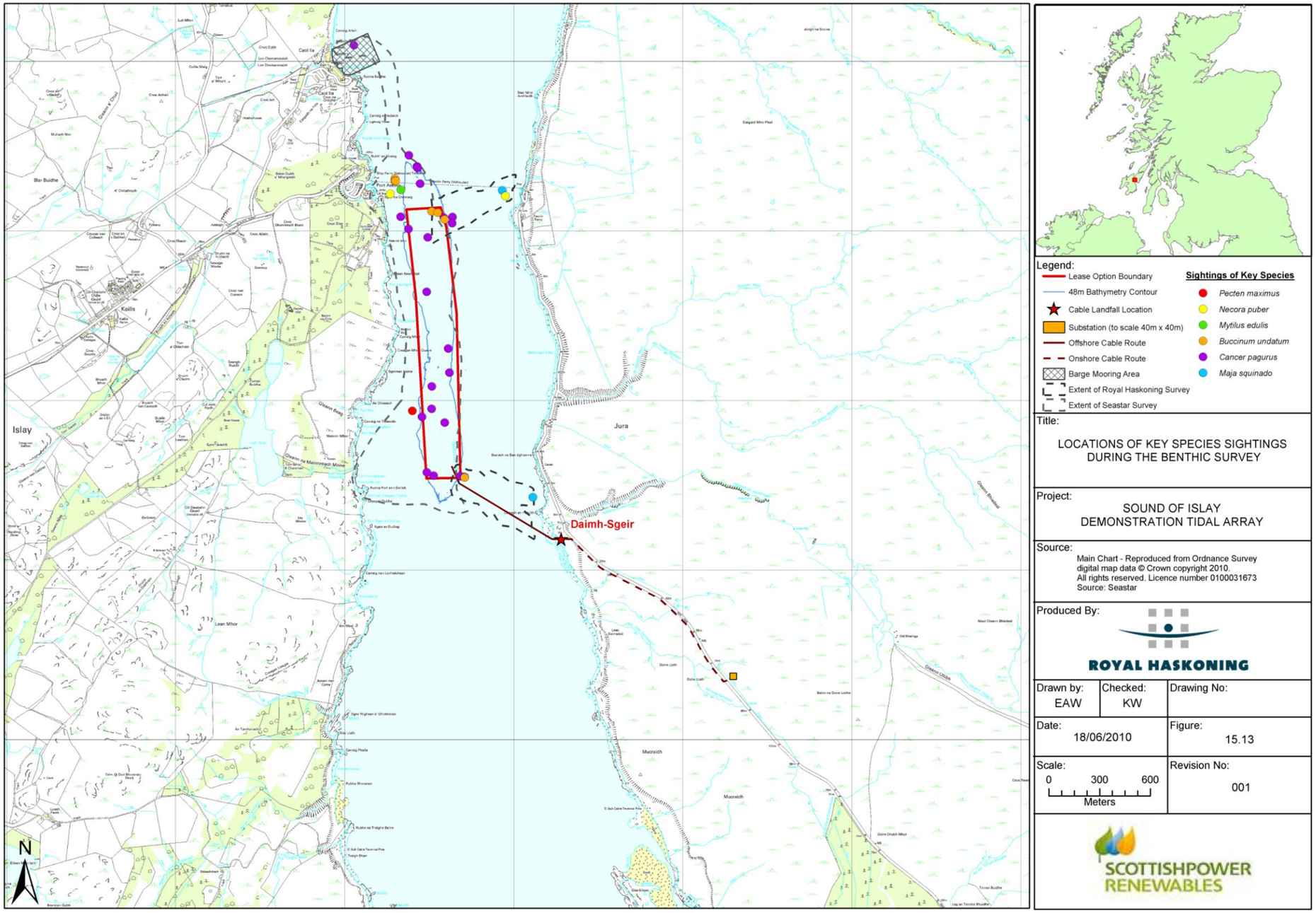

Figure 15.13 Showing the locations of sightings of key species during the benthic survey (data from SeaStar Survey Ltd, 2009 and Royal Haskoning, 2010).

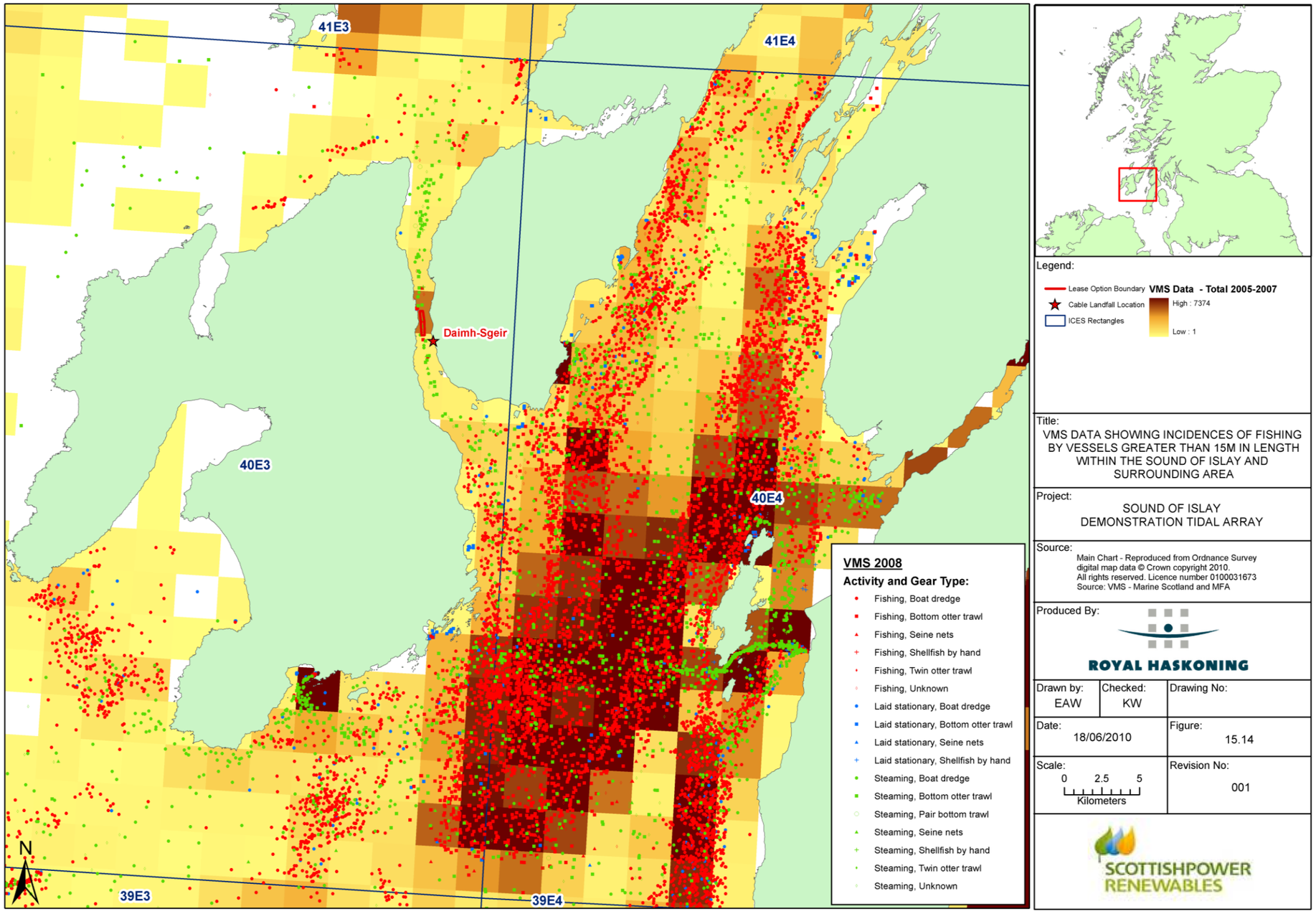

Figure 15.14 VMS data, showing amount of fishing effort by vessels greater than 15m in length within the study area and the wider region

16.0 Terrestrial and Intertidal Ecology

16.1 Introduction

16.1. This chapter addresses the impacts of the proposed Development relevant to terrestrial and intertidal ecology, with particular reference to the impacts associated with cable landing sites and associated onshore infrastructure including the substation and connecting cabling, along with potential access tracks required.

16.2. For the purposes of the ES, the intertidal ecology is combined with the terrestrial ecology and not with the benthic ecology. Nature conservation features have been defined as terrestrial flora and fauna, including mammals (which may be partially marine e.g. otter) and reptiles, along with intertidal biotopes and species from strandline to low water spring tide.

16.3. The aims of this chapter are to:

- Outline the present state of the existing terrestrial and intertidal ecology and nature conservation features;
- Establish the prognosis for these under the 'do nothing' scenario;
- Assess the implications of the proposed Development for these features;
- Recommend a range of mitigation measures to minimise the impacts;
- Assess cumulative impacts; and
- Consider the residual effects (after mitigation of impacts).

16.4. A wide study area was surveyed, encompassing 10 potential cable landfall and substation options across the islands of both Islay and Jura, and this is shown outlined in red in Figure 16.1. Through consideration of several factors, including engineering feasibility and ecological sensitivity, one landfall location has been selected at Daimh-sgeir, on the Isle of Jura (marked as Site J-C on Figure 16.1). This is further discussed in Chapter 4 *Site Selection*. The preference for the landfall at Daimh-sgeir is to land south of the river, with the cable laid alongside the road to the substation (see Figure 16.1). Further details are provided in Chapter 5 *Project Description*. Within this chapter, the term 'Development' refers to the preferred intertidal and terrestrial cable route and substation.

16.5. This chapter deals solely with the potential impacts of the proposed Development on terrestrial and intertidal habitats and species, including nature conservation issues and the risk of spreading terrestrial and coastal invasive and/or non native species. Potential impacts on birds, marine mammals, marine benthos, and salmonid fish, are assessed in *Chapter 8: Benthic Ecology*, *Chapter 9: Marine Mammals*, *Chapter 12: Anadromous Fish* and *Chapter 14: Ornithology.*

16.6. The aesthetic and landscape implications of onshore infrastructure are dealt with separately in *Chapter 17: Landscape and Visual*

16.2 Potential Effects

16.7. The potential adverse effects of the Development's cable landfall and onshore infrastructure on terrestrial and marine ecology relate to habitat disturbance or removal, death, injury or disturbance of flora and fauna and/or their habitat, and the spread of invasive species. In particular, disturbance to protected species may have legal implications (see Section 16.3.1 and *Chapter 6: Regulatory and Policy Context*). Adverse impacts can be mitigated through best practice and habitat enhancement, and opportunities for mitigation are discussed in each impact section.

16.3 Summary

Assessment is based on the proposed substations and cable route incorporating one cable land fall location at Daimh-sgeir. Except for otters and terrestrial habitat loss, all terrestrial and intertidal receptors the significance of effect are assessed as being negligible or no significant effect during construction, operation and maintenance of the onshore elements of the proposed Development.

With regards to otters, several feeding areas and potential holt sites have been identified already within a 2km radius of the potential land fall site. Further otter surveying is proposed once the final footprint of cable landfall is confirmed to inform the need for an EPS licence from the Scottish Government should a holt or resting site be located within the footprint of the cable route. This will be informed by a targeted otter survey once the cable route plan is finalised. No potential resting sites have been recorded at the proposed landfall site (J-C),however feeding otters have been recorded and the river is likely to be an important freshwater resource for this species. With the cable to come ashore south of the bridge, therefore avoiding the more sensitive river habitat, the significance of effects is assessed to be **minor**.

There will be approximately 1400m of cable routing across wet heath habitat, the dominant habitat type for the surrounding area. However, this cable route will run adjacent to an existing road that crosses the wet heath and therefore disturbance and impacts here are considered of **minor** significant effect.

16.4 Methodology

16.8. This environmental impact assessment considers the likely effects of the Development on terrestrial and intertidal ecology that may arise during the construction, operational (including maintenance) and decommissioning phases of the proposed scheme, particularly the cable and cable landfall, and onshore infrastructure. The sections below describe the assessment methodology, including relevant legislation, policies and plans, consultation, data collection and surveys, and impact assessment criteria that were used to undertake the impact assessment.

16.4.1 Legislative Background

16.9. This section identifies the legislation, policies, plans and guidance that are relevant to terrestrial and intertidal ecology and which have been considered in relation to the proposed Development.

16.10. The relevant legislation and policies are outlined in Table 16.1 and further detail is provided in *Chapter 6: Regulatory and Policy Context*.

Table 16.1 Relevant legislation, policy or plan – Terrestrial and Intertidal Ecology
Legislation, Policy or Plan
Wildlife and Countryside Act (1981) as amended by the Nature Conservation (Scotland) Act (2004)
Nature Conservation (Scotland) Act (2004) (as amended)
Town and Country Planning (Scotland) Act 1997 (Section 57 (2))
The Environmental Impact Assessment (Scotland) Regulations 1999
The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)
Coastal Protection Act (1959) Section 34
Marine Scotland Act 2010

Table 16.1 Relevant legislation, policy or plan – Terrestrial and Intertidal Ecology
Legislation, Policy or Plan
SEPA Policy 21 – Strategy for implementing actions under the UK Biodiversity Action Plan (UK BAP)
Marine (Scotland) Act 2010
SNH Policy 0203– Wilderness in Scotland's Countryside
SNH Policy 0102 SNH's Policy on Renewable Energy
NPPG 14 (Natural Environment)
PAN 60 (Planning for Natural Heritage)
SNH, 2002, A Handbook on Environmental Impact Assessment, Guidance for Competent Authorities, Consultees and others

Development Plan Policy

16.11. The intertidal area (to mean low water mark) and onshore infrastructure of the proposed Development lies within the local planning authority area of Argyll and Bute Council.

16.12. The current structure plan for the area is the Argyll and Bute Approved Structure Plan (2002) and recognises the potential of all forms of renewable energy in Argyll and Bute. Relevant policies to this chapter are identified in *Chapter 6: Regulatory and Policy Context*, Table 6.4.

16.13. The Local Plan for Argyll and Bute was adopted in August 2009. Relevant policies regarding this chapter are presented in Table 16.1. A new Argyll and Bute Local Development Plan (LDP) as required under the Planning etc (Scotland) Act 2006 is proposed for adoption in 2010, (www.argyll-bute.gov.uk), which will replace the current Local Plan and Structure Plan.

16.4.2 Consultation

16.14. Consultation with statutory bodies and key stakeholders was undertaken by ScottishPower Renewables on scoping document: 'Proposed Demonstration Tidal Site, Sound of Islay. Request for a Scoping Opinion' (ScottishPower Renewables, 2008). In their response to the Sound of Islay Scoping Opinion (Appendix 2.1), SNH, FRS and SEPA requested that:

- The impact on designated sites be assessed;
- Opportunities to improve ecological interest in line with the Local BAP be included;
- Collision risk of otters be assessed; and
- Baseline surveys of reptiles, amphibians and invertebrates to be included.

16.4.3 Data sources

16.15. The baseline conditions of all ecological elements, including conservation areas and protected species or habitats within or adjacent to the proposed Development, along with potential substation locations and cable route areas have been determined from existing data sources.

16.16. Data sources included the following:

- Scottish Executive (2007) Scottish Marine Renewables Strategic Environmental Assessment (SEA);
- Argyll and Bute Local Biodiversity Action Plan;
- SNH Scotland wide otters surveys (1977-79; 1984-85 and 1991-94);
- JNCC website (www.jncc.gov.uk);
- SNH website (www.snh.gov.uk);
- Spatial environmental data from Magic website (www.magic.gov.uk);
- Islay Phase 1 habitat survey (including invasive species and protected species) (Royal Haskoning, August 2009 (Appendix 16.1));
- Islay Intertidal Survey (Royal Haskoning, August 2009 (Appendix 16.2));
- Jura Phase 1 habitat survey (including invasive species and protected species) (Royal Haskoning. December 2009 (Appendix 16.3)); and
- Jura Intertidal Survey (Royal Haskoning. January 2010(Appendix 16.4)).

16.5 Impact Assessment Methodology

16.5.1 Assessment Methods

16.17. This section identifies the impact assessment methodology. The criteria used to determine the magnitude of the impact and sensitivity (importance / value) are described below in Table 16.2. A full description of the EIA process and methodology is provided in *Chapter 2: Scoping Assessment Methodology*.

Impact magnitude

16.18. Impact magnitude is the potential degree of change that an impact may cause compared to baseline conditions (as determined from ecological surveys and consultation). This is a qualitative judgement based on our assessment of the likely impacts of the Development. However, wherever possible, quantitative information is used to support the impact assessments.

Table 16.2 Magnitude of Impact		
Magnitude of Impact	**Description**	**Ecological Vulnerability**
High	A fundamental change to the baseline condition of the receptor.	The local population of the species or the habitat are likely to be permanently removed/displaced by the impact under consideration
Medium	A detectible change resulting in the non-fundamental temporary or permanent condition of a receptor.	Some individuals of a species / population or part of a habitat may be permanently removed/displaced by the effect under consideration and the viability of a species population / habitat may be adversely affected
Low	A minor change to the baseline condition of the receptor (or a change that is temporary in nature).	Some individuals of a species / population or part of a habitat may be permanently removed/displaced by the impact under consideration but the viability of a species population / habitat will not be affected
Negligible	An imperceptible and/or no change to the baseline condition of the receptor.	No detectable impact on the species / population / habitat is likely

16.19. Based on the determined level of magnitude from Table 16.2 and the importance or value of the feature (refer to Table 16.3 below), the significance of the impact can then be assessed using the characterisation identified in Table 16.4. The importance or value of the feature used in Table 16.3 has been adapted and modified to fit a Scottish context from Regini (2000) and IEEM (2002).

Table 16.3; Sensitivity / Value of the Receptor

Sensitivity/Value of Receptor	Importance	Description
High	International	Sites supporting populations of internationally important species. Any regularly occurring population of an internationally important species which is rare or threatened in the UK, i.e. a Red Data Book species, or listed occurring in 15 or fewer squares in the UK, or of uncertain conservation status or of global conservation status or of global conservation concern in the UK BAP.
Medium	National / Regional / County	Any regularly occurring population of a nationally important species which is threatened or rare at a regional scale (see Local BAP). A regularly occurring, regionally significant population of any nationally important species during a critical phase of its life cycle. Sites supporting viable breeding populations of Nationally Scarce species (occurring in 16-100 10km squares in the UK) or those included in a regional Biodiversity Action Plan (BAP) on account of their rarity, or supplying critical elements of their habitat requirements. A regularly occurring, locally significant number of a regionally important species during a critical phase of its life cycle.
Low	District / Local	Site supporting viable breeding populations of a species known to be rarities on a local scale. A regularly occurring, locally significant number of a locally important species during a critical phase of its life cycle.
Negligible	Undesignated	A widespread species.

Table 16.4: Derivation of Significance Criteria for Magnitude / Value Comparisons

Magnitude of Impact	Receptor Sensitivity/Value			
	Negligible	Low	Medium	High
High	No significant effect	Moderate	Major	Major
Medium	No significant effect	Minor	Moderate	Major
Low	No significant effect	Negligible	Minor	Moderate
Negligible	No significant effect	Negligible	Negligible	Minor

16.20. It should be noted that any residual effect (the effect after the implementation of mitigation) which remains at the level of 'Moderate' or 'Major' is still regarded by the EIA Regulations as being of significant effect .

16.6 Existing Environment

16.21. The existing environment, with regards to designated sites and habitats, and designated fauna, along with the results of the surveys are discussed within this section.

16.6.1 Designated Sites and Habitats

16.22. This section outlines the terrestrial and coastal designated sites and habitats within, adjacent or close to the footprint of the study area. Designations relating to marine or ornithological features are discussed in *Chapter 8: Benthic Ecology, Chapter 9: Marine Mammals* and *Chapter 14: Ornithology,* with geological designations discussed in *Chapter 7: Physical Environment and Coastal Processes*. Designated sites and their proximity to the proposed Development are shown on Figure 16.2.

16.23. Argyll and Bute is an internationally important area for nature. The convoluted coastline hosts a variety of important sheltered and exposed habitats, such as mudflats, saltmarsh, deepwater muds, coastal sand dunes, and machair (Argyll and Bute LBAP).

International Designations

16.24. Special Areas of Conservation (SACs) are protected sites under the EC Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (the "Habitats Directive"), for which the Conservation (Natural Habitats, &c.) Regulations 1994, as amended, (the "Habitats Regulations") apply. These sites are part of a network of important high value conservation sites which contain species or habitats listed in Annex I or Annex II of the Habitats Directive. The proposed Development is located approximately 15km from the nearest SAC. Islay and Jura have several SACs within or adjacent to their geographical coverage, presented in Table 16.5. Those sites designated for marine mammals are discussed in *Chapter 9: Marine Mammals* and are not considered further here.

Table 16.5: International Designations

Site	Feature	Approximate distance from proposed Development
Rhinns of Islay SAC	Marsh fritillary butterfly *Euphydryas aurinia**	20km West
Feur Lochain SAC	Blanket Bogs* Natural dystrophic lakes and ponds Depressions on peat of *Rhynchosporion*	20km West
Eilean na Muice Duibhe SAC	Blanket Bogs* Depressions on peat of *Rhynchosporion*	15km South West
Glac na Criche SAC	Blanket Bogs* Vegetated seacliffs of the Atlantic and Baltic coasts European dry heaths Marsh fritillary butterfly	18 km West

Table 16.5: International Designations		
Site	**Feature**	**Approximate distance from proposed Development**
South East Islay Skerries SAC	Harbour seal*	18km South

*Primary feature for designation

16.25. Three terrestrial habitats listed under Annex I of the Habitats Directive are abundantly present on the islands of Islay and Jura. These are as follows:

- North Atlantic wet heath;
- Blanket bog; and
- European dry heath.

16.26. Both wet and dry heaths are dominating habitats across much of the study area of both islands, with Sphagnum bog features present in hollows within the topography of the study area.

National Designations

16.27. Sites of Special Scientific Interest (SSSI) are designated under the National Parks and Access to the Countryside Act 1949 and have since been re-notified under the Wildlife and Countryside Act 1981 and the Nature Conservation (Scotland) Act 2004. All SSSIs on Islay and Jura are outwith the Sound of Islay, and are presented in Table 16.6.

16.28. In addition to the SSSIs stated in Table 16.3, Feur Lochain Moine Nam Faoileann SSSI and The Oa SSSI are designated for bird populations (and are discussed in *Chapter 14: Ornithology*) and Beinn Shiantaidh SSSI, Rubh' A' Mhail To Uamhannan Donna Coast SSSI and West Coast Of Jura SSSI are designated for geological features are discussed in *Chapter 7: Physical Environment and Coastal processes*.

16.29. A National Nature Reserve (NNR) is defined as an area of importance for flora, fauna or features of geological or other special interest, which are reserved and managed for conservation and to provide special opportunities for study or research. There are no nature reserves relevant to the proposed tidal development site within the Sound of Islay, and no National Nature Reserves are present on Jura (http://www.nnr-scotland.org.uk). The Isle of Jura is designated as a National Scenic Area, discussed in further detail in *Chapter 17: Landscape and Seascape*.

16.30. The RSPB Loch Gruinart Nature Reserve lies to the North West of Islay and covers some 1600ha. 23% of the reserve comprises of farm land for grazing, silage or arable crop production. The rest consists of approximately 250ha of mud flats and salt marsh, and 980ha of heather moorland (http://www.islayinfo.com).

Table 16.6: National designations			
Island	**Site**	**Feature**	**Approximate distance from proposed Development**
Islay	Laggan Peninsula And Bay SSSI	Blanket bog Greenland barnacle goose (non breeding)	18km

Table 16.6: National designations			
Island	**Site**	**Feature**	**Approximate distance from proposed Development**
		Greenland white fronted goose (non breeding) Sand dune	
	Bridgend Flat SSSI	Saltmarsh Sandflat breeding bird assemblage Greenland barnacle goose (non-breeding) Greenland white fronted goose (non-breeding) Greylag goose (non-breeding)	12km
	Rinns Of Islay SSSI	Beetles Blanket bog Breeding bird assemblage Chough (breeding) Coastal geomorphology Corncrake (breeding) Greenland barnacle goose (non-breeding) Greenland white-fronted goose (non-breeding) Hen harrier (breeding) Machair	18km
	Loch Tallant SSSI	Basin fen	14 km
	Glac Na Criche SSSI	Blanket bog Chough (breeding) Seabird colony (breeding)	18 km
	Gruinart Flats SSSI	Blanket bog Brent goose (non breeding) Chough (breeding) Chough (non-breeding) Coastal geomorphology Dalradian Greenland barnacle goose (non-breeding) Greenland white-fronted goose (non-breeding) Lichen assemblage Mudflat Saltmarsh Sand dune Shingle	12km
	Ardmore, Kildalton And Callumkill Woodlands SSSI	Upland oak woodland	15km

Table 16.6: National designations			
Island	**Site**	**Feature**	**Approximate distance from proposed Development**
	Eilean Na Muice Duibhe (Duich Moss) NNR	Blanket bog Greenland white fronted goose (non-breeding)	16 km
	Loch Gruinart RSPB Nature Reserve	Greenland white fronted goose Greenland barnacle goose	12km
	Craighouse Ravine, Jura SSSI	Bryophyte assemblage Upland oak woodland	9km
Oronsay and Colonsay	Oronsay And South Colonsay SSSI	Chough (breeding) Corncrake (breeding) Grey seal Machair Sand dune	17km

Regional / Local Designations

16.31. There are no Local Nature Reserves (LNR), County Wildlife Sites (CWS) or Sites of Interest to Natural Science (SINS) within or adjacent to the study area.

16.32. Argyll and Bute have several habitats and species, for which Biodiversity Action Plans (BAPs) have been developed, which were found within the study area. They are recorded in Table 16.7.

Table 16.7 Argyll and Bute Biodiversity Action Plan habitats and potential species within the study area (refer to *Chapter 14: Ornithology* for bird species included in the BAP)	
Habitats	
Broad habitats	Coniferous woodland
	Improved grassland
	Rivers and streams
	Standing open water and canals
Local habitats	Open hill ground
	Peatlands
	Species rich grassland
	Unimproved/semi-improved grassland
Priority Habitats	Coastal vegetated shingle
	Maritime cliff and slopes
Species (non birds)	
Red deer *Cervus elaphus*	
Otter *Lutra lutra*	
A lichen *Pseudocyphellaria norvegica*	
Bats	

16.6.2 Terrestrial Habitats

Islay

16.33. A Phase 1 habitat survey was completed on the East coast of Islay encompassing the locations of all potential cable landing sites on that Island. The study area consisted of the Caol Ila Distillery and land South of this point for approximately 3.5km to Fionn-phort, and Westward inland for approximately 0.5km. In addition, a small pocket of land was included in the study area approximately 1.5km South of Fionn-phort, at Traigh Bhan, at the location of the existing Islay-Jura cable. As the preferred land fall location is for Jura, the terrestrial habitats on Islay are no longer considered within this assessment. A Phase 1 Habitat Report listing species and habitats or the study area is provided in Appendix 16.1, with the intertidal report provided in Appendix 16.2.

Jura

16.34. A Phase 1 habitat survey for Jura was conducted over 16th-19th November 2009. The study area extended approximately 4km down the Sound of Islay, and approximately 1km inland, encompassing four potential cable landing sites and one substation location. The results are shown in Figure 16.1, with the full report provided in Appendix 16.3. The majority of the study area was dominated by wet heath habitat, with areas of sphagnum bog, flushes, bracken and marshy grassland/neutral grassland complexes forming a matrix throughout the habitat. These habitats were observed to extend east of the study area towards inland Jura and the Paps of Jura. Several small oligotrophic lochans were also present. In flatter areas the ground was found to be waterlogged, supporting sphagnum mosses with drier heath habitat or bracken characteristically on sloping ground. Other characteristic species present included cotton grass *Eriophorum angustifolium*, lousewort *Pedicularis sylvatica*, soft rush *Juncus effusus*, heath rush *Juncus squarrosus*, purple moor grass *Molina caerulea* ling *Calluna vulgaris*, tormentil *Potentilla erecta*, *Cladonia floerkeana*, *Cladonia portentosa*, *Polytricum commune*, bog myrtle *Myrica gale*, cross leaf heather *Erica tetralix* bell heather *Erica cinerea*, bog asphodel *Narthecium ossifragum, Polytricum commune*, sharp flowered rush *Juncus acutiflorus*, bilberry *Vaccinium myrtillus*, devils-bit scabious *Succisa pratense* and round leaved sundew *Drosera rotundifolia*. Two major streams cut through the study area, flowing from East to West into the Sound of Islay, and these have formed deep ravines (or re-entrants) lined by bracken, riparian trees and exposed inland cliff habitats.

16.35. The ferry slip for the Islay-Jura ferry is located in the Northwest corner of the study area at Feolin (Site J-A), where a couple of small buildings are also present. The existing Islay- Jura cable connection lies in the South west of the study area (Site J-D), where the undersea cable connects power lines. Vehicle access on Jura itself is limited to a single track road (Site J-B) along the South west coastline of the island, with intermittent passing places. In the Northern half of the study area, the Western seaward margin is depicted by the single track road, immediately East of which is a steep cliff up to 10m high in places. Approximately halfway down the proposed study area, the coastal road cuts inland and uphill (Site J-C). The only other evidence found of anthropogenic management or influence were areas of peat cutting.

16.36. The whole Jura study area is freely roamed and grazed by red deer.

16.37. Plates 16.1 and 16.2 show the bracken, heath and grassland matrix around the Daimh-sgeir site (J-C), the proposed landfall site, along with the stone road bridge and riparian habitat along the steep river banks. There are options to bring the cables ashore either North or South of the Abhainn an Daimh-sgeir river, with preference to the South. The narrow riparian habitat at the river consists of lichen covered deciduous trees, including holly *Ilex aquifolium*, white willow *Salix alba*, common alder *Alnus glutinosa*, grey alder *Alnus incana*, crack willow *Salix fragilis*, and many silver birch *Betula pubescens*. Within the study area on Jura, trees

are predominantly limited to within the riparian habitats of the major rivers. South of the river, marshy grassland is present between the coast and the shore, with bracken dominating the steep ground, leading to wet heath habitat along the road and beyond the location of the proposed substation for the Development, at NR 45260 66350.

Plate 16.1:
Daimh-sgeir from the Sound of Islay, showing potential landing sites North (N) and South (S) of the river

Plate 16.2:
Daimh-sgeir taken from the Isle of Jura, showing potential landing sites North (N) and South (S) of the river

16.6.3 Otters

16.38. Otter *Lutra lutra* is classed as a European protected species.

16.39. Otters are also fully protected under the Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007 it is now illegal to:

- Deliberately or recklessly kill, injure or take (capture) an otter;
- Deliberately or recklessly disturb or harass an otter; and
- Damage, destroy or obstruct access to a breeding site or resting place of an otter (i.e. an otter shelter).

16.40. Thus, otter shelters are legally protected whether or not an otter is present.

16.41. If otters, their holts, couches or other places of shelter are found within the Development footprint, the impact on this species must be assessed. Wherever possible these impacts should be avoided or minimised. However, if they can't be avoided and the development might otherwise result in an offence being committed, than a licence would be necessary to be able to proceed. Licences to permit development can only be granted subject to strict tests being met. Scottish Government is the appropriate licensing authority for such licences.

16.42. Otters are also a priority UK BAP species.

16.43. Populations in coastal areas utilise shallow, inshore marine areas for feeding but also require fresh water for bathing and terrestrial areas for resting and breeding holts (JNCC, 2004). Where otters live in coastal areas (particularly in Scotland) they tend to have a largely diurnal habit, live in group territories, and have home ranges of less than 5km (Kruuk, 1996).

16.44. Otters were recorded at several locations throughout the study area and given the relatively undisturbed environment on Islay and Jura, it was presumed the whole study area encompasses territory for otters, with the regular sightings around the mouths of the two streams in the middle of the Jura study area suggest these freshwater sources are important to local otters for washing fur, and provision of other habitat requirements. Signs of otters (footprints, spraints and remains of feeding activity) were recorded on Islay during surveys of the potential cable landing sites during summer 2009 (Appendix 16.1 and 16.2), and otters were recorded just North of the proposed footprint on Jura during surveys for the proposed Inver Estate Hydro scheme (MacGillivray, 2009). As a mobile species, otters and their habitat are considered for both islands.

Islay

16.45. On Islay, the majority of otter signs and activity were found in the Southern half of the Islay study area (Figure 16.3), with an otter observed foraging just North of Site I-D, and otter spraints and crustacean remains found at Sites I-C and I-A. An otter footprint was also found at Caol Ila Distillery (Site I-E) (Appendix 16.1 and 16.2).

16.46. At intertidal Site I-A, otter spraints, anal jelly and crustacean remains were located on pronounced bedrock by Transect 2 (NR 43047 65472). At intertidal Site I-C, otter spraints were identified on the rocky headland at the seaward end of the wall, and up the river as far as the large Eas Forsa waterfall. Approximately 200m North of Intertidal Site I-D, an otter was observed foraging, fishing and eating along the sea-coastal margin. At intertidal Site I-E, several otter prints and crustacean remains were identified in the dirt on the road margin on the coastal front of the distillery buildings.

Jura

16.47. During the intertidal survey of site J-B a large otter was spotted approximately 30m offshore at 13:40pm (on the incoming tide), from there it moved south along the shore whilst fishing (Figure 16.3). The otter came ashore at the site where the Abhain Mhor (stream) enters the Sound of Islay and emerged from the water with a prey item (likely a fish), which it ate on the intertidal substrates. The otter then swam up the stream to just below the bridge where it dived and surveyors lost sight of it. No signs of otters (tracks or spraints) were found on the shore at this site. Rock armouring is present around a small new road bridge over the stream (NR 4427 6802) and it is possible that the otter may have retreated to a lie-up within the rock armouring. During further salmonid habitat surveys in January 2010 (Appendix 12.1) very fresh spraints, along with older spraints were found by the rock armouring immediately East of the new road bridge (Figure 16.3).

16.48. During the survey at site J-C a large otter was sighted approaching rocks at the Northern end of the bay. The otter approached from the North at 10.55am (around slack water low tide) then spent 20 minutes on and around the rocks uncovered by the low tide before swimming West into the Sound of Islay. No other signs (tracks, spraints, or feeding remnants) of otter were found at this location.

16.49. During the salmonid habitat surveys in January 2010 (Appendix 12.1) many spraints were recorded close to small undercut streams approximately 200m upstream from the coast at Mucraidh, Southwest Jura. Given the distance from the shore, this indicated the presence of a breeding holt nearby.

16.6.4 Reptiles, amphibians and invertebrates

16.50. The adder *Vipera berus* is one of four British reptiles found in Scotland and is listed on Schedule 5 (Protected animals) of the LUK2 - Wildlife and Countryside Act 1981 of the United Kingdom. (W5.Oct01) (Sections 9(1) "killing & injuring" and 9(5) "sale" only). This species is listed on the Dangerous Wild Animals Act 1976 (as amended by The Dangerous Wild Animals Act 1976 (Modification) Order 1984).

Islay

16.51. On Islay, a female adder was discovered basking on the track at Site I-A (Figure 16.3), approximately 50m up from the coast. On disturbance it disappeared into the dense bracken habitat. A female adder was also identified at the same site just above the intertidal zone during a cabling study walkover (August 2009). Suitable habitat (including heath, bog and open woodland) is present across much of the Islay study area.

16.52. Caterpillars of the Cinnabar moth *Tyria jacobaeae* were recorded grazing on ragwort in the study area on Islay. This species is not protected. No other invertebrates have been recorded in walkover surveys.

16.53. No evidence of amphibians has been recorded during the habitat walkover surveys.

Jura

16.54. The habitat walkover surveys on the Isle of Jura were completed in November, and therefore it is likely adders would have been hibernating. Similar habitat to that present at the lower Islay study area, i.e. heath and bog, was also present throughout Jura, therefore it can be assumed that adders are likely to be present within the Jura study area also.

16.55. No evidence of either amphibians or invertebrates has been recorded during the habitat walkover surveys.

16.6.5 Coastal and Intertidal Habitats and Species

16.56. The coastline of Islay and Jura adjacent to the Sound of Islay is comprised primarily of steep vegetated cliffs (predominantly bracken or heath habitat consisting of ling and bell heather, with occasional rowan, birch and sycamore trees established on the cliffs) and raised beaches, characteristically of bedrock boulder, shingle and sandy substrates. Cliff and cliff-top vegetation in the region varies markedly even over short distances and cliff habitats in the Sound may include: bare ground; spray-zone lichen-covered rock; rock-crevice; cliff edge, seabird colony, maritime grassland; or maritime heath (Davidson, 1997). Northern Islay has some of the highest and largest spreads of late glacial raised beach shingle in Scotland. Raised beach habitats in the Sound are formed of gravel and exposed rock platforms with boulders (Davidson, 1997 and MAGIC website).

Islay

16.57. An intertidal survey was completed on Islay from the 5th to 7th August 2009 (Royal Haskoning, 2009) at six potential embayments (coded I-A to I-F) Full details are provided in Appendix 16.2 of this ES; however as Islay is no longer considered to be a suitable landfall option these are not considered further within the impact assessment.

Jura

16.58. An intertidal survey was completed on Jura from the 17th to 19th November 2009 (Appendix 16.4 at four potential embayments (coded J-A to J-D) where cables could be potentially brought ashore. A description of each landfall area on Jura is provided in Appendix 16.4, with the survey results at Site J-C (the preferred location) discussed below.

16.59. The biotopes recorded during the intertidal survey at site J-C are identified in Table 16.8. Full species lists are provided in the intertidal report (Appendix 16.4).

Table 16.8 Biotopes present in potential landing sites J-C

Biotope Code	Biotope Description
LR.MLR.BF.PelB	*Pelvetia canaliculata* and barnacles on moderately exposed littoral fringe rock
LR.LLR.F.Fspi.X	*Fucus spiralis* on full salinity upper eulittoral mixed substrata
LR.LLR.F.Asc.FS	*Ascophyllum nodosum* on full salinity mid eulittoral rock
LR.LLR.F.Fserr.X	*Fucus serratus* on full salinity lower eulittoral mixed substrata
LR.FLR.Lic.YG	Yellow and grey lichens on supralittoral rock
LR.FLR.Lic.Ver.B	*Verrucaria maura* and sparse barnacles on exposed littoral fringe rock
LS.LCS.Sh	Shingle (pebble) and gravel shores
LS.LSa.St	Strandline

16.60. **Site J-C** was surveyed just to the South of the mouth of the Abhainn an Daimh-sgeir river and was accessed via the A486 which had adequate roadside parking. The site consisted of a small embayment bordered on the North by a small rocky headland that in turn forms the Southern bank of the Abhainn an Daimh-sgeir (a small river that flows down a steep sided gorge and into the Sound of Islay). Exposed bedrock continues down from the rocky headland and into the Sound to the Northern shore of the bay. The shore in the middle and Southern sections of the bay was composed of shingle with occasional patches of bedrock. Two small unnamed and unmapped streams were present on the shore at the time of the survey the first which was located in the South and flowed across the shore in a diffuse nature while the second, which was very small, flowed down the shore in a more obvious channel. The lower and mid shore across much of the bay was dominated by fucoids and *A. nodosum*, whilst the upper shore supported few species. The upper shore was bordered by a bank upon which was matrix of marshland and grassland habitat existed. The bank was steeper and higher in the North and less than 1m high in the South. Two transects were surveyed at this site – the first (NR 44241 67190 at 195˚) took a line from the base of a small headland down through the edge of the border between bedrock and shingle and was positioned to capture as many different habitats as possible. The second transect (NR 44267 67167 at 225˚) assessed the middle of the bay along a line with few features to gather information which was more typical of the bay and also a more appropriate line for cable landfall. These are amalgamated in Table 16.8, with further details provided in Appendix 16.4. A walkover of the shore North of the river identified no further biotopes to those identified to the South.

16.61. Plates 16.3 and 16.4 show the South beach and North beach at Daimh-sgeir respectively.

Plate 16.3 – South Beach at Daimh-sgeir

Plate 16.4 – North Beach at Daimh-sgeir and mouth of Abhainn an Daimh-sgeir

16.62. No rare or protected biotopes were found at any bay within the footprint of the proposed scheme during the intertidal surveys on Islay and Jura, and the zonation of biotopes identified were typical of the area.

16.6.6 Non-native Species

16.63. Non-native species are considered within this chapter as there is a risk they may be spread to new areas during construction activities.

16.64. During the Phase 1 habitat and intertidal surveys (Appendix 16.3 and 16.4) recordings were made of terrestrial and marine invasive and/or non-native species encountered. No records were made of freshwater aquatic invasive species during the habitat walkover or salmonid habitats surveys.

Rhododendron

16.65. Rhododendron (*Rhodendron ponticum*) can be difficult to control. It forms dense impenetrable thickets that are difficult to treat, and is a threat to biodiversity by out-competing native species and monopolising local environments. Rhododendron also exudes toxic chemicals into the soil around them to suppress competing vegetation.

16.66. Rhododendron is not required by legislation to be removed. No further work is therefore required for this species by law; however, accepted best practice would be to ensure minimisation of spread.

16.67. On Jura, rhododendron was sparser than that recorded on Islay, and was predominantly recorded in the North of the study area at Feolin.

16.6.7 Summary of Findings

16.68. The Jura study area is dominated by wet heath habitat, with Sphagnum bog and oligotrophic lochans, with two streams running East to West across the footprint. The coastal margin is characterised by steep vegetated sea cliffs set back from and separated from the shore by Jura's single track road. Small shingly embayments are present along the length of shore, with bedrock protruding particularly at small headlands. The footprint of the proposed Development is characterised by marshy grassland leading to wet heath, and is characteristic of the surrounding area.

16.69. No rare or protected intertidal floral species or biotopes were recorded during the survey on either Islay or Jura.

16.70. Otters are prevalent throughout the study area on both sides of the Sound of Islay, with several individuals observed and prints, spraints and potential holts recorded.

16.7 Assessment of Effects and Mitigation

16.71. The impact assessment is based on the cable landfall to occur at site J-C, near to the mouth of Abhainn-an-Daimh-sgeir. It is assumed the landfall will occur South of the river, and this impact assessment is conducted accordingly. As per the scheme description in *Chapter 5: Project Description*, it is assumed cables will be buried both intertidally and terrestrially, and once ashore, will follow the road South to a substation site construction by the Inver Estate Hydro scheme at grid reference NR 45260 66350.

16.7.1 Do Nothing Scenario

16.72. On Islay the existing ecology is unlikely to change in the near future in either terrestrial or intertidal environments. In particular, the Southern section of the study area is unlikely to be developed due to its remoteness. The areas around Port Askaig and Caol Ila have potential to be further developed in the future.

16.73. Activity in the study area on Jura, is currently limited to deer grazing across the site (inhibiting natural succession processes) and associated stalking activities, as well as rare peat cutting activities.

16.74. The proposed hydro scheme at the Inver Estate, North of the Jura footprint, would cause some disruption to the wet heath habitat during construction, as cables are currently planned to be buried and connected to a small substation close to the road (NR 45260 66350) within an extensive area of wet dwarf shrub heath before linking with the existing Jura electricity line.

16.75. During a 'do nothing scenario' there is unlikely to be a major significant change to the terrestrial and intertidal ecology at the footprint on either island.

16.7.2 Potential Impacts during Construction Phase

Impact 16.1: Impact to Designated Sites

16.76. There are no terrestrial or intertidal designated sites within or adjacent to the study area with the closest SSSI situated 9km from the proposed development. Although designated sites are of high value, no element of the terrestrial or intertidal works planned as part of the proposed scheme is predicted to have any impact on any of the designated sites of the wider area. Therefore the significance of effect of the impact to designated sites is **no significant effect**.

MITIGATION IN RELATION TO IMPACT 16.1
• No mitigation required

Residual impact

16.77. As no mitigation is required, the significance of effect of the impact to designated sites will remain **no significant effect**.

Impact 16.2: Terrestrial habitat loss

16.78. The electricity generated by the tidal turbines will be transmitted to the substation at 6.6kV and the turbines will be laid out in two separate electrical arrays. Once the cables (each will be a precautionary estimate of 500mm in diameter, however are likely to be in the region of 100mm) reach the intertidal and terrestrial zones they will be installed in trenches approximately 0.45m wide by 1m deep. There will be approximately 1400m distance of trenching required to link the cabling to the onshore substation, across wet dwarf shrub heath. The trench will run alongside the road from the landfall site at Daimh-sgeir, minimising the disturbance of the heath habitat. Access will also be required for vehicles and personnel to the shore, the footprint of which is currently unknown.

16.79. Cables will be laid in sand or peat, and the trenches will then be backfilled with excavated subsoil and peat topsoil. Earthing cables and communications cables will be installed within the same trench. Trenching of the cable route constitutes a short term temporary impact to the wet heath; however this disturbance will be situated adjacent to the existing road therefore having a lesser impact to the terrestrial habitat than works within the less frequently disturbed and therefore higher quality wet heath away from the existing road.

16.80. This avoids bringing the cables ashore North of the Abhainn an Daimh-sgeir river. The narrow riparian habitat here consists of lichen covered deciduous trees, including holly, white willow, common alder, grey alder, and many silver birch. Within the study area on Jura, trees are predominantly limited to within the riparian habitats of the major rivers, and by choosing the South option, SPR have reduced the potential for adverse effects to the terrestrial habitats, aquatic habitats and riparian trees.

16.81. The substation has a proposed footprint of 30x50m and will be dug into the hillside to camouflage into the landscape. Further details are provided in *Chapter 17: Landscape and Visual*. The existing environment at the proposed substation location is similar to the surrounding area. As the road contours around a hillside at the location of the substation, the ground rises to the East, allowing the footprint of the substation to be cut into the hillside with limited impact to the terrestrial habitat. The substation housings will be single storey to reduce their impact and will be coloured green or brown to blend with the surrounding landscape. The substation will be combined with the transformer site for the Inver Hydro Scheme for Inver Estate North of the Jura study area. A small footprint (40x40m) of regionally important wet heathland will be permanently removed by the substation, with short term temporary disturbance of the construction footprint.

16.82. The BAP and Annex I habitats which will be impacted by the cable routing are as follows:

Bap habitat	Annex 1 Habitat	Impact
Open hill ground		Temporary impact from trenching of cable (1400m) and construction footprint. Permanent removal within footprint of substation (40x40m).
Peatlands	North Atlantic wet heath, blanket Bog, European Dry Heath	Temporary impact from trenching of cable (1400m) and construction footprint. Permanent removal within footprint of substation (40x40m).

16.83. During construction, the following best practice activities will be followed:

- Construction activities, materials, machinery and vehicles will be limited to defined construction areas and routes, minimising the footprint to prevent disturbance of nearby habitat;
- During trenching of the cable route, heathland turf from the site will be stored within the construction footprint away from watercourses. Once cabling is installed, the turf will be replaced to increase the speed of re-vegetation of the disturbed wet heath habitat;
- All construction material will be removed from site;
- Clearance or trimming of trees and shrubs will be undertaken in accordance with British Standard 3998 – Recommendations for tree work;
- Trees to be removed will be marked clearly by the contractor and checked by the contract supervisor;
- Trees to be retained close to construction works will be temporarily fenced to protect them during construction using British Standard Methods;
- All trees or branches will be appropriately disposed of or re-used within the site; and
- Planting schemes of species of native, local provenance will be planted within any disturbed ground within the footprint of the proposed Development.

16.84. The proposed scheme will therefore have low magnitude impact on terrestrial habitats. Whilst Annex I habitats are of international importance, the area is not designated and these habitats are assessed to be of regional, medium importance. The BAP habitats are also of regional importance, so the terrestrial habitats can be seen as being of **minor** sensitivity.

MITIGATION IN RELATION TO IMPACT 16.2
• No mitigation required.

Residual impact

16.85. As no mitigation is required, the significance of effect of the impact of terrestrial habitat loss will remain **minor**.

Impact 16.3: Intertidal habitat loss

16.86. No rare or protected species were recorded during intertidal surveys along the study area coastline. It is proposed the cables will be buried within both the intertidal and terrestrial environments (as per *Chapter 5: Project Description*) and therefore temporary short term disturbance will occur to intertidal habitats. There will be some temporary localised smothering of intertidal habitats over a limited area; however, of the species recorded within the site at Daimh-sgeir, only *A. nodosum* is recorded to be sensitive to smothering with low recoverability (http://www.marlin.ac.uk) and this species was common along the surveyed coastline of the Jura study area.

16.87. The following best practice activities will be followed during construction:

- Construction activities, materials, machinery and vehicles will be limited to defined construction areas and routes, minimising the footprint to prevent disturbance of nearby habitat;
- Construction material will be removed from site; and
- Material removed from the intertidal habitat will be stored and replaced within the same intertidal zone following the trenching of the cables.

16.88. There is predicted to be short term low impact on undesignated intertidal habitats and species of negligible significance, resulting in an expected **negligible** effect on the intertidal zone during construction.

MITIGATION IN RELATION TO IMPACT 16.3
• No mitigation required.

Residual impact

16.89. As no mitigation is required, the significance of effect of impact of construction on intertidal habitats will remain **negligible**.

Impact 16.4: Disturbance to otters

16.90. The Scottish Wildlife Series publication ‘Otters and development’ is available from http://www.snh.org.uk/publications/on-line/wildlife/otters/default.asp

16.91. Otters and signs of otter activity have been recorded throughout the coastline of the study areas on both Islay and Jura. It is therefore recognised that this coastline is an important habitat for this species. An otter was recorded feeding on rocks just off shore of the landfall site at Daimh-sgeir (J-C) during intertidal surveys (Royal Haskoning, 2010) and the river itself is likely to be important for otters to wash their fur. No evidence of holts, lie ups or couches were identified at this location, however in the absence of a detailed survey this cannot be seen as definitive. The cable landfall is planned for the South of the river, thus avoiding disturbance to this habitat, and the potential impact to otters will be considerably less, particularly as the river will be sheltered from construction noise and disturbance by the small headland immediately to the South.

16.92. Potential holts have been recorded close to site J-D and at the road bridge over Abhainn Mhor, South and North respectively of the proposed cable landfall site. Given the cable will follow the line of the road, there is not expected to be any impact of this species away from the coastline. As otters are known to utilise this area of coast, impact assessment is based on worse-case scenario and is expected to be short term and temporary having low disturbance impact on otters. As this species is of high value, this is assessed to be of **moderate** significance of effect.

MITIGATION IN RELATION TO IMPACT 16.4
• Detailed otter surveys will take place prior to final cable landfall design to check the footprint for holts, lie-up and couches and other otter activities in consultation with SNH. This will be used to inform the application for a licence to disturb otters which may be required. • Construction work will be undertaken during agreed daylight working hours (07:00-18:00), where practicable. Artificial light will not be used next to the coastline or rivers at night to allow otters to migrate through the area undisturbed. During summer months, construction may continue later into the evening without the need for artificial lighting.

MITIGATION IN RELATION TO IMPACT 16.4
• Construction areas will be left in a safe condition during periods of inactivity, with chemicals and construction materials stored safely in accordance with SEPA's Pollution Prevention and Chemical Guidelines (PPG2- Above ground oil storage tanks, and PPG5 – Works in, near or liable to affect watercourses). Key measures may include capping all pipes, covering all trenches or providing a means for otter to escape. • Construction activities will maintain a strict footprint of works for the corridor of the cable trenching, and construction vehicles and equipment will not be active on or stored by the coastline for longer than is necessary.

Residual impact

16.93. Following mitigation the significance of effect of the impact to otters and otter habitat will be reduced to **minor**.

Impact 16.5: Disturbance to reptiles, amphibians and invertebrates

16.94. The walkover of the study area on Jura was conducted in November, and so amphibians, reptiles or invertebrates could not be assessed. There is potential for the site to provide habitat for some of this group of species, some of which are protected and the proposed works could lead to the removal of some individual and some species supporting habitat. There would be potential for a low magnitude of impact on species of national importance, resulting in a worse case of **minor** significance of effect to these species.

MITIGATION IN RELATION TO IMPACT 16.5
• On final decision of cable landfall site, detailed surveys for amphibians, reptiles and invertebrates will be conducted within the footprint, and should any protected species or sign of protected species be found, the necessary mitigation will be implemented after consultation with SNH.

Residual impact

16.95. Following mitigation the significance of effect of the impact of disturbance to reptiles, amphibians and invertebrates will be **negligible** in the worst case.

IMPACT 16.6: Spread of non-native invasive species

There is a small chance that rhododendron will be present within the footprint of the cable route and substation. As best practice, should rhododendron be present within the finalised footprint of the cable landfall, this species will be removed from the construction area and disposed of. The surrounding habitats are of medium sensitivity to the spread of non-native species; however there is an expected negligible risk of spread of rhododendron. There will therefore be the significance of effect for the spread of non-native species during construction is deemed to be **negligible**

MITIGATION IN RELATION TO IMPACT 16.6
• No mitigation required.

Residual impact

16.96. The significance of effect of the risk of spread of non-native species during operation and maintenance remains as **negligible**.

16.7.3 Potential Impacts during Operational Phase

Impact 16.7: Terrestrial habitat loss

16.97. During operation, maintenance to the substation may be required. The substation is adjacent to the existing road, and therefore there will be no disturbance to terrestrial habitats during access to this site. It is presumed that maintenance to the buried cabling would not be required. No detectable effect on the regionally important habitat is predicted and the significance of effects is expected to be **negligible**. As best practice, maintenance at the substation will adhere to a tight footprint to avoid damage to surrounding habitats.

16.98. There will be **negligible significance of effect** during operation in addition to the permanent habitat loss already discussed during construction.

MITIGATION IN RELATION TO IMPACT 16.7
• No mitigation required.

Residual impact

16.99. Following mitigation the significance of effect of the impact of terrestrial habitat loss during operation and maintenance remains **negligible**.

IMPACT 16.8: Disturbance to otters

16.100. A number of factors combine to indicate that direct interaction with the turbines is unlikely, including the highly tidal environment at the Sound of Islay, the depth of water required for turbine installation, the depth at which the rotors operate, and the preference of otters to feed in shallower waters where the water velocity is calmer. Otters show a strong preference for multiple short dives in shallow waters of 0-3m of depth, with evidence suggesting deep dives are less successful for catching prey (Nolet *et al.*, 1993). Therefore, although otters may cross the Sound of Islay, it is unlikely they would dive in deeper water in search of food, and highly unlikely they would dive to sufficient depth to interact with the turbine rotors.

16.101. Although otters are of high value, no interaction between the Development and otters are expected during operation. No detectable effect is therefore likely on otters during operation of the turbines, resulting in a **negligible** significance of effect.

16.102. There is not predicted to be any impact to otters during onshore maintenance work, as this will be limited to works in the vicinity of the substation, away from the coast and water courses.

MITIGATION IN RELATION TO IMPACT 16.8
• No mitigation required

Residual impact

16.103. As no mitigation is considered necessary for this impact the significance of effect for the impact of disturbance to otter populations will remain **negligible**.

16.7.4 Potential Impacts during the Decommissioning Phase

16.104. The potential impacts during decommissioning are expected to be of the same type and magnitude to those predicted during the construction phase, with the assumption that cabling

will be dug up and removed from site, and that the substation will be dismantled. As per construction, adhering to tight footprints of works.

16.7.5 Cumulative effects

16.105. Construction work for the Inver Estate Hydro scheme will also construct a corridor of cabling through the wet heath habitat on Jura. As the cable routing for the current project will run adjacent to the existing road, the impacts of the tidal array cable route will be less than that of the Hydro scheme. This is due to the fact that the area occupied by the road already suffered disturbance when the road was built and continues to suffer disturbance due to traffic using the road. The two schemes are considering aligning their substation works to enable them to share an area for their substations. This in turn will reduce the impacts on the terrestrial habitats. The significance of cumulative effects are assessed to be **minor** significant effect during construction, and **negligible** significant effect during operation and maintenance.

16.7.6 Summary of effects

Impact	Construction				Operation and maintenance				Decommissioning			
	Magnitude	Sensitivity	Impact	Residual impact	Magnitude	Sensitivity	Impact	Residual impact	Magnitude	Sensitivity	Impact	Residual impact
Impact to Designated sites	Negligible	High	No significant effect	No significant effect					Negligible	International	No significant effect	No significant effect
Terrestrial habitat loss	Low	Medium	Minor	Minor	Negligible	Medium	Negligible	Negligible	Low	Medium	Minor	Minor
Intertidal habitat loss	Low	Negligible	Negligible	Negligible					Low	Negligible	Negligible	Negligible
Disturbance to otters	Low	High	Moderate	Minor	Negligible	High	Negligible	Negligible	Low	High	Moderate	Minor
Disturbance to reptiles, amphibians and invertebrates	Low	Medium	Minor	Negligible					Low	Medium	Minor	Negligible
Spread of non native invasive species	Negligible	Medium	Negligible	Negligible					Negligible	Medium	No significant effect	No significant effect

16.8 Conclusions and Statement of Significance

16.106. Assessment is based on the proposed substations and cable route incorporating one cable land fall location at Daimh-sgeir. Except for otters and terrestrial habitat loss, all terrestrial and intertidal receptors the significance of effect are assessed as being negligible or no significant effect during construction, operation and maintenance of the onshore elements of the proposed Development.

16.107. With regards to otters, several feeding areas and potential holt sites have been identified already within a 2km radius of the potential land fall site. Further otter surveying is proposed once the final footprint of cable landfall is confirmed to inform the need for an EPS licence from the Scottish Government should a holt or resting site be located within the footprint of the cable route. This will be informed by a targeted otter survey once the cable route plan is finalised. No potential resting sites have been recorded at the proposed landfall site (J-C),however feeding otters have been recorded and the river is likely to be an important freshwater resource for this species. With the cable to come ashore south of the bridge, therefore avoiding the more sensitive river habitat, the significance of effects is assessed to be **minor**.

16.108. There will be approximately 1400m of cable routing across wet heath habitat, the dominant habitat type for the surrounding area. However, this cable route will run adjacent to an existing road that crosses the wet heath and therefore disturbance and impacts here are considered of **minor** significant effect.

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SNH Otters and Development http://www.snh.org.uk/publications/on-line/wildlife/otters/default.asp Website accessed 06/06/2010

The Marine Life Information Network http://www.marlin.ac.uk website accessed 04/02/2010

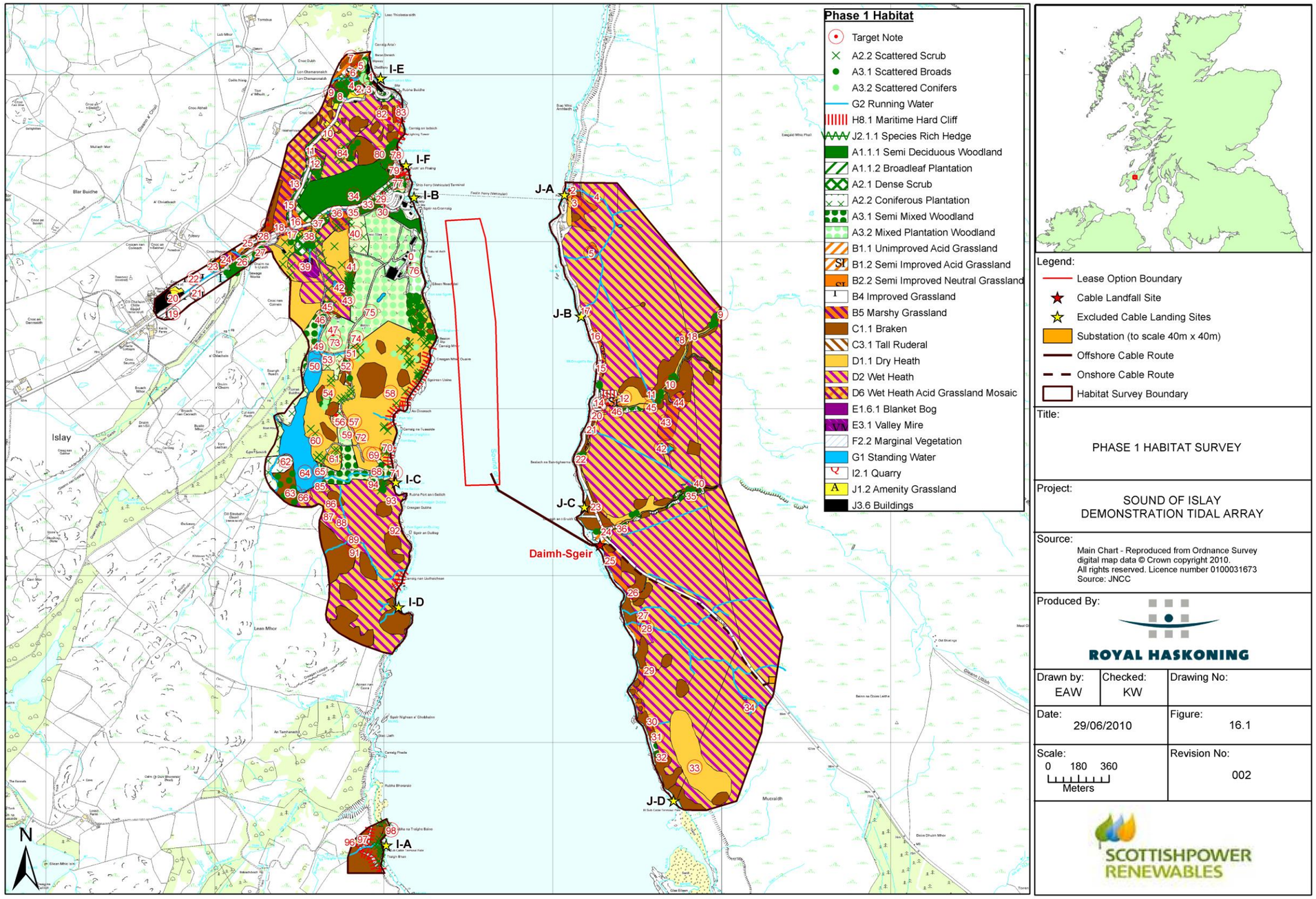


Figure 16.1 Phase one habitat surveys and the locations of potential land fall sites where intertidal surveys were completed. Site J-C identifies the preferred cable landing sites at Daimh-sgeir.

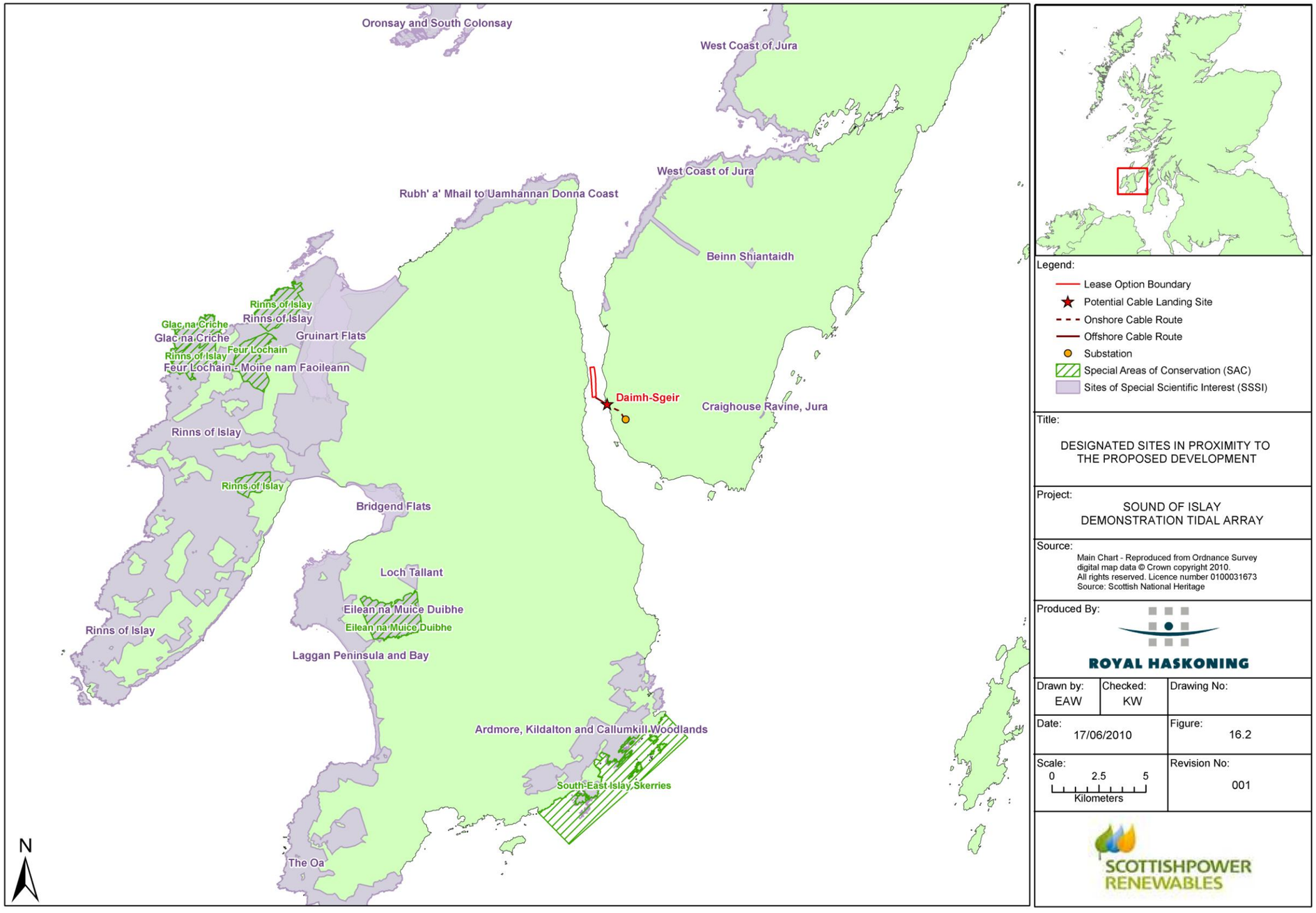


Figure 16.2 Designated sites in proximity to the proposed Development

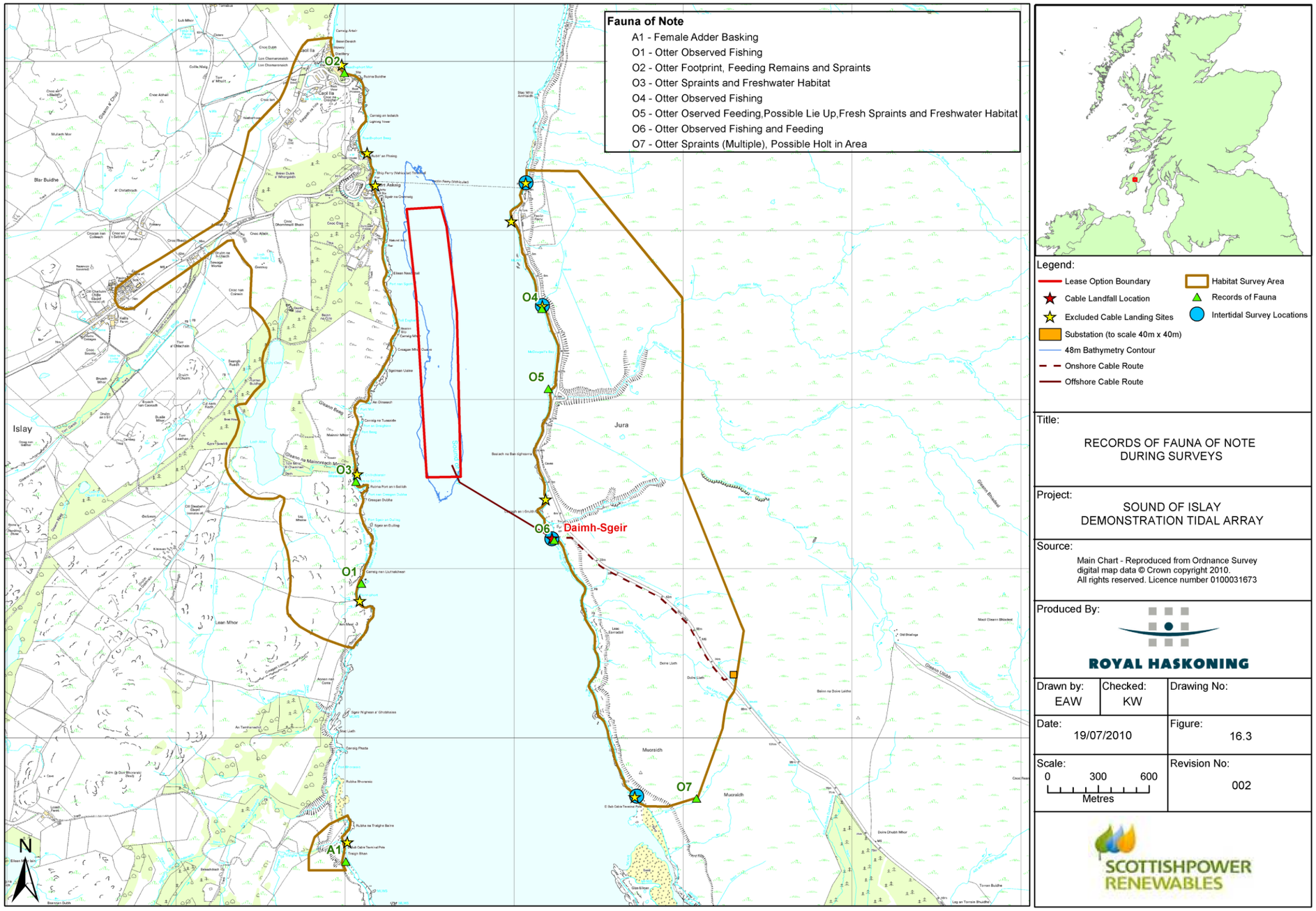


Figure 16.3 Records of Fauna of note during surveys

17.0 Landscape and Seascape

17.1 Introduction

17.1. This chapter considers the landscape and visual impacts of the proposed Development and associated infrastructure, (including sub station and cables) during the construction, operation (and maintenance) and decommissioning phases.

17.2. Landscape impacts consider changes to the character of the landscape (and in this case, also the seascape of the Sound of Islay) which can include both physical alterations to the landscape, such as ground modification, removal of vegetation cover and other features which make a contribution to character, together with the perceptual qualities associated with the experience of that landscape, such as the sense of remoteness or naturalness associated with the landscape or seascape. Visual impacts are inter-related to landscape impacts. Visual impact assessment relates solely to the effect of a development on views and visual amenity. It considers the likely extent of visibility of a development and the impacts on people.

The Sound of Islay covers a range of different landscape and seascapes, from high moorland plateau to coastal ridges. For the proposed development there would be minor/no significant landscape effects during the construction and operational phases of the development. However, there would be moderate significant effects on views from the Dunlossit Estate on Islay, the Kennacraig to Port Askaig ferry and from the Jura road south of Feolin during construction. These impacts would be temporary, lasting approximately 3 months, with minor/no significant effects anticipated during the operational phase.

17.2 Potential Effects

17.3. Potential landscape and visual impacts are likely to arise in association with the following features of the Development:

- Ten submerged turbine devices only visible during the construction and decommissioning phases when being placed or removed by 'heavy lift' vessel(s). It is assumed that there will be two storage barges moored in Caol Ila Bay. The turbine devices will not be marked by buoys or any other visible features.
- Periodic maintenance of the devices which may be lifted and cleaned and other works undertaken on vessels in the Sound of Islay .
- The site is to house 2 substations (SPR and Inver Hydro Scheme) and comprises an overall footprint of approximately 40m x 40m, with a total of 6 GRP housings situated within it. The proposed footprint required for SPR is 14m x 8.65m. It is proposed to cut the substation site into a hill side adjacent to the public road. The housings would be coloured a recessive dark brown or olive green, with features designed to be sympathetic to the surroundings. The cable will be buried from the substation to the Jura-Islay subsea cable landing point except for a very short overhead section where two poles maybe required, subject to separate consent.

17.4. The LVIA has been based on assumptions made as to the likely appearance of the proposed Development. It is envisaged that there would be stock fencing around the substation and that it will not be constantly manned (thus reducing the visual impact of permanently parked vehicles). The subsea cable will be jointed to an onshore cable at the landing point on Jura with both cables being buried, therefore limiting visual impact.

17.3 Methodology

17.3.1 Consultation and Scoping

17.5. Scottish Natural Heritage (SNH) was initially consulted in by SPR in July 2007 and has been kept up to date with the progression of the Development through a series of meetings and ongoing dialogue since then. SNH advise in their Scoping Opinion of October 2008 that 'An assessment of the sensitivity and capacity of the Scottish seascape in relation to windfarms' (SNH, 2005) (and in particular the description of Area 23) is of relevance to the Sound of Islay. They also highlight the usefulness of PAN 68 and 'Guidelines on the Environmental Impacts of Windfarms and Small Scale Hydroelectric Schemes' (SNH, 2001) in outlining the importance of providing a design statement for a development proposal and in considering the design of the onshore ancillary elements of the proposed tidal array, including the control building, grid connection and access tracks. No specific guidance exists for the design and assessment of tidal energy devices or tidal turbine arrays.

17.6. SNH advised that onshore facilities such as grid connections and substations should be sympathetic to the outstanding quality of the landscape in the area if either sited within the Jura National Scenic Area (NSA) or if they could be viewed from the NSA. Details such as the design and colour of external building materials, routing of tracks and overhead lines and landscaping works should be designed to minimise visual impacts on the landscape. The focus of the assessment should be on the onshore elements although any requirements for marker buoys and/or night-time lighting around the tidal array location should also be considered together with any cumulative landscape and visual impacts of the Development in combination with other types of development likely to occur in the area.

17.3.2 Guidance on Landscape and Visual Impact Assessment (LVIA)

17.7. The landscape and visual impact assessment (LVIA) is based on the 'Guidelines for Landscape and Visual Assessment' (Second Edition - 2002) published by the Landscape Institute and the Institute of Environmental Management and Assessment. Other documents have also been reviewed as part of the assessment and are listed in the references at the end of this section.

17.3.3 General Approach to LVIA

17.8. The LVIA involved the following key stages of work;

- Identification of the key features of the proposed Development which would have potential to incur landscape and visual impacts;
- Consultation with SNH to confirm the scope of the LVIA and to update information and requirements further to the Scoping Opinion dated October 2008;
- Field work to establish landscape and seascape character and to determine likely visibility and key viewpoints for detailed assessment; and
- Impact assessment of the proposed Development and consideration of potential mitigation measures.

17.9. Due to the limited visibility of much of the proposed Development during the operational phase and the small-scale nature of visible onshore features, computer-aided visibility tools, such as Zone of Theoretical Visibility (ZTV) mapping and visualisations, have not been used in the assessment.

17.3.4 The Assessment of Landscape Impacts

17.10. The assessment of landscape impacts considers the effects of the proposed Development on key components contributing to landscape character and the perceptual qualities associated with that landscape, through identifying landscape sensitivity and the magnitude of likely change.

17.11. Landscape character types have been defined within the Sound of Islay, these being largely based on published SNH landscape character assessments. The sensitivity of each character type to a development of this scale and nature was assigned a rating of High, Medium or Low. The review took into account the existing openness and scale of the landscape or seascape, its diversity and the perceptual qualities associated with that landscape/seascape.

17.12. The magnitude of change associated with the proposed development was then categorised as High, Medium, Low, Negligible or None and considers the extent of likely change to landscape and seascape character. The following factors were considered to influence the magnitude of change;

- Changes to the physical fabric of the landscape including ground modification, removal of vegetation and demolition of built features which contribute to landscape character;
- Direct or indirect changes to the perception of scale and openness of the landscape or seascape;
- Direct or indirect changes to the sense of remoteness, seclusion and/or naturalness that may be associated with the landscape or seascape;
- The compatibility of the proposed development with the character of the landscape or seascape including consideration of the contrast in scale and character between proposed structures and existing natural or built features characteristic of the area; and
- Changes to the setting the landscape or seascape may provide to landmark natural or built features in this, or adjacent character types.

17.3.5 The Assessment of Visual Impacts

17.13. Visual impacts relate to changes in views of the landscape and the effect of these changes on people (i.e. visual receptors). They include direct impacts of a development upon views of the landscape and sea through intrusion or obstruction and the overall impact on visual amenity and the scenic composition of the view.

17.14. The overall likely visibility of the proposed Development was appraised during field work, principally undertaken during March 2010 but with a follow-up visit also undertaken in late May 2010. Four key viewpoints (discussed later in this Chapter) were then identified based on the likely accessibility and use of viewpoints and their relative proximity to the Development given its scale and nature. Further detail on the type and number of potential receptors is given in the assessment. Visual receptors likely to use these viewpoints were assigned a sensitivity rating from High, Medium or Low dependant on their activity based on the definitions contained in Table 17.1.

Table 17.1: Sensitivity of visual receptors

Sensitivity	Definition
High	Users of outdoor recreational facilities whose attention may be focussed on the landscape; people visiting landscape/coastal features with physical, cultural or historic attributes where landscape context is important; principal views from residential buildings.
Medium	People using non-tourist route roads and other transport routes; secondary views from residential buildings.
Low	People engaged in outdoor sports, work activities whose attention may be focussed on their work (or sport activity) rather than the wider landscape.

17.15. The magnitude of visual change likely to be experienced at each viewpoint was then assessed and categorised as being either, High, Medium, Low, Negligible or None. This assessment took into account the following factors;

- The distance of the proposed Development infrastructure from the viewpoint and its apparent scale in relation to the scale of key landscape features seen in the view.
- The number of components likely to be visible in the view and the extent of Development infrastructure visible in relation to the view.
- Aspect and orientation of the view and consideration of lighting effects during night-time.
- Whether the proposed development would be seen in an open context, back-dropped by sea or seen within a more developed context.
- The compatibility of the proposed Development with the surrounding landscape and seascape forming the view in terms of its form, structure and colour; and
- The potential obstruction or intrusion of views and effects on existing landmark features.

17.16. Definitions of the magnitude of change in relation to views are set out in Table 17.2 although it should be stressed that these are examples and the full range of factors listed above will have been additionally considered in the assessment.

Table 17.2: Magnitude of change definitions for visual impact assessment

Magnitude of change	Definition
High	Close views where the development will appear in the foreground of the view and where it may obstruct existing views or foci. The development would be a dominant and defining feature of the view.
Medium	The development (seen either partially or wholly) is clearly visible and may be seen against the sky or sea, or in a notably open location which increases its visibility. The Development may detract from existing foci and may be a prominent feature, depending on its location, distance from the viewpoint and the context of the view.
Low	Only a small part of the Development is visible and/or it is seen at distance. The Development is noticeable but will form a minor element in the view where views are panoramic perhaps or where it is seen in a context of other built development which lessens its contrast and visibility.
Negligible	The Development is barely perceptible, being seen at considerable distance and/or with only a small part or component being potentially present in the view.

17.3.6 Significance of Landscape and Visual Impacts

17.17. Professional judgement was used to determine the significance of the Development on landscape character and on views, taking into account the following factors;

- The nature of the impact, whether adverse or beneficial, direct or indirect, its longevity and whether impacts would be reversible;
- The sensitivity of the landscape resource/visual receptors;
- Likely numbers of visual receptors potentially affected; and
- The magnitude of change to the landscape or view.

17.18. The significance assessment defines impacts as being either adverse or beneficial and the severity of the impact as Major, Moderate, Minor, Negligible or No significant effect Where the impact is assessed as being either Major or Moderate this is considered to be a significant effect in terms of the *Environmental Impact Assessment Regulations (Scotland) 1999.* Further details are provided in *Chapter 6: Regulatory and Policy Context.*

17.4 Planning Policy Background

17.4.1 National policy

17.19. The southern part of Jura is defined as a National Scenic Area (NSA). The boundary of this NSA extends into the Sound of Islay and is shown in Figure 17.1. Scottish Planning Policy (February 2010) states that development that affects a NSA should only be permitted where – ”*it will not adversely affect the integrity of the area or the qualities for which it has been designated, or any such adverse effects are clearly outweighed by social, environmental or economic benefits of national importance*”.

17.4.2 The Argyll and Bute Local Plan (adopted August 2009)

17.20. Policy LP ENV 9 – Development Impact on National Scenic Areas (NSAs) states the following: “*Development in or adjacent to National Scenic Areas that would have a significant adverse effect on a National Scenic Area will be refused unless it is demonstrated that:*

- *The objectives of the designation and overall integrity of the area will not be compromised;*
- *Any significant adverse effects on the quality for which the area has been designated are clearly outweighed by social and economic benefits of national importance;*
- *Where acceptable, development must also conform to Appendix A of the Local Plan.*

In all cases the highest standards, in terms of location, siting, landscaping, boundary treatment, materials and detailing will be required within a National Scenic Area”.

17.21. The proposed development lies approximately 2km to the north of an Area of Panoramic Quality defined in the Local Plan on part of the coast of Islay within the Sound of Islay. Policy LP ENV 10 – Development Impact on Areas of Panoramic Quality states that: *“Development in or adjacent to an Area of Panoramic Quality will be resisted where its scale, location or design will have a significant adverse impact on the character of the landscape unless it is demonstrated that:*

- *Any significant adverse effects on the quality for which the area has been designated are clearly outweighed by social and economic benefits of National or regional importance;*
- *Where acceptable, development must also conform to Appendix A of the Local Plan.*

In all cases the highest standards, in terms of location, siting, landscaping, boundary treatment and materials, and detailing will be required within Areas of Panoramic Quality.”

17.22. Appendix A: Sustainable Siting and Design Principles within the Local Plan considers development affecting National Scenic Areas and Areas of Panoramic Quality. It provides general advice on the need to retain the unique identity of these landscapes which it considers are – ”*likely to be strengthened either by design that draws on traditional forms and materials, or that builds on best qualities of modern design*”. While no specific guidance is provided on detailed design of new development within designated landscapes in Appendix A, it is stressed that – ”*The conservation and enhancement of the landscape will be given prime consideration in the determination of development proposals*”. The role of good design and sensitive siting in avoiding damage to the landscape is acknowledged.

17.23. Guidance on the design of isolated industrial/commercial development is also set out in Appendix A. This stresses the importance of considering the extent to which the proposal would be clearly visible from public roads, viewpoints and neighbouring local communities. It also states that in assessing the appearance of these types of development, the Planning Authority will take the following into consideration:

- *“The size and extent of the proposal(s). This includes the visual impact of the scheme and the distance/location from which it is visible.*
- *The location of the proposal(s) and its landscape setting, including the way in which the development has used the natural contours of the site is of prime importance. A large building must be absorbed by the landscape as much as possible, whether by excavating and building into the landform, using existing landforms to mask the development or screening by new trees; and*
- *The design and colour of the development(s) and ancillary structure can be used to minimise their perceived bulk and visual impact. Natural materials such as timber and stone will help to fit a large building into the landscape, as will dark natural colours (particularly on the roof)”.*

17.24. Policy LP ENV 19 – Development Setting, Layout and Design stresses the importance of executing a high standard of appropriate design in accordance with the design principles set out in Appendix A of the Local Plan and the Council’s sustainable design guide and criteria such as paying regard to siting in relation to landscape context and the sensitivity of the area.

17.25. The NSA and Area of Panoramic Quality designated areas are shown on Figure 17.1.

17.5 Baseline Description

17.5.1 Landscape and Seascape Character

17.26. Broad landscape character types are set out in the *Landscape assessment of Argyll and the Firth of Clyde (SNH, Review 78).* The ‘Moorland Plateau’ character type extends over much of Jura and the south-western high ground of Islay. The south-eastern coast of Jura is defined as the ‘Coastal Parallel Ridges’ character type while the Paps of Jura are categorised

as the 'High Tops' character type. Broad seascape character types are also identified in '*An assessment of the sensitivity and capacity of the Scottish seascape in relation to windfarms' (SNH, 2005).* Seascape Area 23 covers the 'South Mull/Colonsay/West Jura/Sound of Islay'. A more detailed assessment has been undertaken for the Sound of Islay for the purposes of this LVIA.

17.27. Landscape and seascape character types are described below and illustrated in Figure 17.2.

17.5.2 Moorland Plateau

17.28. The SNH landscape assessment [SNH Review, 78)] describes this as an upland plateau with undulating landform of mainly open moorland broken by rock outcrops and upland lochs. It has a massive scale and is relatively inaccessible and uninhabited. This character type is only found on Jura and Islay within the Argyll and Firth of Clyde Area. On Jura, this landscape character type is described as forming the extensive hinterland to the renowned Paps. The plateau forms a steep, rocky coastline, often with cliffs, caves and stacks (these are more prominent features on the isolated north-western coast of Jura outside the viewshed of the proposed Development).

17.29. Although the 'Moorland Plateau' extends either side of the Sound of Islay, a distinct difference in character occurs at a micro-scale and this is described in more detail within the 'Sound of Islay' seascape character type in Paragraph 17.30.

17.30. The following guidance outlined in the SNH published Landscape Character Assessment is also relevant due to the location of the built on-shore features of this proposed Development within the 'Moorland Plateau';

- "*This wild land is valued for its remote, natural qualities and any form of development should be strictly controlled. The existing evidence of man's influence, in the pylons, roads, conifer plantations and occasional buildings on the fringes of the moor, is often intrusive and any further development would add to this"; and*

- *Any small-scale developments, such as improvements to infrastructure or car parks, would be very prominent in this open, large-scale landscape and should be carefully designed to minimise their visual impacts using local landform and any existing vegetation"*.

17.31. The proposed substation and buried electricity cable connection on Jura would be located within this character type.

17.5.3 The Sound of Islay

17.32. The seascape of the 'Sound of Islay' comprises the sea, the coastal edge and the immediate hinterland to the Sound.

17.33. The Sound of Islay forms a narrow channel of water which is contained by the upland landform of Jura and Islay. A number of small islands occur close to the southern coast of Jura, although in general, the Sound forms a clear, open stretch of water separating the two islands of Jura and Islay. On the eastern shores of Islay, in the area where the proposed tidal devices will be located, the landscape is intimately scaled with greater diversity than on the Jura shore of the Sound. Broadleaved woodlands colonise lower coastal cliffs along the Islay shore and the indented coastline of rocky coves has a more settled (albeit still sparsely populated) character. The mansion house of Dunlossit sits in an elevated position close to the shore while the village of Port Askaig and the Caol Ila distillery are tucked within small bays and strongly contained by steep wooded slopes.

17.34. The Jura coast has a simple, bold form with a pronounced raised beach and scarp edge containing the narrow rocky shoreline in the Feolin area. The Jura coastline and hinterland is open, with little woodland and is sparsely populated with few buildings. Water courses cut dramatic narrow rocky gorges between the moorland plateau of the interior of Jura and the coast; these seen to greatest effect from the Jura road south of Feolin. The expansive moorland plateau which comprises the hinterland to the Sound, forms the foreground to views of the striking landform of the 'High Tops' of the Paps of Jura which are a dominant feature seen from the Sound of Islay.

17.35. The submerged turbine devices would be sited within this character type.

17.5.4 Coastal Parallel Ridges

17.36. The SNH landscape assessment describes this character type as comprising narrow linear ridges which fragment into small rocky islands at the coast. Sandy bays, marshy areas and mudflats occur along the coastal edge. Native woodlands are often a key characteristic of this character type and some small coniferous plantations and policy landscapes also feature, for example Jura House and its walled garden and policy woodlands. Small coastal pastures are enclosed by stone walls and narrow roads follow the coast. The 'Coastal Parallel Ridges' are noted as having a distinctive diverse and scenic character and small-scale with a rich variety of landform and vegetation.

17.37. Although no elements of the proposed development would be sited within this character type, relevant guidance on development from the SNH landscape assessment is set out below and may be of value should any relocation of the proposed substation be proposed:

- "*New built development should be strictly controlled and subject to careful visual assessment. Buildings should be small in scale, of a simple design and finished in local stone or white harling. New buildings should generally be concentrated in existing settlements, but should not be strung out along coastal roads; the relatively open, loose-knit form of existing villages should be respected and conserved*".

17.38. Annex B of the LCA offers further guidance on 'Opportunities to Accommodate Change', stating that – "*There are no opportunities for large-scale development, although the rocky ridges and patchy woodland would provide the potential for screening small built developments. ...The landscape has a small scale and can only accommodate relatively small developments, which can be partially screened by native woodland and stands of Scots pine".*

17.5.5 High Tops

17.39. This character type identified in the SNH landscape assessment occurs relatively extensively across the northern part of Argyll and on Mull. It includes the Paps of Jura within the study area from this LVIA. The 'High Tops' are described as comprising rugged, steep-sided mountain ranges with a massive scale and a diverse landform of gullies, scarp slopes and rocky screes. Much of the description of the 'High Tops' in the SNH landscape assessment does not specifically relate to the Paps of Jura however and it is additionally noted from the field work undertaken during this LVIA that these are notably distinctive in their separation

and sheer slopes and isolation from the surrounding lower-lying 'Moorland plateau' which accentuates their relatively lowly height and scenic quality.

17.40. No components of the proposed development would be located within this character type.

17.5.6 The Jura National Scenic Area

17.41. The southern part of Jura, and part of the Sound of Jura, is defined as a National Scenic Area (NSA) (Figure 17.1) in recognition of its outstanding scenic interest. A description of the area is set out in *Scotland's Scenic Heritage (Countryside Commission for Scotland, 1978)* which focuses on the Paps of Jura, noting their steep-sided elegance and – *"shapely cones (which) rise abruptly from rolling moorland*".

17.42. SNH have recently undertaken a detailed assessment of the special qualities of all NSAs which updates and expands upon the information contained in *Scotland's Scenic Heritage.* This study is due to be published in early Summer 2010. A draft of the work has meanwhile been made available by SNH to inform the assessment of effects on the Jura NSA with the expectation that the final version will not differ significantly. Due to the draft status of this work, it is summarised in the assessment which follows and is not reproduced in full in an appendix.

17.43. The key features of the Jura NSA, as set out in '*Scotland's Scenic Heritage'* comprise the following:

- The quartzite geology which produces remarkable upland landforms including the shapely cones and steep-sided, shimmering scree slopes of the Paps of Jura;
- The visual dominance of the Paps of Jura in views from the mainland and Islay;
- The abrupt rise of the Paps from the surrounding rolling moorland;
- The dramatic raised beaches and cliff lines on the West side of Jura; and
- Indented bays and islets on the East shore with some semi-natural and planted woodlands.

17.44. The draft SNH report on the Jura National Scenic Area Special Qualities (dated 13/5/10) summarises the key special qualities as being;

- The distinctive Paps of Jura;
- Human settlement on the margins of a vast moorland terrain;
- A continually varying coast;
- Large tracts of wild land;
- The raised beaches of the West coast;
- An island of deer;
- An island close yet remote; and
- The inaccessible Loch Tarbet.

17.5.7 Area of Panoramic Quality

17.45. An Area of Panoramic Quality is designated on the Eastern coast of Islay adjacent to the Sound of Islay. There is no citation for this designated area and the reasons for its designation are unknown. No components of the proposed development would be located within the Area of Panoramic Quality, which is indicated in the Local Plan as applying to the land area only (see Figure 17.1).

17.6 Assessment of Landscape Impacts and Mitigation

17.6.1 Do Nothing Scenario

17.46. Currently if the proposal does not proceed there would be minimal changes likely to the character of the Sound of Islay. There may be some change to the Moorland Plateau character type on Jura should the proposed Inver Hydro scheme be consented and construction works are undertaken.

17.6.2 Potential Landscape Impacts during Construction Phase

Moorland Plateau

17.47. The substation, and buried cable connection to it, would be located within the Moorland Plateau character type on Jura. This character type is extensive and open with a massive scale and few built features. The SNH published character assessment notes the diverse landform of the steep and rocky coastline of this type and its wildland characteristics of remoteness and naturalness. This character type would be of high sensitivity to most forms of built development in general due to its openness and largely undeveloped character.

17.48. The cables would be buried close to the existing public road and would be likely to incur minimal disturbance of the landscape fabric during the construction phase. The construction of the substation would involve cutting into the hill side of Beinn na Doire Leithe with some limited removal of moorland vegetation and ground modification. The magnitude of change would be medium within the local area. However the overall significance of effect of the impact on the Moorland Plateau character type would be **minor** as construction activity will only affect a small area of this extensive character type close to the public road, and only for a period of around 3 months, where wildland characteristics are less pronounced.

Sound of Islay

17.49. The Sound of Islay comprises a narrow stretch of water with a generally simple coastline in the vicinity of the proposed Development. It has a remote, uncluttered character with little built development on the coastal edge and hinterland and only occasional shipping, fishing and recreational watercraft visible. This seascape would be of high sensitivity to most forms of built development due to its openness and largely undeveloped character.

17.50. The tidal devices would be located within the Sound of Islay. Heavy lift vessels will be present and construction activity to place the devices on the sea bed would occur over a period of approximately three months. While the presence of these construction vessels would be unusual in this relatively remote and undeveloped seascape, the ferry and occasional commercial shipping is a feature through the Sound and there would be a low magnitude of change. Impacts would be of **minor significant effect**.

Coastal Parallel Ridges

17.51. The proposed Development would not be located within this character type and there would be no visibility of construction activities from this character type. There would be **no significant effect** on the Coastal Parallel Ridges character type.

High Tops

17.52. The proposed Development would not be located within this character type. There would be likely to be no visibility of the substation and cable laying construction works from this character type although there would be limited visibility of construction activity within the Sound of Islay from some of the upper slopes and hill summits of the High Tops. This activity would be short term lasting approximately three months and, at the distances involved, would not be perceived as being contrary to the existing character, or affecting the current landscape setting of the High Tops, as existing large scale vessels are already a feature within the Sound of Islay. There would be **no significant effect** on the character of the High Tops.

Jura National Scenic Area

17.53. Construction activity within the Sound of Islay will directly affect the NSA as the boundary of the designated area extends to cover part of the Sound where the tidal devices are located (see Figure 17.1). However, the Sound of Islay is not identified as a key feature or special quality of the NSA and it is assumed that the views from the Sound to the key landscape features on Jura, such as the Paps and the indented southern coastline, form the key reasons for its designation. It is unlikely that construction activity within the Sound of Islay, which will be temporary occurring over three months, will adversely affect the appreciation of these special qualities of the NSA.

17.54. The proposed onshore features of the substation and cable connections would be located within the NSA but would only directly affect a very small part of the 'rolling moorland' which surrounds the Paps of Jura. Construction activity would not significantly affect views to or from the Paps of Jura, which form the key focus of the description set out in *'Scotland's Scenic Heritage'* and a key special quality of the NSA. However, there would be some minor and temporary impacts on the qualities of remoteness characteristic of this NSA.

17.55. There would be **no significant effect** of this impact on the other special qualities of the NSA. A more detailed appraisal of the impact on the special qualities of the NSA is set out under the operational impacts section of this LVIA.

Area of Panoramic Quality

17.56. The proposed Development would not be located within the Area of Panoramic Quality. Policy LP ENV 10 of the Local Plan requires consideration of developments sited within and adjacent to the Area of Panoramic Quality. The proposed tidal devices would be the closest components of the Development to this designated area, lying approximately 2.2km at the closest point. Construction activity within the Sound may be visible from the designated area although cable laying and substation construction on Jura would be barely perceptible due to the likely screening provided by the hill slope of Beinn na Doire Leithe, the distance (2.7km from the closest point) and the presence of rough terrain limiting accessibility within the part of the Islay coast adjacent to the Sound of Islay. It is concluded that there would be **no significant effect** on the Area of Panoramic Quality.

17.6.3 Potential Landscape Impacts during Operational Phase

Moorland Plateau

17.57. The substation and buried cables would be located within the Moorland Plateau character type on Jura. While the physical impacts of the proposed development will be limited there would be long term impacts on landscape character associated with the substation where it will introduce an obviously man-made structure into this characteristically open and largely undeveloped landscape. In addressing the guidance set out for this character type within the SNH character assessment, it is considered that while the substation would appear as in incongruous and isolated feature in this landscape and may have a moderate effect on a localised area, it would be relatively small, be coloured to be less conspicuous, use local landform to limit intrusion and be located adjacent to the public road thus limiting impacts on the wildland qualities of remoteness and naturalness associated within much of this character type. It would incur a minor magnitude of change on the character type as a whole.

17.58. The significance of effect on the character of the Moorland Plateau overall would be **minor**.

Sound of Islay

17.59. The tidal devices would be located within this character type. They would be submerged during the operational phase of the development with no visible markers evident on the surface of the water. There may be occasional lifting of the devices from the seabed for periodic maintenance. Impacts would be intermittent but **negligible** significant effect overall given the likely short duration of any lifting operations.

Coastal Parallel Ridges

17.60. The proposed development would not be located within this character type and there would be no visibility of any components of the proposed development from this character type. There would be **no significant effect** on the Coastal Parallel Ridges character type.

High Tops

17.61. The proposed development would not be located within this character type. There would be likely to be no visibility of the substation from this character type although there may be very limited visibility of periodic maintenance activity on the tidal devices within the Sound of Islay from some parts of the High Tops. This activity seen at this distance would be unlikely to adversely affect the perception of the landscape, appearing similar in character to existing shipping using the Sound. There would be **no significant effect** on the character of the High Tops.

Jura National Scenic Area

17.62. The proposed onshore features of the substation and cable connections would be located within the NSA but would only directly affect a very small part of the 'rolling moorland' which surrounds the Paps of Jura. It would not significantly affect views to or from the Paps of Jura, which form the key focus of the description set out in *'Scotland's Scenic Heritage'* and a key special quality of the NSA.

17.63. There would be **no significant effect** on the dramatic raised beaches and cliff lines on the West side of Jura or on Loch Tarbet.

17.64. Although the buried 6.6kV cable would be located on the South coast of Jura, it has been carefully routed to avoid the more sensitive indented bays and islets which occur further South and East towards Jura House.

17.65. The proposed substation would form the only longer term visible component of the proposed Development. The substation site lies on the margins of a vast moorland area with few built features. It does not, however, lie within a Search Area for Wild land identified by SNH. Although it would introduce built development into a presently unsettled area, the scale of the development is small and it is sited close to a public road which reduces its impact on the special qualities of the *'vast moorland terrain'* and remoteness characteristic of this NSA.

17.66. *Scottish Planning Policy* (February 2010) states that development that affects a NSA should only be permitted where – "*it will not adversely affect the integrity of the area or the qualities for which it has been designated, or any such adverse effects are clearly outweighed by social, environmental or economic benefits of national importance".* It is concluded that this proposal would not adversely affect the integrity of the NSA and while there would be a limited adverse effect on the special quality of the 'vast moorland terrain', this would not be of significant effect.

Area of Panoramic Quality

17.67. The proposed development would not be located within the Area of Panoramic Quality. Policy LP ENV 10 of the Local Plan requires consideration of developments sited within and adjacent to the Area of Panoramic Quality. The proposed tidal devices would be the closest components of the development to this designated area, the nearest device lying approximately 2.2km to the boundary of the Area of Panoramic Quality, although these would be submerged with only possible periodic maintenance works visible over a short period of time. The substation sited on Jura would be barely perceptible from the designated area due to the likely screening provided by the hill slope of Beinn na Doire Leithe, the distance (2.7km from the closest point) and the presence of rough terrain limiting accessibility within the part of the Islay coast adjacent to the Sound of Islay. It is concluded that there would be **no significant effect** on the Area of Panoramic Quality.

Impacts on local policy and guidance

17.68. Policy LP ENV 9 – Development Impact on National Scenic Areas (NSAs) states the following: "*Development in or adjacent to National Scenic Areas that would have a significant adverse effect on a National Scenic Area will be refused unless it is demonstrated that:*

- *The objectives of the designation and overall integrity of the area will not be compromised;*
- *Any significant adverse effects on the quality for which the area has been designated are clearly outweighed by social and economic benefits of national importance; and*
- *Where acceptable, development must also conform to Appendix A of the Local Plan.*

In all cases the highest standards, in terms of location, siting, landscaping, boundary treatment, materials and detailing will be required within a National Scenic Area".

17.69. The following guidance outlined in the LCA is also relevant due to the location of the built on-shore features of this development sited within the 'Moorland Plateau';

- "*This wild land is valued for its remote, natural qualities and any form of development should be strictly controlled. The existing evidence of man's influence, in the pylons, roads, conifer plantations and occasional buildings on the fringes of the moor, is often intrusive and any further development would add to this*"; and
- *"Any small-scale developments, such as improvements to infrastructure or car parks, would be very prominent in this open, large-scale landscape and should be carefully designed to minimise their visual impacts using local landform and any existing vegetation*".

Conclusions

17.70. It is concluded that the proposal will not compromise the objectives of the NSA designation (which are taken to be the special qualities identified in *Scotland's Scenic Heritage* and new work recently undertaken by SNH) or the overall integrity of the Jura NSA. The proposed development would conform in general with the advice set out in Appendix A of the Local Plan in that the tidal devices will be submerged and electricity connections buried with these components therefore not visible during the operational phase. The substation would form the only visible component of the proposal and this has been designed to be as small as possible and set into a hill side to limit visibility to some extent. The use of muted dark colour finishes proposed on the GPS housings within the substation complex and avoidance of intrusive security fencing and permanently parked vehicles will further reduce intrusion. There is assessed to be minor significant effects to the moorland plateau during construction and operation; and minor significant effects to the Sound of Islay during construction only. No other significant effects are predicted,

MITIGATION IN RELATION TO LANDSCAPE IMPACTS
• Minimising the footprint of the proposed substation to reduce its landscape impact.
• Creation of an earth mound against the North-western boundary of the substation to aid the integration of the substation within the open moorland context. This mound should be vegetated with reserved heather/grass turves cut from the base of the substation.

Residual Impacts

17.71. There would be no material change to the impacts on landscape character outlined above should the mitigation measures be adopted. There will still be minor significant effects to the moorland plateau during construction and operation; and minor significant effects to the Sound of Islay during construction only. No other significant effects are predicted,

17.7 Assessment of Visual Impacts and Mitigation

Potential visibility

17.72. Consideration was given to the likely visibility of the proposal from the Paps of Jura during field work. It was concluded that while there may be some limited visibility of construction activity within the Sound of Islay, this would be a considerable distance (over 6km) from the three most popularly accessed peaks, with Heavy Lift vessels appearing similar to commercial shipping which uses the Sound at this distance. There would be likely to be no visibility of construction works on Jura from these hills or of the substation during the operational phase, principally due to the shielding effect of the intervening hill of Beinn na Doire Leithe.

17.73. There would be no, or severely restricted, visibility of the proposal both during construction and operational phases from the minor road which provides the only access to the west coast of Islay within the Sound of Islay north of Port Askaig to the Bunnahabhain distillery. This road offers spectacular views which focus on the Paps of Jura and the northern part of the Sound, with views south of Port Askaig being restricted by landform. Views of the proposed development would not be possible from the A846 on the approach to Port Askaig due to the containment provided by steep slopes which offer a restricted extent of view, towards Feolin and the Paps of Jura.

17.74. Views from Port Askaig would be restricted by its containment within a tight cove although some more elevated individual properties, for example Dunlossit House which is sited within 0.5km of the nearest tidal device, would have views of the Development; these comprise a small number with relatively few receptors potentially affected.

Assessment from key viewpoints

17.75. Representative viewpoints for detailed assessment were selected on the basis of having likely visibility of the substation as well as visible works during the construction phase. They are shown on Figure 17.3 and comprise the following viewpoints:

- Sound of Islay – Kennacraig to Port Askaig Ferry;
- Dunlossit Estate, west coast of Islay;
- Public road on Jura, travelling south; and
- Public road on Jura, travelling north.

17.7.1 Do Nothing Scenario

17.76. Currently if the Development does not proceed there would be minimal changes likely to existing visual amenity within the Sound of Islay itself. There may some changes to views from parts of Islay, Jura and from the Sound of Islay should the proposed Inver Hydro scheme be consented and built.

17.7.2 Potential Visual Impacts during Construction Phase

Viewpoint 1: Sound of Islay – Kennacraig to Port Askaig Ferry

17.77. This view is from the Kennacraig to Port Askaig ferry on the approach to Port Askaig and is shown in Figure 17.4. It would be experienced by tourists and local people who would be of high sensitivity. The viewpoint lies approximately 1.9km from the proposed substation site and within the area of the Sound of Islay where the tidal devices would be placed.

17.78. The view takes in the Western shore of Jura. Although not seen in the photograph, views extend to the North and focus on the Paps of Jura which form a visually arresting feature throughout the ferry route within the Sound of Islay. The open water of the Sound forms the foreground to the view and is edged by the generally simple coastline of Jura. The eye is drawn to the deeply incised valley of the Abhainn an Daimh-sgeir while the narrow public road is visible as it climbs away from the coast onto the lower slopes of Beinn na Doire Leithe. The landscape of Jura is open and expansive in the view with few built features evident.

17.79. During the construction phase, there would be views of the turbine lifting operations within the Sound, although these may be more likely to be seen from the other side of the ferry and not in this particular view. Cable-laying and construction of the substation would be visible close to the public road on Jura. These activities would occur over approximately 3 months and the magnitude of change would be medium. The significance of the effect would be **moderate** during the construction phase.

Viewpoint 2: Dunlossit Estate, west coast of Islay

17.80. This viewpoint is located on a ridge overlooking the Sound of Islay on the Dunlossit Estate, south of Port Askaig on the west coast of Islay. While a network of promoted footpaths are present on the estate (to the Lily Pond and between Ballygrant and Port Askaig), there would be no views of the proposed development from these footpaths. This viewpoint is therefore unlikely to be well-visited and also involves some traverse of rough ground which may additionally inhibit some walkers. The few receptors likely to experience this view would be of high sensitivity. The viewpoint lies approximately 2.8km from the proposed substation on Jura and around 0.5km from the part of the Sound where the tidal devices would be placed.

17.81. The open water of the Sound forms the foreground to the view. The photograph shown on Figure 17.4 was taken in poor weather and in clear conditions the Paps of Jura would form a key focus to the left of this view. The narrow minor road on Jura is visible (although is not clear on the photograph) and this comprises the only built feature seen in this view. The coastal edges of the Sound draw the eye of the viewer with the detail of ragged rocky promontories and clumps of woodland on the Islay shore contrasting with the bold, barren forms of the raised beach and scarp edge on Jura.

17.82. Construction activity would be likely to be visible within the Sound as the tidal devices are positioned by Heavy Lift vessels. Cable-laying may also be visible on Jura depending on the nature of equipment used, with visibility heightened by likely contrasts in colour of vehicles and personnel seen against the dull backdrop of open moorland. These effects would be

temporary and occur over a period of approximately 3 months. The magnitude of change would be medium. The significance of the effect during construction would be **moderate**.

Viewpoint 3: Public road on Jura, travelling south

17.83. This viewpoint is located on the narrow public road on Jura to Feolin (Figure 17.5). The road hugs the coast at the foot of the raised beach scarp until it crosses the Abhainn an Daimh-sgeir and then climbs the lower slopes of Beinn na Doire Leithe. The viewpoint is located approximately 0.9km from the proposed substation and around 1.4km from the area of the Sound where the tidal devices would be placed. This view would be experienced by both local people and tourists who would be of high sensitivity. The substation would be visible over a distance of approximately 1.25km from this road.

17.84. The view takes in the simple and open, rolling moorland plateau with key foci being the rocky coastal edge of Jura and the open Sound of Islay. The public road is the only built feature visible in the view and the eye of the viewer tends to be drawn along its curving alignment.

17.85. During the construction phase, heavy lift vessels may be visible in the Sound (although the main focus of activity is likely to occur to the North and therefore behind this view where the tidal devices will be positioned). Cable-laying along the public road on Jura, and activity associated with the construction of the substation, would occur in close proximity to the viewpoint. This construction activity would occur over approximately 3 months. The magnitude of impact would be medium. The significance of the effect during construction would be **moderate**.

Viewpoint 4: Public road on Jura, travelling north

17.86. This viewpoint is located on the narrow public road on Jura as it traverses the lower slopes of Beinn na Doire Leithe, travelling north towards Feolin (Figure 17.5). It is located approximately 0.7km from the proposed substation site and around 2.8km from the part of the Sound where the tidal devices would be placed. This view would be experienced by both local people and tourists who would be of high sensitivity. While the substation would be visible over a distance of approximately 1.25km from this road, it would only be seen in the direction of travel for a very short distance due to the screening likely to be provided by the lower hill slopes of Beinn na Doire Leithe.

17.87. The view takes in the simple, open, rolling moorland plateau with key foci being the coast and uplands of Islay and the open water of the Sound of Islay. The public road is the only built feature visible in the view and the eye of the viewer tends to be drawn along it.

17.88. During the construction phase, heavy lift vessels would be visible in the Sound (although construction would only last around 3 months) and cable-laying along the public road on Jura would occur in close proximity to the viewpoint. There may be some visibility of construction activity associated with the substation, although this is likely to be shielded by the lower hill slopes of Beinn na Doire Leithe in this view. The magnitude of change would be medium. The significance of effect during the construction phase would be **moderate**.

17.7.3 Potential Visual Impacts during Operational Phase

Viewpoint 1: Sound of Islay – Kennacraig to Port Askaig Ferry

17.89. The substation would be the only component of the proposed development visible during the operational phase from this viewpoint. It would be clearly seen against the public road as it rises along the lower slopes of Beinn na Doire Leithe. The backdrop of the hill slope would aid its visual integration as the materials used for the GRP housings would be a muted dark brown or olive green. The magnitude of change would be low, given the distance and the context of the wider view which focuses on the Paps of Jura and Port Askaig (when travelling north). The magnitude of change may increase when travelling south on the ferry as the Paps of Jura do not form a key focus in views, but views would be fleeting. The significance of the effect would be **minor** during the operational phase.

Viewpoint 2: Dunlossit Estate, west coast of Islay

17.90. During the operational phase, only the substation on Jura would be visible from this viewpoint. It would be 2.8km from the viewpoint and would appear as a very small feature within the expansive scale of this view. While it would not compete with the key foci within the view, which comprise the Sound and the Paps of Jura, in clear weather conditions it would be discernable due to its exposed located within an open landscape where few built features are present. The backdrop of the hill slope would aid its visual integration as the GRP housings would be coloured dark brown or olive green. The magnitude of change would be negligible, given the distance and broad panoramic context of the view.

17.91. The significance of the effect during the operational phase would be **negligible**, taking into account the likely small numbers of receptors potentially affected.

Viewpoint 3: Public road on Jura, travelling south

17.92. During the operational phase, only the substation building would be visible from this viewpoint. This would form a small feature in the view at this distance; it would be noticeable in clear weather conditions due to the openness of the landscape and the absence of other built features. However, the muted colour of the GRP units would merge with the backdrop of the hill which is covered with patchy dark heather moorland thus reducing impact. There would be a low magnitude of change. The significance of effect during the operational phase would be **minor**.

Viewpoint 4: Public road on Jura, travelling north

17.93. The visibility of the substation from this viewpoint during the operational phase would be dependant on its precise location, scale and the extent to which it could be set into the hill slope and thus be partially shielded from view when travelling north on the public road at this point. The magnitude of change would range from no change to minor depending on the degree of visibility of the building.

17.94. The significance of effect during the operational phase would be **no significant effect** to **minor** depending on the precise location and design of the substation.

MITIGATION IN RELATION TO VISUAL IMPACTS
• Minimising the footprint of the proposed substation to reduce the visual impact from all viewpoints considered in the LVIA and lowering the base of the GRP units to optimise the screening provided by the lower slopes of Beinn na Doire Leithe from the public road when travelling north.
• Creation of an earth mound against the North-western boundary of the substation to aid screening from the public road. This mound should be vegetated with reserved heather/grass turves cut from the base of the substation.

Residual Impacts

17.95. Impacts from Viewpoint 4 would reduce to **no significant effect** if the mitigation measures were adopted.

17.8 Cumulative Landscape and Visual Impacts

17.96. Cumulative landscape and visual impacts may occur in combination with the proposed Inver Hydro scheme. In terms of cumulative visual impacts associated with the combination of both these proposed developments, it is considered that very few receptors would be affected due to the different visual influence of each development. If both developments were constructed during an overlapping timescale, sequential views of construction activity associated with both developments may be possible from boats using the Sound of Islay although there is an absence of public roads and paths which would allow views of both developments along their length in either Jura or Islay. It is considered that cumulative landscape and visual impacts during the construction phase would have **no significant effect**.

17.97. During the operational phase the only visible onshore elements would comprise the substation building. It is proposed that the Inver Hydro scheme and the Sound of Islay Demonstration Tidal Array Development would both utilise the same substation site and this would minimise the number of built features in the landscape and result in **no cumulative landscape and visual impacts** occurring during the operational phase.

17.9 Summary

17.98. Table 17.3 summarises the potential significant effects of the proposal on landscape character.

Table 17.3: Summary of significance of effect of landscape impacts

Landscape character type	Construction	Operation
Moorland Plateau	Minor	Minor
Sound of Islay	Minor	Negligible
Coastal Parallel Ridges	No significant effect	No significant effect
High Tops	No significant effect	No significant effect

17.99. The proposal would not compromise the objectives of the NSA designation (which are taken to be the special qualities identified in *Scotland's Scenic Heritage* and new work recently undertaken by SNH) or the overall integrity of the Jura NSA. There would be no significant or direct impact on the Area of Panoramic Quality.

17.100. Table 17.4 provides a summary of significance of effect of the proposal on visual character from each of the viewpoints considered in the assessment.

Table 17.4: Summary of significance of visual impacts

Viewpoint	Construction	Operation
1: Port Askaig Ferry	Moderate	Minor
2: Dunlossit Estate	Moderate	Negligible
3: Public Road Jura (south)	Moderate	Minor
4: Public Road Jura (north)	Moderate	No significant effect/Minor

17.101. Following the implementation of mitigation, the significance of visual impact on Viewpoint 4 is reduced to no significant effect.

17.102. The proposed development would conform in general with the advice set out in Appendix A of the Local Plan in that the tidal devices will be submerged and electricity connections buried with these components therefore not visible during the operational phase. The substation would form the only visible component of the proposal and this has been designed to be as small as possible and set into a hill side to limit visibility. The use of muted dark colour finishes proposed on the GRP housings within the substation complex and avoidance of intrusive security fencing and permanently parked vehicles will further reduce visual intrusion.

17.10 Statement of Significance

17.103. There would be **minor/no significant effect** of landscape impacts during the construction and operational phases of the development.

17.104. There would be a moderate significant effect on views from the Dunlossit Estate on Islay, the Kennacraig to Port Askaig ferry and from the Jura road south of Feolin during the construction of the Development. These impacts would be temporary lasting approximately 3 months. There would be **minor/no significant effect** on views during the operational phase.

17.11 References

Argyll and Bute Local Plan (adopted August 2009).

Countryside Commission for Scotland: 'Scotland's Scenic Heritage' (1978).

Countryside Council for Wales, Brady Shipman Martin and University College Dublin: 'Guide to Best Practice in Seascape Assessment', Marine Institute (2001).

Environmental Resources Management (1996). 'Landscape assessment of Argyll and the Firth of Clyde'. Scottish Natural Heritage, review No 78.

Landscape Institute and the Institute of Environmental Management and Assessment. 'Guidelines for Landscape and Visual Assessment' (Second Edition - 2002).

Scott, K.E., Anderson,C. and Benson,J.F. (2005). An assessment of the sensitivity and capacity of the Scottish seascape in relation to offshore windfarms. Scottish Natural Heritage Commissioned Report No. 103.

Scottish Natural Heritage, Review 78. Landscape assessment of Argyll and the Firth of Clyde

Scottish Natural Heritage. Jura National Scenic Area Special Qualities. Draft report (13/5/10).

Figure 17.1: Landscape Designations

Figure 17.2 Landscape Character

Proposed location of substation

Viewpoints

1 Sound of Islay

2 Dunlossit Estate, Islay

3 Public road, Jura (south)

4 Public road, Jura (north)

Scale 1 : 25,000

0 0.5 1 km

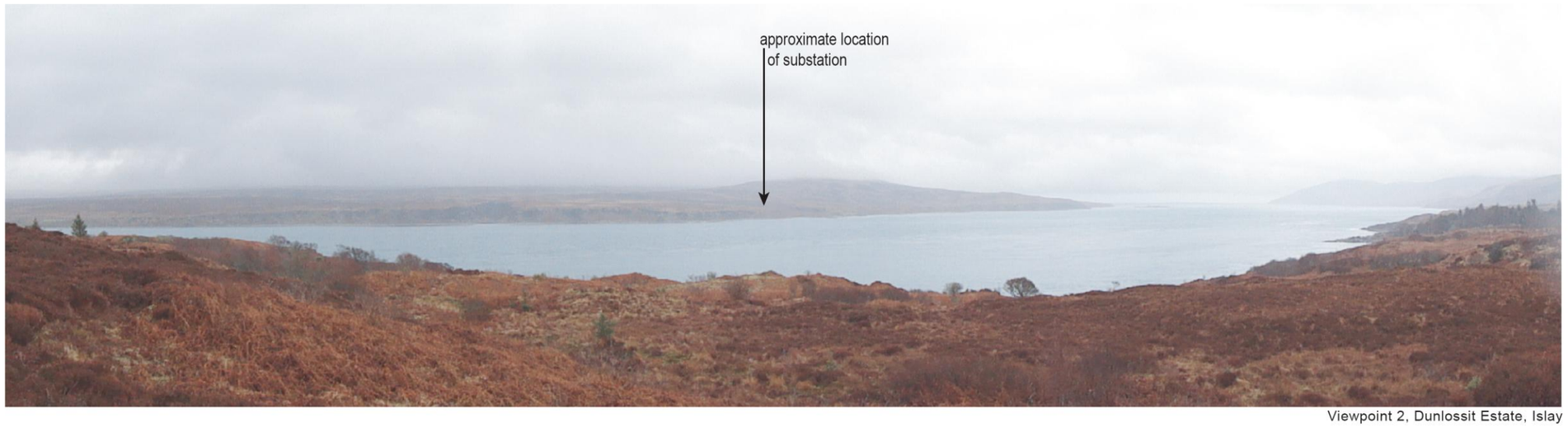
Sound of Islay Demonstration Tidal Array

Assessment Viewpoints

Fig No: 17.3

Figure 17.3 Assessment Viewpoints

Viewpoint 1, Sound of Islay

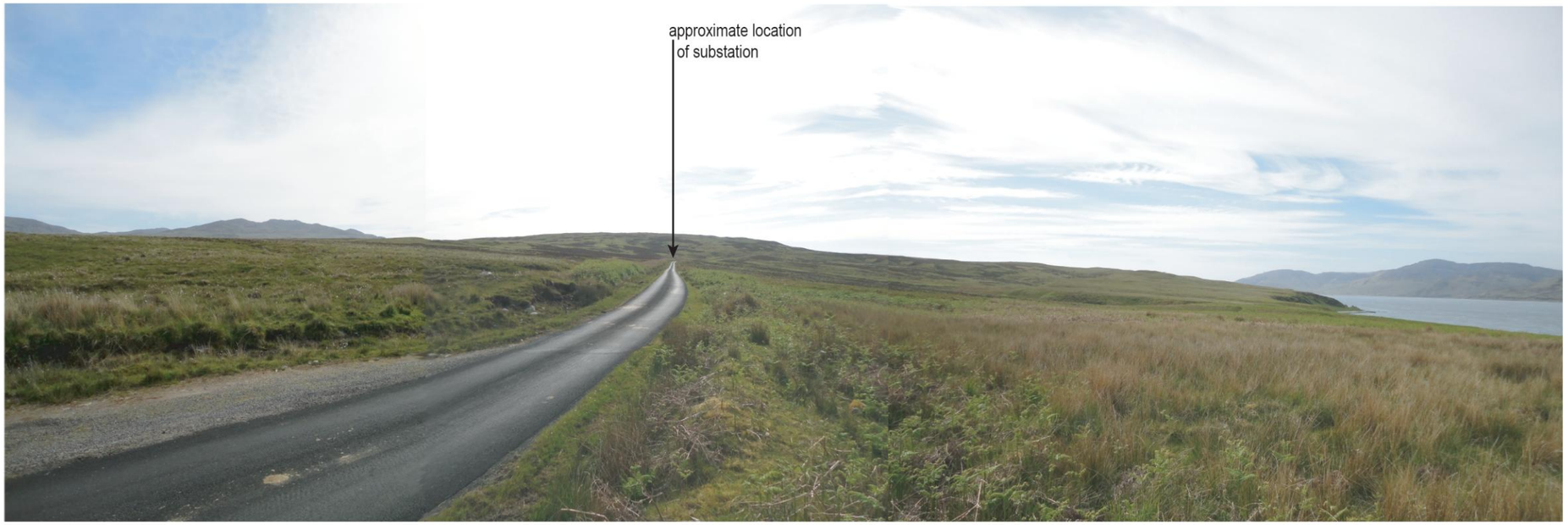


Viewpoint 2, Dunlossit Estate, Islay

Photographs: Viewpoints 1 and 2

Fig No: 17.4

Figure 17.4 Photographs at Viewpoints 1 and 2



Viewpoint 3, Public road, Jura (south)

Viewpoint 4, Public road, Jura (north)

Photographs: Viewpoints 3 and 4
Fig No: 17.5

Figure 17.5 Viewpoints 3 and 4.

18.0 Cultural Heritage

18.1 Introduction

18.1. This chapter addresses the potential impacts of the proposed Demonstration Tidal Array in the Sound of Islay with an associated substation and export cable routes, upon cultural heritage assets.

18.2. The chapter describes the cultural heritage environment that has the potential to be affected by the proposed development and outlines the approach and methodology used. In addition, an archaeological assessment of geophysical data (sidescan sonar, sub-bottom profiler and multi-beam bathymetry) alongside aerial photographs (Appendix 18.5) was undertaken and the results incorporated into this assessment.

18.3. Cultural heritage assets are defined here as those man-made features which appear on or predate the Ordnance Survey First Edition map (surveyed 1878 in this area), selected later features, including Scheduled Monuments, listed buildings and wartime sites, and submerged archaeology and palaeoenvironments[1] within the Sound of Islay, including maritime losses such as wrecks and aircraft and their associated debris. Historic gardens and designed landscapes, conservation areas and the historic dimension of the landscape are dealt with in *Chapter 17: Landscape and Seascape.*

18.4. Cultural heritage assets considered in this assessment are listed in a Gazetteer and Concordance (Appendix 18.1) and in the interests of clarity are referred to by Headland Archaeology (HA) numbers issued in the course of this assessment.

18.5. Throughout this chapter, 'site' is used only to refer to cultural heritage assets and not the Development area.

Summary of Assessment on Cultural Heritage Resources

There are a number of cultural heritage assets located around the Sound of Islay, including a number of known wrecks within the surrounding area. All relevant known cultural heritage assets within the study area have been identified and the potential for unknown remains discussed. Impacts range from being of **negative adverse** significance to **no impact**. Where there are any potential impacts of adverse significance identified, mitigation has been outlined.

18.1.1 Potential Effects

18.6. Potential effects of developments upon cultural heritage assets may include:

- Physical damage to the fabric of onshore cultural heritage assets, generally resulting from groundworks associated with the construction, but also potentially from changes to groundwater levels or soil chemistry;
- Physical damage to the fabric of offshore cultural heritage assets, generally resulting from seabed disturbance associated with construction, but also potentially from disturbance and redeposition of sediments and activities associated with installation such as vessel anchoring; and
- Adverse impacts upon the setting of onshore cultural heritage assets. Largely, this relates to visual impacts but may also include noise in some instances.

18.2 Methodology

18.7. This assessment is conducted in line with industry best practice. Particular reference is made to the following:

- The Joint Nautical Archaeology Policy Committee (JNAPC) Code of Practice for Seabed Developers (JNAPC, 2007). This is a UK-wide code developed in conjunction with key industries. The JNAPC Code is voluntary but provides a framework that seabed developers can use in conducting their activities in an archaeologically sensitive manner;
- Historic Environment Guidance for the Offshore Renewable Energy Sector (COWRIE/Wessex Archaeology, 2007); and
- Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore renewable Energy (COWRIE/Oxford Archaeology, 2007).

18.3 Legislation, Guidelines and Policy Framework

18.3.1 Relevant International and European Charters and Conventions

18.8. The United Nations Convention on the Law of the Sea 1982 (UNCLOS, 1982). UNCLOS provides international protection of archaeological and historical objects located on the seabed and was ratified by the UK in 1997.

18.9. ICOMOS Charter (1996) on the Protection and Management of Underwater Cultural Heritage aims to encourage the protection and management of underwater cultural heritage in inland, nearshore and offshore waters. The Charter provides decision makers, such as curators, and archaeologists with criteria for the management of archaeological projects and is important as a statement of international 'best practice' for the investigation of underwater cultural heritage.

18.10. The Valletta Convention was ratified by the UK Government in 2000 and came into force in 2001. The convention binds the UK to implement protective measures for the archaeological heritage within the jurisdiction of each party, including marine areas. Insofar as the UK exerts jurisdiction over the Continental Shelf, then it would appear that the provisions of the Valletta Convention apply to that jurisdiction.

18.11. UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001 (UNESCO 2001) provides an international legal framework to regulate underwater cultural heritage in domestic and international waters The Convention is not currently ratified by the UK Government, but the Annex outlining rules and standards for conducting archaeological investigations is accepted by UK Government as 'best practice'.

18.3.2 UK & Scottish Legislation

Scheduled Ancient Monuments

18.12. Scheduled Ancient Monuments (SAMs) are sites of national importance that the Scottish Ministers have given legal protection under The Ancient Monuments and Archaeological Areas Act 1979. Historic Scotland works on behalf of the Scottish Ministers to compile, maintain and publish a schedule of these monuments. Any work affecting these sites or their setting may only be undertaken with the consent of the Scottish Ministers, following guidance by Historic Scotland.

[1] Elements of previous environments from the period of human occupation of an area which are still preserved

Listed buildings

18.13. Listed buildings are defined as buildings of special architectural or historic interest in the 1997 Planning (Listed Buildings and Conservation Areas) Scotland Act. This act states that:

"the planning authority, in determining any application for planning permission for development that affects a listed building or its setting, is required to have special regard to the desirability of preserving the building, or its setting, or any features of special architectural or historic interest which it possesses." (Section 59(1)).

Protection of Wrecks Act 1973

18.14. Under the Protection of Wrecks Act 1973, wrecks and wreckage of historical, archaeological or artistic importance within UK territorial waters can be protected by way of designation. It is an offence to carry out certain activities within a specified designated area without obtaining a license from Historic Scotland as administrative authority on behalf of Scottish Government.

Protection of Military Remains Act 1986

18.15. Under the Protection of Military Remains Act 1986 the Ministry of Defence (MoD) has the powers to protect the remains of military aircraft and vessels within 'protected areas', even if the position of the wreck is not known. In this case all remains must have been lost after 4th August 1914. In addition, the MoD can create designated 'controlled sites' around wrecks whose position is known, provided no more than 200 years have elapsed since loss.

Merchant Shipping Act 1995

18.16. The Merchant Shipping Act 1995 may affect marine development if, during the course of construction of a development, material is discovered that is classified as 'wreck'. If the original owner or successor fails to make a claim within one year to the Receiver of Wreck then the property within territorial waters becomes property of the Crown or to a person to whom rights of wreck have been granted.

National Planning Policy

18.17. Scottish Planning Policy (SPP) (2010) has recently superseded SPP23: Scottish Planning Policy 23: Planning and the Historic Environment (2008). SPP sets out Scottish planning policy for the historic environment and should be read in conjunction with the Scottish Ministers' policies as set out in the Scottish Historic Environment Policy (SHEP) (2009). SPP states that '*Planning authorities should support the best viable use that is compatible with the fabric, setting and character of the historic environment (para 111) and that 'where planning control extends offshore, planning authorities should ensure that development will not adversely affect the integrity and setting of scheduled wreck sites or wrecks designated under the Protection of Wrecks Act 1973 or the Protection of Military Remains Act 1986'* (para 119).

18.18. SPP has been recently introduced and consolidates a number of previous policies and guidelines. It distinguishes between different categories of archaeological importance, and the way in which such sites should be treated. SPP deals with listed buildings, Conservation Areas, Scheduled Ancient Monuments, designated wreck sites, World Heritage Sites, Gardens and Designed Landscapes, the Marine Historic Environment and other historic environment interests and their settings.

18.19. With regard to Scheduled Ancient Monuments, SPP states:

'Where works requiring planning permission affect a Scheduled Monument, the protection of the monument and its setting are important considerations...' (para 118)

18.20. SPP, Paragraph 113 states "*Listed buildings are buildings of special architectural or historic interest*." SPP requires that new development should be designed to retain the special interest, character and setting of listed buildings (para 114)

18.21. Other cultural heritage assets as discussed in this assessment are not covered by legislation, though are commonly defined as of regional, local or less significance. In relation to other cultural heritage assets (i.e. non-scheduled known resources and unknown sites) SPP states:

'*The presence and potential presence of archaeological assets should be considered by planning authorities when allocating sites in the development plan and when making decisions on planning applications. Where preservation in-situ is not possible planning authorities should, through the use of conditions or a legal agreement, ensure that developers undertake appropriate excavation, recording, analysis, publication and archiving before and/or during development.' (para 123).*

18.22. SHEP sets out the Scottish Ministers' policies for the historic environment. SHEP deals primarily with Scheduled Ancient Monuments, listed buildings, Conservation Areas, Properties in Care and Gardens and Designed Landscapes. A key principle of SHEP is that:

'*there should be a presumption in favour of preservation of individual historic assets and also the pattern of the wider historic environment; no historic asset should be lost or radically changed without adequate consideration of its significance and of all the means available to manage and conserve it'* (para 1.14, b.)

18.23. SHEP states that 'Ministers have consulted on policy on the Marine Historic Environment and finalised policy on this subject will be incorporated in a future revision of the SHEP' (para 5).

18.24. Reference is also made to the Marine (Scotland) Act 2010 which will, over the next two to three years, introduce a simplified and more effective mechanism for the conservation, management and protection of the marine environment in Scottish territorial waters, and for some devolved issues out to the 200 nautical mile limit in UK waters. The protection of the marine historic environment at present is still provided through the legislation highlighted above. However, mention is made regarding the protection of non-designated assets of 'lesser' importance which will be considered in measures introduced for marine planning in due course.

18.3.3 National Planning Advice and Guidance

18.25. PAN 42: Archaeology: The Planning Process and Scheduled Monuments Procedures (1994) provides advice in relation to development control and its role in safeguarding archaeological resources. It sets out provisions for monitoring development as it progresses, and defines where it may be appropriate to preserve remains in situ or excavate or record them.

18.26. PAN 45: Renewable Energy Technologies (2002) provides advice in relation to development and renewable energy, including wave and tidal power. [Provide detail of advice]

18.3.4 Argyll and Bute Structure Plan

18.27. Within the Argyll and Bute Structure Plan (approved 15th November 2002) STRAT DC 9 Historic Environment and Development Control states;

'Development that damages or undermines the historic, architectural or cultural qualities of the historic environment will be resisted; particularly if it would affect a Scheduled Ancient

Monument or its setting, other recognised architectural site of national or regional importance, listed buildings or its setting, conservation area or historic garden and designed landscape.'

18.3.5 Argyll and Bute Local Plan

18.28. Within the Argyll and Bute Local Plan (adopted 6th August 2009) there are a number of policies within Chapter 3 'Environment' which are relevant to this development. These include Policy LP ENV 13a (Development Impact on Listed Buildings), Policy LP ENV 16 (Development Impact on Scheduled Ancient Monuments) and Policy LP ENV 17 (Development Impact on Sites of Archaeological Importance).

18.29. Policy LP ENV 13a Listed Buildings states:

"Development affecting a listed building or its setting shall preserve the building or its setting, and any features of special architectural or historic interest that it possesses."

18.30. Policy LP ENV 16 Scheduled Ancient Monuments states:

"Where development would affect adversely a heritage asset or its setting the developer will be expected to satisfactorily demonstrate that the impact of the development upon that asset has been assessed and that measures will be taken to preserve and enhance the special interest of the asset."

18.31. Policy LP ENV 17 Sites of Archaeological Importance states:

"There is a presumption in favour of retaining, protecting, preserving and enhancing the existing archaeological heritage and any future discoveries found in Argyll and Bute."

18.3.6 Key Consultations

18.32. Historic Scotland and Argyll and Bute Council were consulted on the possible impacts of the proposed development. Their responses are summarised below.

18.33. Historic Scotland - The response from Historic Scotland (letter dated 19/08/2009) highlighted the need to look at both direct impacts within the proposed development and indirect impacts on cultural heritage assets in the wider landscape. In addition, it was requested that assessment of potential setting impacts should include (but not necessarily be limited to) the following sites:

- Keills House cross shaft (Index No. 2362);
- Cil Challium Chille, chapel, Keills (Index No. 2361);
- Cill Sleabhan, chapel (Index No. 2371);
- Dun Bhoraraic, dun (Index No. 3959); and
- Cill Eilegain, chapel (Index No. 2356).

18.34. Argyll and Bute Council - The response from the West of Scotland Archaeology Service (WoSAS) on behalf of Argyll and Bute Council (letter dated 04/12/2009) also suggested that setting impacts on Cill Sleabhan (Index No 2371) and Dun Bhoraraic (Index No 3959) might need to be considered.

18.35. Design changes since the scoping documents were finalised have resulted in there being no upstanding structural elements on the island of Islay during the operational phase and upstanding elements on Jura being limited to a small substation, which will be painted and landscaped to fit into the hillside at Beinn na Doire Lèithe. Of the Scheduled Monuments raised in scoping responses above, only the two chapels at Cil Challium Chille and Cill Sleabhan and the cross shaft at Keills House have possible intervisibility with the proposed development. As they are each further than 4km from the proposed substation it is considered that the substation will not be discernable from any scheduled areas. Consequently, these five sites have not been considered further.

18.4 Assessment Methods

18.4.1 Overview

18.36. This cultural heritage assessment comprises a baseline survey (documentary research including the assessment of marine survey data, and field survey) followed by an assessment of the direct and indirect impacts of the construction, operation and decommissioning phases of the proposed scheme. Marine survey data was also utilised and included sidescan sonar, sub-bottom profiler and multi-beam bathymetry (see Appendix 18.5). Cultural heritage assets considered to be susceptible to impacts upon their setting were visited during 2009 and 2010. Where appropriate, measures to mitigate the impacts are also presented.

18.37. This baseline study covers all known cultural heritage assets within the study area (defined below).

18.4.2 Study Area

18.38. The study area used in this assessment has been defined as a 1km buffer around all potential cable landfall and sub-station construction areas identified in the initial design. This design has altered over the course of the assessment and fewer potential cable landing points are now being considered. However, the initial study area has been retained.

18.39. The study area is comprised of two very different environments.

- Onshore - This extends 1km from all cable routes, areas of construction and from an initial group of six possible cable landing points on Islay and Jura. Only one of the possible locations for the export cable landfall is to be included in the proposed design (see Figure 18.1). This is at Daimh-sgeir. This study area is distinct to that used in the initial cultural heritage coastal zone assessment on Islay (Campbell, 2009). The onshore study area extends to the low water mark. Within this area all known sites of cultural heritage interest have been considered for construction impacts and all designated cultural heritage assets have been considered for setting impacts; and

- Offshore - This extends 1km north and south of the proposed turbine locations and is confined to the east and west by the high water mark on Islay and Jura.

18.4.3 Data Sources

18.40. The desk-based study has been based on readily available and relevant documentary sources. The following archives were referred to:

- The Schedule of Ancient Monuments, the Statutory List of Buildings of Special Architectural or Historic Interest;
- The National Monuments Record of Scotland (NMRS);
- The WoSAS Sites and Monuments Record (SMR);
- Designated wreck data (Historic Scotland);
- Superseded Ordnance Survey maps held in the Map Library of the National Library of Scotland;
- Pre-Ordnance Survey Maps held by the National Library of Scotland;
- Oblique and vertical aerial photography held by the Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS);
- UK Hydrographic Office (UKHO) Wrecks Database (record of wrecks and obstructions);

- Information held by Historic Scotland (HS) on Designated Wrecks;
- Marine archaeological records held in the National Monuments Record for Scotland (RCAHMS Canmore and Pastmap database);
- National Archives of Scotland (NAS);
- National Library of Scotland (for cartographic sources and historic charts);
- UK Hydrographic Office (UKHO) Review of cartography, historic charts and sailing directions;
- Ministry of Defence (MoD) (Information on protected wreck remains and military losses);
- Records held with the Receiver of Wreck (RoW) (Maritime and Coastguard Agency);
- Relevant Strategic Environmental Assessment (SEA) reports (UK Continental Shelf SEA Archaeological Baseline; SEA 6);
- Information and collections held in national and local museums (National Museum of Scotland);
- Records held with the Archaeology Data Service (ADS);
- Marine Environment Data information Network (MEDIN);
- Readily accessible published sources and grey literature;
- Relevant external marine historic environment specialists;
- Relevant Dive Groups; and
- Other readily available published sources and grey literature e.g. marine geophysical and geotechnical survey reports.

18.4.4 Field Survey Methodology

18.41. The study area was visited in order to verify the data gathered through desk-based research and identify possible variations in archaeological potential. Initial visits to Islay were carried out for a baseline assessment on the archaeology and built heritage on Islay's eastern coastal zone (Campbell, 2009). Subsequent visits were carried out on the 10th November 2009 to Islay and the 9th of February 2010 to Jura for the current Environmental Impact Assessment. The surrounding area was toured and visits made to cultural heritage assets in order to establish the potential for impacts upon their setting and to gather data to allow impacts to be assessed.

18.4.5 Assessment Methodology

18.42. The assessment has been carried out as follows:

- Identification of cultural heritage asset;
- Defining baseline conditions of the asset (e.g. physical condition and setting);
- Identification of potential impacts upon the asset;
- Assessment of sensitivity of cultural heritage assets to identified impacts, using the criteria outlined below;
- Assessment of magnitude of identified impacts, using the criteria outlined below; and
- Assessment of significance of impacts, a product of the cultural heritage asset's sensitivity and the magnitude of the impact upon it, as outlined below.

18.43. Within the study area the potential for both direct impacts and indirect impacts caused by construction, operation and decommissioning of the proposed development will be considered.

18.5 Significance Criteria

18.5.1 Significance Criteria for Construction Impacts

18.44. The construction of a tidal array, substation and associated cables has the potential to damage or destroy cultural heritage assets. This may occur either as a result of the design of the tidal array or as an accidental consequence of construction activities, such as plant movement or the anchoring of craft involved in installation. The impacts may be direct, for instance where an archaeological deposit is removed during ground-breaking works; indirect, for example disturbance of sediments in the offshore areas may lead to covering of nearby archaeological remains; or secondary ,such as vessel anchoring activities during installation. Setting impacts pertaining to the construction and decommissioning phases are short-lived and therefore not considered to be significant; in this case, therefore they have not been considered further within this chapter.

18.45. The sensitivity of a cultural heritage asset to construction impacts reflects the level of importance assigned to it. This is the product of a number of factors, including its potential as a resource of archaeological data, its association with significant historical events, its role as a local landmark with cultural associations and its aesthetic value.

18.46. Official designations applied respectively to archaeological sites and buildings have been taken as indicators of importance as they reflect these factors. Scheduled Ancient Monuments, inventory designed landscapes, Category A listed buildings and undesignated cultural heritage assets of schedulable quality are of national importance. Category B and C(S) listed buildings are categorised respectively as being of regional and local importance (SHEP Note 2.19). Sensitivity is assigned to undesignated cultural heritage assets according to the professional judgment of the assessor.

18.47. In determining the magnitude of impact, the values (HS 2008, Appendix 1) of the asset affected are first defined. This allows the identification of key assets and provides the baseline against which the magnitude of change can be assessed; the magnitude of impact being proportional to the degree of change in the asset's baseline value.

18.48. The criteria used for defining a cultural heritage asset's sensitivity to direct and indirect physical impacts and then assessing the magnitude of those impacts are summarised in Table 18.1 and Table 18.2.

Table 18.1: Sensitivity of Cultural Heritage Assets

SENSITIVITY OF RECEPTOR	DEFINITION
High	Scheduled Monuments, Category A listed buildings, and undesignated cultural heritage assets and historic buildings of national importance; also Designated Wrecks or known maritime losses and obstructions where the position is known and positively identified. In addition targets of high potential identified in the geophysical and geotechnical data are considered be of high sensitivity pending further investigation to establish their level of significance.
Medium	Category B listed buildings and undesignated cultural heritage assets and historic buildings of regional importance. Known maritime losses whose position is either unknown or where positive ID is tentative, and targets of medium potential identified in the geophysical and geotechnical data are considered be of medium sensitivity pending further investigation to establish their level of significance.
Low	Category C(S) listed buildings and undesignated cultural heritage assets and historic buildings of local importance; In addition targets of low potential identified in the geophysical and geotechnical data are considered be of low sensitivity pending further investigation to establish their level of significance.

Table 18.1: Sensitivity of Cultural Heritage Assets	
SENSITIVITY OF RECEPTOR	**DEFINITION**
Negligible	A badly preserved or extremely common type of archaeological site or building of little value at local, regional or national levels; or targets identified through the assessment of geophysical and geotechnical data that may be of some archaeological interest but that is likely to represent a natural feature

Table 18.2: Criteria for Assessing the Magnitude of impacts on Cultural Heritage Assets	
MAGNITUDE OF IMPACT	**DEFINITION**
High	Total loss or major alteration of the cultural heritage asset
Medium	Loss of, or alteration to, one or more key elements of the cultural heritage asset
Low	Slight alteration of the cultural heritage asset
Negligible	Very slight or negligible alteration of the cultural heritage asset

18.5.2 Significance Criteria for Operational Impacts

18.49. During the operational phase, developments may affect the setting of cultural heritage assets. There is considerable debate over definitions of setting and approaches to the assessment of setting impacts (Lambrick, 2008), with no standardised industry-wide approach. In the course of this assessment, reference has been made to the Historic Scotland document 'Assessment of Impact on the Setting of the Historic Environment Resource - Some General Considerations' (2009). As the title implies this is a document that deals with setting in very general terms, but does not attempt to define setting. However, it states that:

> *'the archaeological/historic context, the visual appearance and the aesthetic qualities of a site's surroundings play an important role in modern perceptions of the site and that the alteration of those qualities has the potential to impact upon its character and value'.*

18.50. English Heritage (2008, 39) has indicated that the definition of a cultural heritage asset's setting '*will normally be guided by the extent to which material change within it could affect the [asset's] significance'* and this approach has been adopted here, 'significance' being interpreted as broadly synonymous with 'character and value' in this context. Hence setting is not simply the visual envelope of the asset in question. Rather, it is those parts of the asset's surroundings that are relevant to the character and value of the asset. In the current assessment the character and value of assets have been considered with reference to the values identified by SHEP (Appendix 1): intrinsic; contextual and associative. In general, there will be an appreciable historical relationship between the asset and its setting, either in terms of a physical relationship, such as between a castle and the natural rise that it occupies, or a more distant visual relationship, such as a designed vista or the view from, for example, one Roman signal station to another. The former is referred to in this assessment as immediate setting and the latter as landscape setting. Many assets will only have an immediate setting. Some assets' character and value will relate to an aesthetic relationship with their surroundings. In such instances the relevant landscape elements will be considered to form part of the asset's landscape setting.

18.5.3 Sensitivity

18.51. The sensitivity of a cultural heritage asset to changes can be evaluated in the first instance by reference to any relevant designation, whereby those designated as nationally important will generally be considered the most sensitive. Consequently, only nationally important cultural heritage assets in the study area are considered in relation to impacts upon setting. Following this, sensitivity can be more finely assessed by reference to the importance of the asset's surroundings to its character and value as a cultural heritage asset and the appreciation of its value. Also taken into account is the extent to which an asset is visible on the ground. Some assets may have a well-defined and appreciable setting but the asset itself is barely perceptible; such assets will generally be less sensitive than those that are readily appreciable on the ground.

18.52. Table 18.3 is a general guide to the attributes of cultural heritage assets of high, medium, low or negligible sensitivity. It should be noted that not all the qualities listed need be present in every case, and professional judgement is used in balancing the different criteria.

Table 18.3: Criteria for Assessment of Sensitivity of a Cultural Heritage Asset to Impacts on its Setting	
SENSITIVITY	**GUIDELINE CRITERIA**
High	The asset has a clearly defined setting that is readily appreciable on the ground and is vital to its character and value or the appreciation thereof. The asset will generally be readily appreciable on the ground
Medium	The asset's character and value and the appreciation thereof relate to some extent to its setting. The asset will generally be appreciable on the ground.
Low	The asset's surroundings have little relevance to its character and value or the appreciation thereof. The asset is difficult to identify on the ground or its setting is difficult to appreciate on the ground.
Negligible	The asset is imperceptible in the landscape and its character and value or the appreciation thereof does not relate to its surroundings.

18.5.4 Magnitude

18.53. The magnitude of an impact reflects the extent to which relevant elements of the cultural heritage asset's setting are changed by the development, and the effect that this has upon the character and value of the asset and the appreciation thereof. Guideline criteria for magnitude defined as high, medium, low or negligible magnitude are described in Table 18.4. As with other criteria presented, this is intended as a general guide, and it is not anticipated that all the criteria listed will be present in every case.

18.54. The following are guides to the assessment of magnitude of impact:

- **Obstruction of or distraction from key views.** Some assets have been sited or designed with specific views in mind, such as the view from a Roman signal station to an associated fort or a country house with designed vistas. The obstruction or cluttering of such views would reduce the extent to which the asset could be understood and appreciated by the visitor. Developments outside key views may distract from them and make them difficult to appreciate on account of their prominence and movement. In such instances the magnitude is likely to be greatest where views have a particular focus or a strong aesthetic character.

- **Changes in prominence.** Some assets are deliberately placed in prominent locations in order to be prominent in the surrounding landscape, for example prehistoric cairns are often placed to be silhouetted against the sky and churches in some areas are deliberately placed on ridges in order to be highly visible. Developments can reduce

such prominence and therefore reduce the extent to which such sites can be appreciated.

- **Changes in landscape character**. A particular land use regime may be essential to the appreciation of an asset's function, for instance the fields surrounding an Improvement period farmstead are inextricably linked to its appreciation. Changes in land use can leave the asset isolated and reduce its value. In some instances, assets will have aesthetic value or a sense of place that is tied to the surrounding landscape character.

- **Duration of impact.** Impacts that are short term are generally of lesser magnitude than those that are long term or permanent.

18.55. Readily reversible impacts are generally of lesser magnitude than those that can not be reversed.

18.56. Impacts upon the defined setting will be of greater magnitude than those that affect unrelated elements of the asset's surroundings or incidental views to or from an asset that are unrelated to the appreciation of its value.

Table 18.4: Criteria for Assessment of Magnitude of an Impact on the Setting of a Cultural Heritage Asset

MAGNITUDE OF IMPACT	GUIDELINE CRITERIA
High	The characteristics of landscape elements relevant to the setting of the cultural heritage asset are radically and irreversibly changed as a result of the development, so that the relationship between the asset and its setting is no longer readily appreciable.
Medium	The characteristics of landscape elements relevant to the setting of the cultural heritage asset are substantially changed as a result of the development and cannot easily be reversed to approximate pre-development conditions. Relevant setting characteristics can still be appreciated, but, for example, the introduction of new unrelated elements results in distraction from and competition with the relevant setting elements.
Low	The characteristics of landscape elements relevant to the setting of the cultural heritage asset are slightly changed as a result of the development, but without adversely affecting the interpretability of the asset and its setting; characteristics of historic value can still be appreciated, the changes do not strongly conflict with the character of the asset, and could be easily reversed to approximate the pre-development conditions.
Negligible	The characteristics of landscape elements relevant to the setting of the cultural heritage asset are only imperceptibly changed as a result of the development, or are changed in ways that positively complement the character of the asset; the only noticeable adverse changes to the landscape are to elements that are not considered relevant to the setting of the cultural heritage asset.

18.5.5 Significance

18.57. The significance of an impact on a cultural heritage asset, whether a physical impact (direct or indirect) or an indirect impact on its setting, is assessed by combining the magnitude of the impact (see Tables 18.2 and 18.4) and the sensitivity of the cultural heritage asset (Table 18.1 and Table 18.3). The matrix in Table 18.5 provides a guide to decision-making but is not a substitute for professional judgement and interpretation, particularly where the sensitivity or impact magnitude levels are not clear or are borderline between categories. Predicted impacts of major or moderate significance equate to potentially significant impacts in terms of the EIA Regulations.

Table 18.5: Criteria for Assessing the Significance of Effect of Impacts on Cultural Heritage Assets

		SENSITIVITY OF RECEPTOR			
		Negligible	Low	Medium	High
MAGNITUDE OF IMPACT	High	Negligible significant effect	Moderate	Major	Major
	Medium	Negligible significant effect	Minor	Moderate	Major
	Low	Negligible significant effect	Negligible significant effect	Minor	Moderate
	Negligible	Negligible significant effect	Negligible significant effect	Negligible significant effect	Minor

18.6 Existing Environment

18.58. The Sound of Islay, of which the study area forms a part, is a narrow strait of water around 18km long running north-south between the islands of Jura to the east and Islay to the west. For most of its length is it between 800m and 2km wide. The Sound was formed due to erosion of fault lines laid down in the Dalriadan rocks around 440 million years ago (Oakley 2009, Vol. 1, 18). The sea around both islands benefits from the Gulf Stream which contributes to a relatively mild climate. Islay, the westernmost of the two, is a mixture of low-lying fertile land with abundant sources of fresh water and elevated moors and mountains (Moore and Wilson, 2003). Jura is far more inhospitable than Islay and the earliest historical descriptions show a far lower population which was concentrated to the east of the island (NSA 1834-45, 535). The distribution of archaeological sites of all periods also follows this pattern with comparatively few sites on Jura's west coast (Youngson, 2001).

18.59. Human occupation of the area around Islay dates back to 8000BC in the Mesolithic period (Ritchie, 1997) although some recent publications have suggested dates as far back as 11,000BC (Caldwell, 2008). Occupation of Jura is thought to date back to 10,500BC (Youngson, 2001). Much of the evidence for Mesolithic settlement on the islands is found along the shorelines, in the form of shell middens, flint scatters and ephemeral settlement sites. One such Mesolithic site was identified on the east coast of Islay, at Rubha Port an t-Seilich, during the initial cultural heritage assessment for the proposed Sound of Islay Demonstration Tidal Array in July 2008 and confirmed by examination of flint artefacts and a site visit in August 2009 by Professor Steven Mithen of Reading University (Southern Hebrides Mesolithic Project 1988-1998). The site falls outwith the study area as defined for this assessment (Campbell, 2009). Further archaeological investigation of the site will begin in August 2010, under the direction of Professor Mithen.

18.60. An improvement in climate encouraged the first farmers to come to Islay and Jura leaving behind their settlement remains and a series of chambered cairn tombs. Later periods also left numerous ritual, burial and defensive sites but for several periods, notably the Iron Age and the Viking period the settlement pattern is poorly understood (Moore and Wilson, 2003). Recent research into the place-names of Islay has suggested that the culture of the area remained largely Norse until around 1600 and that many names were subsequently changed to Gaelic (McNiven, 2006a). Although the majority of place-names in the study area are Gaelic there are some surviving Norse names in the surrounding area, such as Feolin, derived from the Old Norse term for shingle (Youngson, 2001) and Daimh-sgeir, which is believed to derive from the Norse dauf-sker or blunt rock. Most of these place-names relate to topographical elements rather than settlements.

18.61. For most of the medieval period up to 1493 the islands were under the control of the MacDonalds, Lords of the Isles, who had a stronghold at Finlaggan on Islay. From the 16th century onwards the area came increasingly under the control of the Campbells and the influence of the mainland. This period saw the expansion of the fishing, linen and distilling industries. A ferry operated between Islay and Jura at Feolin from at least 1768 (Smith, 2001). After the potato famine of the mid-19th century, emigration and land clearances took their toll and the population began to fall (Moore and Wilson, 2003). From this point onwards ownership of much of the island has been concentrated into large estates and has remained so up to the present day.

18.62. A significant factor in assessing the archaeological potential of an onshore and offshore study area such as this is the relative change in sea level which is known to have occurred during the period of human occupation. The seabed along the western seaboard of Scotland and particularly around Islay, Jura, Mull and the Small Isles is thought to have potential for archaeological sites which were formerly on dry land to be found at depths up to 20m below current sea level (Wessex Archaeology, 2006).

18.63. The Sound of Islay is a deep and narrow stretch of water subject to fast flowing tidal streams. The width of the Sound is between 1.5 and 0.8km and it is up to 62m deep in the area of the proposed scheme. There are few navigational hazards within the central part of the channel but the shores are rocky with occasional outcrops and small islands. The comparatively sheltered topography of the Sound and the proximity between Islay and Jura at this point makes it useful as a crossing point and harbour, and the Sound represents a natural maritime passage, suitable for smaller vessels (see Appendix 19.1).

18.7 Designated cultural heritage assets within the study area

18.64. There are ten designated cultural heritage assets within the onshore element of the study area (see Table 18.9). There are no Scheduled Monuments within the study area; all of the designated assets are listed buildings, of which two are B-listed and eight C(S)-listed. The majority of these are 19th/20th century buildings and most of them are in or around the village of Port Askaig on Islay. On Jura there are only two designated sites, the B-listed Feolin Ferry Jetty (HA12) and the associated C(S)-listed Feolin Ferry cottage (HA15). There are no designated wrecks or scheduled sites within the offshore part of the study area.

18.7.1 Undesignated cultural heritage assets within the study area

Onshore

18.65. There are 22 known undesignated cultural heritage assets within the onshore part of the study area. They represent a wide variety of site types and are listed below in Table 18.10. These sites mainly date to between the eighteenth and twentieth centuries with the exception of Loch nan Deal Crannog (HA18) which is likely to be of prehistoric date and the caves and rock shelters on the Sound of Islay (HA31, 32, 34 & 35), which all have the potential for prehistoric remains.

Offshore

18.66. Although numerous strandings and wrecking episodes are recorded around Islay and Jura (approximately 80), accurate co-ordinates are only available for a few loss events. In addition, it is likely that many of the vessels involved were later recovered or dispersed. There are two wrecks whose co-ordinates appear to fall within the offshore part of the study area (the co-ordinates are taken from Seazone data, which is derived from UK Hydrographic office data and digital marine charts). These are listed in Table 18.11 (all reported maritime losses in the region around the Sound of Islay from published sources and the National Monument Record of Scotland are included as Appendices 18.3 and 18.4 respectively). The Glen Holme (HA19) was a steamship wrecked in 1893 near the west shore of Jura opposite Port Askaig. The Kay D (HA24) is a modern vessel which sank in the Sound in 1982. This is not considered to be of cultural heritage interest due to its modern date, but is included here only as a wreck of roughly known location. A single target (HA29) was identified from the archaeological assessment of marine geophysical data examined as part of the baseline research for this chapter. It is considered to represent the possible remains of an uncharted wreck.

18.67. Tables 18.9 – 18.11 provide a breakdown of cultural heritage assets by statutory designation.

Table 18.9: Listed buildings in the Study Area

HA NO	NAME	TYPE	LOCATION	CATEGORY
4	Heatherhouse	Cottage	Islay (onshore)	B
6	D MacBranes	Store House	Islay (onshore)	C (S)
7	Piermasters Shipping Office	Office	Islay (onshore)	C (S)
9	Port Askaig Jetty	Jetty	Islay (onshore)	C (S)
10	Port Askaig (Shop)	House, Post Office, Shop	Islay (onshore)	C (S)
12	Feolin Ferry Jetty	Jetty/Slipway	Jura (onshore)	B
13	Port Askaig Hotel	Hotel	Islay (onshore)	C (S)
14	Dunlossit House Cross	Commemorative monument	Islay (onshore)	C (S)
15	Feolin Ferry House	Cottage	Jura (onshore)	C (S)
16	Dunlossit House	Country House	Islay (onshore)	C (S)

Table 18.10: Undesignated cultural heritage assets in the Study Area

HA NO	NAME	TYPE	LOCATION
1	Torabus	Farmstead	Islay (onshore)
2	Caol Ila	Lead Smelter	Islay (onshore)
3	Caol Ila Distillery	Distillery	Islay (onshore)
5	Persebollis	Farmstead	Islay (onshore)
8	Port Askaig	Village	Islay (onshore)
11	Dunlossit House Gate Lodge	Gate lodge	Islay (onshore)
17	Feolin	Steading	Jura (onshore)

Table 18.10: Undesignated cultural heritage assets in the Study Area			
HA NO	**NAME**	**TYPE**	**LOCATION**
18	Loch nan Deala	Crannog	Islay (onshore)
20	Killkolumkill	Farmstead	Islay (onshore)
21	Keills Mine	Lead Mine	Islay (onshore)
22	Carragh Mhor	Beacon	Islay (onshore)
23	McDougall's Bay Bridge	Bridge	Jura (onshore)
25	Carragh an t-Sruith	Landing Point	Jura (onshore)
26	Carragh an t-Sruith	Stone spread	Jura (onshore)
27	Carragh an t-Sruith	Area of reinforced concrete	Jura (onshore)
28	Daimh-sgeir	Steading	Jura (onshore)
30	An Tamhanachd	Building	Islay (onshore)
31	Rubha Bhoraraic	Rock Shelter	Islay (onshore)
32	Rubha Bhoraraic	Rock Shelter	Islay (onshore)
33	Baleachdrach	Farmstead, Corn Drying Kiln, Lime Kiln	Islay (onshore)
34	Beinn Dubh	Cave	Islay (onshore)
35	Earachan	Rock Shelter	Islay (onshore)

Table 18.11: Known offshore cultural heritage assets in the Study Area			
HA NO	NAME	TYPE	LOCATION
19	Glen Holme	Wreck	Sound of Islay (offshore)
24	Kay D	Wreck	Sound of Islay (offshore)
29	-	Sonar Contact (possible vessel)	Sound of Islay (offshore)

18.7.2 Potential for previously unrecorded cultural heritage assets within the study area

Onshore

18.68. The shore of Islay has been the subject of a detailed study and the potential for previously unrecorded cultural heritage assets is well understood (Moore and Wilson, 2003). It is unlikely that any currently unknown sites which have a surface expression, occur anywhere within the inner study area on the island of Islay. However, there remains a potential for sub-surface remains without any surface expression and recent studies have suggested that there is a higher potential for prehistoric settlement along coastal areas of sand (Moore and Wilson, 2003). The coast of Islay which falls within northern part of the onshore study area is mainly composed of rock platform and shingle beaches with a hinterland of 'drift on visible rock' (Moore and Wilson, 2003). However, that part of Islay's coast which falls within the southern part of the onshore study area, although parts of it are similar, also has significant areas of sandy beach - between Carraig Fhada to the north of the landing point and the southern limit of the buffer zone. The former part is considered to have a low potential for unknown archaeological features dating to the prehistoric period while the latter is considered to have a moderate to high potential for unknown prehistoric archaeological features. Potential for cultural heritage assets post-dating the medieval period is considered to be low across the Islay part of the onshore study area due to the better quality of mapping available for this period and the higher likelihood that features from this period would still be recognisable on the surface. However, archaeological monitoring during excavation of a channel for a surface water outflow pipe at Port Askaig in 2004 uncovered remains of an 18th or 19th century harbour wall (Maguire, 2004).

18.69. The shore of Jura has yet to be archaeologically surveyed to the same degree as Islay. The island is composed of extremely hard metamorphic quartzite and is very poorly suited for farming (Youngson, 2001). As a result there has been a low population on the island throughout human history. Typical evidence of human activity relates to the road and ferry access between the islands and the movement of livestock across the Sound, and small scale vernacular industries such as the purported former boatbuilding facility at Daimh-sgeir. The area of the proposed sub-station and the onshore cable routes are within land mapped as being till-covered, which do not appear to have significant peat deposits. These areas are therefore unlikely to contain deposits of palaeoenvironmental potential and the potential for archaeological remains is considered to be generally **low**.

Offshore

18.70. Submerged archaeology, palaeoenvironments and prehistoric remains.

18.71. Changes in relative sea level since the end of the Pleistocene and the beginning of the Holocene period around 12,000 years ago appear to have been complex, with changes in absolute sea level interacting with changes in land level due to isostatic rebound. The sea-level model for Islay and Jura is based on relatively few dates mainly clustered at the beginning of the Holocene which appear to be a relatively poor match with the main model in current use (Shennan and Horton, 2002).

18.72. Recent strategic environmental assessment of the area has suggested that submerged landscapes and associated deposits with palaeoenvironmental potential may occur on a local basis around Islay (and by extension Jura) in particular where there are low beach and off-shore gradients, topographic shelter and a context of cohesive deposits, such as peat, in which archaeological remains are embedded (Wickham-Jones and Dawson, 2006). In particular, areas falling within the depth range of 4.5 to 10m below sea level may contain submerged archaeological remains of Mesolithic (c. 8000BC-4000BC) or early Neolithic (4000BC-2500BC) date.

18.73. The west coast of Scotland comprises a complex network of firths, sea lochs, islands, sounds and archipelagos, all of which have provided a backdrop for a rich historic and cultural past, some of the tangible links for which survive in the archaeological record. The area of the proposed demonstration tidal array in the Sound of Islay is intrinsically linked to this maritime landscape.

18.74. There are two elements to the proposed development which require assessment with regard to potential for palaeoenvironmental and archaeological deposits: the location of the main tidal array with associated cable route and the location of the on-shore cable route and substation.

18.75. The tidal array is to be located within the main channel of the Sound of Islay (at depths >48m) which rapidly attains depths of 40+m below chart datum (Oakley, 2009). Geological mapping and sonar survey indicates that the basal sediments of the channel are sands and gravels, often with outcropping of bedrock. Current flow measurements as high as 3m/s have been recorded, with more typical flow rates being 2-2.5m/s (Oakley, 2009). This indicates a rapid current, capable of shifting suspended material up to 3cm in diameter. Such an environment would be highly erosive of any relatively soft material, such as peat or submerged topsoil. The channel bed forms are megaripples, which are indicative of a highly mobile sediment base (Oakley, 2009). On this basis the survival of in situ submerged archaeological remains is highly unlikely. However, durable redeposited material, such as lithics, may survive.

18.76. At Daimh-sgeir on Jura, the shelving of the shoreline in the area of the cable landfall mean that deposits of palaeoenvironmental interest are unlikely to survive, as the intertidal zone is likely to be extremely narrow, and to be subject to similar conditions to the channel, deeper deposits of palaeoenvironmental interest are therefore highly unlikely to occur on either coastline. The cable routes will be cut into trenches 0.45m wide and 1m deep and backfilled with earth and peat and will link with the substation. The substation site will be cut into a hillside on Jura. The small scale of the construction footprints means that there will be no impact on the palaeoenvironmental potential of any onshore peat deposits.

Maritime losses

18.77. There are approximately 80 recorded maritime loss events for vessels within the confines of the Sound of Islay which confirms the relatively high level of maritime traffic in the recent past. The bias of these loss events to the post-medieval and modern eras is testament to the introduction of comprehensive record keeping in the last 250 years. With a few exceptions such as those noted above, the locations of these loss events are not accompanied with accurate positions. This is also true for maritime archaeological remains dating to earlier periods for which there is no record. Given the highly dynamic nature of the receiving environment, however, it is considered unlikely that extensive remains of maritime losses survive within the development area (confirmed in the available marine survey data). An exception to this may be the presence of dislocated remains and associated debris that may have survived in isolated pockets of seabed that are not subject to excessive dynamics. Overall, the potential for archaeological remains to be present within the Development area therefore is considered to be **low**.

18.8 Impact Assessment

18.8.1 Nature of the development

18.78. The proposed development comprises 10 submerged turbines in the deepest part of the Sound of Islay with cable routes running ashore at Daimh-sgeir. The turbines will be secured to the seabed using a tripod design with gravity based foundations of concrete and steel. Each structure will weigh up to approximately 800 tons. The cables will be laid on the seabed within the Sound and protected as required.. This will have the additional benefit of minimising any possible intrusive impacts on unrecorded archaeological remains within the Sound. The turbines and cables will be placed during the construction phase and removed during the decommissioning phase using vessels equipped with Dynamic Positioning (DP) systems which will not require anchors, thus minimising impacts upon cultural heritage assets. Dumb barges may be anchored in the area of Caol Isla bay. The onshore cable routes will be buried in a trench approximately 0.45m wide by 1.0m deep. The cable will run to a substation on the Isle of Jura. The substation compound will be cut into a hillside adjacent to the public road and the GRP housings would be coloured a recessive dark brown or olive green to minimise visibility.

18.8.2 Potential Impacts during Construction Phase

Onshore

Impact 18.1: Damage to/removal of unknown onshore undesignated cultural heritage assets

18.79. No direct impacts are predicted upon onshore designated or known undesignated cultural heritage assets during the construction phase. Any impacts on the setting of designated cultural heritage assets during the construction phase are considered to be too short-term to have the potential to be significant and hence are not considered further.

18.80. There is a low potential for the removal of currently unknown sub-surface remains dating from the prehistoric period to the post-medieval period. This is considered to be a major impact on assets of unknown sensitivity, representing an impact of **negligible** to **major** significance.

Offshore

18.81. Construction of the tidal array has the potential to cause direct and indirect impacts on cultural heritage assets within the Sound of Islay. Direct impacts may be caused during installation of the turbines as well as from the laying of marine cables. Indirect impacts, both positive and negative, may be caused by the disturbance and subsequent redeposition of sediments which may partially or completely cover or uncover cultural heritage assets within the Sound. Further indirect impacts may be caused by the anchors of any dumb barges involved in these operations.

Impact 18.2: Damage to known offshore undesignated cultural heritage assets

18.82. There are two wrecks within the offshore study area with known co-ordinates. These are the Glen Holme (HA19) and the Kay D (HA24).

18.83. The Glen Holme is at a distance of approximately 380m from the nearest cable route and over 500m from the nearest turbine. At this distance from the proposed construction areas, there is considered to be no potential for impacts caused by construction activities, including anchoring vessels or placement of devices.

18.84. The Kay D is a modern vessel included here for locational information purposes only and is not considered to be a receptor of impacts.

18.85. One feature of possible cultural heritage interest (HA29) has been identified within the offshore study area through the archaeological assessment of marine geophysical data (Table 18.10; Appendix 18.5). It is possible that this represents the remains of an uncharted wreck. This target is over 700m from the nearest cable route and over a kilometre from the nearest turbine. At this distance from the proposed construction areas, there is considered to be no potential for impacts caused by construction activities.

Impact 18.3: Damage to unknown offshore cultural heritage assets

18.86. There is a potential for impacts upon currently unrecorded submerged sites within the Sound of Islay. Such sites are most likely to be wrecks which have not been identified through marine geophysical and geotechnical survey. Such sites may be subjected to both indirect and direct impacts, of potentially major magnitude. They are of unknown sensitivity and therefore the significance of the potential impact is of **negligible** to **major** significance.

18.8.3 Potential Impacts during Operational Phase

Onshore

18.87. Potential impacts during the operational phase of the proposed development comprise changes to the setting of cultural heritage assets with statutory designations within the study area caused by the presence of the substation on Jura. The turbines will not be visible and will therefore have no impact on the setting of onshore cultural heritage assets. All onshore cables will be buried underground and the only visible upstanding element will be the substation.

18.88. All the designated cultural heritage assets within the study area are either B-listed or C(S)-listed structures.

18.89. There is no intervisibility between the substation location and the Grade B and C(S)-listed buildings on the island of Jura. There is some possible intervisibility between the substation location and some of the Grade C(S)-listed buildings on the island of Islay. However, the closest listed buildings on Islay with possible intervisibility with the substation are more than 3.5km distant, on the far side of the Sound of Islay.

18.90. It is considered that it will be extremely difficult or impossible to identify the substation housings from the listed buildings on Islay and, therefore there are considered to be **no impacts** on designated cultural heritage assets during the operational phase.

Offshore

Potential Impacts during Decommissioning Phase

18.91. There are considered to be **no impacts** on onshore cultural heritage assets during the decommissioning phase.

Impact 18.4: Damage to known offshore undesignated cultural heritage assets

18.92. Impacts upon offshore cultural heritage assets where the location is known, in the offshore part of the proposed development are the same as those of the construction phase. Given the distance of all known offshore undesignated cultural heritage assets from the turbines and cables, there is considered to be no potential for impacts caused by decommissioning activities.

Impact 18.5: Damage to unknown offshore cultural heritage assets

18.93. Damage to unknown offshore cultural heritage assets during the removal of the turbines is not considered to constitute a further impact upon possible cultural heritage assets within the footprint of the turbines beyond that of the construction phase. Potential Indirect impacts upon such sites will be restricted to damage caused by the anchors of dumb barges in Caol Ila Bay. Such an impact is considered to be of **negligible** to **major** significance.

18.9 Mitigation and Management

18.9.1 Construction Phase

Impact 18.1: Damage to/removal of unknown onshore cultural heritage assets

18.94. Direct impacts on unknown onshore undesignated cultural heritage assets during the construction phase could be mitigated through a programme of archaeological works, the scope of which would be provided in a WSI to be agreed by West of Scotland Archaeology Service (WoSAS) on behalf of the Planning Authority. Such a programme has the potential to completely mitigate any adverse significant effect and may result in **positive** impacts due to the recovery of information about past human activity in the area.

Impact 18.2: Damage to known offshore undesignated cultural heritage assets

18.95. No potential impacts have been identified in the case of known offshore undesignated cultural heritage assets (i.e. HA 19 and HA29) during the construction phase. Therefore no mitigation is proposed.

Impact 18.3: Damage to unknown offshore cultural heritage assets

18.96. A procedure will be agreed with WoSAS to mitigate construction impacts in the event of previously unknown archaeological remains coming to light during the construction of the tidal array.

18.9.2 Operational Phase

IMPACT 18.4: Damage to known offshore undesignated cultural heritage assets

18.97. No potential impacts have been identified in the case of known offshore undesignated cultural heritage assets (i.e. HA 19 and HA29) during the decommissioning phase. Therefore no mitigation is proposed.

18.9.3 Decommissioning Phase

Impact 18.5: Damage to unknown offshore cultural heritage assets

18.98. A procedure will be agreed with WoSAS to mitigate impacts in the event of previously unknown archaeological remains coming to light during the decommissioning of the tidal array.

Residual Effects

18.99. It is considered that through a programme of mitigation all potential impacts will be reduced to **nil significance** and that in some cases there is a potential for **positive impacts**.

18.100. Impact 18.1 - Through a programme of archaeological works the potential adverse impact upon currently unknown onshore cultural heritage assets will be completely mitigated and may result in a **positive impact** due to the recovery of archaeological information about the area.

18.101. Impact 18.2 – There is considered to be no potential impact in this case and therefore no residual effects.

18.102. Impact 18.3 - Through implementation of a procedure agreed with WoSAS, the potential impact upon currently unknown offshore cultural heritage assets during the construction phase will be **completely mitigated** and may result in a **positive impact** due to the recovery of archaeological information about the area.

18.103. Impact 18.4 - There is considered to be no potential impact in this case and therefore no residual effects.

18.104. Impact 18.5 - Through implementation of a procedure agreed with WoSAS, the potential impact upon currently unknown offshore cultural heritage assets during the decommissioning phase will be **completely mitigated** and may result in a **positive impact** due to the recovery of archaeological information about the area.

18.9.4 Cumulative Impacts

18.105. Cumulative impacts for the proposed scheme on cultural heritage assets have been considered for the Sound of Islay demonstration tidal array in relation to the proposed Inver Hydro scheme. The only visible constructional elements relating to these projects during the operational phase would be the substation (which is utilised by both). Therefore no cumulative impacts have been identified.

18.10 Summary

18.106. The cultural heritage chapter has considered the potential impacts of the proposed development upon cultural heritage assets. In the onshore area, cultural heritage asset is defined as relict features predating the First Edition Ordnance Survey map (1878 in this area), selected later features of historic interest, such as wartime and industrial features, and all designated assets such as listed buildings and Scheduled Monuments. Potential impacts upon the physical fabric and setting of assets have been considered. In the offshore area, a cultural heritage asset is defined as a submerged relict landscape, submerged archaeological remains and all types of maritime loss such as vessels and aircraft and associated debris.

18.107. A desk-based study, walkover survey and site visits have been carried out in order to identify assets that may be impacted upon by the proposed development and establish their current condition. This work also provided information upon which to base the assessment of archaeological potential.

18.108. There are 35 known sites of cultural heritage interest within the identified study area (Figure 18.1). Of these, 24 are on the east coast of Islay; 9 are on the west coast of Jura; and 3 are offshore. There are no Scheduled Monuments, two B-listed buildings and 8 C(S) listed buildings within the study area. There is also the potential for previously unrecorded archaeological features to be present; this potential is considered to be highest along the coastal fringe and foreshore. Offshore potential varies, but on the whole the potential for submerged prehistoric archaeological remains, evidence of submerged relict landscape surfaces and deposits and palaeoenvironments is considered to be **low**.

18.109. **Construction impacts** will be mitigated as far as possible through avoidance and design modification. The construction of the proposed development may have direct and indirect impacts upon cultural heritage assets, both onshore and offshore. The resultant impacts have been assessed as being of negligible to potentially major significance. Some of the onshore impacts will be mitigated through the implementation of a suitable programme of archaeological works that will allow for the preservation by record of the assets affected. Mitigation of potential impacts offshore will involve the introduction of protocols and procedures for any unexpected discoveries. Any proposed mitigation measures are subject to approval by Historic Scotland (including the Senior Inspector for Marine Archaeology) and WoSAS. There are considered to be **no significant effects after mitigation from the construction process**.

18.110. The predicted **operational impacts** of the proposed development are confined to impacts upon the setting of onshore listed buildings. These impacts are considered to be of **no significant effect**.

18.111. It is considered that **decommissioning** impacts are the same as the offshore construction impacts (**no significant effect**) and may be mitigated through implementation of the same procedures.

18.112. It is considered that there will be **no cumulative impacts of significant effect**.

18.11 Conclusions

18.113. The known cultural heritage assets within the study area have been identified, and the potential for unknown remains discussed. Various distinct impacts of negligible to major significance have been identified. Mitigation has been outlined which is considered to completely mitigate residual impacts and which has the potential to result in positive impacts in some cases, thereby leaving a residual impact of **no significant effect**.

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18.12.2 Cartographic sources

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1715 Mount, J. and Page, T. A new chart of the sea coast of Scotland with the islands thereof London

1728 Knapton A chart of the Coast of Scotland with all its islands: drawn according to the Globular Projection London

c.1730 Tiddeman, M Draught of Part of the Highlands of Scotland

1794 Huddart, J A new chart of the West coast of Scotland from the Mull of Galloway to Dunan Point in Sky London

1801 Langlands, G This map of Argyllshire Campbeltown

1803 Depot Generale de la Marine Carte particuliere de la cote occidentale d'Escosse, depuis la Pointe d'Ardnamurchan jusqu'au Mull de Galloway Paris

1820 Thomson, J Northern Part of Argyll Shire. Southern Part Edinburgh

1849-55 Admiralty Chart of Scotland 2515 Islay, Jura, Colonsay &c.

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1882 Ordnance Argyllshire Survey 6" 1st Edition CXCVIII.7 (Surveyed 1878)

1899 Ordnance Survey Argyllshire 25” 2nd Edition CXCVIII.3 (Surveyed 1897)

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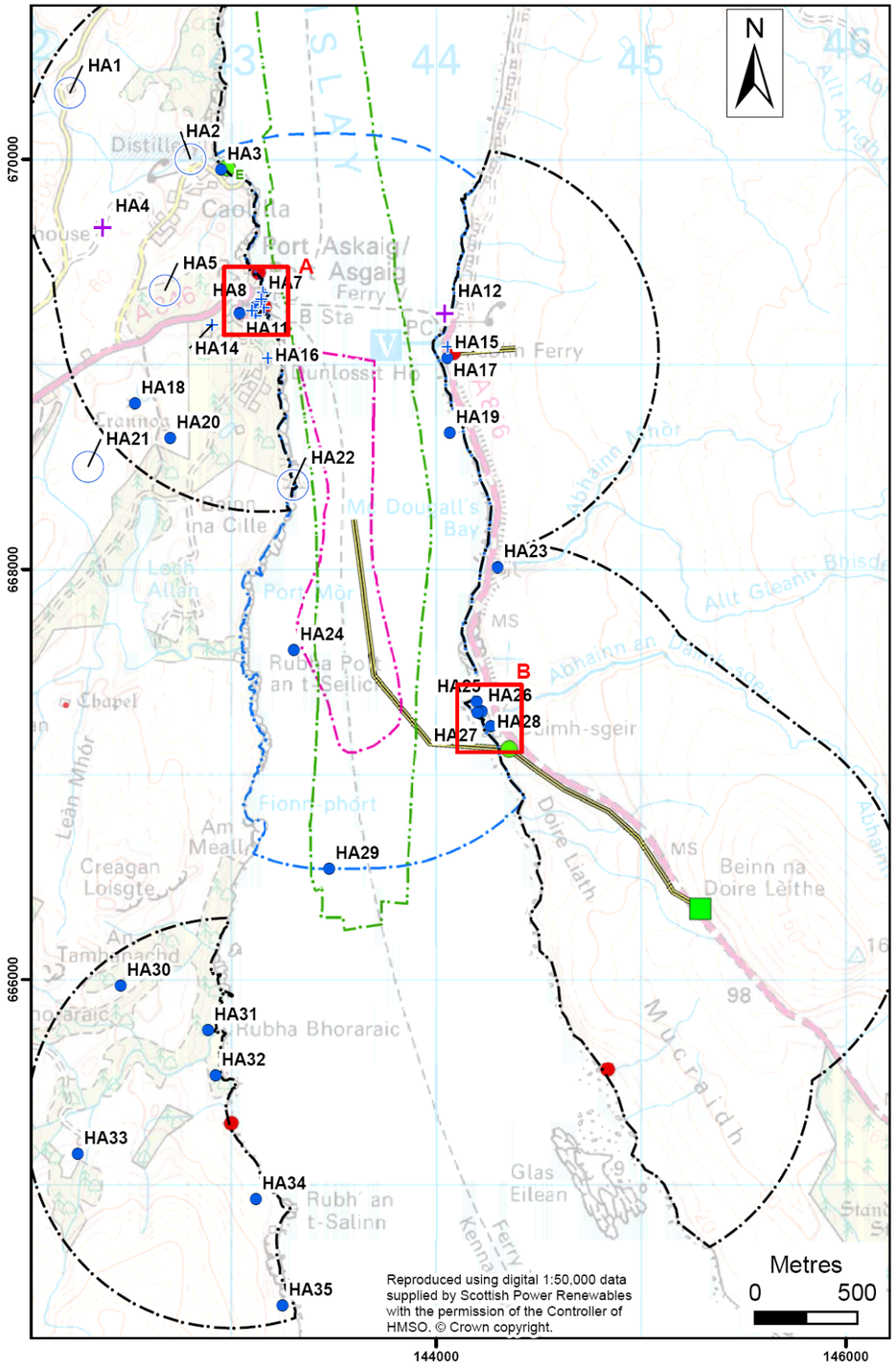
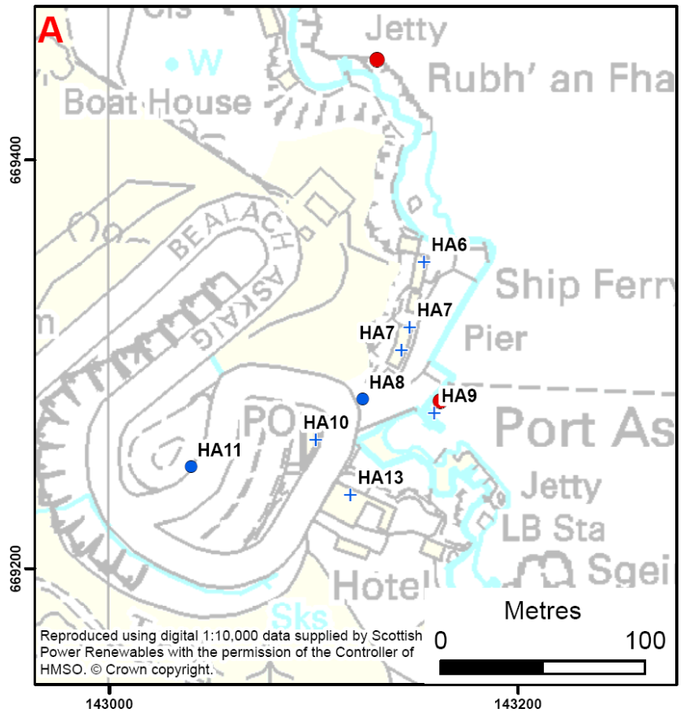
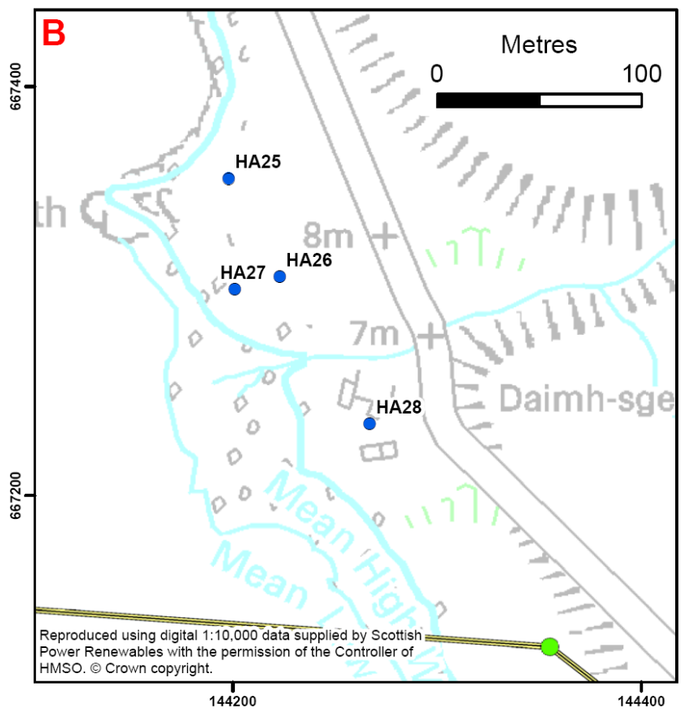
1981 Ordanace Suevry Agyllshire 1:10,000 NR46NW (Surveyed 1979)







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Key

- B Listed Building
- C(S) Listed Building
- HA sites with approximate locations
- HA sites with known locations
- Substation location
- Final cable landfall sites
- Initial cable landfall candidates
- Cable routes
- Area of interest - 48m contour
- Inner study area (onshore)
- Inner study area (offshore)

Sites and Monuments Record information derived from WOSAS data dated 07/09/2009 © Crown Copyright WOSAS

NMRS data provided by the RCAHMS dated 14/09/2009 © Crown Copyright RCAHMS

Scheduled monument area information derived from Historic Scotland data dated 3/09/2009 © Crown Copyright Historic Scotland

Listed Building data provided by Historic Scotland dated 3/09/2009 © Crown Copyright Historic Scotland

Sound of Islay Demonstration Tidal Array

Figure 18.1 Sites of Cultural Heritage Interest at the Sound of Islay Tidal Array

19 Traffic and Transport

19.1 Introduction

19.1. This chapter describes the baseline conditions of the existing traffic and transport network within the vicinity of the proposed Sound of Islay Demonstration Tidal Array and export cable route. Also considered are further network links to the wider region.

19.2. An assessment of the potential impacts on traffic and transport from construction, operation (and maintenance) and decommissioning of the proposed development has been provided in this chapter and, where appropriate, mitigation measures are proposed. Cumulative impacts are also considered.

19.3. The geographical scope considered within this chapter covers the area of the Sound of Islay, in particular where the array will be located, and the road network around the location of the proposed Development on both Islay and Jura, the extent of which is shown in Figure 19.5. This includes:

- Major transport routes, including air, sea and road links on and between the mainland and the Islands of Islay and Jura;
- The potential routes to be used for the delivery and disposal of material to both the barge loading point and the substation construction site;
- The roads which would be adversely affected in traffic impact terms as a result of either of the above; and
- New haul roads and site accesses which would be located within the construction sites for the substation and supporting grid networks.

19.4. This chapter is intrinsically linked with the construction methodology (i.e. number and type of construction traffic required) and the wider context of the environment around the Sound, and as such should be read in close conjunction with *Chapter 5: Project Description*, *Chapter 20: Socio-economics, Tourism and Recreation* and *Appendix 19.1 Navigational Safety Risk Assessment.*

Summary of Impact on Traffic and Transport:

The Sound of Islay has a number of ferry routes which are of high importance to the local community. The impact of the proposed Development (including substation, cables and infrastructure) on these routes could cause relatively high level disruption during construction and decommissioning; however this will be temporary and with careful planning and mitigation these can be reduced.

The onshore traffic and transport facilities on Islay and Jura may be affected temporarily during construction and decommissioning. However, due to the high capacity of the roads in relation to the predicted current levels of traffic and the delivery of equipment and materials by boat directly to Jura, the impacts are expected to be minimal.

19.2 Methodology

19.2.1 EIA Guidance

19.5. There are no specific guidelines developed for tidal turbine Environmental Impact Assessments (EIAs) with regards to impacts on traffic and transport. It is proposed as part of continuous consultation that local businesses and industry are kept informed about the proposed Development and that the Development is discussed with local residents. Consultation is a key element of this process, and as with best practice, it will be ongoing throughout the project.

19.6. In addition, guidelines produced by the Department of Transport (2007) state that:

> *"If the TA confirms that a development will have material impact on the highway network, the level of impact at all critical locations on the network should be established. A particular example of material impact would be a worsening of congestion. In congested areas, the percentage traffic impact that is considered significant or detrimental to the network may be relatively low (possibly below the average daily variation in flow), and should have been determined in discussions with the relevant highway authorities".*

19.7. In the case of the proposed Development , its impact will not exceed either of the limits outlined within the guidance provided above. The approach to how impacts are assessed is outlined within Chapter 2 *Scoping and Assessment Methodology.*

19.2.2 Legislative Background

19.8. This section identifies the international, national and regional legislation, policies, plans and guidance that are relevant to traffic impact assessment. These have been considered in relation to the proposed Development and during the impact assessment process.

National Planning Policies

19.9. Pertinent points from relevant national, regional and local planning policies (including the Argyll and Bute Council Local Plan Policies) are briefly summarised below.

19.10. Scottish Planning Policy (Paragraph 165 of that document) - Development likely to affect trunk and other strategic roads should be managed so as not to adversely impact on the safe and efficient flow of strategic traffic. Developers must be prepared to mitigate impacts through contributing to necessary works.

19.11. Policy Advice Note 75 (PAN 75) Planning for Transport - Planning for Transport indicates that schemes in committed programmes and/or those in an advanced state of preparation where work is expected to begin in the plan period should be included in the local plan proposals map

Regional Planning policy

19.12. PROP TRANS 1 – Development Control, Transport and Access – States that the Local plan should make policy to facilitate that the following is not compromised during development:

- Public transport;
- Non-car borne journeys i.e. footpaths, cycle tracks;

- Disability access and access for horse riders if required;
- Public access if it is needed by public service vehicles and public rights of way;
- Roads built as part of the development should be of appropriate standard if they will be used for public access; and
- Maximum car parking standards to be applied.

19.13. TRAN 4 – New and existing Public Roads and Private Access Regimes - refers to standards appropriate for road construction consent. These can currently be found in the Roads Development Guide Strathclyde Regional Council 1995 (to be reviewed by the Councils Road Services).

19.14. TRAN 2- Development and Public Transport Accessibility - Refers to development which allows appropriate access and network.

19.15. Where considered appropriate by the planning authority, or Scottish Government, developers will be asked to submit an independent Transport Assessment, Traffic Impact Assessment and/or Travel Plan to help support their proposal.

19.2.3 Consultation

19.16. During the development of the array, both formal and informal consultations have been carried out by ScottishPower Renewables (SPR) with a number of relevant organisations and the local community. *Chapter 2: Scoping and Assessment Methodology* and *Chapter 3: Consultation* outlines the consultation which has been undertaken to date listing all parties involved including those outlined in relation to traffic and transport. Transport Scotland, Argyll and Bute Council and Jura Community Council are the main consultees that were approached for a scoping opinion.

19.17. Transport Scotland has commented that due to the development not impacting upon trunk roads that they have no comment to make. Other consultees raised concerns over potential impact on the Islay to Jura ferry and specifically highlighted the need to see further detail on the impact of the proposed development on marine navigation. This has been specifically covered in *Appendix 19.1: Navigational Safety Risk Assessment.*

19.2.4 Data Collection

19.18. The main sources of information used to establish baseline conditions are as follows:

- Caledonian MacBrayne: Hebridean and Clyde Ferries. Carrying statistics (2003-2009), vessels information and sailing times for Caledonian MacBrayne operated ferries;
- Civil Aviation Authority. UK Airport statistics. Islay Airport (Glenegedale) passenger numbers (1990-2009);
- Argyll and Bute Council - Local plans management plan adopted in 2009 and the Road maintenance plan adopted in 2005;
- Waterman Environmental 2000 (Port Askaig Redevelopment Environmental Statement);
- Web based mapping facilities such as Multimap and Bing; and
- The 2001 National Census (general register office for Scotland).

19.19. The information sources listed above provide sufficient information to describe traffic and transport activities likely to be encountered within the Sound of Islay and surrounding islands. As such, no site-specific traffic and transport surveys have been undertaken for this EIA.

19.2.5 Assessment of Significance

19.20. The broad methodology used for determining significance of effect through magnitude of impact and the sensitivity/importance/value of the receptor is outlined in *Chapter 2: Scoping and Assessment Methodology.* The significance of the effect is assessed on the basis of both the magnitude of a potential traffic impact (Table 19.1) and the sensitivity/importance/value of the traffic and/or transport receptor (Table 19.1). Tables 19.1 and 19.2 have been produced in line with the Significance Assessment Criteria established in the Scottish Marine Renewables SEA (Scottish Executive, 2007).

19.21. The level of significance will be described as either ‘major’, ‘moderate’, ‘minor’, ‘negligible’ or ‘no significant effect’, on the basis of the matrix provided in Table 19.3.

Table 19.1 Magnitude of Impact

Magnitude of Impact	Description
High	A fundamental long term change to baseline traffic and transport conditions. For example change resulting in collision or displacement of transport resulting in limited access.
Medium	A non-fundamental but detectable temporary or permanent change in the condition of traffic and transport. For example a long term displacement of traffic resulting in significantly increased journey times
Low	A minor change to the baseline condition of traffic and transport (or a change that is temporary in nature). For example a short term displacement of traffic resulting in significantly increased journey times
Negligible	An imperceptible and/or no change to the baseline condition of traffic and transport facilities.

Table 19.2 Sensitivity/Importance/Value of the receptor

Receptor Sensitivity/Importance/ Value	Description
High	Traffic and transport are vital. For example, “lifeline” traffic links for which there are no alternatives.
Medium	Traffic and transport facilities which are important e.g. major routes for which the alternative adds significantly to journey time and cost.
Low	Traffic and transport facilities which are in regular use e.g. routes for which the alternative will provide a slight inconvenience
Negligible	Traffic and transport facilities which are in low use e.g. rarely used routes or routes which are easily diverted

Table 19.3 Impact significance matrix				
Magnitude of impact	**Receptor Sensitivity/Importance/Value**			
	Negligible	**Low**	**Medium**	**High**
High	No significant effect	Moderate	Major	Major
Medium	No significant effect	Minor	Moderate	Major
Low	No significant effect	Negligible	Minor	Moderate
Negligible	No significant effect	Negligible	Negligible	Minor

19.22. It should be noted that the potential for disturbance caused by construction traffic is assessed in *Chapter 10: Noise and Vibration Affecting Human Receptors*, *Chapter 23: Air Quality* and *Chapter 17: Landscape and Seascape.* The disturbance to other receptors, i.e. species, is assessed in the relevant Chapters (*Chapter 8: Benthic Ecology*, *Chapter 9: Marine Mammals*, *Chapter 14: Ornithology* and *Chapter 16: Terrestrial and Intertidal Ecology*).

19.23. Any residual effect (the effect after the implementation of mitigation) which remains at the level of 'Moderate' or 'Major' is still regarded by the EIA Regulations as being of significant effect

19.3 Baseline Description

19.24. This section of the ES describes the baseline condition of traffic and transport on the islands of Islay and Jura and also includes information about the transport links to the wider region including to mainland Scotland. The scope of this Chapter is therefore not defined by geographical area (as is the case with many of the other chapters) but is defined by the transport network associated with Islay and Jura.

19.3.1 Populations and settlements

19.25. Jura is one of the most sparsely populated Islands of the Inner Hebrides. At the last Census in 2001, the total population of Jura was 188 with the majority of people living in Craighouse on Jura's south eastern coast.

19.26. The majority of services on Jura, including a post office and hotel are located in Craighouse.

19.27. For the population of Jura, the link with Islay, and subsequently the mainland, is vital for many reasons including:

- Education of the population at school age;
- Medical problems, both emergency and routine;
- Policing;
- Export of whisky and venison from the island; and
- Tourism, which is a major income to the Island (further details are provided in *Chapter 20: Socioeconomics, Tourism and Recreation*)

19.28. Islay's population is significantly larger than Jura's and was estimated to be approximately 3,500 in 2007, with an estimated increase to 3,600 by 2012 (Argyll and Bute Structure Plan, 2002). The population of Islay has three main links to the mainland which are; the Kennacraig to Port Ellen ferry service, the Kennacraig to Port Askaig ferry service and the Islay to Glasgow flight service. Only the Kennacraig to Port Askaig ferry route operates within the vicinity of the proposed Development (Figure 19.5).

19.29. There are a number of towns and villages on Islay, with the nearest to the proposed Development being Port Askaig, and the largest being Bowmore, located approximately 16km Southwest of the proposed development (Figure 19.5).

19.30. Port Askaig is a small settlement and port on Islay, situated on the Sound of Islay (Figure 20.5). Recent redevelopment work, completed in 2009, has increased facilities at the port, including a new linkspan and other berthing facilities for mainland ferries, new facilities for the Jura ferry, and new car parks and waiting rooms.

19.31. Port Askaig is also home to the Islay RNLI Lifeboat, whose station opened in 1934. This is open to visitors all year round (www.undiscoveredscotland.co.uk).

Islay and Jura transport forum

19.32. In 2004 the Islay and Jura Transport Forum was set up. Members include: transport operators, members of the community council, service users, medical professionals and the British Red Cross. The Transport Forum is a forum for discussion and coordination of transport policy.

19.3.2 Onshore traffic and transport

19.33. A traffic assessment for Port Askaig and the surrounding area was conducted during the EIA for the Port Askaig redevelopment (Waterman Environmental, 2000). The assessment found that road traffic activity at Port Askaig was regulated by the carrying capacity of the ferries and that background levels of traffic in Port Askaig were extremely low. This is also thought to be true of the traffic levels on Jura albeit that the traffic is regulated by one single small ferry (The Port Askaig to Feolin service). This is discussed further in Paragraph 19.37.

Local Road Network

19.34. The A846 runs for 13km alongside Jura's Southern and Eastern coastlines terminating at Lussagiven (Figure 19.5). This is the only tarmac/ surfaced road on the Island and is therefore a crucial link between Craighouse (where the majority of the population of Jura live) and the ferry terminal at Feolin. This road was classified as road hierarchy Category 2 (as defined by Department for Transport (DfT) and Transport Scotland trunk roads classification) in Argyll and Bute Council's 2005 Road Maintenance and Asset Management Plan (2005) and provides the sole method of access for small villages to services within the main populated areas on the island.

19.35. A desktop investigation has shown that there are currently no known traffic counts that have been conducted on Jura. However, as the population of Jura was recorded at 188 in the last census (2001) it is likely that that are no more than 80 vehicles that use the A846 on a regular basis (based on residential property and census numbers). This number will increase during the tourist season and effects of this increase are discussed in *Chapter 20: Socio-economics, Tourism and Recreation*.

19.36. The A846 continues on the Islay side of the Sound, from Port Askaig to Bowmore (Figure 19.5). During the completion of the EIA for the Port Askaig Redevelopment (Waterman Environmental, 2000) a traffic assessment was submitted. Traffic data provided by Argyll and

Bute Council was used to assess the capacity of the A846 on Islay and to determine the existing levels of road traffic. The traffic counts which were conducted at Kilmeny, approximately 5.5km east of Port Askaig (Figure 19.5) are summarised below in Table 19.4.

Table 19.4 Typical daily historical flow data – Typical daily. Data Source Waterman Environmental 2000

Location- Islay			
Time period(Peak hour (2 way flow)	**Number of vehicles**	**Time period (All day 12 hour 0700-1900)**	**Number of vehicles**
Total Vehicles	101	Total Vehicles	698
Light vehicles	96	Light vehicles	648
HGVs	5	HGVs	50

Bus services

19.37. The Jura bus service travels between the ferry terminal at Feolin to Ardlussa and Inverlussa near to the North of the island and provides transport for the island's children of high school age who travel to Bowmore on Islay using the Jura ferry each day. The bus functions as the island's mobile post office and also serves as a taxi. The Jura bus services are an important amenity and offer an essential service to much of the island's population.

19.38. West Coast Motors operate a coach service from Glasgow Buchanan Street bus station to Campbeltown which is scheduled to meet the Islay ferry at Kennacraig twice per day.

19.39. A local bus service is available on Islay and operates on several different routes on the island. The main routes on Islay are:

- Portnahaven - Bowmore - Port Ellen - Ardbeg service;
- Bridgend - Bowmore - Port Ellen - Ardbeg service,;
- Ardbeg - Bowmore - Bridgend - Portnahaven service; and
- Ardbeg - Bowmore - Bridgend - Port Askaig service

19.40. Only the Ardbeg - Bowmore - Bridgend - Port Askaig service operates in the vicinity of the proposed Development.

19.3.3 Marine Traffic and Transport

Commercial vessels

19.41. Automatic Identification System (AIS) data[1] shows that at least one tanker vessel transits through the Sound of Islay, but generally tankers do not appear to use the small inter island channels along the West coast of Scotland (Scottish Executive, 2007). AIS data collected as part of the Navigational Safety Risk Assessment (Appendix 19.1) shows that 26 medium sized cargo vessels transited through the Sound during a 28 day period (split equally between January and June 2007). This is discussed further in Appendix 19.1 (Section 5.2).

19.42. Approximately ten fishing vessels use the Sound for creeling, the majority of which is conducted in winter and early spring when other grounds cannot be used due to seasonal bad weather, although some vessels use it all year round. Detailed fisheries information is provided within *Chapter 15: Commercial Fisheries.*

Ferries

19.43. The Sound of Islay has two important ferry routes. The two ferry services that use the Sound are the Kennacraig to Port Askaig service (which is extended to Colonsay and Oban during the summer) and the Islay to Jura service. Each ferry service is detailed below.

Kennacraig to Islay

19.44. The Kennacraig to Port Askaig service is operated by Caledonian MacBrayne who currently sail two vessels from Kennacraig to Islay. The service also docks at Port Ellen. Information about the two ferries is included in Table 19.5 and Figure 19.5. A third ferry, which is currently being built, is due to join this service in 2011; details of this ferry (to be named the MV Finlaggan - Fionn Laggan) are also included in Table 19.5.

Table 19.5 Vessel specification of vessels that sail the Kennacraig to Islay service operated by Caledonian Macbrayne

Specification	**MV Hebridean Isles - Eileanan Innse Gall**	**MV Isle of Arran - Eilean Arrain**	**MV Finlaggan - Fionn Lagan**
Built	1985, Cochrane Shipbuilders Ltd,	1984, Ferguson Ailsa, Port Glasgow	2011, Remontowa SA, Gdansk, Poland
Gross tonnage	3046	3296	5209
Size	85.2m x 15.8m	84.9m x 15.8m	89.8 x 16.4m
Service speed	15 knots	15 knots	16.3knots
Capacity	62 cars and 494 passengers	62 cars; 659 passengers	85 cars, 550 passengers

19.45. The Kennacraig to port Askaig Ferry docks in Port Askaig once or twice per day and the ferry from Kennacraig to Port Ellen sails between one and three times daily. Caledonian MacBrayne increases the number of sailings in the summer months to cope with an increase in tourism. During the tourist season a service is added that continues on from Port Askaig through the Sound of Islay to Colonsay (Figure 19.5).

19.46. Based on available data provided by Caledonian MacBrayne (Caledonian MacBrayne, 2010), the following conclusions can be drawn about the carrying statistics for the Kennacraig to Islay (both the Port Askaig and the Port Ellen services) ferry service. Passenger numbers on this service increased year on year from 139,859 in 2003 to 171,380 in 2009 (Figure 19.1). Car numbers also increased year on year from 45,859 in 2003 to 56,316 in 2009. This represents an overall increase in both passenger numbers and car numbers by 23%. The number of coaches and commercial vehicles using this service showed an overall increase of 20% and 115% respectively during the time period 2003-2009 with the level of increase in numbers fluctuating year on year (Figure 19.1).

[1] All vessels over 300 gross registered tonnes are required to carry AIS equipment which transmits information about the ship and its movements to other suitably equipped vessels and coastal authorities

19.47. The Kennacraig to Islay to Colonsay to Oban ferry service (Figure 19.5) which only runs in the summer also saw a steady increase in passenger numbers (of 38%), cars (65%) and commercial vehicles (58%) between 2004 and 2009, but did not see an increase in coach numbers.

19.48. The Ferry service to Port Askaig also caters for significant amounts of foot and cycle passengers (Port Askaig Redevelopment EIA, 2000). Foot traffic, once on Islay, mainly utilises the bus links that take passengers West on the Island.

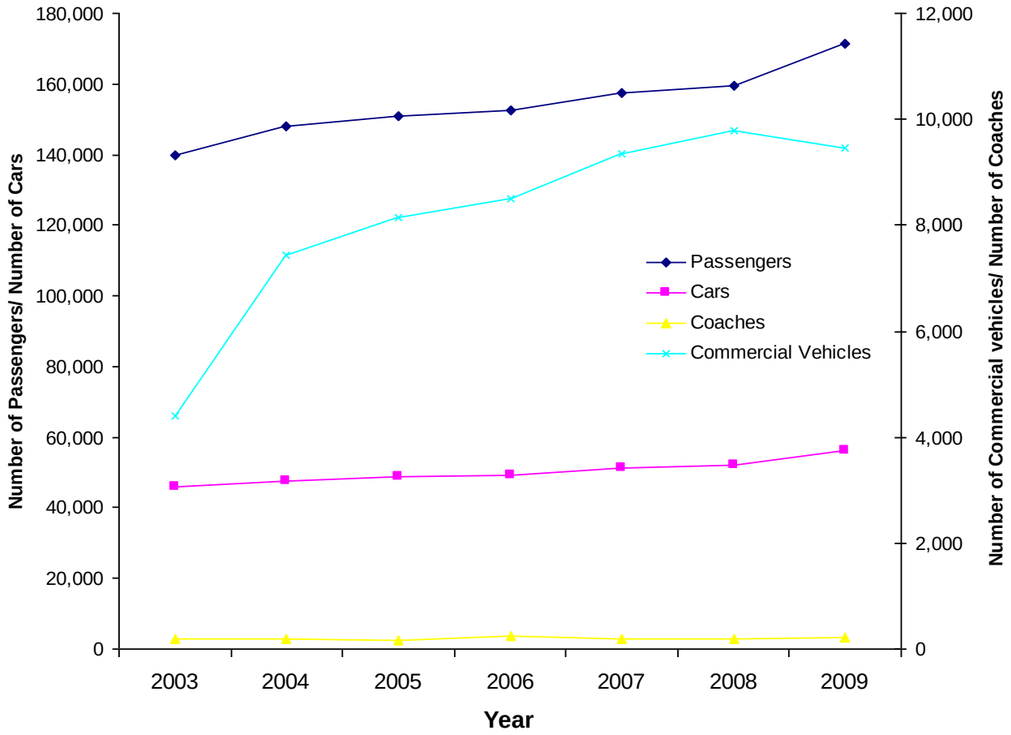

Figure 19.1 Carrying statistics for the Kennacraig to Islay ferry service operated by Caledonian MacBrayne. Data Source: Caledonian MacBrayne, 2010: Note that the primary Y axis refers to Passenger and car numbers and the secondary Y axis refers to commercial vehicles and coaches.

Islay (Port Askaig) to Jura (Feolin)

19.49. The Port Askaig to Feolin ferry transports passengers and vehicles between port Askaig on Islay to Feolin on Jura (Figure 19.5) and is operated by ASP Ship Management Ltd. A single vessel (the Eilean Dhuira) runs daily from 07:35 until 20:00 and occasionally until 23:00 if pre-booked. It has a capacity of 41 tonnes which is approximately 6 cars (depending on their size) or 1 tanker. It is currently the only method of public transport to access Jura (via Islay) with a vehicle, and during the winter it is the only public transport link between Jura and Islay. Carrying statistics for this ferry service for 2009 were obtained from Argyll and Bute Council and are displayed in Figure 19.2. In total, 70,821 passengers travelled on the service in 2009 during 5980 sailings equating to average passenger numbers per trip of 11.8 people.

19.50. During 2009 passenger numbers were at their highest in spring and summer (Figure 19.2), with July carrying the greatest number of passengers at 8949. The trend in passenger numbers was mirrored in the number or cars/vans which used the service during 2009. The average number of passengers per trip during the winter months is as low as 7.5 whereas in the summer it is as high as 16.6.

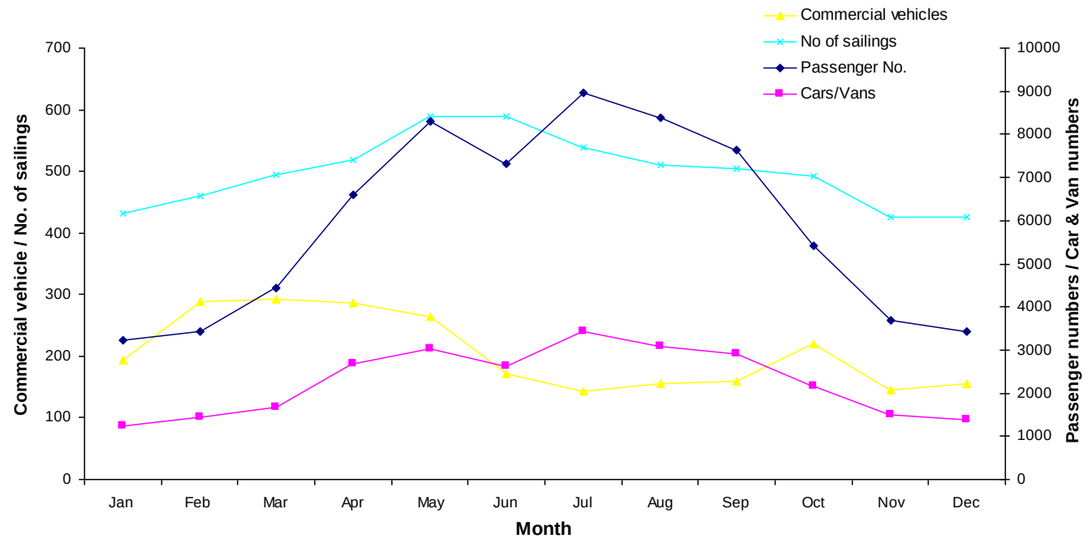

Figure 19.2. Carrying statistics of the Feolin to Port Askaig ferry service during 2009. Note: the primary Y axis refers to Commercial vehicles and Number of sailings and the secondary Y axis refers to Passenger numbers and the Number of Car/vans that used the ferry. Data source: Argyll and Bute Council.

19.51. A small 12 seat passenger ferry run by Jura Development Trust operates during the summer months between Craighouse on the south east coast of Jura and Tayvallich on the Kintyre peninsular. The service runs twice per day (except Wednesday) from May to September with a slightly reduced service in April.

Air

19.52. With the exception of the Caledonian MacBrayne ferry service to Islay, the only other public transport link to the island is by air. Glenegedale Airport is situated in the South eastern part of Islay (Figure 19.5) and receives two commercial flights daily from Glasgow International Airport as well as a number of private flights form various different airports. Passenger numbers travelling through Glenegedale airport increased by approximately 38% between 1990 and 2008. However, numbers decreased between 2008 and 2009 (Figure 19.3) by approximately 11.5%. The Airport is generally busiest during the summer months, with June and August seeing the greatest passenger numbers (Figure 19.4)

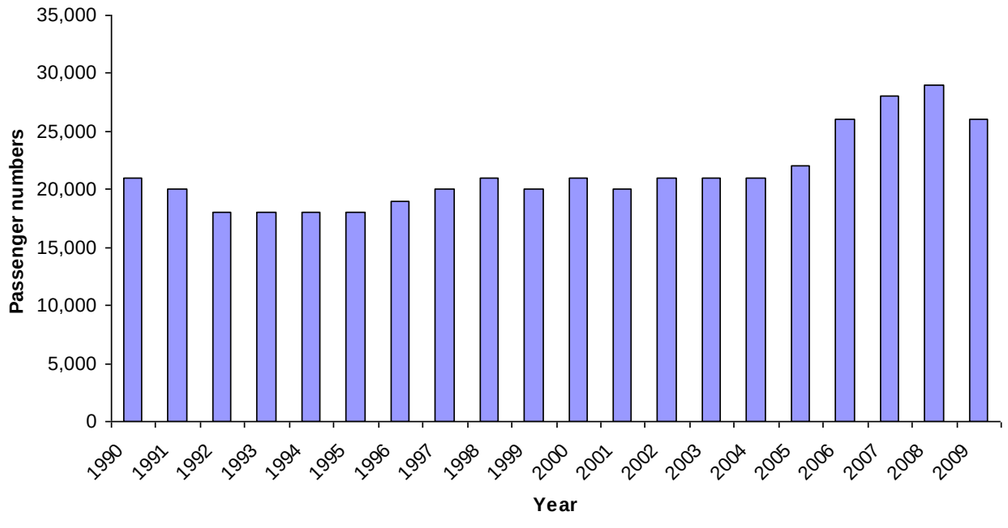

Figure 19.3. Passenger numbers travelling through Glenegedale airport, Islay Data source: Civil Aviation Authority

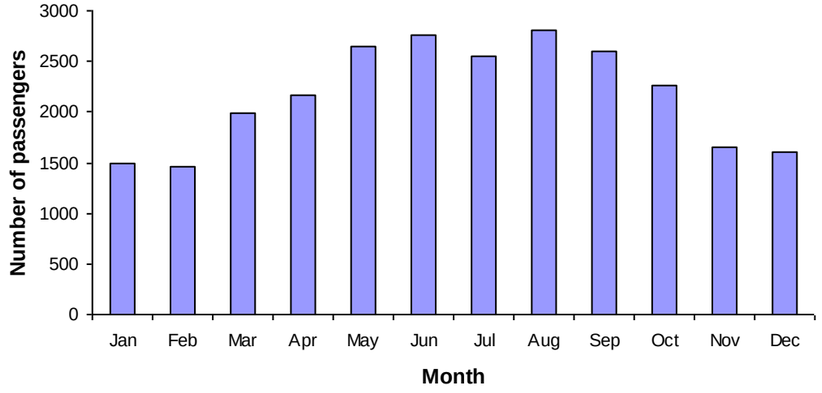

Figure 19.4. Average number of passengers travelling through Glenegadale Airport, Islay airport per month during the years 2005 to 2009.

19.4 Assessment of Effects and Mitigation

19.4.1 Do nothing scenario

19.53. Under a 'do nothing' scenario it is expected that the transport network would continue as it does currently. There is no indication that the population of Islay or Jura is likely to change significantly (in the near future (Argyll and Bute Structure Plan, 2002). Although Bowmore was identified for "small scale development" (Scottish Government /Strategic Rail Authority, 2005) this has and will continue to occur on a scale that will not impact upon the existing transport network. There is currently a trend of increasing passenger numbers using the Caledonian MacBrayne ferry services and Islay airport, which is associated with the tourism industry. This trend is likely to continue; however, the speed of increase is unlikely to cause a significant change to the existing transport levels during the life span of the proposed development.

19.4.2 Potential Impacts during Construction Phase

Impact 19.1: Disruption of the Islay to Jura Ferry (Eilean Dhuira)

19.54. The Port Askaig to Feolin ferry service is of great importance to the local community and is a lifeline traffic link of which there are no alternatives therefore it has been identified as being of **high** sensitivity/ importance (Table 19.2).

19.55. There are a number of ways in which the Development could potentially disrupt this service, each of which is addressed below.

Increased demand for the Feolin slipway

19.56. Deliveries of equipment and materials for the construction of the substation on Jura are planned to go directly to the slipway at Feolin and while this does not the increase demand for the Feolin ferry it does increase the demand for the Feolin slipway which is used by the ferry, possibly causing disruption. It is anticipated that there will be in total 13-14 delivery events during the three month period of construction, during which demand for the slipway will increase. As this is approximately one a week the magnitude of this impact can be considered to be **low**.

19.57. It is anticipated that substation construction staff may use the ferry for transport to the construction site on a daily basis however a maximum of four members of staff are predicted to be located in the area at anyone time which will not represent significant increase in demand for the ferry and therefore the magnitude of this impact is likely to be **low**.

Increased demand for the Port Askaig slipways

19.58. It is anticipated that the majority of materials used in construction of the tidal array itself will be delivered directly to barges moored in Caol Ila Bay (*Chapter 5: Project Description*). However there may be occasions when a vessel associated with the development may dock at Port Askaig. This will only occur if and when the dock is available and priority will always be given to the ferry and therefore will not affect this service.

Construction vessels interacting with the Eilean Dhuira (Islay to Jura ferry)

19.59. The mooring area at Caol Ila Bay is located to the north of the Jura to Islay ferry route and the proposed Development is located to the South (Figure 19.5). Construction vessels, mainly the

DP (Dynamic positioning) vessel (see Appendix 19.1) will transit across the ferry route possibly causing delay to the ferry. The turbines have been designed so that they can be positioned on the seabed during a single tidal cycle and therefore the DP vessel should only interfere with the Islay to Jura ferry on a maximum of 20 occasions. In addition to the DP vessel, other vessels associated with construction will also cross the Islay to Jura ferry route these will include:

- Two Anchor Handling tugs - crossing the ferry route approximately twice each;
- Up to four storage barges - crossing the ferry route approximately twice each;
- Two mooring tugs - crossing the ferry route approximately twice each; and
- One cable installation vessel - crossing the ferry route up to 10 times.

19.60. The use of DP vessel during the installation process reduces disruption to marine users of the Sound in comparison to the use of moored barges. DP vessels will be able to move away from the main navigable channel within the Sound in between construction activities.

19.61. The boundary of the array was, from the inception of the project, positioned with a buffer between it and the Islay to Jura ferry service, therefore only vessels in transit could potentially cause disruption to this service. Installation of the array will only take place during favourable weather conditions (which includes good visibility) when vessel navigation will not be impeded and therefore any of the construction vessels will be able to avoid causing delay to the ferry service. The magnitude of impact caused by any disruption is therefore expected to be **low**.

19.62. During the Navigational Safety Risk Assessment it was considered that none of the construction vessels posed an “intolerable” safety risk to the ferries that operate in the Sound of Islay (Appendix 19.1). This is mainly due to the fact that the construction site does not include any ferry routes and that construction vessels will only work during favourable conditions that don’t impede navigation or manoeuvrability.

19.63. As the magnitude of the impact is considered to be **low** and the sensitivity of the receptor (the Islay to Jura ferry service) is considered to be of **high** sensitivity the resulting effect is expected to be of **moderate** significance to the local community.

MITIGATION IN RELATION TO IMPACT 19.1
• Construction vessels, where possible, will avoid unnecessary crossing of the ferry route. • Careful timing of activities (such as deliveries to the Feolin slipway) that may impact upon the ferry service to be conducted outside of peak usage where possible. • Vessels will be marked with appropriate flags and lights in accordance with COLREGS to warn other users of any restricted manoeuvrability. • Onshore construction works carefully sited to avoid traffic access routes to the ferry terminals on both Islay and Jura. • Staff travelling on the Islay to the Jura ferry service during construction of the substation should use the minimum number of vehicles as is practical (car sharing when possible). • Notice to mariners will be transmitted by radio each day during construction operations to ensure all users are aware of construction activities. • Disruption will be monitored during deployment including through contact with ferry operator.

Residual impact:

19.64. If the mitigation suggested above is implemented it is likely that the impacts to the Islay to Jura ferry service will be reduced to **minor adverse** significance.

Impact 19.2: Disruption of the Kennacraig to Islay Ferry service.

19.65. The Kennacraig to Port Askaig ferry route is important to the population of both Islay and Jura. This service docks at two locations (Port Askaig and Port Ellen) on Islay; with only one (Port Askaig) in the vicinity of the Development. As there are alternative routes to travelling by ferry to Port Askaig which include, by air from Glasgow and by ferry to Port Ellan the sensitivity of this receptor is at worst **medium**.

19.66. It is anticipated that the DP vessel is likely to be in the vicinity of the Kennacraig to Port askaig ferry route on 20 separate occasions during the 72 (approximately) day construction period. This will only occur two hours either side of slack water which equates to roughly 40hrs on the construction site, through which the ferry will transit. When deploying the support structure or nacelles the DP vessel will have limited manoeuvrability and will be most at risk of causing disruption to the ferry during this time.

19.67. The use of the DP vessels during the installation process reduces the chance of disruption to this ferry services as it will be able to move away from the main navigable channel within the Sound in between construction activities, and is highly mobile enabling it to avoid other vessels.

19.68. The cable laying vessel may provide some disruption as it may be on site for up to a maximum of 8 weeks, in reality it is likely to be less than this but this value is taken as the worst case scenario. Also during this 8 week period the vessel moves away from the main channel when not cable laying and it will only operate in favourable conditions that will allow for maximum manoeuvrability. In addition the cable laying vessel will be clearly marked allowing navigation around the vessel. This may cause a small but short lived change to the baseline environment and therefore the magnitude of this impact is considered to be **minor**.

19.69. Other vessels associated with the construction phase are also likely to come within the vicinity of the Kennecraig to Port Askaig ferry route (these vessels together with their anticipated movements are listed in Paragraph 19.56 (of Impact 19.1)). However, these vessels are unlikely to interfere with the ferry as they will be transiting up and down the Sound rather than crossing the route (as is the case in Impact 19.1).

19.70. The Navigational Safety Risk Assessment (Appendix 19.1) concludes that the safety risk posed by the construction phase of the Development to all vessels (including ferries) is “tolerable with monitoring”, and therefore the impact of a collision with the Kennacraig to Port Askaig ferry is not considered here.

19.71. As a result the **minor** magnitude of the impact and the **medium** sensitivity of the receptor the effect of disruption to the Kennacraig to Port Askaig ferry service is likely to be of **minor** significance.

MITIGATION IN RELATION TO IMPACT 19.2
• Radio communication between DP vessel, cable laying vessel and the Kennacraig to Port Askaig to be open whenever any of these vessels are on approach or operating within the Sound. • The contractor responsible for the cable lay activity will notify the UK Hydrographic Office (UKHO) of all the activity using the maritime safety information (MSI) system for promulgation to all vessels by notices to mariners (NMs) and radio navigational warnings. • All construction vessels to comply with the international regulations for preventing collision at sea 1972 (COLREGS). • Appropriate flags and lighting to show the manoeuvrability of the construction vessels in accordance with COLREGS. • Disruption will be monitored during deployment through contact with ferry operator in order to minimise impact. • Notice to mariners will be transmitted by radio each day during construction operations to ensure all users are aware of construction activities.

Residual impact:

19.72. If the mitigation suggested above is implemented it is likely that the magnitude of the impact will be reduced and therefore the overall residual impact will be of **negligible** significance.

Impact 19.3: Disruption of other marine traffic using the Sound

19.73. The use of the DP vessel during the installation process reduces disruption to other marine users that operate within the Sound. The dynamic positioning vessel will be able to move away from the main navigable channel within the Sound in-between construction activities, whereas a moored barge (which was another option considered for construction) would not (Appendix 19.1).

19.74. The cable laying vessel may provide some disruption but will be clearly marked allowing navigation around the vessel. Use of safety zones has not been deemed necessary or appropriate for this project as the risk posed to vessel by the Development was considered to be "Tolerable" in the Navigational Safety Risk Assessment (Appendix 19.1). Therefore the magnitude of this impact is **low**.

19.75. As is described in Section 19.3.3 few vessels use the Sound of Islay on a regular basis (Paragraph 19.38). The sensitivity of marine traffic (other than the key ferry services identified in Impacts 19.1 and 19.2) within the Sound is therefore considered to be **low**. With a predicted **low** magnitude of impact and **low** sensitivity of receptor is expected that the impact of the Development on other marine traffic will be of **negligible** significance.

MITIGATION IN RELATION TO IMPACT 19.3
• No mitigation is required

Residual impact:

19.76. As no mitigation is require, the residual impact will remain of **negligible** significant effect.

Impact 19.4: Increase in road traffic resulting in congestion and degradation of roads

19.77. The A846 on Jura (Figure 19.5) is a "lifeline" transport link for the population of Jura and with no alternatives this route is of high importance. The A846 also continues on Islay (Figure 19.5) where the road is still considered to be of high importance

19.78. The traffic assessment conducted for the Port Askaig redevelopment (Waterman Environmental, 2000) found that traffic in the Port Askaig area was regulated by the carrying capacity of the ferry. The data shown in Table 19.4 was collected in 1998 for the A846 on Islay. In order to make a prediction as to how the road traffic numbers in Table 19.4 may have changed since 1998, ferry carrying statistics were used as a proxy to estimate the increase as follows:

19.79. Between 2004 and 2009 (inclusive) the number of vehicles travelling on the Kennacraig to Islay ferry services increased by 31% and with an average year on year increase of approximately 5% (Caledonian MacBrayne, 2010). It has been estimated that during the period from 1999 to 2003 (for which there is no ferry data available) an increase of approximately 20% occurred giving a total predicted increase in vehicles of 51%. As nearly all the vehicles that exit the ferry at Port Askaig transfer directly onto the A846 this approach is likely to give a good indication as to the increase of traffic on this road.

19.80. Data is only available for the Kennacraig to Port Askaig and the Kennacraig to Port Ellen ferry services combined. Therefore it has been necessary to make the assumption that changes in carrying statistics of both these services are approximately the same.

19.81. Using the numbers in Table 19.4 calculations have been made to predict the possible increase in road traffic on the A846 Bowmore to Port Askaig stretch from 1998 to 2009 (Table 19.6).

Table 19.6 Estimated 2009 A846 traffic levels – Typical Day.

Location – Kilmeny (Islay) +51%			
Time period	**Number of vehicles**	**Time period**	**Number of vehicles**
Peak hour (two way flow)	153	All day 12 hour (0700-1900) flow	1054
Light vehicles	145	Light vehicles	978
HGVs	8	HGVs	76
Data Sources from which these calculations have been made: Waterman Environmental (2000); Caledonian MacBrayne, 2010. Estimated 51% increase to simulate possible traffic flows in 2009			

19.82. During the traffic assessment it was calculated that the notional carrying capacity of the A846 was approximately 1200-1500 vehicles per hour (Waterman Environmental, 2000). Given that the highest increase in traffic on this stretch of road is likely to result in up to 153 vehicles per hour (Table 19.6), it is extremely unlikely that capacity will be exceeded even during peak times.

19.83. While there is no such information for Jura traffic levels, it is expected that the A846 on Jura will have the same capacity as Islay however with far less traffic.

19.84. No increase in traffic caused by the Development is expected on Islay as all deliveries are planned to come by sea directly to the moored barges at Caol Ila Bay or to the Feolin slipway on Jura. It is not expected that the A846 on Jura will be made impassable for any length of

time during construction; however, the following vehicle movements are expected to use the road over the three month construction period:

- 3 vehicle movements to transport substation equipment;
- 1 vehicle movement to transport the cable;
- 60 vehicle movements to transport sand for cable trenching; and
- 2 vehicle movements to provide general building equipment.

19.85. It is also anticipated that a small number of movements may be required following any failures/ breakdown of construction equipment and so for the impact assessment a further 14 vehicle movements are predicted to provide a conservative assessment.

19.86. This provides a total of 80 vehicle (160 two way journeys) movements over the entire construction period. It is anticipated that, construction works will continue for 3 months, with only 4 days of high traffic levels resulting in possible congestion. Therefore, even if the vehicle movements anticipated for the entire construction period were to occur in the same hour the carrying capacity of the A846 would not be exceeded and the magnitude of this impact can be considered **low**.

19.87. As a result of the expected low magnitude of impact and the **high** importance of the A846 it is predicted that the overall effect of increased traffic will be of **moderate** significance.

MITIGATION IN RELATION TO IMPACT 19.4
• Use of suitable methodology to ensure road disruption is minimised, such as half road closure or use of passing places whilst construction is undertaken. • The contractor will provide a traffic management plan which will insure that the increase in traffic on Jura will reduce affect to the normal A846 traffic. • Further mitigation measures, if required, will be determined in discussions with the relevant highway authorities (Argyll and Bute Council) • Remedial works to improve road surfaces if it is deemed that the Development has caused degradation of the (A846)

Residual impact:

19.88. If the mitigation measures suggested above are implemented the likely impacts of physical disturbance to major roads is likely to be of **minor** significant effect.

19.4.3 Potential Impacts during Operation Phase

Impact 19.5: Disruption of marine traffic using the Sound

19.89. Once installed it is anticipated that the turbines will have a clearance distance of at least 14.5m from the highest point that the blades can reach to the surface. No vessels that are likely to use the Sound draw this amount due to the depth constriction in the Northern part of the Sound (Appendix 19.1). Caledonian MacBrayne ferries would normally be built with a draft of around 5 metres (Scottish Executive, 2005).

The turbines will be controlled remotely using SCADA connections (more detail is provided in *Chapter 5: Project Description*) therefore reducing the need for access to the turbines. Taking this into account it is likely that with a negligible sensitivity of any vessels using the Sound requiring depths of greater than 14.5m and low magnitude due to the requirement of any such vessels to navigate around the array the impact to marine traffic using the Sound will be of **no significant effect**.

MITIGATION IN RELATION TO IMPACT 19.5
• No mitigation required.

Residual impact:

19.90. As no mitigation measures are required, the residual impact will remain of **no significant effect**.

Impact 19.6: Physical disruption and congestion to important roads

19.91. It is anticipated that once the substation and the cable network has been installed, there will be little or no disruption to the A846 on Islay or Jura outwith activities which would have occurred under the do nothing scenario. The onshore substation and cable network will need periodic inspection and maintenance resulting in a small increase in the amount of traffic using the A846, primarily on Jura (although personnel may travel though Islay to get to Jura). This work is likely to involve one to two vehicles of small size and therefore the impact will be of negligible magnitude causing no noticeable congestion or disruption. Inspection and maintenance visits will be kept to a minimum, using a minimal number of vehicles on each inspection and maintenance visit.

19.92. Although the sensitivity of the A846 was assessed as being high in Impact 19.4 the infrequency and likelihood of any disruption caused by the maintenance and operation phase of the Development the sensitivity of the receptor has been decreased to **medium** for this impact. Therefore with a **medium** sensitivity and a negligible magnitude the overall impact of disruption and congestion to important roads will be of **negligible** significance.

MITIGATION IN RELATION TO IMPACT 19.6
• No mitigation required

Residual impact:

19.93. As no mitigation measures are required, the impact will remain of **negligible** significant effect.

19.4.4 Potential Impacts during decommissioning Phase

19.94. The impacts during the decommissioning phase are expected to be the same as those during the construction phase; However, it is anticipated that the duration of decommissioning will be lower as some infrastructure will remain in place and will not require to be removed.

19.4.5 Cumulative effects

19.95. A planning assessment produced for the Scottish Government identified Bowmore on Western Islay as an area for small scale residential development (Scottish Government / Strategic Rail Authority 2005). Key impacts will occur during construction; however it is not expected that the residential development would be in construction during the construction phase of the tidal array. As the volume of traffic related to the Sound of Islay tidal array will be, at worst, low magnitude during operation it is not expected that it will impact cumulatively with any residential developments. As discussed previously, impacts during decommissioning must consider the traffic conditions at the time of decommissioning, the cumulative impacts with projects at that time must also be considered.

19.96. No other areas of Islay or Jura were identified for development.

19.5 Summary of effects

19.97. Table 19.7 below summarises the findings of the traffic and transport assessment.

Table 19.7 Impact Assessment Summary

Impact	Construction/Decommissioning				Operation/Maintenance			
	Magnitude of Impact	**Receptor Sensitivity/Value/Importance**	**Significance of effect**	**Residual Significance of effect**	**Magnitude of Impact**	**Receptor Sensitivity/Value/Importance**	**Significance of effect**	**Residual Significance of effect**
Disruption of the Islay to Jura Ferry	Low	High	Moderate	Minor				
Disruption of the Kennacraig to Islay Ferry service.	Minor	Medium	Minor	Minor Adverse				
Physical disruption and congestion to important roads					Negligible	Medium	Negligible	Negligible
Disruption of other marine traffic using the Sound	Low	Low	Negligible	Negligible	Low	Negligible	No significant effect	No significant effect
Increase road traffic resulting in congestion and degradation of roads	Low	High	Moderate	Minor	Low	Medium	Negligible	Negligible

Statement of Significance

19.98. It is anticipated that the proposed Development has the potential to cause impacts of major adverse significance to traffic and transport. Any disruption of crucial traffic links between Islay and Jura will result in the population of Jura becoming isolated. However mitigation measures to prevent this scenario can be implemented relatively easily, and, if implemented, will reduce the significance of the effect of the impacts to **minor** or **negligible**.

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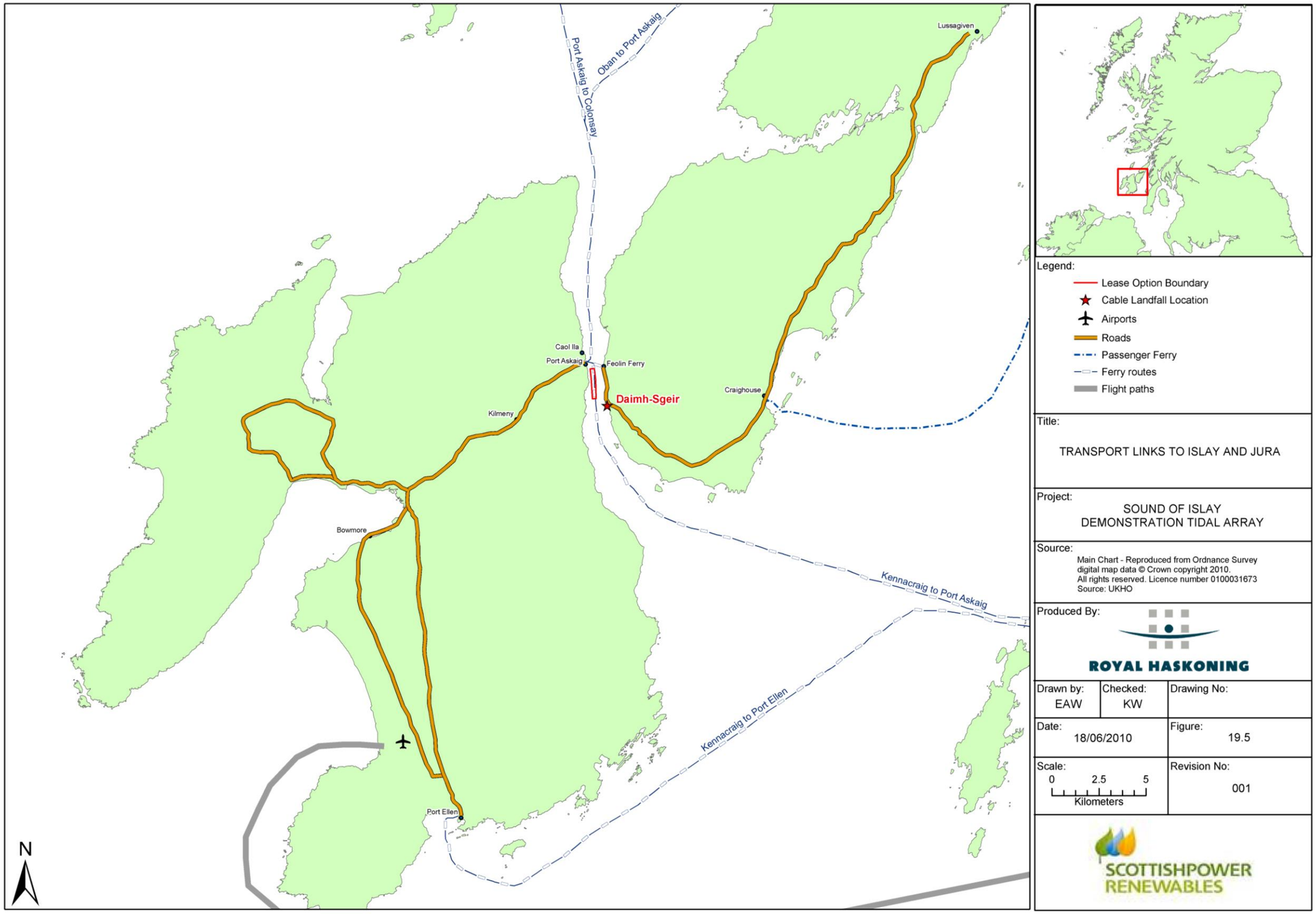

Figure 19.5 Transport Links to Islay and Jura

20. Socio-economics, Tourism and Recreation

20.1 Introduction

20.1. This chapter provides information on the potential socio-economic effects of the proposed Development. This includes possible implications of the project on existing employment, education, health, community, tourism and recreational activities on Islay and Jura and the surrounding seas.

20.2. The potential effects of the Development on these existing activities and conditions are then assessed in terms of their significance. Where required, mitigation measures are proposed in order to avoid or minimise any adverse effects.

20.3. ScottishPower Renewables (SPR) recognises the importance of the marine industry to local communities in both social and economic terms. Because of this, SPR ensured that they engaged early and actively with the Islay Energy Trust (IET), who are the local community energy organisation. This relationship, which has been formalised in a Memorandum of Understanding (MoU), has provided the Environmental Impact Assessment (EIA) process with strong links to key community stakeholders. This close relationship with the local community is an important part of the Sound of Islay Demonstration Tidal Array project.

Summary of Socio-economics, Tourism, Recreation and impacts:

The development of the array will bring with it **minor beneficial** socio-economic benefits. A small number of local jobs may be created along with a temporary increase in spend on local services during the construction of the project. There will also be ongoing spend on local services associated with operation and maintenance.

Tourism and recreation are vitally important to the economy and communities of Islay and Jura. Development of the tidal array is not expected to have any significant long term adverse effect on existing marine and coastal activities, or on visitor numbers / visitor experiences. Any negative effects will be short-term and experienced during the construction and decommissioning phases; they will be associated with the temporary displacement of activities across the array and onshore works sites. With completion of stated mitigation, the significance of effect is assessed to be at worst case **minor adverse** during construction and decommissioning and **negligible** during operation.

The proposed Development will create a new visitor attraction of Islay and Jura, increasing the islands' profiles for renewable energy with effects of **minor beneficial** significance to tourism and the local community.

The project will, on average, supply approximately the equivalent of Islay's electricity demand. SPR has an agreement with Diageo to supply electricity to three of their facilities on Islay; namely the distilleries at Caol Ila and Lagavulin and the malting at Port Ellen.

Potential Effects

20.4. The effects on landscape, seascape and visual amenity are discussed in *Chapter 17: Landscape and Visual*. The landscape, seascape and views around the Argyll and Bute coastline are intrinsic to the area's ability to attract tourists and visitors.

20.5. Installation activities (including onshore connections) may temporarily affect the general attractiveness of certain areas which could potentially affect visitor's perceptions and enjoyment of an area.

20.6. During installation of the array, access issues could arise where onshore movements of heavy construction plant may cause temporary congestion on narrow roads. Marine installation vessels could also disrupt sailing routes, fishing activities and other water sports. In the interests of efficiency and safety, installation activities may involve some restriction of public access to areas where construction is underway. Depending on location, this may affect sailing activities, diving, water sports and wildlife watching.

20.7. Visitors and local residents may be disturbed whilst participating in recreational activities (e.g. angling, walking, sailing, etc.) as a result of the noise generated during installation works.

20.8. Installation, maintenance and decommissioning of the array will make use of some local contractors based on Islay or Jura. The development is therefore likely to support local job creation.

20.9. Local businesses may benefit from increased local spend (e.g. accommodation, restaurants, shops, transport operators), particularly during the installation phase, but continuing through operation to decommissioning.

20.10. There is potential for the project to have a positive effect on tourism by becoming a tourist attraction. With increased awareness of climate change and the opportunities for gaining firsthand experience of the evolution of new technologies, the attraction of marine devices could be potentially high in the short-term.

20.11. Upgrading and strengthening of the electricity grid over Jura to the mainland may improve the security and stability of the electricity supply to Islay and Jura. However, this will depend on the work that the distribution and transmission operators require as part of the grid connection agreement.

20.12. SPR are working with IET to maximise the benefits of the project to the local community. This includes identification of opportunities for local employment as well as the options for financial benefits to the community during operation.

20.2 Methodology

20.4.1. Legislative Background

20.13. Statements of Scottish Government policy in the National Planning Framework (NPF), the Scottish Planning Policy (SPP), Designing Places and Circulars can be material considerations to be taken into account in development plans and development management decisions.

20.14. Certain elements of the SPP are particularly relevant to the proposed Development. The SPP recognises that the coast of Scotland is a major focus for economic activity, recreation and tourism, and that the sustainable development of coastal areas is an important contributor to sustainable economic growth. It also states that renewable energy generation will contribute to more secure and diverse energy supplies and support sustainable economic

growth. The SPP acknowledges that there is potential for communities and small businesses to invest in ownership of renewable energy projects.

20.15. The Scottish Government Economic Strategy sees the 'green' economy as being central to the growth of Scotland's economy. This includes the start up and growth of Scottish business, encouraging and supporting key manufacturing industries and supporting innovation and technology transfer to grow high value and high skills businesses with the potential for expansion. 'Going for Green Growth: a Green Jobs Strategy for Scotland' sets out how this priority should be delivered through sustainable economic development.

20.16. The Scottish Government believe that a thriving renewables industry in Scotland has the potential to develop new indigenous industries, particularly in rural areas; to provide significant export opportunities and to enhance Scotland's manufacturing capacity. The planning system has a key role in supporting Scotland's economic competitiveness and employment market. The scope for developments to contribute to national or local economic development priorities should be a material consideration when considering policies and decisions.

20.17. This policy context indicates that the scope of socio-economic assessment for the development of the proposed tidal array should focus on the potential for the development to contribute to sustainable economic development.

20.4.2. Consultation

20.18. The Scottish Government's response to the SPR request for a Scoping Opinion stated that the Environmental Statement (ES) should include relevant economic information connected with the project, including the potential number of jobs, and economic activity associated with the procurement, construction, operation and decommissioning of the development.

20.4.3. Data Sources

20.19. SPR has a collaborative agreement with IET, a local community organisation and employs a Tidal Energy Project Officer. This collaboration has enabled the project to actively engage with key stakeholders and investigate the potential impacts of the project.

20.20. In light of the nature of the Development (i.e. devices are sub-surface and at a depth that will not result in any interaction with marine vessels, onshore infrastructure is minimal) no specific surveys have been undertaken in relation to the potential effects of the development on tourism and recreation. Given the availability of published data, no specific survey was undertaken in relation to the potential effects of the Development on socio-economics.

20.21. A desk-based assessment has been carried out to establish the baseline for socio-economic, tourism and recreation for the project area, and to assess potential impacts resulting from project construction, operation, maintenance and decommissioning, using information drawn from available literature and data. Key information sources include:

- Office for National Statistics;
- Argyll Renewables Communities commissioned study relating to the socio-economic effects of proposed Argyll offshore wind farms (ARC, 2010);
- VisitScotland Research Statistics;
- Marine and Coastal Visitor Management, Public Engagement and Interpretation in Argyll and the Islands: the way forward (Benfield and McConnell, 2007);
- Review of Marine and Coastal Recreation in Scotland (Land Use Consultants, 2006); and
- Scottish Marine Renewables SEA – Tourism and Recreation (Scottish Executive, 2007).

20.22. Part of the role of the IET Project Officer has been to consult with local stakeholders including the Islay and Jura Community Councils. This work has been ongoing since April 2009.

20.3 Assessment of Significance

20.23. The broad methodology used for determining impact significance is outlined in *Chapter 2: Scoping and Assessment Methodology*. The significance of the effect is assessed on the basis of both the magnitude of the impact (Table 20.1) and the sensitivity of the receptor (Table 20.2). Also to be taken into account when making the assessment is the potential for impact occurring.

Table 20.1 Magnitude of Impact

Magnitude of Impact	Description
High	A fundamental change to the baseline condition of socio-economics and/or tourism and/or recreation.
Medium	A detectible change resulting in the non-fundamental temporary or permanent condition of socio-economics and/or tourism and/or recreation.
Low	A minor change to the baseline condition of socio-economics and/or tourism and/or recreation (or a change that is temporary in nature).
Negligible	An imperceptible and/or no change to the baseline condition of socio-economics and/or tourism and/or recreation.

Table 20.2 Sensitivity/value of the receptor (adapted from significance criteria outlined in the Scottish Executive Marine Renewables SEA (Scottish Executive, 2007).

Receptor Sensitivity/value	Description
High	Environment is subject to major change(s) due to impact. For example the loss of an attribute(s) in its entirety or significant loss of the quality or integrity of an attribute(s) which would have a long term or lasting, damaging effects on the tourist industry and recreation. This would imply a substantial reduction in the number of people participating in an activity and have resultant effects on local business.
Medium	Environment clearly responds to effect(s) in quantifiable and/or qualifiable manner. For example the loss of part of an attribute(s) or loss of the quality or integrity of an attribute(s) which would have an effect on the tourist industry and recreation. This would imply a reduction in the number of people participating in an activity and resultant effects on local business.
Low	Environment responds in minimal way to effects such that only minor change(s) are detectable. For example a slight change to an attribute(s) or the quality or integrity of an attribute(s). Theses impacts are normally temporary or reversible and are unlikely to have effects on local businesses.
Negligible	Environment responds in minimal way to effect such that only very minor change(s) occur which may or may not be detectable, or no changes at all.

20.24. By combining the magnitude of the impact and the sensitivity of the receptor in a matrix (see Table 20.3) the final significance of the effect (prior to the implementation of mitigation measures) can be obtained. The level of significance will then be described as either 'major', 'moderate', 'minor' or 'negligible' based on the outcome of the impact matrix.

Table 20.3 Impact significance matrix

Magnitude of Impact	Receptor Sensitivity			
	Negligible	**Low**	**Medium**	**High**
High	No significant effect	Moderate	Major	Major
Medium	No significant effect	Minor	Moderate	Major
Low	No significant effect	Negligible	Minor	Moderate
Negligible	No significant effect	Negligible	Negligible	Minor

20.25. As is detailed in *Chapter 2: Scoping and Assessment Methodology* and Table 20.4 below, impacts can be either adverse (causing a negative change in the baseline conditions) or can be beneficial (causing a positive change in the baseline conditions). It will be made clear in the assessment of each impact as to whether the impact has been assessed to be adverse or beneficial.

Table 20.4 Terminology for classifying environmental impacts

Significance of impact	Definition
Major adverse	The impact gives rise to serious concern and should be considered unacceptable.
Moderate adverse	The impact gives rise to some concern but is likely to be tolerable depending on scale and duration.
Minor adverse	The impact is undesirable but of limited concern.
Negligible	The impact is not of concern.
No significant effect	There is an absence of one or more of the following: impact source, pathway or receptor.
Minor beneficial	The impact is of minor significance but has some environmental benefit.
Moderate beneficial	The impact provides some gain to the environment.
Major beneficial	The impact provides a significant positive gain.

20.26. In terms of effects on socio-economic attributes, potential impacts have been quantified where possible (e.g. number of jobs to be generated). Otherwise, impacts have again been assessed subjectively.

20.27. It should be noted that any residual effect (the effect after the implementation of mitigation) which remains at the level of 'Moderate' or 'Major' is still regarded by the EIA Regulations as being of significant effect.

20.4 Existing Environment

20.4.1. Socio-economics

Local Community

20.28. Islay and Jura lie within a region classified by Highlands and Islands Enterprise (HIE) as a fragile area, characterised by a history of population loss, low incomes, limited employment opportunities, poor infrastructure and remoteness (ARC, 2010).

20.29. The population for the combined area of Islay, Jura and Colonsay was 3,822 in 2008, an increase of 1.5% since 2001 as compared to a fall of almost 1% in Argyll and Bute as a whole (Office for National Statistics). This overall increase has been driven by a 20% increase in the pension age population but there has been an 11% fall in the number of children on the islands. The working age population has also fallen slightly by 1%.

20.30. The population of Islay, Jura and Colonsay is structured differently from that of Scotland. The islands have a smaller proportion of working age people between the ages of 20 and 34 which may be explained by the need to move to the mainland to study or in search of employment opportunities. The second main difference is the higher proportion of older people within the island's population which reflects the in-migration of people moving into the area for retirement or 'lifestyle' reasons. This is an on-going trend: in 2001, those of pension age made up 21.4% but this increased to 25.4% by 2008 while the proportion of the total population made up of children has fallen from 19.6% to 17.2% across the same period. The result of this 'top heavy' population is a dependency ratio which is slightly higher than the Argyll and Bute average and much higher than the dependency ratio for Scotland.

20.31. The main settlement on Islay is Bowmore with a population of around 1,000 while the main settlement on Jura is Craighouse (approximately 160 people).

20.32. The Scottish Index of Multiple Deprivation (SIMD) is the Scottish Government's official tool for identifying small area concentrations of multiple deprivations across Scotland. The SIMD does identify that Islay, Jura and Colonsay are more deprived than the Argyll and Bute average in terms of health and education and much more deprived in terms of the housing stock. It is also clear that Islay, Jura and Colonsay face serious issues in terms of access to services which is unsurprising given their geographic isolation (ARC, 2010).

20.33. The community on Islay is generally receptive to renewable energy proposals and have formed the Islay Energy Trust (IET), a community-owned company that aims to develop and operate renewable energy projects. IET is a member of the Argyll Renewables Communities (ARC) Consortium.

Industry and Employment

20.34. The pattern of employment in Argyll and Bute is different to the Scottish average by virtue of the rural nature of the area.

20.35. The Annual Business Inquiry reports that there were a total of 236 data units[1] across Islay, Jura and Colonsay in 2007. In absolute terms, the most important sectors were distribution, hotels and restaurants (67 units), followed by the public sector (32 units) and agriculture and fishing (30 units). Compared to Argyll and Bute and Scotland, a number of sectors are over-represented on the island economies of Islay, Jura and Colonsay: agriculture and fishing, transport and communications and manufacturing (principally due to the high number of whisky distilleries on Islay) have around double the proportional representation on the islands compared to the rest of Argyll and Bute and Scotland (ARC, 2010).

20.36. In terms of employment, Islay and Jura are characterised by high levels of self employment (with 15% of all 16 - 75 year olds on Islay and Jura and 24% on Colonsay reporting that they were self-employed in the 2001 census), above average levels of part time employment and below average levels of full time employment. Unemployment in Argyll and the Islands is cyclical, with rates rising in the winter months and falling in the summer season. This seasonality reflects the relative dominance of tourism and agriculture in the local economy. Earnings on the islands in general are lower than on the mainland.

20.37. There are several small businesses in the marine service sector on Islay and Jura that have the potential to develop based on the growing marine renewables sector in Argyll. This includes CD Campbell Marine Contracts who provide commercial diving and marine survey services and StormCats, Scotland's largest GRP (glass-reinforced plastic) manufacturer.

Valuing the Output of the Local Economy

20.38. Gross Value Added (GVA) comprises the difference between the value of goods and services produced and the cost of raw materials and other inputs used in production; it represents the difference between output and immediate consumption, and is principally made up of compensation paid to employees (largely salaries and other benefits) and profit. There are no published gross value added (GVA) figures for Islay, Jura and Colonsay. Published data is available for the NUTS[2] Level 3 geography which covers Lochaber, Skye and Lochalsh, Argyll and the Islands at a sectoral level. By applying the GVA per employee values from this geography to the number of employees in each sector on Islay and Jura, it is possible to estimate the GVA generated by the two island economies. The total GVA for Islay, Jura and Colonsay in 2007 was £46.1m; of which £35.5m was accounted for by the whisky industry (ARC, 2010).

20.4.2. Tourism and Recreation

20.39. Tourism is one of Scotland's largest business sectors with an estimated value of over £4 billion per annum to the Scottish economy (Scottish Executive, 2007). Scotland's coastline and islands play an influential role in attracting tourists and recreational users to the country through the provision of stunning scenery, wildlife, cultural assets and a wide range of organisations providing a variety of sports and activities.

20.40. Argyll and Bute's proximity to the central belt of Scotland makes it accessible to both UK and overseas visitors via the motorway network and international airports. Visitors to the region often partake in coastal recreational activities; the Argyll coast and islands is the region of Scotland deemed to be of greatest importance for coastal recreation (Land Use Consultants, 2006).

20.41. There are several ways for tourists to access Islay. The island has its own airport, Glenegedale Airport, on the south east of the island, with services to and from Glasgow. In addition, there are regular ferry services to Port Ellen and Port Askaig from Kennacraig on the Kintyre Peninsula. During the summer, the ferry to Port Askaig also runs on to Scalasaig on Colonsay and on to Oban. These services are run by Caledonian MacBrayne. There is also a ferry that runs from Port Askaig to Feolin on Jura. The small road from Port Askaig forms one of the few major transport links across the island. A new passenger ferry route opened in 2008 to link Craighouse on Jura with Tayvallich on the mainland, and operates during the summer months. The locations of these access routes are shown in *Chapter 19: Traffic and Transport* (Figure 19.5).

20.42. The main attractions on Islay and Jura are the whisky distilleries and wildlife, particularly the over-wintering geese. The year round accessibility to the distilleries and the presence of the geese during the winter months means that Islay gets a significant number of visitors year-round (Benfield and McConnell, 2007).

20.43. The scenic coastlines of Islay and Jura and their natural heritage are to a large extent the foundation of the local tourism, leisure and recreation industries. Local attractions and popular recreational activities include:

- **Wildlife and Nature**: Islay is a regular destination for botanists and birdwatchers. The RSPB Nature Reserve at Loch Gruinart, Bridgend had 11,000 visitors in 2007 (VisitScotland, 2009). The RSPB run guided walks for visitors at Loch Gruinart and The Oa on Islay and the Natural History Trust on Islay run family activities such as rock pooling and seashore visits. On the coastline of the Sound there are recognised wildlife watching viewpoints near Feolin Ferry on Jura and north of Bunnahabhain on Islay.

- **Distilleries**: There is one distillery located on Jura and eight distilleries located on Islay; two of these (Bunnahabhain and Caol Ila) are located adjacent to the Sound of Islay. The creation of both these distilleries led to the development of small communities where traditionally distillery workers and their families lived. Caol Ila, built in 1846, is situated close to the proposed scheme. According to the Argyll and Bute Structure Plan (2002) the distilleries on Islay contribute most significantly to the local tourism sector.

- **Walking**: South East Islay and Jura are regularly enjoyed by walkers. The South of Jura is designated a National Scenic Area (*Chapter 17: Landscape and Visual*) and includes the Paps of Jura approximately 6km from the Sound of Islay coastline. The Paps of Jura are a small mountain range including three major peaks which rise to 728m above sea level. The Islay Community Access Group was established in 2001 to provide a link between land managers and the general public in parts of Islay where there was the possibility of conflict between the two. Several access routes have been created across Islay, with one forming a loop through woodland and on good surfaces from Ballygrant to Port Askaig via the Lily Loch (Figure 20.1). Local footpaths also exist over the cliff tops

[1] Data (or local) units do not readily correspond to the commonly used terms firms, companies or businesses by which employers are sometimes identified. They are roughly equivalent to workplaces but because of the way the data are collected two or more units can be present in the same workplace. For example, a bank may have several branches and offices in a city, each one of these would be counted as a separate data unit.

[2] In order to enable the collecting, compiling and disseminating of harmonised regional statistics, the EU has introduced the NUTS classification. The NUTS level to which an administrative unit belongs is determined on the basis of population thresholds (NUTS level 3 equates to a minimum population of 150,000 and maximum of 800,000.

between Port Askaig and Caol Ila Distillery (Figure 20.1), enabling walkers to access between the two places without having to take the long detour around the established road network. These footpaths are also popular with dog walkers and the local community. Several adventure races also take place annually on Islay and Jura, including the Isle of Jura Fell Race, the Islay Half Marathon and an ultra marathon.

- **Watersports**: Port Ellen provides 20 berths for recreational vessels, with peak activity over the summer. The islands are popular for canoeing, sea kayaking, fishing, wind surfing and surfing. The RYA has a number of identified cruising routes around Islay (including the Sound of Islay) which are popular during the summer months. The main cruising routes are shown in Figure 20.1 and there are several anchorages in the Sound (RYA, 2008). The Sound itself is classed by the RYA as being of 'light recreation use' (RYA, 2008). The Sound is not recommended for anchorage except during fine weather in the summer as the tidal streams are strong and the bottom of gravel, rock and shells encumbered with long seaweed is very uneven and is not good holding ground. Admiralty Chart 2481 identifies anchorages at McDougall's Bay, Whitefarland Bay and Bunnahabhain Bay within the Sound (see Figure 20.1); however these are not recommended by the RYA in their routing system (Navigation Safety Risk Assessment, Appendix 19.1).

- **Diving**: There are some interesting diving sites around Islay including the MV Wyre Majestic, close to the Bunnahabhain distillery in the Sound of Islay, with drift diving also taking place in the Sound's strong currents. A dive at 'Port Askaig Deeps' is situated within the proposed Development site (Navigational Safety Risk Assessment, Appendix 19.1). Other sites are situated around the south and west of the island (Figure 20.1).

- **Cycling**: There are a number of cycle routes which link the main settlements and distilleries, with cycle touring becoming increasingly popular. Bicycle hire is available at Port Charlotte, Port Ellen, Port Askaig and in the Bowmore post office. Routes used by cyclists are shown alongside the footpaths on Figure 20.1.

- **Stalking**: Approximately 6000 deer are present on the Isle of Jura (www.juradevelopment.co.uk) and stalking is an important activity on the island.

20.44. Several annual festivals on Islay and Jura attract visitors, especially the Islay Festival of Malt and Music, which is held annually in May and brings many people to the island (www.islayinfo.com). Further events such as the Walk Islay walking festival, the local Mod (a Gaelic festival), Beach Rugby, the Jazz Festival and the Jura Music Festival, continue throughout the year.

20.45. There are a number of marine based tourism interests in the area. Table 20.5 identifies the marine tourism related companies operating from the Isles of Colonsay, Jura and Islay. In addition several other operators based in Kerrera, Ardfern, Craobh Haven, Connel, Crinan and Oban include trips to Jura and Islay within their services.

Table 20.5 Marine tourism based on Islay and Jura (Source: Benfield and McConnell, 2007).

Island	Port	Company	Activities
Islay	Port Charlotte	Islay Birding	Wildlife and bird activities
	Port Askaig	Islay Marine Charters	Private charter vessel for sea-angling and wildlife tours
	Port Ellen	Islay Sea Safari	Marine wildlife tours
	Port Ellen	Islay Dive Centre	Diving
Mainland	Tayvallich	Venture West	Private charter vessel for scenic and wildlife tours
Isle of Jura	Ardlussa	Isle of Jura Exploration	Guided wildlife and scenic walks

20.5 Assessment of Impacts and Mitigation

20.5.1. Do Nothing Scenario

20.46. This section addresses the 'Do Nothing' scenario (i.e. what impacts and changes to these activities would be expected if the proposed scheme does not go ahead) in relation to recreation, tourism and socio-economics.

20.47. It is considered that if the array was not installed, the current economies of tourism, agriculture, fishing and whisky would remain as the main industries in Islay. These industries sustain the local population. Should the proposed scheme not go ahead it is envisaged these industries would continue to maintain the islands sustainable growth.

20.48. Similarly, if the array was not installed, there would be no anticipated change in tourism and recreational activity.

20.5.2. Potential Impacts during Construction Phase

Impact 20.1: Direct Capital Expenditure (Manufacture and Assembly)

20.49. The proposed development is a major undertaking, with substantial total capital costs expected to be in excess of £40 million. The manufacture of the sub-structures requires substantial infrastructure and many of the parts for the nacelles (turbines, gearboxes etc.) will require specialised suppliers. Argyll has been involved in the manufacture of onshore wind farms and is in the process of developing the major infrastructure for offshore wind farm manufacture. As such there are opportunities for manufacturing capital expenditure to benefit the Argyll region. Therefore the pressure of this impact can be considered to be of a medium magnitude.

20.50. Assembly of the nacelles will require substantial onshore infrastructure but the final assembly of the blades to the nacelles may be done close to the project site. Whilst this is likely to be mainly carried out by specialist contractors there may be opportunities for local businesses to be involved.

20.51. There is an opportunity for at least some of the manufacturing to be carried out in Argyll. Therefore the sensitivity of socio-economics to this impact can be considered to be medium, and an impact of long term temporary **moderate beneficial** significance is anticipated.

MITIGATION IN RELATION TO IMPACT 20.1
• No mitigation required.

Residual Impacts

20.52. As No mitigation is required, the residual impact is expected to remain **moderate beneficial** significance.

Impact 20.2: Indirect Capital Expenditure (Marine Services and Onshore Construction)

20.53. It is believed that local marine contractors could benefit from contracts worth approximately £100k during installation with a further requirement for between two and four crew for a six month period for operation on work boats and guard boats.

20.54. It is estimated that the onshore construction phase will create employment for approximately four people for a three month period. It is also likely that the marine activities will create opportunities for people with local marine knowledge.

20.55. With continued provision of local logistical support from the Islay Energy Trust combined with the onshore and offshore contract work mentioned above, it is thought that the economic contribution to Islay and Jura of the construction phase would be approximately £400k. This will result in temporary detectable change in the socio-economics of the area and therefore this impact can be considered to be of medium impact.

20.56. The indirect effects of capital Expenditure are likely to be felt by a number of local businesses, and as there are only a small number of businesses on Islay and Jura the socio-economics in the area can be considered to be of medium sensitivity.

20.57. Therefore an impact of long term **moderate beneficial** significance is anticipated.

MITIGATION IN RELATION TO IMPACT 20.2
• No mitigation required

Residual Impacts

20.58. As no mitigation is required, the residual impact is expected to remain of **moderate beneficial** significance.

Impact 20.3: Indirect Economic Benefits (Employment, Accommodation and Services)

20.59. The Development will be the first commercial tidal array in the world and therefore the first stepping stone on the road to a green economy. Scottish Government (Marine Energy Group, 2009) figures state that marine renewables could support over 12,000 jobs and be worth £2.5 billion to the economy by 2020. This Development is envisaged as the first important step to achieving that goal.

20.60. A number of specific employment opportunities will be created by the project, including:

- Project Officer - One full time local job has already been created with the appointment of the Tidal Project Development Officer at Islay Energy Trust; and
- Survey Work – Local employment has been used for seabed, ornithological and archaeological surveys. Local boats and crew are being used wherever possible and this will continue throughout the project.

20.61. Construction workers employed by the project will spend up to six months on Islay and Jura, depending on the type of vessels used for installation. These workers will use local travel facilities (e.g. hire cars), accommodation, restaurants and shops. As a result, local spend will increase on a temporary basis. The project will continue to benefit the local economy through indirect spend on accommodation, food and sundries.

- Accommodation – The project involves relatively large numbers of overnight visits from the mainland thus helping the accommodation industry on Islay. During development, it is estimated that £8,000 has been spent on accommodation and that approximately £20,000 will be spent during installation;
- Food – It is estimated that over £2,000 has been spent in local shops during development and that over £8,000 will be spent during installation; and
- Equipment – Local shops have benefited from sale of equipment and sundries to the project team and this will continue.

In total it is thought that provision of services to the construction teams would be worth approximately £50k.

20.62. Accommodation is in short supply during the summer months and it is important that a short term increase in demand from construction workers does not damage the longer term demand for holiday accommodation. Consultation with the local marketing board will be important to ensure that this opportunity is maximised.

20.63. The short term benefits to socio-economics in the area caused by the Development may therefore be neutralised by longer term adverse effects on tourism and recreation which will as a consequence have knock-on effects to socio-economics. Consequently this impact can be considered to have a **l**ow magnitude.

20.64. As employment on Islay and Jura is limited the socio-economics can be described as being of medium sensitivity.

20.65. Therefore the increased employment opportunities and the increased local spend overall will be of **minor beneficial** significance.

MITIGATION IN RELATION TO IMPACT 20.3
• No mitigation required

Residual Impacts

20.66. As no mitigation is required, impacts will remain of **minor beneficial** significance in the short term.

Impact 20.4: Disturbance to Tourism and Recreational Activity

20.67. Noise generated during the installation of the marine devices will potentially have direct and indirect effects on recreation and tourism, although the effects will only be short term. The main sources of construction noise include:

- Vessels;
- Movement of machinery/device components;
- Installation of machinery/device components; and
- Installation of onshore infrastructure e.g. the local substation.

The main direct effects of installation noise is related to general disturbance that will be experienced by visitors to coastal attractions/locations e.g. distilleries and coastal paths, and participants in key coastal and marine recreational activities. Installation noise may have adverse effects on the breeding, feeding and migratory patterns of marine wildlife and

seabirds, leading to their displacement or avoidance of areas. For an in-depth assessment of this topic, see *Chapter 14*: *Ornithology*. This could potentially have an indirect effect on the marine wildlife watching industry and bird watchers.

20.68. Disturbance will be short-lived and given that no particularly noisy works (e.g. piling) are to be undertaken, effects will be confined to small areas around works sites at Daimh-sgeir on Jura and along the proposed cable route, neither of which are areas specifically identified as wildlife watching locations. The storage of dumb barges at Caol Ila is not anticipated to impede industrial or tourism activities at Caol Ila Distillery. As such, the pressure of the impact is anticipated to be of a low magnitude.

20.69. There will be disruptions to tourists and visitors travelling along the A468 from / to Feolin on the Isle of Jura during construction. An impact assessment and mitigation for this is provided in *Chapter 19*: *Traffic and Transport*. As this is a lifeline road link for the island, a Traffic Management Plan will be implemented prior to and during construction to maintain access and therefore to minimise disruptions to tourists visiting Jura's attractions, such as the Jura Distillery. The Traffic Management Plan will also take account of large events on Jura including the Isle of Jura Fell Race and the Jura Music Festival.

20.70. The islands of Islay, and in particular, Jura boast a relatively undisturbed natural environment which is relatively unspoilt by anthropogenic activity. This asset brings many visitors to the area and is driving factor for the tourism and recreation industry which also provides socioeconomic benefits. Although impacts will be limited in scale (both temporal and spatial) the receptor (socio-economics, tourism and recreation) can be considered to be of medium sensitivity.

20.71. Therefore the overall impact of the disturbance to recreational activity and the knock-on effects of this are considered to be of **minor adverse** significance.

MITIGATION IN RELATION TO IMPACT 20.4
• Installation will be designed to minimise unnecessary noise. • See *Chapter 10*: *Noise and Vibration Affecting Human Receptors* and *Chapter 14: Ornithology* for further details. • Adherence to Traffic Management Plan and mitigation laid out in *Chapter 19*: *Traffic and Transport*, including consideration of large Jura public events.

Residual impact

20.72. Assuming mitigation is in place, disturbance of recreational activity will be of **negligible** significant effect.

Impact 20.5: Displacement of Tourism and Recreational Activity

20.73. In the interests of efficiency and safety, installation activities may involve some restriction of public access to areas where construction is underway. This may displace sailing and activity within the footprint of the tidal array, or coastal activities (walking, wildlife watching, cycling) around landfall/onshore works.

20.74. Divers will not be able to access the deep dive at Port Askaig Deeps during construction and operation for health and safety reasons (Appendix 19.1).

20.75. There will also be temporary increases in shipping movement within the Sound of Islay associated with construction, which again may displace sailing. Any disruption to the passenger ferries, particularly those operating between Port Askaig and Feolin, and Port Askaig and Kennacraig will be an inconvenience to tourism accessing the islands and their associated tourist attractions, including local distilleries. A full assessment of the impacts to ferries and the associated mitigation is provided in *Chapter 19:* Traffic and *Transport,* with reference to the Navigational Safety Risk Assessment in Appendix 19.1. This will be a temporary change and it is only expected to create minor changes to the baseline conditions. Consequently the magnitude of this impact will be medium.

20.76. Existing activity within the direct footprint of the array and of the onshore works is limited and it is not expected that construction will entirely prevent any activity from taking place, but rather displace it temporarily (e.g. recreational vessels will still be able to transit the Sound of Islay, but may need to set a slightly different course). Furthermore, displacement will only last for the duration of works. The sensitivity of the receptor can therefore be considered to be medium. As a result of these short term temporary effects the impact is considered to be of **moderate adverse** significance.

MITIGATION IN RELATION TO IMPACT 20.5
• The array will be appropriately charted as an underwater obstruction and annotated, as discussed further in the Navigational Safety Risk Assessment. • The array will also be charted as a 'no fishing' and 'no diving' area and consultation will continue with relevant diving organisations. • During construction activities the following safety procedures will be implemented: • Notice of the activities would be promulgated through the UKHO Maritime Safety Information system (i.e. Notices to Mariners (NMs) and Radio Navigational Warnings (NavWarns/WZs)) and will occur just prior to and during the maintenance works • Installation vessels will comply with the COLREGS in that they would display the appropriate lights and marks for vessels engaged in such activities • Presence on site of manned vessels capable of monitoring and advising the other marine traffic using the Sound of Islay, • The Navigational Safety Risk Assessment has been undertaken (Appendix 19.1) and identifies management of potential conflict with ferry routes. Further mitigation is discussed in *Chapter 19*: *Traffic and Transport.*

Residual Impacts

20.77. The level of publicity and consultation carried out to date is likely to have raised the project profile significantly around Islay and Jura; therefore it is considered that the significance of risk of negative interaction between construction vessels and tourism and recreation stakeholders is **minor adverse**.

20.5.3. Potential Impacts during Operational/Maintenance Phase

Impact 20.6: *Creation of a Visitor Attraction*

20.78. There is potential that the array could have positive effect on recreation and tourism by becoming a key visitor attraction. With increased awareness of climate change and the opportunities for gaining first hand experience of the evolution of new technologies, the

attraction of marine devices could be potentially high. Interest may decrease as wave and tidal power become more commonplace.

20.79. As the first commercial tidal array in the world, the Development will be subject to significant press coverage and the profile of Islay is expected to benefit from being broadcast widely among many organisations within and beyond the UK.

20.80. Islay is already home to the world's first commercial wave generator (Wavegen's "Limpet" at Portnahaven) and the tidal project will enhance Islay's reputation as a flagship for marine energy exploitation in Scotland.

20.81. The project is expected to be the first operational tidal array site in the world but since the devices will not be visible to land-based observers, the level of attraction will depend on the provision of good quality interpretative materials in the vicinity of the site. The project's role as a tourist attraction will be of a low magnitude and the receptor (tourism and recreation) of a medium sensitivity resulting the impact being of **minor beneficial** significance.

MITIGATION IN RELATION TO IMPACT 20.6
• SPR have worked extensively, and will continue to work to raise the profile of the project and demonstrate the benefits of tidal energy. • SPR will work with the Islay Energy Trust to develop and promote good quality interpretative materials to encourage interest and understanding of tidal energy. • It is likely an onshore information centre will be provided to inform tourists, visitors and the local community on the proposed Development through interpretation boards etc.

Residual Impacts

20.82. Residual impacts will remain **minor beneficial**.

Impact 20.7: Displacement of Tourism and Recreational Activity

20.83. During operation the Development is not expected to impede tourists travelling across Islay or Jura or restrict their access to tourism facilities such as the local distilleries.

20.84. The minimum depth of the turbine tips will be 15m below the surface. This depth is well below the keel depth of any pleasure or commercial craft and is not expected to impact recreational sailing however vessels are likely to avoid passing directly above the turbines. Depths of 15m are within the average swimming depth for recreational SCUBA divers and a deep dive is currently situated within the proposed Development area. There is also potential that sea anglers may fish in the Sound, therefore there is a minor risk that angling equipment may get caught on the devices. The magnitude of this impact is considered to be low and the sensitivity of the receptor medium. Therefore operational effects on marine users are considered to be of long term **minor adverse** significance.

MITIGATION IN RELATION TO IMPACT 20.7
• Each sub-array to be charted as an "underwater obstruction" providing the least depth of each sub-array using International Symbol L21 or L24. • Application should be made for the area containing the array to be designated and charted as a "No Fishing (Int Symbol N21) and No Diving" area. • Consultation will continue with relevant diving associations. • As a safety precaution Hammerfest Strom are fitting rope cutters on the devices to prevent entanglement of fishing gear.

Residual Impacts

20.85. It is predicted that the interference with sailing, boating, and other recreational activities in the Sound, will be of **negligible** significant effect once the array is in place.

Impact 20.8: Effects on Employment

20.86. The IET Project Officer will remain in employment until the completion of the installation. During the operational phase, the IET will provide logistic and administrative support for ongoing maintenance. This is likely to be a part-time role.

20.87. There will be employment opportunities associated with maintenance of the array components, both on and offshore. In some cases local contractors may be employed to undertake non-specialist works. This is not likely to alter the base line condition dramatically (and therefore magnitude of pressure is low), however, given that there is limited employment in the area and the extra employment will be quantifiable the receptor can be considered to be of medium sensitivity.

20.88. As such, the effect on employment will be long term and of **minor beneficial** significance.

MITIGATION IN RELATION TO IMPACT 20.8
• No mitigation required

Residual Impacts

20.89. As no mitigation is required, it is predicted that any long term benefits for employment will be of **minor beneficial effect**.

Impact 20.9: Community Benefits

20.90. SPR is working with IET to maximise the potential benefits to the local community. This includes indentifying opportunities for local businesses and liaising with stakeholders to minimise the impacts.

20.91. IET currently employs a full-time Project Officer and this role would continue throughout the development and construction phases.

20.92. SPR is in discussions with the IET regarding direct financial support to a trust fund that would be invested back in the community.

20.93. The project will supply approximately the equivalent of Islay's electricity demand (on average). SPR has an agreement with Diageo to supply electricity to three of their distilleries on the island - Caol Ila, Lagavulin and Port Ellen.

20.94. Consequently, the significance of effect of community benefits is assessed to be long term **minor beneficial**.

MITIGATION IN RELATION TO IMPACT 20.9
• No mitigation required

Residual Impacts

20.95. As no mitigation is required, it is predicted that long term community benefits will be of **minor beneficial** significant effect.

20.5.4. Potential Impacts during the Decommissioning Phase

20.96. During decommissioning there will be similar impacts to those outlined during the construction phase, albeit on a smaller scale. The decommissioned project is expected to have no significant effect on tourism, recreation or socio-economic conditions following adherence to Traffic Management Plans and Navigational Safety Risk Assessments.

20.5.5. Cumulative Impacts

20.97. As no further activities are currently scheduled for the Sound of Islay there are no anticipated adverse cumulative effects.

20.98. Beneficial cumulative effects may be experienced with other renewables developments around Islay (e.g. proposed offshore wind farms and the tidal park proposed by DP Energy), with opportunities for employment and other community benefits.

20.6 Summary of effects

Table 20.6 Impact assessment summary								
Impact	**Construction/Decommissioning**				**Operation and Maintenance**			
	Magnitude	**Value/ significance**	**Impact**	**Residual impact**	**Magnitude**	**Value/ significance**	**Impact**	**Residual impact**
Direct capital expenditure (manufacture and assembly)	Medium	Low	Moderate beneficial	Minor beneficial				
Indirect capital expenditure (marine services and onshore construction)	Medium	Medium	Moderate beneficial	Minor beneficial				
Indirect economic benefits (employment, accommodation and services)	Low	Medium	Minor beneficial	Minor beneficial				
Disturbance to tourism and recreational activity	Low	Medium	Minor adverse	Negligible				
Displacement of tourism and recreational activity	Medium	Low	Moderate adverse	Minor adverse	Low	Medium	Minor adverse	Negligible
Creation of a tourist attraction					Low	Medium	Minor beneficial	Minor beneficial
Effects on employment					Low	Medium	Minor beneficial	Minor beneficial
Community benefits					Low	Medium	Minor beneficial	Minor beneficial

20.7 Conclusions

20.99. The development of the array will bring with it **minor beneficial** socio-economic benefits. A small number of local jobs may be created along with a temporary increase in spend on local services during the construction of the project. There will also be ongoing spend on local services associated with operation and maintenance. **beneficial**

20.100. Tourism and recreation are both vitally important to the economy and communities of Islay and Jura. Development of the tidal array is not expected to have any significant long term adverse effect on existing marine and coastal activities, or on visitor numbers / visitor experiences. Any negative effects will be short-term and experienced only during the construction phase; they will be associated with the temporary displacement of activities across the array and onshore works sites, and disturbance to access for tourists travelling along the A846 on Jura. With completion of stated mitigation, the significance of effect is assessed to be **minor adverse** during construction and **negligible** during operation.

20.101. The proposed Development will create a new visitor attraction of Islay and Jura, increasing the islands' profiles for renewable energy and wet renewables development with effects of **minor beneficial** significance to tourism and the local community.

20.102. The project will, on average, supply approximately the equivalent of Islay's electricity demand. SPR has an agreement with Diageo to supply electricity to three of their facilities on Islay; namely the distilleries at Caol Ila and Lagavulin and the maltings at Port Ellen.

20.8 References

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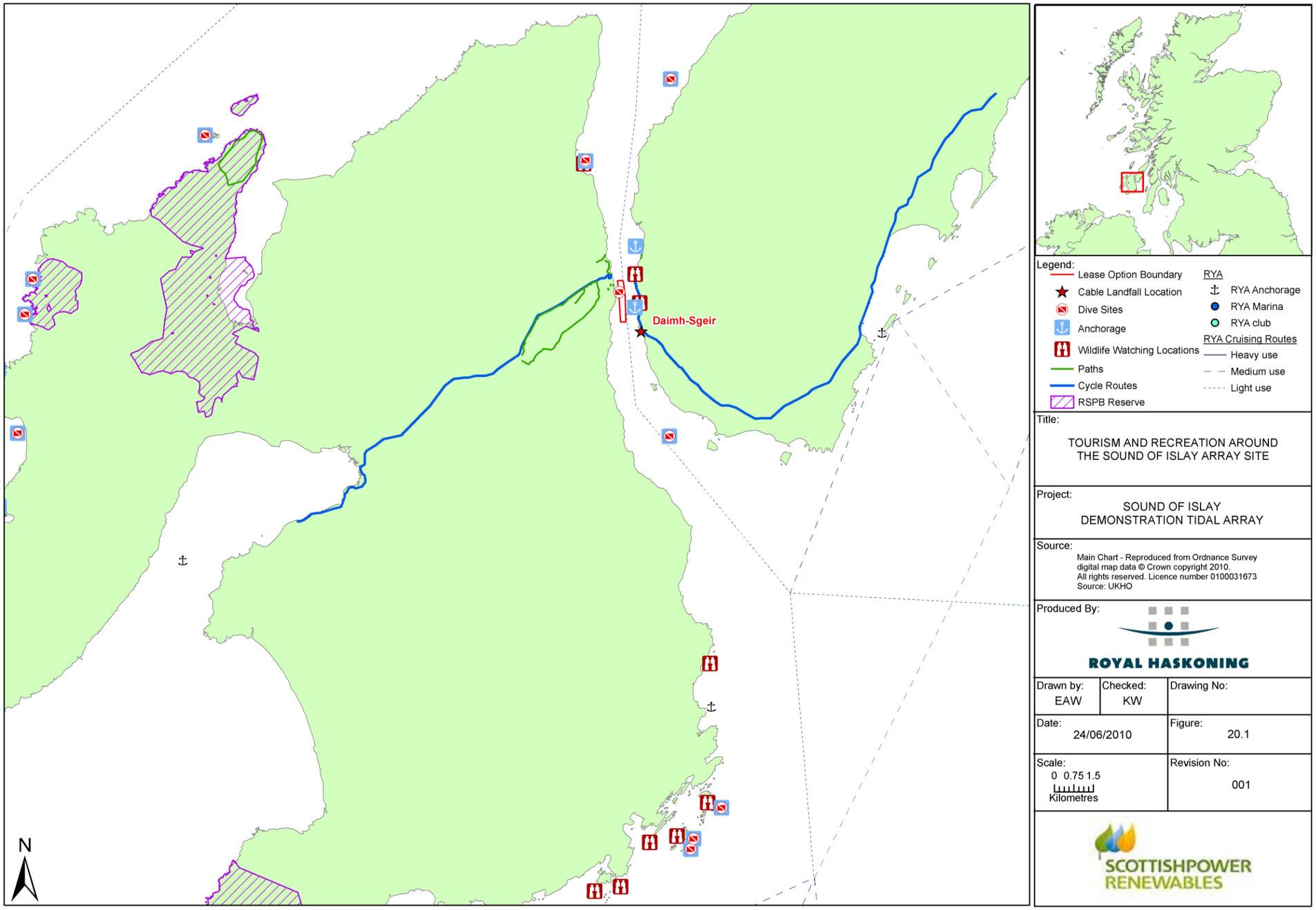

Figure 20.1 Tourism and recreation around the Sound of Islay array site.

21.0 Water and Sediment Quality

21.1 Introduction

21.1. This chapter identifies the water and sediment quality characteristics of the Development and assesses the impacts associated with the proposal, including cable route and inter-array cables.

21.2 Potential Effects

21.2. Potential impacts on sediment quality were deemed to be unlikely and of negligible significance during the Scoping phase. In addition to the limited physical disturbance to the seabed caused by the installation and operation of the array, the proposed location of the turbines is also within a high energy sedimentary substrate (mainly gravel and boulder seabed), with negligible anthropogenic inputs.

21.3. The cable route is considered to have limited potential to alter sediment quality as the proposed methodology for cable installation, (i.e. laying armoured cables directly onto the seabed) will result in minimal disturbance to substrate and sediments.

21.4. The magnitude of impacts on water and sediment quality during construction, operation (including maintenance) and decommissioning are identified and evaluated, where appropriate, against guidance and thresholds from international and national directives and legislation. Where available, information collected as a result of various monitoring programmes is used to support the findings. The sensitivity/value/importance of the receptor (water and sediment quality) is then considered, and these results considered against the magnitude of impacts in order to ascertain the significance of effect of the impact on the receptor.

21.3 Summary

Water and sediment quality within the study area (defined as the entire sound) is considered to be good. It is also identified that there is a very low volume of sediment within the sound and, as such, limited sediment is available to be re-suspended. The effects of the proposed development on water and sediment quality are deemed to be of **minor** significance due to the limited footprint of the array and the methodology to be employed in installing and maintaining the devices during operation.

21.4 Methodology

21.4.1 Legislative Background

21.5. There are a number of legislation and guidance aimed at protecting and enhancing the water and sediment quality both at an international and national level. Those which are particularly relevant to water and sediment quality, and which the proposed development will take full consideration of, are summarised below.

Water Framework Directive

21.6. The Water Framework Directive (WFD) (2000/60/EEC), which came into force in 2000, establishes a legal framework for the protection, improvement and sustainable use of all water bodies. The aim of the WFD is to ensure that all water bodies are of 'good ecological status', or similar, by 2015. The WFD includes coastal waters within its scope, and in Scotland the ecological status of coastal waters must be considered out to 3 nautical miles from the shore. As such, the Sound of Islay waters are covered by WFD requirements as it is classified as a coastal water body. The Directive became law in Scotland through the Water Environment and Water Services (Scotland) Act 2003, which is enforced by the Scottish Environment Protection Agency (SEPA).

Marine Strategy Framework Directive

21.7. The Marine Strategy Framework Directive (MSFD) is yet to be transposed into UK legislation but is likely to come into force in July 2010. Provided that this is done, it will echo the requirements of the WFD, but in marine rather than fresh and transitional waters. The aim of the Directive is to achieve 'good environmental status' in Europe's seas by 2020. An initial assessment of UK waters will be completed by July 2012. A monitoring programme and marine strategies that protect and preserve the marine environment will subsequently be implemented.

Urban Waste Water Treatment Directive

21.8. The Urban Waste Water Treatment Directive (UWWTD) (91/271/EEC) will not have any implications for the development as the proposed array has no discharges and is not impacting upon any waste water systems within the sound.

Bathing Waters Directive

21.9. The Sound of Islay is not currently designated under Bathing Water Directive (76/160/EEC).

Shellfish Waters Directives

21.10. The Sound of Islay is not currently designated under the shellfish waters directive although there are a number of sites where shellfish are taken.

Food and Environment Protection Act

21.11. Scottish Ministers have a statutory duty to control, through the issue of licences, the deposit of articles or substances in the seas / tidal waters under powers conferred by Part II of the Food and Environment Protection Act 1985 (FEPA). The role of licensing authority is undertaken, on behalf of the Scottish Ministers, by Marine Scotland (formerly Fisheries Research Services (FRS)). FEPA provides the necessary statutory means to meet the UK's obligations under the Oslo and Paris Conventions for the protection of the marine environment of the North-East Atlantic (OSPAR) (1992) and London (1972) Conventions which address the prevention of marine pollution from dumping at sea. Marine construction activities and disposal of dredged material are controlled under FEPA, which will be controlled under the forthcoming Marine Licence (which Marine Scotland has indicated will be enforced from April 2011) under the Marine (Scotland) Act 2010.

Pollution Prevention Guidelines

21.12. Pollution Prevention Guidelines (PPGs) produced by the Environment Agency, Northern Ireland Environment Agency and SEPA outline statutory responsibilities and provide guidance on good practice to reduce pollution risk. A number of PPGs such as construction, waste and aquaculture are relevant to coastal and marine works.

21.4.2 Consultation

21.13. Initial consultation with statutory bodies and key stakeholders was undertaken by SPR via the following scoping document: 'Proposed Demonstration Tidal Site, Sound of Islay. Request for a Scoping Opinion' (ScottishPower Renewables, 2008). The responses made by SEPA and FRS (now Marine Scotland) are particularly relevant to this chapter.

21.14. Both SEPA and Marine Scotland have identified and confirmed the issues that they require to be addressed in the ES (with specific regard to this chapter), which include: pollution due to spill/leakage and pollution prevention, seabed contaminants and accidental release of contaminants, and effects on water quality.

21.4.3 Data Sources

21.15. The Sound of Islay is considered to be a 'coastal water' and is, therefore, captured in SEPA's coastal water quality monitoring and classification systems, which provide data to support the aims of the WFD. The latest results of monitoring and classification have been used to describe the existing water environment in the vicinity of the proposed development.

21.16. Available information on seabed sediment quality across the proposed development or in the wider Sound of Islay is limited, primarily as a result of there being no reason to suspect the presence of contaminants in this high energy and relatively undeveloped location. Some inference regarding surface sediment quality can be made on the basis of the nature of the sediments and the status of associated benthic communities. Further information on seabed sediment in the Sound can be found from BGS drift geology maps of the area which have been supported by specific geophysical surveys at the proposed array location. In addition to this, seabed data has been used from Mapping European Seabed Habitats (MESH) and EU SeaSed (Coring database from EUROCORE, EUMARSIN and EUROSEISMIC DATABASES) to provide more detail on sediments lying within the Sound itself.

21.17. Data was gathered from geophysical and benthic surveys completed for the Sound of Islay by SeaStar, IX Survey (IX) and Partrac, which were designed to assess the tidal resource and the benthic environment where the proposed development is to be placed. The SeaStar survey was designed to provide detailed information on the habitat and species at the proposed turbine array locations and gives an indication of sediment type and distribution in the proposed development. The other surveys (IX, Partrac 2009) focused on obtaining key geophysical data for the site including tidal velocity, turbulence and direction of flow in relation to the seabed contours of the site. Data has subsequently been used to consider the most efficient array layout for the turbines and to provide key information on bathymetry and wake interaction.

21.4.4 Assessment of significance

21.18. From the above, it is evident that the main impacts identified relate to the effects on water quality.

21.19. The approach to assessing the potential effects on water quality arising from the development is based on a comparison of the predicted changes to the relevant water quality parameters against the criteria established as environmental quality standards (EQS) within the relevant European Directives (discussed above in the Section 21.2.1 Legislative Background). Where EQS do not exist, the impact is assessed with reference to background conditions.

21.20. Impacts have been assessed in line with the guidance presented in *Chapter 2 Scoping, Assessment Methodology*. Impacts have been assigned a level of significance of effect (from major to negligible) as defined in Table 21.3. The assignment of significance includes consideration of the natural variability of the coastal and nearshore system and the inherent uncertainty within a dynamic environment. A qualitative impact assessment using expert judgement considers the likely significant effects of the development on water and sediment quality. Where applicable the qualitative assessment is backed up by the use of previously gathered empirical data alongside modelling completed as part of the resource assessment (as discussed previously within *Chapter 7 Physical Environment and Coastal Processes*) within the Sound.

21.21. Impact assessment is based on an assessment of the magnitude of the impact and the sensitivity/importance/value of the receptor. The criteria used to determine the magnitude of likely impacts and sensitivity/importance/value are described below in Tables 21.1 and 21.2 respectively.

Table 21.1: Example Definitions of Magnitude of Impact

Magnitude of Impact	Description of Magnitude
High	Prolonged / widespread disturbance or pollution of marine or coastal waters resulting in temporary or permanent consequential changes to water or sediment quality (as defined by toxicity level, time scale and persistency in the marine environment).
Medium	Short-term disturbance or pollution of marine or coastal waters resulting in temporary consequential changes to water and sediment quality.
Low	Detectable disturbance or pollution of section of marine or coastal waters of very short duration, but with no consequential changes to water or sediment quality.
Negligible	An imperceptible and/ or no change to the baseline water and sediment quality

Table 21.2 provides a framework for assessing the sensitivity/importance/value of the receptor.

Table 21.2: Sensitivity/Importance/Value of Water/Sedimentary Environment

Sensitivity/Importance/Value	Description
High	• Water body, or sites dependant on water body, designated under international or national legislation (e.g. Ramsar Sites, SPA, SAC, SSSI). • Water body, or sites dependant on water body, containing Habitats Directive Annex 1 water dependant habitats, or sites supporting populations of international important water dependant species. • Water body with "excellent [A] "water and sediment quality. • Water body has natural sedimentary regime with no

Table 21.2: Sensitivity/Importance/Value of Water/Sedimentary Environment	
Sensitivity/Importance/Value	**Description**
	anthropogenic controls to water or sediment quality. • Water body of significant recreational or amenity value.
Medium	• Water body with "good water" and sediment quality. • Water body has a semi-natural sedimentary regime. • Water body of moderate recreational or amenity value.
Low	• Locally designated sites of varied quality containing water or sediment dependant habitats/species. • Water body has an unnatural sedimentary/morphological regime. • Drainage channel or ditch with poor water and sediment quality. • Water body of low recreational or amenity value.
Negligible	• Undesignated sites of varied quality containing water dependant habitats/species. • Seriously polluted water and sedimentary system. • Water body of no recreational or amenity value.

21.22. Table 21.3 combines the assessment for the sensitivity/importance of a receptor (Table 21.2) with the potential impact magnitude (Table 21.1) to give an overall assessment of the environmental impact significance. Impacts can be either beneficial (positive) or adverse (negative). It should be noted that any residual effect (the effect after the implementation of mitigation) which remains at the level of 'Moderate' or 'Major' is still regarded by the EIA Regulations as being significant. Further detailed within in *Chapter 2: Scoping, Assessment Methodology*.

TABLE 21. 3 IMPACT SIGNIFICANCE MATRIX				
Magnitude of Impact	**Receptor Sensitivity**			
	Negligible	**Low**	**Medium**	**High**
High	No significant effect	Moderate	Major	Major
Medium	No significant effect	Minor	Moderate	Major
Low	No significant effect	Negligible	Minor	Moderate
Negligible	No significant effect	Negligible	Negligible	Minor

21.5 Baseline description

Coastal Water Classification

21.23. SEPA's water quality monitoring results indicate that marine and inshore water quality is generally good in Scotland, which largely reflects the dynamic oceanographic regime, and has been improving over the last decade (Faber Maunsell and Metoc Plc., 2007). Within the Sound of Islay, where tidal flows are strong and anthropogenic influences are limited, monitoring similarly indicates that water quality is good.

21.24. Scottish coastal waters are classified by SEPA using an ecological classification system with four quality classes. It is underpinned by regular monitoring of a range of biological and chemical parameters, and a consideration of aesthetics, hydrology and morphology.

21.25. The Sound of Islay was most recently classified in 2007 and achieved 'good [B]' overall status (on a scale that runs Excellent [A] / Good [B] / Unsatisfactory [C] / Seriously Polluted [D]). The classification is based on combined monitoring results from a number of locations (shown in Figure 21.1 below), details of which are provided below in Table 21.4. The most recent available set of full monitoring results comes from 2006. Results indicate that water quality in the Sound of Islay currently varies between 'excellent' and 'good'. Prior to 2003 'unsatisfactory' and 'seriously polluted' results were recorded within the Sound (Table 21.4) at Bunnahabhain and Caol Ila, mainly as a result of sampling being undertaken at distillery outfall points. Port Ellen, which lies outwith the sound of Islay, recorded results which are classified as "Unsatisfactory" as recently as 2006, this is due to the water quality being reduced by discharges from the distillery.

Table 21.4: Islay coastal monitoring locations – monitoring results 1996 – 2006. Data sourced from SEPA.

Location	Date First Classified	Stretch Length (km)	Stretch start	Stretch end	Overall Class										
					2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996
Sound of Islay															
Islay, Bunnahabhain	1996	0.6	NR 419735	NR 424732	**A**	A	A	B	B	B	D	D	D	D	D
Islay, Caol Ila/Port Askaig	2001	0.1	-	-	**A**	A	A	B	D	D	-	-	-	-	-
Islay, Caol Ila/Pt. Askaig	1996	0.8	NR 429703	NR 430695	**A**	A	A	A	A	A	C	C	C	C	C
Pt. Askaig, Islay	1996	0.6	NR 430695	NR 432689	**B**	B	B	B	B	B	B	B	B	B	B
South and west of Islay															
Ardbeg, Islay	1996	1.3	NR 418462	NR 407456	**B**	B	B	B	B	B	B	B	B	B	B
Bowmore, Islay	1996	2.2	NR 307599	NR 338605	**B**	B	B	B	B	B	B	B	B	B	B
Bridgend, Islay	1996	0.8	NR 335618	NR 330624	**B**	B	B	B	B	B	B	B	B	B	B
Islay, Bowmore	1996	0.3	NR 305597	NR 307599	**A**	A	A	C	C	C	C	C	C	C	C
Islay, Bruaichladdich	1996	1.1	NR 268615	NR 263605	**A**	A	A	B	B	B	D	D	D	D	D
Islay, Port Ellen	1996	1	NR 363447	NR 364452	**C**	C	C	C	C	C	C	C	C	C	C
Lagavullin, Islay	1996	1.3	NR 407456	NR 400453	**A**	A	A	B	B	B	D	D	D	D	D
Laphroaig, Islay	1996	1	NR 389448	NR 385450	**B**	B	B	B	B	B	B	B	B	B	B
Pt. Charlotte, Islay	1996	0.6	NR 257590	NR 253585	**B**	B	B	B	B	B	B	B	B	B	B
Pt. Charlotte, Islay	1996	0.3	NR 251580	NR 249575	**B**	B	B	B	B	B	B	B	B	B	B
Pt. Ellen, Islay	1996	1	NR 364452	NR 356457	**B**	B	B	B	B	B	B	B	B	B	B

21.26. No pressures on the water body were identified and the objective is for future classification under SEPA monitoring (in 2015, 2021 and 2027) to maintain good overall status. Table 21.5 provides an explanation of the parameters which are considered in order to determine if a water body is in 'good' status.

Table 21.5: Sound of Islay 2007 'good' classification descriptors

Parameter	Description
User-related condition	Fit for all defined uses
Aesthetic condition	Unpolluted but may show signs of contamination
Biological condition	Flora and fauna normal
Bacteriological condition	Likely to meet quality standards no less stringent that the mandatory standards for EC Designated shellfish and bathing waters
Chemical condition	

Discharges into the Sound of Islay

21.27. There are two whisky distilleries located on the east coast of Islay and they are both to the north of Port Askaig, overlooking the Sound of Islay. These are the Caol Ila and the Bunnahabhain distilleries (Undiscovered Scotland, Accessed 2010). The distilleries previously discharged water, cereal and yeast waste into the Sound of Islay via short pipeline outfalls. In order to meet the requirements of the UWWTD a longer discharge outfall from Caol Ila has been installed, which discharges into deeper waters of the Sound where tidal currents disperse effluent rapidly. Effluent from several other distilleries is tankered by road to the holding tank at Caol Ila, from where it is also discharged. Regular monitoring is being undertaken by SEPA to maintain licences to discharge under the Controlled Activity Regulations (CAR). This monitoring indicates that the distillery discharges are not adversely affecting the quality of coastal waters in the Sound of Islay.

21.28. In addition to the distillery outfalls, SEPA has confirmed that there are no other significant discharges in the area of the development. There are minor sewage discharges at Port Askaig, Bunnahabhain and Caol Ila which do not influence sediment or water quality within the Sound.

Designated Waters

21.29. The development site and wider Sound of Islay are not subject to any water quality designation (e.g. Shellfish Growing Water, Bathing Water). The nearest coastal or marine designated waters are located over 10km from the Development (Shellfish Growing Waters at Loch Gruinart and Small Isles Bay, Jura).

Sediment Quality

21.30. There are no known sources of seabed contamination within the Sound of Islay. The nearest potential source of contamination is the Port Ellen marine disposal site located off the south coast of Islay, which has historically received dredged silt and sand. The disposal site was last used in 2006 when 12,360m^3 of material (mostly sand) was deposited (Colin Megginson, Marine Scotland, pers. comm.). There is no evidence to suggest that material disposed of at this site has been transported to or settled in the Sound of Islay. Moreover, it is anticipated that strong tidal current flows within the Sound will have prevented deposition of fine material within the area of interest.

21.31. A description of substrate types provides some information on their potential to contain significant contaminant levels. For example, gravels (such as those found within the area of the proposed development) are less likely to contain high levels of contaminants as the majority of such contaminants adsorb preferentially to clay particles (i.e. fine sediment) (CIRIA, 2000), which are not present.

21.32. Available drop-down video survey data obtained during prefeasibility investigations (Maxwell *et al.*, 2008) indicates that the seabed in the vicinity of the array site is comprised variously of tideswept gravel, boulders and bedrock. For a more detailed description of seabed characteristics please refer to *Chapter 7: Physical Environment and Coastal Processes* and *Chapter 8: Benthic Ecology*. The nature of the substrate, combined with strong tidal current flows, means that it is considered unlikely that any contaminants will be encountered across the site. Seabed sediments are generally coarse gravel and clean.

21.6 Assessment of Effects and Mitigation

21.6.1 Do nothing scenario

21.33. Currently if the development does not proceed there would be minimal change to the water or sediment quality within the Sound of Islay. The current discharges and industries with the potential to discharge around the proposed development are closely monitored by SEPA and fall under EU legislation to improve water quality.

21.6.2 Potential Impacts during Construction Phase

Impact 21.1: Impacts due to accidental spillage of materials

21.34. There is potential for pollution from spills or leaks of fuel, oil and lubricants during construction and from construction materials that may enter the water column both from the array itself and from the vessels used. Contamination from accidental spillages is likely to enter the environment either through the dissolved phase or as low solubility, slick forming organics (Faber Maunsell and Metoc Plc., 2007).

21.35. The risk of pollution events will be minimised by following standard good practice, such as the Pollution Prevention Guidelines issued by SEPA (e.g. PPG 5: Works and maintenance in or near water). Additionally, any chemicals used during construction will require prior approval through the FEPA licensing process and any lubricants will be non toxic, biodegradable and capable of dispersal in seawater.

21.36. Installation contractors will put in place appropriate Site Environmental Management Plans and Pollution Control and Spillage Response Plans that will be agreed with the relevant statutory bodies prior to offshore construction activities commencing. These plans will act to reduce the potential for accidental pollution and in the unlikely event of a pollution incident, will ensure a rapid and appropriate response.

21.37. Given these management strategies and controls it is expected that even should a spill occur, its scale and the nature of the contaminant will result only in a temporary and localised impact of low magnitude to the receptor of medium value, resulting in the impact of

contamination by accidental spillages being of **minor** significance to water and sediment quality.

MITIGATION IN RELATION TO IMPACT 21.1
• No mitigation required

Residual Impacts

21.38. As no mitigation is required, the residual impact will remain of **minor** significance.

21.6.3 Potential Impacts during Operational Phase

Impact 21.2: Impacts due to accidental spillage of maintenance materials

21.39. During the operational phase of the development, the main potential impact on water quality is expected to result from accidental spillages of materials during maintenance of the turbines and array cables. As per potential impacts in the construction phase, contamination from accidental spillages is likely to enter the environment either through the dissolved phase or as low solubility, slick forming, organics (Faber Maunsell and Metoc Plc., 2007). Paints, resins and lubricants that have been selected for use in construction and during operation are low in Volatile Organic Compounds (VOCs), surface tolerant epoxy coatings that have low toxicity to the marine environment.

21.40. The unexpected nature of pollution incidents means that it is difficult to predict the probability of their occurrence or the scale of contaminant releases. However, given low levels of on-site activity, the risk of pollution during maintenance can be expected to be low.

21.41. Contractors will be required to adhere to standard good practice guidance such as CIRIA Guidance note C650 and SEPA PPG 5.

21.42. Any use and discharge of chemicals during maintenance will be subject to controls as part of consent requirements and it is expected that even should a spill occur, its scale and the nature of the contaminant will result only in a temporary, localised **low** magnitude effect to the **medium** value receptor, resulting in an impact of **minor** significance. In a high energy marine environment, contaminants can be expected to rapidly disperse.

MITIGATION IN RELATION TO IMPACT 21.2
• No mitigation required

Residual Impacts

21.43. As no mitigation is required, the residual impact will remain of **minor** significance.

21.6.4 Potential Impacts during Decommissioning Phase

21.44. The significance of effects for the decommissioning phase are expected to be the same as for the construction phase.

21.6.5 Cumulative Impacts

21.45. Although there are a number of ongoing local activities which may have localised and temporary effects on water quality in the Sound of Islay, such as discharges from distilleries and sea disposal at Port Ellen. The results from ongoing monitoring by SEPA, shown in Table 21.4 indicate that these are not currently adversely impacting water quality.

21.46. Current activities that may have an overlap with the Sound of Islay project are:

- Argyll Array Wind farm;
- Kintyre territorial Wind farm; and
- Further port development at Port Askaig
- DP Energy Tidal Farm Development

21.47. In the high energy, dispersive environment of the Sound, any temporary effects on water quality associated with the tidal array are not expected to act in combination with these existing activities to result in cumulative impacts. Each of these activities is located at considerable distance from the Development and is therefore considered of **negligible** significance.

21.48. That being the case, no mitigation is required, and as no mitigation is required, the significance of effect remains negligible.

21.7 Summary of effects

Table 21.6 Summary Table

Impact	Construction/Decommissioning				Operation/Maintenance			
	Magnitude	Receptor Sensitivity	Significance level	Residual impact	Magnitude	Receptor Sensitivity	Significance level	Residual impact
Impacts due to accidental spillage of materials	Low	Medium	Minor	Minor				
Impacts due to accidental spillage of maintenance materials					Low	Medium	Minor	Minor

21.8 Statement of Significance

21.49. Monitoring data indicate that water quality in the Sound of Islay is generally good, and the high energy nature of the marine environment means that any anthropogenic discharges into the Sound are readily dispersed. Installation of the tidal array may impact water quality as a result of re-suspension of seabed sediments and/or accidental spillages of materials (fuels, oils, and lubricants) used during installation, maintenance and decommissioning.

21.50. Seabed sediments across the array site are coarse and in places bedrock is exposed. Coarse sediments will not be readily suspended in the water column and when disturbed by seabed works will only be transported short distances before being re-deposited. As a result there are not expected to be any significant effects on water quality associated with increased suspended sediment concentrations.

21.51. The risk of accidental spillages occurring during installation, maintenance and decommissioning can be reduced by adherence to pollution prevention guidance. Should a pollution incident occur, rapid response can be encouraged through the implementation by contractors of spill response plans, while the preferential use of materials of low toxicity and high solubility further reduces risk. Although unlikely, should a small scale spillage occur within the Sound, contaminants would be rapidly dispersed in the high energy environment.

21.52. There is no reason to suspect that the seabed sediments across the array site are currently contaminated. Seabed sediments are minimal, coarse and tide swept and would not be expected to be able to contain elevated levels of contaminants. Any pollutant entering the marine environment accidentally during installation, operation (including maintenance) or decommissioning would not be expected to concentrate in seabed sediments, but rather would be dispersed by strong tidal currents.

21.53. The proposed Development is not expected to have any significant effect on water or sediment quality.

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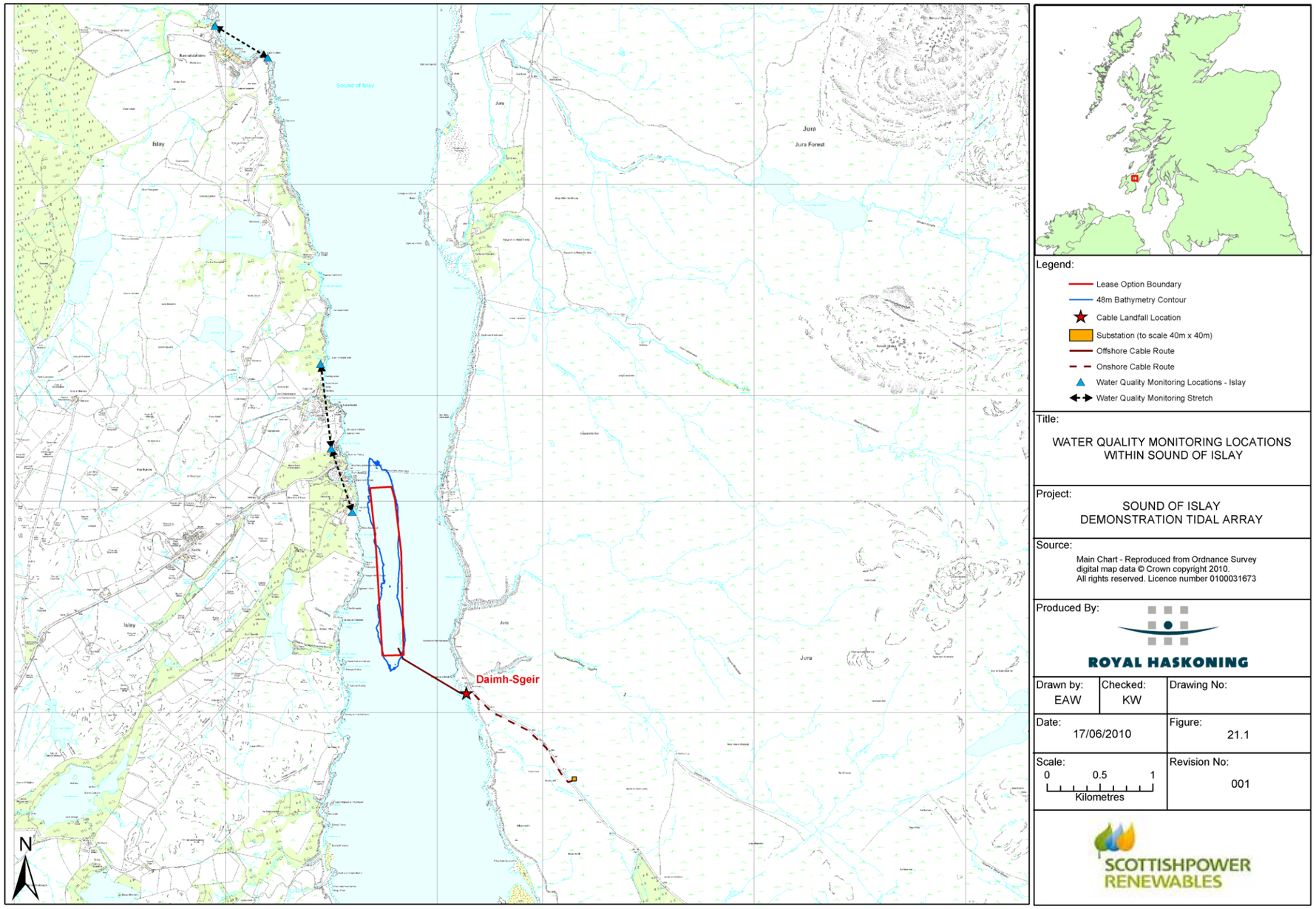

Figure 21.1 Water Quality Monitoring Locations within the Sound of Islay

22.0 Military Activity and Munitions

22.1 Introduction

21.1. This chapter describes current military activity and also identifies the potential for the presence of munitions (both contamination and unexploded ordnance (UXO)) within both the area of the Development, or the surrounding area. The impact of the potential interaction between the development and military activity, past and present, is assessed for the construction, operation (and maintenance) and decommissioning phases of the development). Where appropriate, mitigation measures are proposed to ensure the identified effects are avoided, removed or minimised, where possible. Potential cumulative impacts are also considered.

22.2 Potential Effects

21.2. There is a potential for temporary disruption to military exercises and activities during the installation of the Development, and longer term disruption during operation of the Development. For example, any military vessels wishing to pass through the Sound of Islay may need to modify their route.

21.3. Potential disruption to the marine environment can also include effects from the discovery of unexploded ordnance which historically has been dumped at sea. The potential of this within the sound is highly unlikely due to it location and limited military history. The only recent occurrence, within Scottish Waters was in the Irish Sea where munitions were disturbed when a pipeline was laid through Beauforts Dyke.

22.3 Summary

Summary of Military and Munitions impacts:

The development site is located outside of any designated military areas. Submarines are not expected to use the site; however during construction there may be minor disruption to other military vessels operating near the Sound of Islay in adjacent Practice and Exercise Areas (PEXA). Ongoing communication with the Defence Estates and subsequent scheduling of works at the tidal site will ensure coordination of any potentially conflicting activities. In addition, the implementation of the safety procedures as identified in the Navigational Safety Risk Assessment (Appendix 19.1) will reduce the significance of effects to negligible. There are no known unexploded munitions within or near to the Sound of Islay. It is also unlikely that munitions from official disposal sites could migrate into the Sound of Islay, with the nearest site over 100km away. Should any unexpected munitions be encountered at the Development the works will cease, contractors will leave the site and MoD and emergency services will be consulted as necessary. The significance of effect here is assessed as having **no significant effect**.

22.4 Methodology

22.4.1 Legislative Background

Military Practice and Exercise Areas

21.4. Military PEXA charts produced by the UK Hydrographic Office show the sea areas around the UK coast which are in use or available for use by the Ministry of Defence (MoD) for practice and exercises. These charts also indicate the intended use of such areas, for instance showing whether or not the use of live ammunition is permitted. It is vital that any marine operational activities, whether at the surface or at the seabed, are aware of military PEXA and vice versa. Although PEXAs impose certain constraints and difficulties, development of the seabed can often be accommodated. There exists no legislation or general guideline on development in PEXAs and the MoD must be contacted on a case-by-case basis.

Munitions Disposal – The London Convention and OSPAR

21.5. The two World Wars left a legacy of enormous quantities of munitions requiring disposal. Sea dumping of munitions was considered the most efficient method of disposal, and dumping continued until the 1990s, when an international convention (the London Convention) was introduced which prohibited dumping of all materials (except possibly acceptable waste) on the UK Continental Shelf. Further to the London Convention in 1997, the UK signed the convention for the protection of the marine environment of the North East Atlantic (the OSPAR Convention). This Convention prohibits the disposal of all substances at sea with only minor exemptions, for example dredged material from ports and harbours. The MoD has ceased all sea dumping of conventional ammunition and explosive stocks in line with the requirements of the OSPAR Convention (MoD, undated), notwithstanding, there are still areas which are historic disposal sites around Scotland.

22.4.2 Consultation

21.6. SPR consulted with statutory bodies and key stakeholders for the purposes of this EIA, with the pertinent stakeholder for military activities being the Defence Estates. In their formal response to the request for a Scoping Opinion by SPR the Defence Estates confirmed that they had no concerns regarding the proposed development.

21.7. No concerns have been raised by any other statutory and other consultees in relation to military activity or munitions. As such, even though the likelihood for any significant impacts have been ‘scoped out’, and (as such) no original data collection or detailed assessment activities were deemed necessary, this sensitivity is broadly discussed to ensure impacts are comprehensively considered.

22.4.3 Data Sources

21.8. A desk-based review of available information has been used to describe activities and interest features within and around the proposed development. The following key sources of information have been used:

- Scottish Marine Renewables Strategic Environmental Assessment (SEA) DATE (which includes a munitions and contamination study);
- PEXA Charts; and
- Admiralty Charts.

22.4.4 Assessment of Significance

21.9. The significance of potential impacts is discussed qualitatively in the context of existing activities.

21.10. In assessing impacts, reference has been made to the impact assessment criteria outlined in *Chapter 2: Scoping, Assessment Methodology*. The significance of the effect is assessed in relation to the key aspects of the magnitude of impact (i.e. its nature, duration, direct or indirect etc.) and the sensitivity of the receptor.

21.11. The magnitude of impact is identified and predicted as a deviation from the established baseline conditions in accordance with Table 22.1 for the construction, operation and

decommissioning phases of the project, and is based on criteria identified by the Scottish Executive (2007).

Table 22.1 Magnitude of Impact	
Magnitude of Impact	**Definition**
High	Long term (for the life time of the development) disruption to military activities which cannot be adapted or relocated.
Medium	Long term (for the life time of the development) disruption to military activities causing activities to be adapted or relocated or short term disruption to military activities which cannot be adapted or relocated.
Low	Short term (i.e. during construction) disruption to military activities causing activities to be adapted or relocated.
Negligible	Military activities will be able to take place un-hindered.

21.12. The sensitivity of the receptor/value/importance here is identified as the value of the military activity resource in terms of their importance on a national and local level. These are defined in Table 22.2.

Table 22.2 Sensitivity/value/importance **of the receptor**	
Sensitivity/ Value/Importance of Receptor	**Definition**
High	Generally, but not exclusively, sites of international or national importance and resources / features which if lost, cannot be replaced or relocated. Receptors of greatest sensitivity.
Medium	Features of important consideration at a regional or district scale.
Low	Features important at a local scale.
Negligible	Features of negligible importance / sensitivity.

21.13. A matrix of the significance criteria that are used throughout the rest of this chapter, as relevant to impacts upon military activities, are provided below in Table 22.3. The significance of each impact is characterised as either 'Major', 'Moderate', 'Minor' or 'Negligible' according to the criteria laid out by the Scottish Executive (2007). An impact can be either adverse or positive, or neutral in the case of negligible or 'no significant effect'. It should be noted that any residual effect (the effect after the implementation of mitigation) which remains at the level of 'Moderate' or 'Major' is still regarded by the EIA Regulations as being significant. Further detailed within in *Chapter 2: Scoping, Assessment Methodology*.

Table 22.3 Impact significance matrix				
Magnitude of Impact	**Sensitivity or Importance of the Receptor**			
	Negligible	**Low**	**Medium**	**High**
High	No significant effect	Moderate	Major	Major
Medium	No significant effect	Minor	Moderate	Major
Low	No significant effect	Negligible	Minor	Moderate
Negligible	No significant effect	Negligible	Negligible	Minor

22.5 Existing Environment

22.5.1 Military Activity

21.14. Military activity off the coastline of western Scotland is considerable and large sea areas are designated as PEXA. There is no PEXA within the Sound of Islay, and therefore military submarines are not expected to use the Sound, although the waters around Islay and Jura are used by the Royal Navy for submarine, aircraft and ship exercises (Figure 22.1). Immediately to the north of the Sound is the Colonsay exercise area (X5543) and to the south is the Gigha exercise area (X5534) (Scottish Exercise Areas Information website).

21.15. In addition to the above, Joint Maritime Course (JMC) military training exercises are conducted in waters to the North and West of Scotland. The JMC occurs three times a year in March, June and November. Military jets, submarines, warships, landing craft, power boats and sonobouys are utilised during these exercises. Such exercises are locationally flexible and change from year to year. In recent years they have taken place in the Kirkudbright, Luce Bay and Cape Wrath areas. Exercises would not be expected to take place within the Sound since it is outwith any PEXA.

22.5.2 Munitions and Ordnance

21.16. A review of munitions presence in those waters of interest to marine renewable energy generation has been undertaken as part of the Scottish Marine Renewables SEA (Faber Maunsell and Metoc Plc., 2007, for the Scottish Executive). This review included assessment of munitions presence in the Sound of Islay and wider west coast of Scotland, the details of which are reported below.

21.17. Both conventional and chemical munitions have been dumped at various locations within Scottish waters. The largest official dump site in the wider west coast region is Beaufort's Dyke; a narrow 200m deep trench situated in the North Channel between Scotland and Northern Ireland. This is the most important individual site in Scottish waters. Over a million tons of surplus conventional munitions were dumped there at the end of WWII, with disposals continuing periodically until the early 1970s. In addition to conventional munitions, approximately 14,000 tons of 5.5" phosgene gas rockets were also dumped at the site, making it the only known, official chemical weapons dump site off the west coast of Scotland. There is

clear evidence from the survey conducted in 1996 that considerable quantities of munitions destined for Beaufort's Dyke were, in fact, dumped in the shallower waters adjacent to it, including the area immediately south of Luce Bay where the water depth is only 30 – 40 m (Faber Maunsell and Metoc Plc., 2007).

21.18. Other principal potential sites of munitions contamination, in addition to Beaufort's Dyke, are identified in Table 22.4 below (Faber Maunsell and Metoc Plc., 2007). There are also a number of wrecked vessels which are known to have carried munitions; however, these are also significant distances from the array site. Further details are provided in *Chapter 18: Cultural Heritage*.

.

Table 22.4 Potential sites of munitions contamination

Site	Type of Site	Distance from Sound of Islay (km)	Munitions Type / Quantity
Beaufort's Dyke	Official dump site	111	1,000,000 tons of all types of munitions
SE of Beaufort's Dyke	Unofficial dump site	146	Included in above
Loch Linnhe	Official dump site	108	Conventional munitions, probably not armed
Luce Bay	Official bombing range	134	Cluster bombs
Dundrennan	Official weapon test site	176	Shells fired from tanks
Inner Sound of Raasay	Official weapon test site, and two sunk minelighters	175	Torpedoes, sonobuoys, > 500 mines and 4,000 gun shells
Cape Wrath	Official gunnery and bombing range	316	Shells and bombs
Hebrides	Official weapon test site	188	Missiles, rockets and shells
Lower Loch Fyne & Inchmarnock Water	Old weapon test site	58	Torpedoes
Gareloch	Unofficial dump site	ca. 140	Unknown

21.19. There are no known munitions dump sites, minefields, or wrecks of ships that have carried munitions into the Sound of Islay. Potential migration of munitions from dump sites was examined as part of the Scottish Marine Renewables SEA (Faber Maunsell and Metoc Plc., 2007) within Scottish Territorial Waters. The only major occurrence noted within Scottish Waters resulted from the laying of a pipeline across Beaufort's Dyke(Irish Sea) in the mid 1990s which resulted in the displacement of buoyant phosphorus munitions. (Martin and Smith, 2007).

22.6 Assessment of Effects and Mitigation

22.6.1 Do Nothing Scenario

21.20. Under a 'do nothing scenario', it is not anticipated that any there would be any significant changes to current military activities in and around the Sound of Islay.

22.6.2 Potential Impacts during Construction Phase

Impact 22.1: Disruption of Military Activity

21.21. There will be a temporary disruption to military navigation through the Sound during the construction period given the presence of construction vessels and installation activities. There will be no disruption to PEXA areas given that there are none in the Sound and as access for military vessels can be gained through other routes during the period of construction. This may cause military vessels using parts of the Colonsay and Gigha PEXAs to modify their routes and activities, and any military vessels wishing to pass through the Sound may be unable to do so. Construction vessels, when travelling to the development site, will be subject to the same navigation rules and laws as all other users of the sea, which includes transiting PEXA areas should this be required.

21.22. If submarines were to use the Sound at anytime in a submerged state then this will not be able to occur either during construction or operation if there are any risks of collision etc. Consultation took place with Defence Estates during Project Scoping, and no concern was raised regarding disruption to submarine activity.

21.23. The Scottish Marine Renewables SEA (Faber Maunsell and Metoc Plc., 2007) reports that acoustic output associated with the tidal devices may result in effects upon military sonar; however there is no confirmed evidence of this and the Defence Estates have not expressed concern during the Project Scoping phase. The use of IMM VHF during construction for communication between ship and shore or between vessels has potential to interfere with other marine activities.

21.24. .Any disruption is expected to be limited to the region within or immediately adjacent to the Sound of Islay, and will be temporary to the period of construction. Based on a worst case estimate the magnitude of this impact will be medium in a low sensitivity environment. On this basis the significance of effect is predicted to be **minor**.

MITIGATION IN RELATION TO IMPACT 22.1

- Through consultation with the Defence Estates it was identified that there were no concerns with regard to military activities and the tidal array development. Consultation with the Defence Estates will be continued throughout consenting and site development, allowing any future concerns to be addressed should they arise. The Defence Estates will be informed in advance of intended works dates and any potentially conflicting activities will be coordinated to minimise disturbance.

The Development will adhere to the safety measures identified in the Navigational Safety Risk Assessment (Appendix 19.1), with particular reference to the following points:

- Notice of the works would be promulgated through the UKHO Maritime Safety Information system (i.e. Notices to Mariners (NMs) and Radio Navigational Warnings (NavWarns/WZs)) and will occur just prior to and during the construction works;
- Installation vessels will comply with the COLREGS in that they would display the appropriate lights and marks for vessels engaged in such activities;
- Presence on site of manned vessels capable of monitoring and advising the other marine

MITIGATION IN RELATION TO IMPACT 22.1
traffic using the Sound of Islay; • The array will be appropriately charted as an underwater obstruction and annotated, as discussed further in the Navigational Safety Risk Assessment; and • The Principal Contractor will liaise with local organisations including the Defence Estates to ensure that suitable working channels are selected to avoid compromising authorised communications

Residual Impact

21.25. Any disturbance of military activity will be local and short term, and following successful implementation of mitigation the significance of effect any potential impacts are expected to be **negligible**.

Impact 22.2: Risks Associated with unexploded ordnance

21.26. There is no evidence to suggest that previously dumped munitions, or munitions which have migrated from official marine dump sites, are present in the Sound. The magnitude of impact is assessed as being low with the sound of Islay being assessed as being of low sensitivity. Given this knowledge and based upon previous reports and scoping, the significance of effect during installation of the devices is assessed as **negligible**.

21.27. Although the Health & Safety at Work Act 1974 and the Construction (Design and Management) Regulations 2007 do not specifically require a dedicated UXO assessment, there is an obligation on those responsible for intrusive works to ensure that a comprehensive threat assessment is undertaken and risk mitigation measures are taken with regards to all underground hazards on site. A detailed seabed and cable route survey has been undertaken for the development area and no potential munitions have been observed. Health and safety will continue to take a high priority for SPR on this project and all contractors will be asked to ensure that their working methodologies take into account the potential for finding munitions, irrespective of how small the chance of finding them are.

MITIGATION IN RELATION TO IMPACT 22.2
• No mitigation required. Should suspected items of UXO be discovered during any project phase, their location will be recorded and immediate advice will be sought from the relevant authorities. If a UXO is identified during the construction phase then works will cease immediately until advice and remediative actions are implemented. In addition munitions awareness briefings will be given to contractors and ship staff prior to and during the construction phases. The MoD and emergency services will be consulted as appropriate.

Residual Impact

21.28. As no mitigation is required, the significance of effect will remain **negligible**.

22.6.3 Potential Impacts during Operational Phase (including maintenance)

Impact 22.3: Disruption of Military Activity

21.29. It is not expected that the tidal array will have any effect on military activities. Submarines are not expected to be using the Sound in a submerged state. It is possible that operational maintenance vessels will need to travel through PEXA's on their way to the site but these vessels will be subject to the same rules as other marine users when traversing military areas. The magnitude of impact is assessed as being negligible with the sound of Islay being assessed as being of low sensitivity. Given the low level of maintenance that will be required on site, the significance of effect is assessed to be **negligible**.

MITIGATION IN RELATION TO IMPACT 22.3
• No mitigation required.

Residual Impact

21.30. As no further mitigation is required, the residual impact will remain **negligible significant effect**.

Impact 22.4: Risks Associated with Unexploded Ordnance

21.31. The same assessment and conclusions that were discussed above for construction (see Impact 22.2) are valid here. There is no evidence to suggest that previously dumped munitions, or munitions which have migrated from official marine dump sites, are present in the Sound. Given this knowledge and based upon previous reports and scoping, it has been identified that **no significant effect** is expected during the operation of the devices.

MITIGATION IN RELATION TO IMPACT 22.4
• No mitigation required. Should suspected items of UXO be discovered during any project phase, their location will be recorded and immediate advice will be sought from the relevant authorities. If a UXO is identified during the construction phase then works will cease immediately until advice and remediative actions are identified. In addition munitions awareness briefings will be given to contractor's site and ship staff prior to and during the construction phases. The MoD and emergency services will be consulted as appropriate.

Residual Impact

21.32. As no mitigation is required, the residual significance of effect will remain as **no significant effect**.

22.6.4 Potential Impacts during Decommissioning Phase

Impact 22.5: Disruption of Military Activity

21.33. As per the installation of the Development, decommissioning will involve the movement of a number of vessels to and from the array site. This may cause military vessels using parts of the Colonsay and Gigha PEXAs to modify their routes and activities. . Based on a worst case estimate the magnitude of this impact will be medium in a low sensitivity environment Any disruption is expected to be highly localised to waters at the entrance to the Sound of Islay, and will be temporary. On this basis a **minor** significant effect is predicted.

MITIGATION IN RELATION TO IMPACT 22.5
• Through consultation with the Defence Estates it was identified that there were no concerns with regard to military activities and the tidal array development. Consultation with the Defence Estates will be continued throughout consenting and site development, allowing any future concerns to be addressed should they arise. The Defence Estates will be informed in advance of intended works dates and any potentially conflicting activities will be coordinated to avoid conflict.

MITIGATION IN RELATION TO IMPACT 22.5
• Safety procedures similar to the temporary construction phase will be implemented

Residual Impact

21.34. As with construction and operation, the residual significance of effect following mitigation is expected to be **negligible.**

Impact 22.6: Risks Associated with Unexploded Ordnance

21.35. As per the installation of the array, the magnitude of impact is assessed as being low with the sound of Islay being assessed as being of low sensitivity it is predicted that there will be no interaction between devices and Unexploded Ordnance (UXO) during installation of the array and therefore the significance of effect is assessed as **negligible**.

MITIGATION IN RELATION TO IMPACT 22.6
• No mitigation required. Should suspected items of UXO be discovered during any project phase, their location will be recorded and immediate advice will be sought from the relevant authorities. If a UXO is identified during the construction phase then works will cease immediately until advice and remediative actions are identified. In addition munitions awareness briefings will be given to contractor's site and ship staff prior to and during the construction phases. The MoD and emergency services will be consulted as appropriate.

Residual Impact

21.36. As no mitigation is required, and as with the construction and operation phases, the residual effect of UXO is expected to be remain as negligible**.**

22.6.5 Cumulative Impacts

21.37. It is unlikely that the proposed Development will act in combination with any other existing or proposed activities or projects to result in cumulative impacts on military activities or munitions.

22.7 Summary of effects

Impact	Construction/Decommissioning				Operation (Including Maintenance)			
	Magnitude of impact	Receptor Sensitivity/Importance/Value	Significance of effect	Residual impact	Magnitude of impact	Receptor Sensitivity/Importance/Value	Significance of effect	Residual impact
Disruption of Military Activity	Medium	Low	Minor	Negligible	Negligible	Low	Negligible	Negligible
Risks Associated with Un-exploded Ordnance	Low	Low	Negligible	Negligible	Low	Low	Negligible	Negligible

22.8 Statement of Significance

21.38. The development site is located outside of any designated military areas. Submarines are not expected to use the site; however during construction there may be minor disruption to other military vessels operating near the Sound of Islay in adjacent PEXAs. Ongoing communication with the Defence Estates, and subsequent scheduling of works at the tidal site, will ensure coordination of any potentially conflicting activities. In addition, the implementation of the safety procedures as identified in the Navigational Safety Risk Assessment (Appendix 19.1) will reduce the significance of effects to **negligible**.

21.39. There are no known unexploded munitions within or near to the Sound of Islay. It is also unlikely that munitions from official disposal sites could migrate into the Sound of Islay. Should any unexpected munitions be encountered at the Development the works will cease, contractors will leave the site and MoD and emergency services will be consulted as necessary. The significance of effect here is assessed as **no significant effect**.

22.9 References

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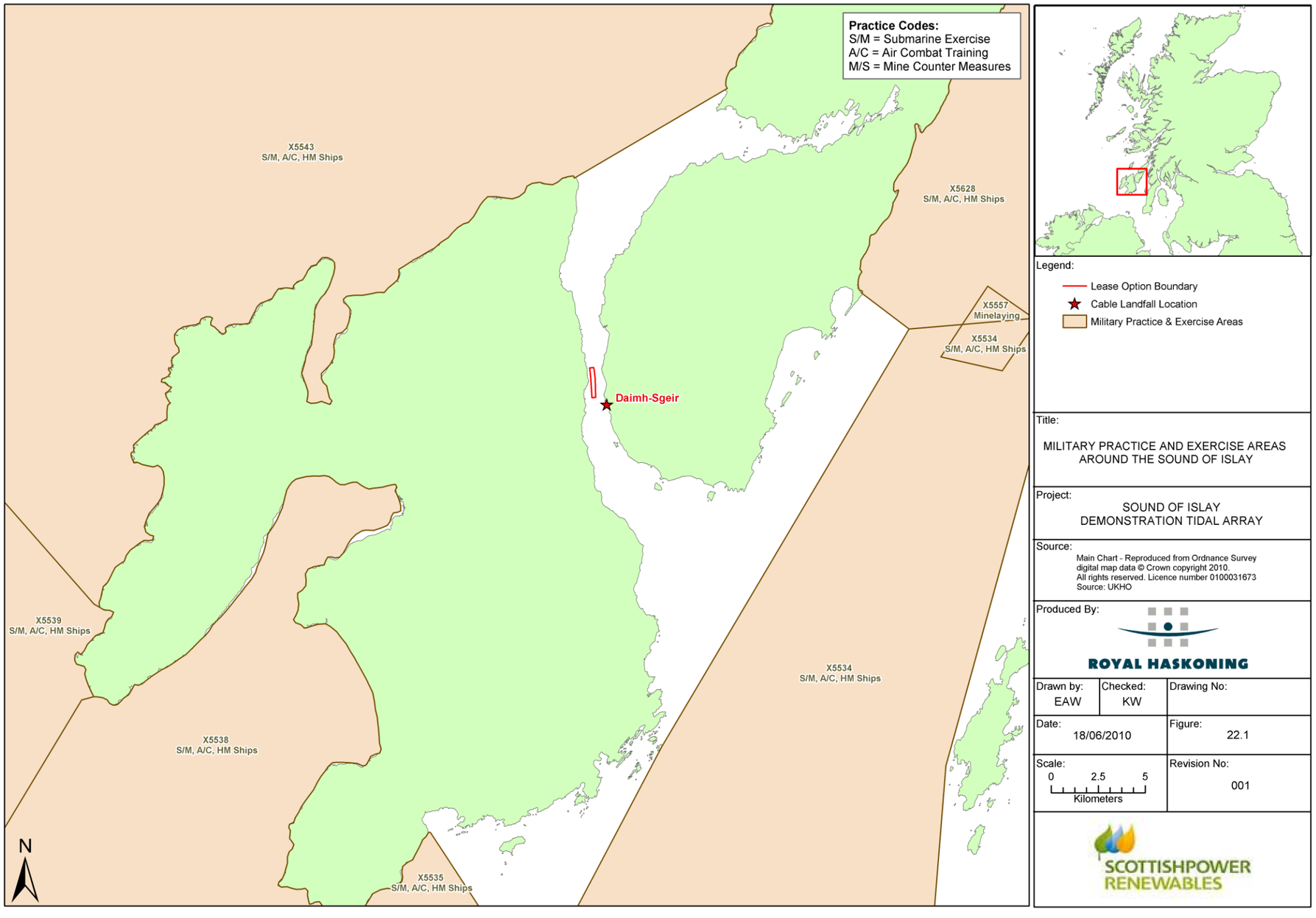

Figure 22.1: Military Practice and Exercise Areas around the Sound of Islay.

23.0 Air Quality

23.1 Introduction

23.1. This chapter provides a review of the existing air quality conditions near to the Development Site and considers the potential effect of the Development on local air quality. The assessment focuses on potential effects relating to the construction phase and operational phase of the Proposed Development. Potential impacts during the decommissioning phase are also considered. Where significant adverse effects have been predicted, suitable mitigation measures are proposed.

23.2. The principal potential air quality impacts from the Development are likely to be associated with engine exhaust emissions from marine vessels and on road traffic (during construction/decommissioning and operation), and Non-Road Mobile Machinery (NRMM) (during construction/decommissioning only).

Summary of Impacts on Air Quality: Air quality within the Sound is good. The main sources of air pollution in the vicinity of the development are engine exhaust emissions from marine vessels in the Sound of Islay, and road traffic on Islay and Jura. The nearest sensitive receptors are residential properties located at Port Askaig; there are no sensitive receptors in the vicinity of construction works. Potential impacts of emissions to air from road traffic and marine vessels during construction/decommissioning and operation were predicted to the negligible and minor respectively, and negligible from Non Road Mobile Machinery. Dust emissions from construction activities are predicted to have negligible impact as there are no sensitive receptors in the vicinity of landside construction works on Jura.

23.2 Potential Effects of the Development

23.3. During construction, impacts are likely to be associated with engine exhaust emissions from marine vessels, resulting road traffic, and NRMM. The main pollutants of concern from these emissions are those relating to fuel combustion such as sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and particulate matter (PM_{10}).

23.4. In addition, a number of construction activities have the potential to generate airborne dust, including PM_{10} which could affect human health, vegetation, and local air quality. However, the application of good construction practice on site will reduce the significance of any effects.

23.5. Once operational, impacts are likely to be associated with engine exhaust emissions from marine vessels during routine maintenance of the turbine array (anticipated twice per year). Turbines will be removed from site every 5 years for maintenance in a method similar to the installation but in reverse, using a similar number and type of vessels.

23.6. Potential impacts during the decommissioning phase are likely to be similar to those occurring during the construction phase, with the main pollutants of concern being SO_2, NO_2, PM_{10} and dust.

23.3 Methodology

23.3.1 Legislation, Guidance and Policy Framework

23.7. Air pollution can have adverse effects on the health of humans and ecosystems. European Union (EU) legislation on air quality forms the basis for UK air quality policy. The 1995 Environment Act[1] required the preparation of a national Air Quality Strategy (AQS) which set air quality standards and Objectives for specified pollutants. The Act also outlined measures to be taken by local planning authorities (LPAs) in relation to meeting these standards and Objectives (the Local Air Quality Management (LAQM) system).

23.8. The UK AQS was originally adopted in 1997[2]. This document is reviewed and updated as necessary in order to take account of the evolving EU Legislation, technical and policy developments and the latest information on health effects of air pollution. The strategy was reviewed and reissued in 2000 as the AQS for England, Scotland, Wales and Northern Ireland[3]. This was subsequently amended in 2003[4] and was updated in July 2007[5].

23.9. The Standards and Objectives relevant to LAQM have been prescribed through the Air Quality (Scotland) Regulations (2000)[6], the Air Quality (Scotland) (Amendment) Regulations 2002[7] and the Air Quality Standards Regulations 2007[8]. These Standards and Objectives are presented in Table 23.1. Pollutant Standards relate to ambient pollutant concentrations in air, set on the basis of medical and scientific evidence of how each pollutant affects human health. Pollutant Objectives however, incorporate future dates by which each standard is to be achieved, taking into account economic considerations, practicability and technical feasibility.

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[1] HMSO (1995) *'The Environment Act 1995 (c.25)'*, London:TSO.
[2] Department of the Environment (DoE) (1997) *'The UK National Air Quality Strategy'*, London: HMSO.
[3] Department of the Environment, Transport & the Regions (DETR) (2000) '*The Air Quality Strategy for England, Scotland, Wales and Northern Ireland*. London:HMSO.
[4] DETR (2003) '*The Air Quality Strategy for England, Scotland, Wales and Northern Ireland - Addendum*'. London:HMSO.
[5] Department for Environment, Food and Rural Affairs (DEFRA) (2007) *'The Air Quality Strategy for England, Scotland, Wales and Northern Ireland'*, London:HMSO.
[6] HMSO (2000) *'Scottish Statutory Instrument 2000 No. 97, The Air Quality (Scotland) Regulations 2000'*, London:HMSO.
[7] HMSO (2002) *'Scottish Statutory Instrument 2002 No. 297, The Air Quality (Scotland) (Amendment) Regulations 2002'*, London:HMSO.
[8] HMSO (2007) *'Scottish Statutory Instrument 2007 No. 182, Air Quality Standards (Scotland) Regulations, 2007'*. London:HMSO.

Table 23.1 Air Quality Strategy Objectives (Scotland) for the Purposes of Local Air Quality Management

Pollutant	Air Quality Objective		To be achieved by
	Concentration	Measured as*	
Benzene	16.25 µg.m^{-3}	Running Annual mean	31/12/2003
	3.25 µg.m^{-3}	Running Annual mean	31/12/2010
1,3 Butadiene	2.25 µg.m^{-3}	Running annual mean	31/12/2003
Carbon monoxide	10 mg.m^{-3}	running 8-hour mean	31/12/2003
Lead	0.5 µg.m^{-3}	Annual Mean	31/12/2004
	0.25 µg.m^{-3}	Annual Mean	31/12/2008
Nitrogen dioxide (NO_2)	200 µg.m^{-3}	1 hour mean not to be exceeded more than 18 times per year	31/12/2005
	40 µg.m^{-3}	Annual mean	31/12/2005
Particles (PM_{10})	50 µg.m^{-3}	24-hour mean not to be exceeded more than 35 times per year	31/12/2004
	40 µg.m^{-3}	Annual mean	31/12/2004
	50 µg.m^{-3}	24-hour mean not to be exceeded more than 7 times per year	31/12/2010
	18 µg.m^{-3}	Annual mean	31/12/2010
Particles ($PM_{2.5}$)	12 µg.m^{-3}	Annual mean (target)	2020
	15% cut in annual mean (urban background exposure)		2010 - 2020
Sulphur Dioxide (SO_2)	350 µg.m^{-3}	1-hour mean not to be exceeded more than 24 times a year	31/12/2004
	125 µg.m^{-3}	24-hour mean not to be exceeded more than 3 times a year	31/12/2004
	266 µg.m^{-3}	15-minute mean not to be exceeded more than 35 times a year	31/12/2005

Note: * how the Objectives are to be measured is set out in the UK Air Quality (Scotland) Amendment Regulations (2002)

23.10. The EU Limit Values (as set out in the EU Council Directive 96/62/EC 'Air Quality Framework Directive' and its daughter directives and the new 'Air Quality Directive' 2008/50/EC and the Air Quality Standards Regulations 2010 laid down statutory air pollutant concentration limits, and the 2000 Regulations (as amended in 2002) effectively implement the AQS Objectives. The limit values in most cases are the same, although the achievement dates differ. The 2007 AQS introduced an exposure reduction approach for $PM_{2.5}$, since 'there is no recognised safe level for exposure to particulates ($PM_{2.5}$)'.

23.11. Part IV of the Environment Act 1995 introduced a system of LAQM under which Local Planning Authorities (LPAs) are required to review and assess the future quality of the air in their area by way of a staged process. Should this process indicate that any of the AQS Objectives will not be met, the LPA must designate that area as an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) to improve the air quality in that area in order to work towards the Objectives.

23.12. LAQM Technical guidance[9] states that likely exceedences of the Objectives (in Table 23.1) should be assessed at locations where public exposure would be realistic (i.e. regularly present and likely to be exposed for a period of time appropriate to the averaging period of the objective).

23.13. Planning Advice Note 51 (PAN 51)[10] advises that *'in Air Quality Management Areas (AQMA's) or adjacent to them, air quality is likely to be a material consideration for large scale proposals or if they are to be occupied by sensitive groups such as the elderly or young children or are likely to have cumulative effects. This does not mean that all such applications should be refused even if they are likely to affect local air quality, but it may mean that conditions have to be applied to mitigate adverse effects. Generally, it may be necessary to consider whether a development could lead to the designation of a new AQMA or if granting planning permissions could conflict with an Air Quality Action Plan'.*

Development Plan Policy

23.14. The Argyll and Bute Structure Plan (approved 2002) and the Argyll and Bute Local Plan (adopted 2009) provide the following policies relevant to safeguarding air quality:

23.15. Argyll and Bute Structure Plan - S1 – Sustainable Development

23.16. Argyll and Bute Local Plan - ENV 1 – Development Impact on the General Environment

23.4 Consultation

23.17. In the formal Scoping Opinion (EIA consultation is outlined within *Chapter 2: Scoping Assessment Methodology*) received from the Scottish Government 12th January 2009, it was requested that this ES describe the likely significant effects of the proposed development on air and climate resulting from:

- The existence of the development;
- The use of natural resources; and
- The emission of pollutants, creation of nuisance and the elimination of waste.

[9] Department for the Environment Food and Rural Affairs (2009) *'Local Air Quality Management Technical Guidance Document LAQM.TG(09)'*, London: DEFRA.
[10] Planning Advice Note PAN 51 Planning, Environmental Protection and Regulation (The Scottish Executive, 2006)

23.5 Data Sources

The air quality assessment has been undertaken with reference to information from a number of sources. Key sources are shown in Table 23.2.

Table 23.2 Key information sources	
Source	**Reference**
Argyll and Bute Council	Argyll and Bute Council, April 2009, *2009 Air Quality Updating and Screening Assessment*
Department for Environment Food and Rural Affairs (DEFRA)	DEFRA (2009) *Local Air Quality Management Technical Guidance TG(09)*
Environmental Protection UK (formerly the National Society for Clean Air)	EPUK (2010) *Development Control: Planning for Air Quality, 2010 Update*
UK Air Quality Archive	Local Air Quality Management 1 x 1 km grid background pollutant maps
Transport and Traffic impact assessment	*Chapter 20 :Traffic and Transport*
Abbott Risk Consulting Ltd.	Abbott Risk Consulting Ltd., May 2010, *Navigational Safety Risk Assessment for Scottish Power Renewables (UK) Limited. Proposed Demonstration Tidal Site, Sound of Islay*. Report No. ARC-266-004-R1
Scottish Power	Traffic movement for substation construction notes from Scottish Power, dated 18th June 2010.

23.6 Assessment of Significance

23.18. The significance of effect of any changes in local air quality was established through consideration of the following factors:

- Geographical extent (local, district or regional);
- Duration (temporary or long term);
- Reversibility (reversible or permanent);
- Magnitude of pollutant concentration changes;
- Exceedence of standards (e.g. Air Quality Strategy Objectives); and
- Changes in pollutant exposure.

23.19. The significance of potential impacts is discussed qualitatively in the context of existing activities.

23.20. In assessing impacts, reference has been made to the impact assessment criteria outlined in *Chapter 2: Scoping, Assessment Methodology*. The significance of the effect is assessed in relation to the key aspects of the magnitude of impact (i.e. its nature, duration, direct or indirect etc.) and the sensitivity of the receptor.

23.21. The magnitude of impact is identified and predicted as a deviation from the established baseline conditions in accordance with Table 23.3 for the construction, operation (including maintenance) and decommissioning phases of the project, and is based on criteria identified by the Scottish Executive (2007).

TABLE 23.3 MAGNITUDE OF IMPACT	
Magnitude of Impact	**Description**
High	A fundamental change to the baseline condition of the receptor.
Medium	A detectible change resulting in the non-fundamental temporary or permanent condition of a receptor.
Low	A minor change to the baseline condition of the receptor (or a change that is temporary in nature).
Negligible	An imperceptible and/or no change to the baseline condition of the receptor.

23.22. The sensitivity of the receptor here is identified as the quality of air resource in terms of its importance on a national and local level. This is defined in Table 23.4.

TABLE 23.4 SENSITIVITY/IMPORTANCE/VALUE OF THE RECEPTOR	
Sensitivity/Importance/Value of Receptor	**Description**
High	Environment is subject to major change(s) due to impact. For example, sites contain features of international or national conservation or cultural designation, or permanent reduction of anthropogenic activity such as fish landings
Medium	Environment clearly responds to effect(s) in quantifiable and/or qualifiable manner. For example sites contain features of national or regional conservation or cultural designation, permanent modification of anthropogenic activity.
Low	Environment responds in minimal way to effects such that only minor change(s) are detectable. For example sites of local conservation or cultural value or temporary modification of anthropogenic activity.
Negligible	Environment responds in minimal way to effect such that only minor change(s) are detectable. For example sites contain features of local interest, little or no change to anthropogenic activity.

23.23. Sensitivity criteria can be based both on the degree of environmental response to any particular impact, as well as the 'importance' or 'value' of the receptor (for example, an area of international significance should be considered more sensitive to impact than an area of little or no conservation value). The sensitivity/importance/value for each impact is determined by consideration of at least one of the following points:

- Comparison with Regulations or standards e.g. British Standards;
- Compliance with policy, plans and guidance documents e.g. Local Plan;
- Reference to criteria such as protected species, designated sites and landscapes;
- Consultation with stakeholders; and
- Experience and professional judgements by specialists on environmental sensitivity.

23.24. By combining the magnitude of the impact and the sensitivity/importance/value of the receptor in a matrix (see Table 23.5) the final significance of the effect (prior to the implementation of mitigation measures) can be obtained. It should be noted that any residual effect (the effect after the implementation of mitigation) which remains at the level of 'Moderate' or 'Major' is still regarded by the EIA Regulations as being significant.

TABLE 23.5 IMPACT SIGNIFICANCE MATRIX				
Magnitude of Impact	**Receptor Sensitivity/Importance/Value**			
	Negligible	**Low**	**Medium**	**High**
High	No significant effect	Moderate	Major	Major
Medium	No significant effect	Minor	Moderate	Major
Low	No significant effect	Negligible	Minor	Moderate
Negligible	No significant effect	Negligible	Negligible	Minor

23.25. Conclusions as to the overall significance of effect of air quality impacts were based on the above factors, with the application of professional judgment, and significance of effect was assigned on the basis of criteria outlined in *Chapter 2: Scoping and Assessment Methodology*.

23.7 Existing Environment

23.26. The site is located within the jurisdiction of Argyll and Bute Council who have a statutory duty to periodically review air quality in their area[11]. An Air Quality Updating and Screening Assessment (USA) Report published by Argyll and Bute Council in 2009[12] concluded that AQS Objectives were likely to be achieved at within the Council area in respect of all pollutants. There are currently no AQMAs within the Council area, and so the proposed Development does not lie within or in close proximity to, an AQMA.

23.27. Background concentrations of nitrogen oxides (NOx), NO2, and PM10 for the 1 x 1 km grid squares corresponding to Port Askaig (nearest residential receptors), the onshore cable landing site at Daimh-Sgeir, and the substation and maintenance building were obtained from the UK Air Quality Archive 13 for the current year (2010) and the anticipated year of opening (2013). These data are presented in Table 23.6.

Table 23.6 Background Pollutant Concentrations(µg.m^{-3})				
Pollutant	**Location**	**2010**	**2013**	**Annual mean Objective**
Oxides of Nitrogen (NO_x)	Port Askaig (142500, 669500)	2.2	2.1	--
	Daimh-sgeir (144500, 667500)	2.1	2.0	
	Substation Site (145500,666500)	2.1	2.0	

[11] Under the Environment Act 1995

[12] Argyll and Bute Council, April 2009, *2009 Air Quality Updating and Screening and Assessment*

[13] http://www.airquality.co.uk

Table 23.6 Background Pollutant Concentrations(µg.m^{-3})				
Pollutant	**Location**	**2010**	**2013**	**Annual mean Objective**
Nitrogen Dioxide (NO_2)	Port Askaig (142500, 669500)	1.9	1.8	40.0
	Daimh Sgeir (144500, 667500)	1.8	1.7	
	Substation Site (145500,666500)	1.8	1.8	
Particulates (PM_{10})	Port Askaig (142500, 669500)	9.6	9.5	18.0
	Daimh Sgeir (144500, 667500)	9.6	9.5	
	Substation Site (145500,666500)	9.6	9.5	

23.28. Table 23.6 shows that existing and future predicted background pollutant concentrations are well below the relevant AQS Objectives for these pollutants.

23.29. The site is located in a rural costal area. Engine exhaust emissions from marine vessels (mainly ferries) and on road traffic in the vicinity of Port Askaig (Islay) and Feolin (Jura) contribute to local air pollution. Annual average daily traffic (AADT) flow on the A846 Bowmore to Port Askaig is estimated to be 1212 (total vehicles), 7% of which are heavy goods vehicles (HGV's)[14].

23.30. The majority of airborne dust in the study area is likely to be formed through mechanical generation for example, from sea-salt particles, friction from wear of vehicle tyres and brakes, and from erosion of agricultural soils.

23.31. The nearest sensitive receptors to the site are in Port Askaig (residential properties).

23.8 Impact Assessment Methodology

23.32. Air quality monitoring surveys specific to the Development were not undertaken and the assessment presented here is based upon a desktop study.

23.33. Existing baseline air quality conditions within the study area were assessed using UK pollutant maps available from the United Kingdom Air Quality Archive[13], and from the Air Quality USA Report published by Argyll and Bute Council in 2009[12].

[14] *Chapter 19: Traffic and Transport*

23.34. Detailed information relating to construction activities and schedules was not available at the time of writing, therefore a qualitative assessment of emissions of NO_2 and PM_{10} from construction traffic was undertaken.

23.35. Potential air quality impacts associated with the construction of the Proposed Development were assessed qualitatively in terms of dust nuisance to adjacent sensitive receptors. Examples of dust sensitive receptors are listed in Table 23.7[15].

Table 23.7 Dust Sensitive Receptors

High Sensitivity	Medium Sensitivity	Low Sensitivity
Hospitals and Clinics	Schools	Farms
Retirement Homes	Residential Areas	Light and Heavy Industry
Hi-Tech Industries	Food Retailers	Outdoor Storage
Food Processing	Offices	

23.36. The following assumptions were made in relation to construction of the development:

- Marine turbines will be deployed by marine vessel directly to site;
- All materials associated with siting of the marine turbines will be delivered by marine vessel either directly to site, or from material storage barges located at Caol Ila Bay;
- Concrete will be required for construction of the substation hard standing. The preferred option is for on site concrete batching;
- A materials storage area will be located on Jura in close proximity to the Feolin slipway;
- The majority of building materials, plant and equipment, underground cabling, sand for cable trenching, security fencing, transformer and GRP housings for the substation will be delivered directly by sea to the storage area on at Feolin;
- Excavated ground materials will be utilised on site where possible; and
- Construction of the substation and maintenance building and onshore cabling works are likely to take place over a 3 month period during summer months.

23.37. Potential impacts associated with engine exhaust emissions from marine vessels and road traffic during routine maintenance of the turbines were assessed qualitatively with reference to the proposed maintenance schedule for the turbines (*Chapter 5: Project Description*).

23.9 Assessment of Effects and Mitigation

23.9.1 Do Nothing Scenario

23.38. Background pollutant concentrations of all the regulated pollutants are expected to decline in future years, as a result of Government and EU policies and legislation to reduce pollutant emissions. Due to the rural coastal nature of the construction site it is not anticipated that any significant changes in air quality would occur under a 'do nothing scenario'.

23.9.2 Potential Impacts during Construction Phase

Impact 23.1: *Emissions from on road traffic*

Potential routes for delivery of building construction materials from the mainland are: 1. via sea to Port Ellen (Islay), along the A846 to Port Askaig, then by ferry from Port Askaig to Feolin, 2. via sea to Port Askaig, then by ferry from Port Askaig to Feolin, and 3. via sea directly to Feolin.

23.39. In order to minimise through-traffic at Port Askaig the preferred option where practicable is to deliver the building materials etc. directly by sea into Feolin (Jura). As a result, HGV construction traffic through Port Askaig is unlikely to be significant.

23.40. During the construction period, the highest HGV flows are anticipated to occur during delivery of aggregate and cement for on site concrete batching (or ready mix concrete if there is no on site batching), and import of sand associated with construction of underground cable trenches. Additional HGV movements will be associated with delivery of underground cabling, general plant and equipment and substation components, and disposal of excavated ground materials off site. A summary of anticipated HGV movements generated during the construction period are provided in Table 23.8. It is likely that there will be four permanent on site contractors, however, their mode of materials transport has not yet been determined.

Table 23.8 HGV movements generated during construction

HGV Delivery of	Total HGV Movements*
Ready mixed concrete or…	40
…Aggregate and cement (for onsite batching)	10
Sand for cabling trenches	120
General Plant and Equipment	36
Sub Station components	6
Underground cabling	2

*Note: Some trips for the disposal of materials off site will be required; however these have not yet been quantified.

23.41. It is anticipated that delivery of aggregate and cement for on site concrete batching, or ready mix concrete if there is no on site batching, will occur over a four day period. The preferred option is to batch concrete onsite which would significantly reduce HGV movements (Table 23.8).

23.42. Total HGV movements associated with delivery of sand for cabling trenches are likely to be lower than those presented in Table 23.8 as the material used from substation and trenching works will be used to backfill the trenches where possible once the cable has been laid.

23.43. Existing traffic flow data for the main road (A846) on Jura are unavailable; however, as the population of Jura was recorded at 188 in the last census 2001 it is likely that no more than 80 vehicles use the A846 on a regular basis (based on house and statistical numbers)[14]. Construction traffic will increase HGV flows on the A846 over the three month construction period; however, congestion is unlikely to occur due to the existing low population levels and associated traffic on Jura.

[15] Office of the Deputy Prime Minister (2005) *Minerals Policy Statement 2: Controlling and Mitigating the Environmental Effects of Mineral Extraction in England,* London: HMSO.

23.44. There are no sensitive receptors at Feolin, between Feolin and the substation site, or at the substation site. The nearest sensitive receptors at Port Askaig are unlikely to be affected by emissions from construction traffic.

23.45. Development control guidance[16] states that air quality assessments are likely to be considered necessary where proposals would significantly alter the traffic composition on local roads, for instance, increase the number of HGV's by say 200 movements or more per day. And/or where proposals generate or increase traffic congestion on roads with more than 10,000 AADT. Due to existing low traffic flows on the A846 (Islay)[14] and the predicted number of HGV movements generated during construction (Table 23.8) it is likely that emissions from construction traffic on the A846 will be negligible.

23.46. Emissions from construction traffic will add to the existing background NO_2 and PM_{10} concentrations; however, these emissions are predicted to be small. Existing air quality in the area is good with NO_2 and PM_{10} background concentrations well below AQS Objectives. There are no sensitive receptors on Jura with the potential to be affected by emissions from construction traffic. The impact will be local and temporary – lasting for the duration of construction only (three months). Overall construction traffic is predicted to have a **negligible significant effect** on local air quality.

MITIGATION IN RELATION TO IMPACT 23.1
• No mitigation required

Residual impact

23.47. As no mitigation measures are required the likely significance of effect will remain **negligible**.

Impact 23.2: *Emissions from marine vessels*

23.48. Marine vessels will be used during construction of the tidal turbine array to deliver the turbines directly to site, for installation of the turbines, and for delivery of building materials to Feolin.

23.49. A summary of marine vessel types to be used for pre-installation activities, sub sea cable installation and turbine installation is presented in Table 23.9. It is expected that offshore elements of work will take place over 60-80 days subject to limiting environmental conditions e.g. tidal rate, wind speed and sea state[17]. The total number of marine vessels associated with construction of the development (including those associated with delivery of materials for construction of the substation and cable trenches to Feolin) has not yet been quantified and a marine vessel inventory is unavailable.

Table 23.9 Marine vessel types to be used for construction of tidal array
Pre Installation
Anchor handling tugs
Barge towing and mooring tugs
Lighter barges
Workboats
Sub sea cable installation
Specialist cable laying vessel
Device installation
Installation vessel
Lighter barge
Heavy lift crane vessel
Specialist cable laying vessel

23.50. The average number of current transits (by marine vessel) of the Sound of Islay is in the order of six per day – four coasters and four ferry movements[17]. Significant users include ferries, fishing vessels, cargo vessels, sailing and motor yachts and other recreational vessels.

23.51. The passage through the Sound of Islay is limited by the shallow waters in the north of the Sound where, even if vessels navigate with care to avoid the shallow bank with a minimum depth of 9.1m, the maximum charted depth of navigable waters is in the order of 10.2m.

23.52. Marine vessels used for construction works will be small or medium sized rather than large due to navigational limitations of the Sound, outlined above. Consequently emissions from these vessels will be limited by their engine size.

23.53. It is likely that emissions from marine vessels used in the construction of the development will add to the existing background sulphur dioxide (SO_2), NO_2 and PM_{10} concentrations. However, the impact on local air quality from these emissions is likely to be local and temporary – lasting for the duration of construction only (60-80 days). Overall emissions from marine vessels are predicted to have a **minor significance of effect** on local air quality.

MITIGATION IN RELATION TO IMPACT 23.2
• The sulphur content of any fuel oil used on board a ship must not exceed limits outlined in the Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008[18] as amended.

Residual impact

23.54. The residual impact of marine vessel emissions on local air quality following successful implementation of mitigation measures is predicted to be of **negligible significant effect.**

IMPACT 23.3: *Emissions from Non Road Mobile Machinery (NRMM)*

23.55. Engine exhaust emissions from off-road vehicles known as NRMM, such as excavators, bulldozers, front loaders and generators have the potential to affect local air quality. The main

[16] EPUK (2010) *Development Control: Planning for Air Quality, 2010 Update*

[17] Abbott Risk Consulting Ltd., May 2010, *Navigational Safety Risk Assessment for ScottishPower Renewables (UK) Limited. Proposed Demonstration Tidal Site, Sound of Islay*. Report No. ARC-266-004-R1

[18] HMSO (2008) Statutory Instrument 2008/2924 '*The Merchant Shipping (Prevention of Air Pollution from Ships) Regulations 2008'*

pollutants of concern from these emissions are those relating to fuel combustion such as carbon monoxide (CO), NO_2, SO_2 and PM_{10}.

23.56. Air quality in close proximity to the 2km cable trenching route, and the substation development site is likely to be affected by emissions from NRMM involved in construction works. However, there are no sensitive receptors in the vicinity of these locations. The impact will be local and short term, lasting for the duration of construction only. Emissions from NRMM used during construction are predicted to have a **negligible significant effect** on local air quality.

MITIGATION IN RELATION TO IMPACT 23.3
• No mitigation required

Residual impact

23.57. As no mitigation measures are required the likely impact will remain of **negligible significant effect.**

IMPACT 23.4: *Construction Dust*

23.58. Fugitive construction dust emissions have the potential to cause nuisance at nearby receptors, such as residential properties, by causing soiling of surfaces. In addition, a proportion of dust emitted will be in the form of fine particles which can have an adverse impact on human health.

23.59. Fugitive demolition and construction dust emissions may also have an impact on short term PM_{10} concentrations in close proximity of dust raising activities (the relevant Objective being 50$\mu g/m^3$ with 7 daily exceedences per year permitted). However, existing background PM_{10} concentrations are well below the objective for within the vicinity of the substation site.

23.60. Dust emissions from construction activities are predicted to have **negligible significant effect** as there are no sensitive receptors in the vicinity of Feolin, the cable trenching route, or the substation development site.

MITIGATION IN RELATION TO IMPACT 23.4
• No mitigation required

Residual impact

23.61. As no mitigation measures are require the residual impact will remain of **negligible significant effect**.

23.9.3 Potential Impacts during Operational Phase

IMPACT 23.5: *Emissions from on road traffic*

23.62. Once operational, it is likely that on road vehicles will be used during routine and emergency maintenance of the export cables and substation. However, maintenance is likely to occur infrequently and will not significantly increase AADT flows on the A846 (Jura). The operation of the proposed development is predicted to have a **negligible** significant effect on local air quality, in terms of road source emissions.

MITIGATION IN RELATION TO IMPACT 23.5
• No mitigation required

Residual impact

23.63. As no mitigation measures are required the residual impact will remain of **negligible significant effect**.

IMPACT 23.6: *Emissions from marine vessels*

23.64. The maintenance interval for the turbine array is scheduled to occur twice per year. In order to carry out maintenance, the turbines will be removed from the substructure in a method similar to the installation in reverse, using a similar number and type of vessels. Each turbine will be taken from site to shore, where it will be maintained and any faults addressed in a clean environment. Emissions from marine vessels associated with this activity are predicted to have a **negligible** significant effect on local air quality.

MITIGATION 23.6 : Emissions from marine vessels
• No mitigation required

Residual impact

23.65. As no mitigation measures are required the residual impact will remain **negligible significant effect**.

23.9.4 Potential Impacts during the Decommissioning Phase

23.66. The tidal array is assumed to have an operational life of approximately 14 years, after which time further consents will be applied for or the turbines would be decommissioned. It is intended that when the lifecycle of the array is complete, the devices and associated cables will be removed. The decommissioning phase is, therefore, likely to be a reversal of the installation process. Potential impacts during decommissioning are likely to be similar to those outlined during the construction phase (assuming removal of underground cables).

23.9.5 Cumulative Impacts

23.67. There are unlikely to be any other significant developments in the Sound of Islay or in proximity to landside works on Jura which would impact air quality.

23.9.6 Summary

Impact	Construction/ Decommissioning				Operation (including maintenance)			
	Magnitude of Impact	Receptor Sensitivity/ Importance/ Value	Significance of effect	Residual impact	Magnitude of Impact	Receptor Sensitivity/ Importance/ Value	Significance of effect	Residual impact
Emissions from on-road traffic	Low	Low	Negligible	Negligible	Low	Low	Negligible	Negligible
Emissions from marine vessels	Medium	Low	Minor	Negligible	Low	Low	Negligible	Negligible
Emissions from NRMM	Low	Low	Negligible	Negligible	Low	N/A	N/A	N/A
Construction dust	Low	Low	Negligible	Negligible	Low	N/A	N/A	N/A

23.10 Conclusions

23.68. This qualitative air quality assessment was undertaken to consider the potential local air quality impacts relating to the construction, operation (including maintenance) and decommissioning of the proposed development, with particular focus on NO_2 and PM_{10}.

23.69. A review of existing air quality confirmed that the proposed development site is not located within or in proximity to an AQMA, with existing and future predicted background pollutant concentrations (NO_2 and PM_{10}) well below the respective air quality Objectives.

23.70. Emissions from on road construction traffic and NRMM utilised during construction were predicted to have a local, temporary **negligible** significance of effect on air quality. These conclusions were based on existing low traffic flows on the A846 (Islay)[14] , the predicted number of HGV movements generated during construction, and the assumption that the majority of building materials will be delivered directly by sea to the storage area on at Feolin.

23.71. Fugitive construction dust emissions were predicted to have a **negligible significant effect** as there are no sensitive receptors in the vicinity of landside construction works on Jura.

23.72. Emissions from marine vessels utilised during construction and for routine maintenance once the turbines are operational were predicted to have a **minor significant effect** on local air quality. However, the residual impact of marine vessel emissions on local air quality following successful implementation of mitigation measures is predicted to be of **negligible significant effect.**

23.73. Exhaust emissions generated by on road traffic and marine vessels involved in operation and maintenance of the export cables and substation were predicted to have a **negligible significant effect** on local air quality.

23.74. Potential impacts during decommissioning are likely to be similar to those outlined during the construction phase (assuming removal of underground cables).

23.11 Statement of significance

23.75. Potential effects to air quality were predicted to be of **negligible** significance, and **negligible** from Non Road Mobile Machinery. Dust emissions from construction activities are predicted to have **negligible** impact as there are no sensitive receptors in the vicinity of landside construction works on Jura.

23.12 References

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24.0 Mitigation, Monitoring and Management

24.1 Introduction

24.1. The purpose of this chapter is to provide a summary of mitigation, monitoring and management measures proposed within this Environmental Statement (ES).

24.2. Table 24.1 lists the commitments made and summarises the mitigation measures proposed by ScottishPower Renewables (SPR) throughout the ES.

24.3. Environmental monitoring requirements prior to installation and post installation are discussed in more detail in Section 24.3.

24.4. Management procedures are identified in Section 24.4.

24.2 Mitigation

24.5. Mitigation measures are provided to limit, but not necessarily to eliminate, the environmental effects of the development.

24.6. If possible, prevention is the most effective form of mitigation, if it can be applied, as the potential impact is avoided. When an effect cannot be prevented, the next form of mitigation is reduction, where the environmental effect is reduced as far as reasonably practicable. If significant residual impacts remain after reduction measures have been put in place, measures delivering environmental benefits can be brought forward in order to offset them.

24.7. Mitigation measures have been outlined in each chapter of the ES in relation to each specific impact.

24.8. Table 24.1 provides a summary of all proposed mitigation measures.

TABLE 24.1 ENVIRONMENTAL STATEMENT COMMITMENTS	
Chapter	**Project Commitment**
Chapter 7: *Physical Environment and Coastal Processes*	No mitigation required.
Chapter 8: *Benthic Ecology*	No mitigation required.
Chapter 9: *Marine Mammals*	Potential impacts have been assessed as **negligible** in most instances, however, for collision risk and barrier effect assessments of **moderate** significance, before mitigation, have been made. An overall approach to mitigation, monitoring and management is proposed, which forms part of a wider deploy and monitor strategy, and should reduce the significance of effect for collision risk and barrier effect to **minor** SPR appreciates that this Development is the first tidal array and that consideration of magnitude of effects for a number of potential impacts includes consideration of elements where knowledge is incomplete. As a result, SPR commits to putting in place a programme of post installation monitoring and any mitigation considered necessary by regulators to avoid significant effects, as part of an ongoing programme of adaptive management. There is a theoretical potential to cause disturbance to marine mammals, and while our judgement is that this is of **minor** or **negligible** significance in all instances, based on industry experience gained from SeaGen and wider assessments, our knowledge is also acknowledged as incomplete. In particular effects from an array rather than a single device are unknown. A deploy and monitor strategy is proposed, with ongoing monitoring, linked to management of the Development. An important component of that strategy will be an application for a licence to disturb European Protected Species (EPS), to enable regulators to allow deployment while further knowledge regarding effects (or lack of effects) from the Development is obtained. Aspects to be monitored to address concerns regarding potential impacts on marine mammals include: • Use of impact sensors on the rotors and cameras to detect potential collisions; • Visual surveys in the first year after deployment to monitor for changes in use of the Development area and wider Sound by marine mammals; • Passive acoustic monitoring of echo-locatory species, particularly harbour porpoise within the Sound of Islay; • Development with Marine Scotland of procedure for reporting marine mammal carcass findings and carrying out post mortem, as part of wider national support to wet renewable industry by Scottish Government; and • Ongoing SMRU aerial surveys will provide approximate adult seal and pup numbers/ distribution and highlight any significant changes in the Sound of Islay. As part of a wider adaptive management and environmental monitoring strategy, SPR is committed to putting in place any appropriate mitigation indicated by monitoring.
Chapter 10: *Noise and Vibration Affecting Human Receptors*	The impacts on human receptors of noise from marine construction operations will be controlled through the application by the principal Contractor for a Section 61 'prior consent' in accordance with the guidance set out in the Control of Pollution Act 1974. Additional generic mitigation against marine construction noise will incorporate conventional best practice in construction operations. Mitigation measures may (not exclusively) where necessary include: • Education and awareness-raising of construction operatives with regard to the prevention of local community noise disturbance; • Minimising the idling of vessels in proximity to the residential properties; • Avoiding excessive revving of vessel or marine plant equipment engines; • Extra care taken in handling and placing materials within vessels; • Ensuring that the most modern plant equipment is used and fitted with appropriate noise attenuation; and • Ensuring proper maintenance and operation of plant equipment and vessels.
Chapter 11: *Marine Fish and Shellfish Resources*	To mitigate against the impact of noise on shellfish and finfish SPR will adhere to best practice outlined in BS5228-2 (2009) British Standards Code of Practice for noise and vibration control on construction and open sites during all construction activities and best practice guidance in CIRIA C584 (2003) Coastal and Marine Environmental Site Guide during all construction activities.

TABLE 24.1 ENVIRONMENTAL STATEMENT COMMITMENTS	
Chapter	**Project Commitment**
Chapter 12: *Anadromous Fish*	No mitigation required; however, contractors will adhere to good construction practice guidance (e.g. CIRIA guidance, SEPA Pollution Prevention Guidelines). No mitigation is considered necessary for potential EMF effects on salmonids; however, the cable design will aim to minimize EMF fields through appropriate shielding to reduce potential impacts with other EMF sensitive species (see *Chapter 13: Elasmobranchs*).
Chapter 13: *Elasmobranchs*	Impacts on elasmobranchs were assessed as **negligible**, with the exception of collision risk, which was assessed as **minor** (after mitigation) during construction and operation. During the construction phase the proposed mitigation is as follows: • The use of vessel and / or shore based visual observers would allow teams undertaking installation works to be alerted to the presence of basking sharks in the Sound. On receiving such an alert, appropriate mitigation would be put in place, potentially including avoidance of areas where sharks are feeding and modification (e.g. slowing of vessels) or cessation of installation activity until the sharks have moved on from the installation area. Appropriate procedures would be agreed with Marine Scotland. • SPR accepts that there is some uncertainty about some potential impacts from the Development and is committed to undertaking a post installation monitoring programme in order to determine the nature of those impacts. • SPR is committed to putting in place measures considered necessary by the regulator to mitigate impacts
Chapter 14: *Ornithology*	No effects were identified as significant under the terms of the EIA Regulations. Nevertheless, it is considered good practice to implement appropriate measures to mitigate any local effects and thereby minimise potential (albeit assessed as **negligible**) adverse significant effects. Surveys to locate the nests of birds listed in Schedule 1 of the Wildlife and Countryside Act will be undertaken prior to construction (and decommissioning) works during the period March-August. These surveys will be undertaken to inform measures to safeguard any breeding attempts from disturbance. Any risk to seabirds of accidental release of marine contaminants will be minimised by adopting safe working practices and having contingency plans in place for dealing with incidents. It should be noted that: • Good practices will aim to minimise disturbance to seabirds by vessels associated with the proposed Development by avoiding, where possible, preferred feeding areas and adopting voluntary speed restrictions. • Artificial nest sites for black guillemots located away from the immediate vicinity of the proposed Development site should help reduce disturbance effects on the breeding population of this species. It could also lead to an increase in the local population size (though this is likely to be limited by food supply) and breeding success, thereby helping offset any adverse effects on this species. Artificial nest sites should take the form of specially designed nest boxes or providing suitable cavities in stone walls or quays next to the sea. It is anticipated that approximately ten such sites should be constructed given the numbers of existing nest sites that may be affected by the proposed Development and that not all artificial sites may become occupied.
Chapter 15: *Commercial Fisheries*	A Safety Management System (including an Emergency Response Coordination Plan (ERCoP), appropriate to the scale and nature of the risks involved by the demonstration array, should be developed and put in place prior to installation of the array. To mitigate against impacts on commercial fishing, turbines and cables should be installed during periods of least fishing activity within the Sound (creeling activity is at its lowest in the summer). Close consultation with local fishermen will help to identify potential mitigation measures. Consultation with fishermen will also ensure that they are fully aware of the locations and timings of installation. All crews operating installation vessels and any shore based workers will remain vigilant at all times, and alert fisherman to any potential dangers. Skippers of fishing vessels will be provided with accurate information on the position of the individual devices immediately after they are installed through appropriate revision of navigation advice by UK Hydrographic Office. An explanatory note will be included in navigational charts explaining the nature of the hazards caused by the turbines. Device positional data will also be provided t to Kingfisher Information Services for inclusion in their advice. To avoid entanglement resulting in possible capsize of fishing vessel, the array area will be subject to an application in order to designate it a “No Fishing” (Int. Symbol N21) area. Turbines will also be fitted with rope cutters to clear any fishing gear that may become accidentally entangled. Cable protection will be installed where appropriate and care will be taken to avoid bridging during cable installation i.e. cable should be flat on the seabed with no space underneath where fishing gear could become trapped. The reporting of any accidents or near misses should occur in a clear and concise manor. A procedure for achieving this will be decided upon which will clearly outline who is responsible for reporting and how it will occur.

TABLE 24.1 ENVIRONMENTAL STATEMENT COMMITMENTS	
Chapter	**Project Commitment**
Chapter 16: *Terrestrial and Intertidal Ecology*	Detailed otter surveys will take place prior to final cable landfall design to check the footprint for holts, couches and other otter activities in consultation with SNH. This will be used to inform the application for a licence to disturb otters if required. On final decision of cable landfall site, detailed surveys for amphibians, reptiles and invertebrates will be conducted within the footprint, and should any protected species or sign of protected species be found, the necessary mitigation will be implemented after consultation with SNH. Construction work will be undertaken during agreed daylight working hours (07:00-18:00), where practicable. Artificial light will not be used next to the coastline or rivers at night to allow otters to migrate through the area undisturbed. During summer months, construction may continue later into the evening without the need for artificial lighting. Construction areas will be left in a safe condition during periods of inactivity, with chemicals and construction materials stored safely in accordance with SEPA's Pollution Prevention and Chemical Guidelines (PPG2- Above ground oil storage tanks, and PPG5 – Works in, near or liable to affect watercourses). Key measures may include capping all pipes, covering all trenches or providing a means for otter to escape. Construction activities will maintain a strict footprint of works for the corridor of the cable trenching, and construction vehicles and equipment will not be active on, or stored by, the coastline for longer than is necessary.
Chapter 17: *Landscape and Seascape*	Mitigation will involve minimising the footprint of the proposed substation to reduce its landscape impact. Creation of an earth mound against the north western boundary of the substation to aid the integration of the substation within the open moorland context. This mound should be vegetated with reserved heather/grass turves cut from the base of the substation. All structures will be appropriately / sympathetically coloured to minimise landscape impacts.
Chapter 18: *Cultural Heritage*	To mitigate damage to or removal of unknown onshore cultural heritage assets during construction a programme of archaeological works will be implemented, the scope of which would be provided in a Written Scheme of Investigation (WSI) to be agreed by West of Scotland Archaeology Service (WoSAS) on behalf of the Planning Authority. Such a programme has the potential to completely mitigate any adverse impact and may result in positive impacts due to the recovery of information about past human activity in the area. Construction Exclusion Zones may be introduced for anomalies that are considered to be of moderate to high archaeological potential or are of medium or high sensitivity to direct impacts. There are not considered to be any such sites within the proposed offshore construction area. However, it is recommended that the site of the Glenholme (HA19) and the potential uncharted wreck (HA29) should be furnished with a 50m exclusion zone in relation to any secondary impacts such as anchoring activities associated with installation of the turbines, inter-array cables and export cable. Although this is not a legal requirement this will ensure that the development is in line with current best practice. The size of any Construction Exclusion Zone is determined on an asset by asset basis, and is dependant upon the archaeological potential and the extent of the known or suspected asset or target. It may be possible to move, reduce or remove any Construction Exclusion Zones in light of further archaeological investigation carried out prior to construction. Such work could include diver investigation, or ROV investigation in the deeper more hazardous areas of the Sound. All protocols and procedures and locational information for assets furnished with exclusion zones will be set out in a Written Scheme of Investigation (WSI) prior to installation, in consultation with Historic Scotland (Senior Inspector of Marine Archaeology) and WoSAS as part of any consent condition.
Chapter 19: *Traffic and Transport*	Construction vessels, where possible, will avoid unnecessary crossing of the ferry route. Careful timing of activities (such as deliveries to the Feolin slipway) that may impact upon the ferry service to be conducted outside of peak usage where possible. Disruption will be monitored during deployment including through contact with ferry operator. Radio communication between DP vessel, cable laying vessel and the ferries to be maintained whenever any of these vessels are on approach or operating within the Sound. Vessels will be marked with appropriate flags and lights in accordance with COLREGS to warn other users of any restricted manoeuvrability. The contractor responsible for the cable laying activity will notify the UK Hydrographic Office (UKHO) of all the activity using the maritime safety information (MSI) system for promulgation to all vessels by notices to mariners (NMs) and radio navigational warnings Onshore construction works will be carefully sited to avoid traffic access routes to the ferry terminals on both Islay and Jura. Staff travelling on the Islay to the Jura ferry service during construction of the substation should use the minimum number of vehicles as is practical (car sharing when

TABLE 24.1 ENVIRONMENTAL STATEMENT COMMITMENTS	
Chapter	**Project Commitment**
	possible). Use of suitable methodology to ensure road disruption is minimised, such as half road closure or use of passing places whilst construction will be undertaken. The contractor will provide a traffic management plan which will reduce effect to that of normal A846 traffic.
Chapter 20: *Socio Economics, Tourism and Recreation*	SPR will continue to work with the Islay Energy Trust (IET), Argyll and Bute Council and Highlands and Islands Enterprise (HIE) to fully develop the local supply chain. Where possible, and economically viable contractors and other services will be sourced locally. Consultation will take place with the Islay and Jura Marketing board to identify the most effective solutions for accommodation provision, particularly during summer months. SPR have worked extensively, and will continue to work to raise the profile of the project and demonstrate the benefits of tidal energy. SPR will work with the Islay Energy Trust (IET) to develop and promote good quality interpretative materials to encourage interest and understanding of tidal energy which may provide a benefit to tourism in the area. Construction activities will be clearly advertised locally. Adherence to a Traffic Management Plan and the mitigation laid out in *Chapter 19: Traffic and Transport*, including consideration of large Jura public events will minimise disruption. Installation will be designed to minimise unnecessary noise, discussed further in *Chapter 10: Noise and Vibration Affecting Human Receptors*. . A Notice to Mariners will be issued in advance of marine works. The array will be appropriately charted as an underwater obstruction and annotated, as discussed further in the Navigational Safety Risk Assessment (Appendix 19.1). The array will also be charted as a 'no diving' area and consultation will continue with relevant diving organisations. During construction activities the following safety procedures will be implemented: • Notice of the activities would be promulgated through the UKHO Maritime Safety Information system (i.e. Notices to Mariners (NMs) and Radio Navigational Warnings (NavWarns/WZs)) and will occur just prior to and during the maintenance works; • Installation vessels will comply with the COLREGS in that they would display the appropriate lights and marks for vessels engaged in such activities; and • Presence on site of manned vessels capable of monitoring and advising the other marine traffic using the Sound of Islay. The Navigational Safety Risk Assessment has been undertaken (Appendix 19.1) and identifies management of potential conflict with ferry routes, discussed in *Chapter 19: Traffic and Transport.*
Chapter 21: *Water and Sediment Quality*	No mitigation required.
Chapter 22: *Military and Munitions*	Through consultation with the Defence Estates it was identified that there were no concerns with regard to military activities and the Development. Consultation with the Defence Estates will be continued throughout consenting and site development, allowing any future concerns to be addressed should they arise. The Defence Estates will be informed in advance of intended works dates and any potentially conflicting activities will be coordinated to minimise disturbance. The Development will adhere to the safety measures identified in the Navigational Safety Risk Assessment (Appendix 19.1), with particular reference to the following points: • Notice of the works would be promulgated through the UKHO Maritime Safety Information system (i.e. Notices to Mariners (NMs) and Radio Navigational Warnings (NavWarns/WZs)) and will occur just prior to and during the construction works. Installation vessels will comply with the COLREGS in that they would display the appropriate lights and marks for vessels engaged in such activities and manned vessels will be on site which can monitor and advise other marine traffic using the Sound of Islay. • The array will be appropriately charted as an underwater obstruction and annotated, as discussed further in the Navigational Safety Risk Assessment (Appendix 19.1). • The Principal Contractor will liaise with local organisations including the Defence Estates to ensure that suitable working channels are selected to avoid compromising authorised communications • Should suspected items of UXO be discovered during any project phase, their location will be recorded and immediate advice will be sought from the relevant authorities. If a UXO is identified during the construction phase then works will cease immediately until advice and remediative actions are implemented. In addition munitions awareness briefings will be given to contractor's and ship staff prior to and during the construction phases. The MoD and emergency services will be consulted as appropriate.
Chapter 23: *Air Quality*	No mitigation required.

24.3 Monitoring

24.9. SPR will develop an appropriate monitoring and reporting programme to cover the construction and operational phases of the array as identified for key receptors in relevant ES chapters.

24.10. An effective monitoring programme will give the opportunity to re-address mitigation measures where they have been more or less successful than anticipated. Pre-installation monitoring and Deploy and Monitor strategy are each considered in turn below.

24.4 Pre-installation Monitoring

24.11. The monitoring strategy prior to installation of the Development will be established through consultation with SNH. A number of elements of pre-installation monitoring are already in place, for example, vantage point monitoring of the area of the Sound for marine mammals and birds, as well as incidental basking shark sightings.

24.4.1. Terrestrial ecology

24.12. Otter surveys will be undertaken in advance of onshore construction works to identify areas being actively used and works planned in such a way as to avoid or minimise disturbance to those areas.

24.13. Amphibians, reptiles and invertebrate detailed survey will be undertaken within footprint in advance of construction to inform management of the construction site.

24.4.2. Ornithology

24.14. The potential impacts of the proposed Development on birds are not deemed to be significant. However, best practice dictates that an appropriately detailed monitoring programme should be agreed and implemented. The value of monitoring the Sound of Islay Demonstration Tidal Array to the wider tidal renewables industry is likely to be particularly high given that this would be the first tidal array, the geography of the site facilitates survey work (as much can be done from the land) and there is a relatively high level of pre-construction baseline survey data for comparison.

24.15. Under the Breeding Bird Protection Plan (BBPP) surveys to locate the nests of birds listed in Schedule 1 of the WCA will be undertaken prior to construction (and decommissioning) works during the period March-August. These surveys will be undertaken to inform measures to safeguard any breeding attempts from disturbance.

24.4.3. Marine mammal and basking sharks

24.16. Baseline vantage point data have already been collected for the Sound.

24.17. The establishment of a system for recording of marine mammal stranding would allow potential direct collision impacts to be assessed against a baseline. Marine Scotland is establishing a process for assessment of any stranding reported. This system could be supplemented by work to increase local awareness and establishment of a local (Islay and Jura) reporting system. Any reporting system could be easily expanded to encompass basking sharks if considered appropriate.

24.18. Modelling as well as consultation with local vessel users and RNLI could be used to indicate areas if the Sound where stranding potential is greatest, allowing recording effort to be focussed there.

24.5 'Deploy and Monitor' Strategy

24.19. Open stream tidal turbine technology is an emerging technology, with limited currently operational commercial scale developments upon which to base aspects of assessment. Where devices have been both operating at a commercial scale and potential environmental interactions have been monitored, the results to date indicate no significant adverse environmental impacts (for example, SeaGen, Northern Ireland). However, SPR appreciates that the potential interactions of an array of turbines is to some extent unknown, and assessments must be necessarily based on data for single devices from expert judgement based on knowledge of potential receptors and current understanding of the potential effects of single devices extrapolated to encompass an array.

24.20. The 'deploy and monitor' strategy for the Development will be established through consultation with Marine Scotland and SNH with the aim of providing sufficient comfort to regulators to allow licensing of installation of the array against a background of uncertain environmental effects. Key elements of the strategy are detailed in the ES and can be summarised as follows:

- Uncertainly regarding effects of an array of devices must be balanced against the desire to develop wet renewable energy. A risk management based approach to deployment, combined with detailed monitoring and mitigation if required is proposed;
- Application to (potentially) disturb European Protected Species (EPS);
- Monitoring of key receptors;
- Commitment by developer to put in place any mitigation indicated.

24.5.1. Ornithology

24.21. The potential impacts of the proposed Development on birds are not deemed to be significant. However, best practice dictates that an appropriately detailed monitoring programme should be agreed and implemented. The value of monitoring the Development to the wider tidal renewables industry is likely to be particularly high given that this would be the first tidal array, the geography of the site facilitates survey work (as much can be done from the land) and there is a relatively high level of pre-construction baseline survey data for comparison.

24.22. Post installation monitoring studies of greatest value will continue baseline studies, including:

- Pre-breeding surveys of black guillemot in the Sound of Islay, including the monitoring of any nest boxes provided;
- Surveys to quantify the distribution, abundance and behaviour of diving seabirds using the Development site and other parts of the Sound of Islay. The behavioural surveys should collect evidence of changes in behaviour in response to the proposed Development including disturbance, displacement, attraction and habituation; and
- Surveys to quantify the level of human activity, in particular vessel movements, associated with the construction and operation phases of the proposed Development.

24.23. The surveys noted above should be conducted during construction and in years 1 – 3, 5 and 10 of the proposed Development's 7-year operation period (with possible extension to 14 years). However, flexibility will be retained to cancel this monitoring programme if it is clear that beneficial information is not being collected.

24.24. Given the Development's novelty, an appropriately detailed bird monitoring programme should be agreed, with an Ornithological Steering Group for the Development to establish protocols and review results on a suitably frequent basis. If distribution and abundance surveys indicate a high likelihood of interaction it would be beneficial to attempt to monitor any mortality which results from collision with the turbines. The need for and methods used to monitor collisions would be considered by the Ornithological Steering Group.

24.5.2. Marine mammals and basking sharks

24.25. Due to the high conservational importance of marine mammals and basking sharks any impact of low to high magnitude is deemed to be significant.

24.26. The primary aim of post installation monitoring is to assess the potential impacts of the development on EPS and on the seals associated with the South East Islay Skerries. The data collected during this phase of monitoring should contribute to an assessment of whether the development is having a significant impact that is likely to affect the Favourable Conservation Status (FCS) of relevant populations.

24.27. The post installation monitoring studies which will provide most useful information in the context of this development include:

- Land based observations from a vantage point overseeing the Development site should be undertaken by an observer with suitable experience. Marine mammals and basking shark surveys will be undertaken in the first year after deployment in combination with diving bird surveys. This should be designed in consultation with SNH, SMRU and HWDT to ensure data collected are comparable with available baseline data;
- Use of strain gauge sensors on the rotors. SPR will establish a methodology for detecting an impact on the turbine rotors equivalent to the weight of a juvenile seal. The impact will be detected in real time and a protocol will be established and agreed through consultation with SNH;
- Ongoing SMRU aerial surveys will provide approximate adult seal and pup numbers/ distribution and highlight any significant changes in the Sound of Islay.

24.6 Management

24.28. A number of management protocols will be implemented during the construction, operation and decommissioning of the Development to ensure suitable actions are taken in the prevention, reduction and offsetting of any impacts.

24.29. A full Environmental Management Plan (EMP) for the operational phase of the Development will be implemented in agreement with the relevant regulators following submission of this ES. The EMP will consist of a working document which details the environmental actions highlighted in the ES, providing a framework for addressing these environmental risks and outlining the mitigation required and the responsibilities of all involved parties.

24.30. The EMP will include details of the post-installation monitoring programme agreed with Marine Scotland, and detail agreed reporting and decision making protocols. A system similar to that used for oil spill response planning, though much simplified, is proposed.

24.31. A detailed Construction Method Statement (CMS) and a Pollution Incident Response Plan (PIRP) will be prepared and agreed with SEPA, SNH and Marine Scotland prior to commencement of construction.

24.32. All work will be undertaken to an overarching Health, Safety and Environmental Management System, which will include the CMS, the PIRP and the EMP. The project will be supervised in accordance with the Construction Design and Management Regulations (2007)

24.33. All wastes activities will be undertaken in accordance with the Waste Management Licensing Regulations 1994 (as amended for Scotland), the Landfill (Scotland) Regulations 2003 (as amended) and the Special Waste Amendment (Scotland) Regulations 2004 (as amended). In addition, the volume of materials excavated and stored will be minimised.

24.34. The appointment of an environmental clerk of works, to be present on site and oversee the construction phase is proposed. The clerk of works would have responsibility for overseeing the implementation of mitigation measures agreed with Marine Scotland during licensing.

24.7 Conclusions

24.35. Measures are proposed to establish a programme of mitigation and monitoring.

24.36. The measures include a number of 'traditional' mitigation measures, of known effect, including careful management of working practices in the marine and terrestrial environments.

24.37. In the marine environment the potential effects of the proposed Development are thought to be limited; however, there are gaps in the knowledge available to inform some assessments. In particular the potential for effects on marine mammals and basking sharks requires ongoing careful investigation. An adaptive approach to management is proposed, with the deployment of the array, combined with a series of focussed monitoring measures and a commitment to establish mitigation as indicated by the results of monitoring. This approach is summarised as deploy and monitor.

24.38. In order to implement deploy and monitor strategy, the potential to damage or disturb marine mammals must be addressed. An application for an appropriate licence, linked closely with the monitoring proposed and a clear mitigation commitment, will be made.

24.39. SPR is committed to the establishment of an appropriate monitoring programme as part of a wider deploy and monitor strategy. Where monitoring indicates that specific mitigation may be reasonably required, SPR is committed to putting this mitigation in place.