SeaGeneration (Kyle Rhea) Ltd

The Kyle Rhea Tidal Stream Array

Volume II

Environmental Statement

Marine Current Turbines
A Siemens Business

Royal HaskoningDHV
Enhancing Society Together

iema EIA

GLOSSARY OF TERMS

Term	Description
Anadromous fish	Fish which spend most of their lives in the sea and migrate to fresh water to breed.
Anthropogenic factors	Factors related to human activities.
Antifouling	Prevention of growth of plants or animals on structures.
Bycatch	Fish caught unintentionally by fishing vessels intending to catch other fish.
Cathodic protection	Use of sacrificial material, such as zinc, in anodes fixed to metal structures in the marine environment to reduce corrosion damage.
dB re 1 μPa	Unit for sound pressure measurement for underwater noise levels. For underwater sounds the reference pressure preference is an root mean square pressure of 1 μPascal.
Drilling fluid	Lubrication for the horizontal directional drill bit.
Environmental Impact Assessment	Assessment of the potential positive or negative impacts of a proposed project on the physical, ecological and social environment.
Environmental Management Plan	A plan outlining measures to ensure construction and operation of a project minimises environmental impacts, fulfilling commitments made during an EIA and consent conditions. May include roles and responsibilities; Communication and co-ordination; training and awareness; operational control; checking and corrective action; and environmental control measures
Geotechnical analysis	The analysis of ground conditions and sediment composition.
Grilse	A young salmon that returns to fresh water after one winter in the sea.
Ground Truthing	Confirmation of remote sensing by collection of data (such as samples) in the field
Grouting	Form of cement material used to secure piles to the seabed .
Heronry	A breeding colony of herons, typically in a group of trees
Hjulstrom curve	Is a graph used by hydrologists to determine whether a river will erode, transport or deposit sediment.
Horizontal directional drilling	Horizontal directional drilling (HDD) is a steerable trenchless method of installing underground pipes, conduits and cables in a shallow arc along a prescribed bore path by using a surface launched (or offshore) drilling rig, with minimal impact on the surrounding area.
Hydro electric	Generation of electricity through water movement.
Isostatic	Equilibrium in the earth's crust such that the forces tending to elevate landmasses balance the forces tending to depress landmasses
Jack up barge	A floating mobile platform that is able to stand still on the sea floor, resting on a number of supporting legs which can be lowered to the seabed / raised as required.
Mean sea level	Average tidal level, taking into account high and low tides over a time period
Metocean	Meteorological and oceanographic data, including wind, sea level

Term	Description
	pressure, tidal elevation and current flow
Monopile	Hollow steel tube that is inserted into the seabed to create a stable build foundation
Natal River	The river that an individual fish originates from and for many species the river to which they will return to breed
Ovigerous	Egg bearing females.
Permanent Threshold Shift	The permanent loss of hearing in some or all frequencies.
Poor ground conditions	Ground or seabed which will not support building works or structures
Potential Biological Removal	The potential mortality level that a population can sustain before it is unsustainable
Renewable Obligation Certificates	A government subsidy for all renewable generation devices
Rochdale envelope	An approach to consenting, named after a UK planning law case, which allows a project description to be broadly defined, within a number of agreed parameters for the purpose of consent application.
Rock anchor	A metal pole inserted into the seabed via a pre-drilled hole and fixed in place via grouting.
Scour	Erosion around an artificial structure like a monopole.
Shear stress	Shear stress arises from the force vector component parallel to the cross section
Smolt	Term used to describe salmon that are entering the sea from their natal river for the first time.

ACRONYMS

Abbreviation	Full Name
AA	Appropriate Assessment
AC	Alternative Current
ADCP	Acoustic Doppler Current Profiler
AfL	Agreement for Lease
ALARP	As Low as Reasonably Practicable
ALB	All-Weather Lifeboat
AOD	Above Ordnance Datum
ASCOBANS	Agreement on Conservation of Small Cetaceans of the Baltic and North Seas
ASFB	Association of Salmon Fisheries Boards
BATNEEC	Best Available Technology Not Entailing Excessive Costs
BBPP	Breeding Bird Protection Plan
BDF	Biodegradable Drilling Fluid
BERR	Business, Enterprise and Regulatory Reform
BGS	British Geological Survey
BoCC	Birds of Conservation Concern
BPEO	Best Practise Environmental Option
BPM	Best Practicable Means
BS	British Standards
BUTEC	British Underwater Testing and Evaluation Centre
CA	Cruising Association
CAR	Controlled Activities Regulations
CBD	Convention on Biological Diversity
CD	Chart Datum
CDM	Construction Design Management
CEFAS	Centre for Environment Fisheries and Aquaculture Studies
CEMP	Construction Environmental Management Plan

Abbreviation	Full Name
CFP	Common Fisheries Policy
CIRIA	Construction Industry Research and Information Association
CO_2	Carbon dioxide
COPA	Control of Pollution Act 1974
COWRIE	Collaborative Offshore Wind Research Into The Environment
CPA	Coastal Protection Act 1949
CRTN	Calculation of Road Traffic Noise
CTMP	Construction Traffic Management Plan
CWS	County Wildlife Site
dB	Decibel
DECC	Department for Energy and Climate Change
DEFRA	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
DNO	Distribution Network Operator
DOC	Dissolved Organic Carbon
DP	Dynamic Positioning
DSP	Dolphin Space Programme
DWR	Deep Water Route
EGA	Expert Geomorphological Assessment
EIA	Environmental Impact Assessment
EMAMP	Environmental Monitoring and Adaptive Management Plan
EMEC	European Marine Energy Centre
EMF	Electromagnetic Fields
EMP	Environmental Management Plan
EPS	European Protected Species
EQS	Environmental Quality Standards
ERCoP	Emergency Response Cooperation Plan

Abbreviation	Full Name
ES	Environmental Statement
ESZ	Eastern Side Zone
ETS	Emissions Trading System
EU	European Union
EU ETS	European Union Emissions Trading System
FCS	Forestry Commission Scotland
FEPA	Food and Environment Protection Act 1985
FLO	Fisheries Liaison Officer
GBRs	General Binding Rules
GIS	Geographical Information Systems
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GPS	Global Positioning System
GW	Gigawatt
GWDTEs	Ground Water Dependent Terrestrial Ecosystems
HBRG	Highland Biological Recording Group
HDD	Horizontal Directional Drilling
HER	Historic Environment Record
HGV	Heavy Goods Vehicle
HIE	Highlands and Islands Enterprise
HRA	Habitats Regulations Appraisal
HVDC	High Voltage Direct Current
HWDT	Hebridean Whale and Dolphin Trust
IALA	International Association of Marine Aids
ICES	International Council for Exploration of the Sea
ICOMOS	International Council on Monuments and Sites
ICS	Impressed Current System
IEEM	Institute of Ecology and Environmental Management

Abbreviation	Full Name
IEMA	Institute of Environmental Management and Assessment
IfA	Institute for Archaeologists
IFG	Inshore Fisheries Group
ILB	Lochalsh Inshore Lifeboat
IMO	International Maritime Organization
IPIECA	The International Petroleum Industry Environmental Conservation Association
IUCN	International Union for Conservation of Nature
JNAPC	Joint Nautical Archaeology Policy Committee
JNCC	Joint Nature Conservation Committee
LBAP	Local Biodiversity Action Plans
LDP	Local Development Plan
LNCS	Local Nature Conservation Site
LNR	Local Nature Reserve
LSA	Local Study Area
LSE	Likely Significant Effects
LWS	Local Wildlife Site
MAIB	Marine Accident Investigation Board
MarLIN	Marine Life Information Network
MAROL	International Convention for the Prevention of Pollution from Ships
MCA	Marine Coastguard Agency
MCA	Marine Conservation Area
MCAA	Marine and Coastal Access Act 2009
MCS	Marine Conservation Society
MEG	Marine Energy Group
MEHRAs	Marine Environmental High Risk Areas
MGN	Marine Guidance Note
MHWS	Mean High Water Springs

Abbreviation	Full Name
MLWS	Mean Low Water Springs
MMO	Marine Management Organisation
MoD	Ministry of Defence
MPA	Marine Protected Area
MSL	Mean Sea Level
MS-LOT	Marine Scotland Licensing and Operations Team
MSP	Member of Scottish Parliament
MSS	Marine Scotland Science
MW	Megawatt
NBN	National Biodiversity Network
NCI	Nature Conservation Importance
NLB	Northern Lighthouse Board
nm	Nautical miles
NMRS	National Monuments Record of Scotland
NNR	National Nature Reserve
NPF	National Planning Framework
NPPG	National Planning Policy Guidance
NPR	National Power Research
NRA	Navigational Risk Assessment
NRP	National Research Projects Limited
NSA	National Scenic Areas
NSP	Noise Sensitive Properties
NTM	Notice to Mariners
NTS	Non Technical Summary
OS	Ordnance Survey
OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
PAC	Pre-Application Consultation

Abbreviation	Full Name
PAD	Protocol for Archaeological Discoveries
PAN	Planning Advice Notes
PBR	Potential Biological Removal
PEXA	Practice and Exercise Areas
PMF	Priority Marine Feature
PPD	Public Participation Directive
PPV	Peak Particle Velocity
RBMP	River Basin Management plan
REZ	Renewable Energy Zone
RIB	Rigid Inflatable Boat
RMS	Root Mean Square
RNLI	Royal National Lifeboat Institution
ROC	Renewable Obligation Certificate
RoW	Receiver of Wrecks
RSA	Regional Study Area
RSPB	Royal Society for the Protection of Birds
RYA	Royal Yachting Association
SAC	Special Area of Conservation
SAM	Scheduled Ancient Monument
SCADA	Supervisory Control And Data Acquisition
SCANS II	Small Cetaceans in the European Atlantic and North Sea
SCOS	Special Committee On Seals
SEA	Strategic Environmental Assessment
SEPA	Scottish Environment Protection Agency
SINCS	Sites of Importance to Nature Conservation
SHEP	Scottish Historic Environment Policy
SHEPD	Scottish Hydro-Electric Power Distribution

Abbreviation	Full Name
SLA	Special Landscape Area
SLVIA	Seascape, Landscape and Visual Impact Assessment
SNCI	Sites of Nature Conservation Importance
SNH	Scottish Natural Heritage
SMRU	Sea Mammal Research Unit
SNIFFER	Scottish and Northern Ireland Forum For Environmental Research
SOPEP	Shipboard Oil Pollution Emergency Plan
SPA	Special Protection Area
SPP	Scottish Planning Policy
SRDL	Satellite Relay Data Loggers
SSI	Scottish Statutory Instrument
SSSI	Sites of Special Scientific Interest
STW	Scottish Territorial Waters
SWDC	Salt Water Drilling Clay
TA	Transport Assessment
TAC	Total Allowable Catch
TCE	The Crown Estate
TS	Transport Statement
UK	United Kingdom
UK BAP	United Kingdom Biodiversity Action Plan
UKCP	United Kingdom Climate Projections
UKHO	United Kingdom Hydrographic Office
UN	United Nations
UNCLOS	UN Convention on the Law of the Sea
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VMS	Vessel Monitoring System
VOC	Volatile Organic Compounds

Abbreviation	Full Name
VP	Vantage Point
WCA	The Wildlife and Countryside Act 1981
WCS	Worst Case Scenario
WDCS	Whale and Dolphin Conservation Society
WEWS	Water Environment and Water Services
WFD	Water Framework Directive
WSA	Wider Study Area
WSI	Written Scheme of Investigation
WSMA	West Scotland Management Area
WSZ	Western Side Zone
ZTV	Zone of Theoretical Visibility

CONTENTS

1 INTRODUCTION

Page

1 CONTENTS

1.1 Background

1.1.1 Sea Generation (Kyle Rhea) Ltd is proposing to construct and operate an 8 megawatt (MW) rated capacity demonstration array of tidal stream turbines.

1.1.2 The ‘Kyle Rhea Tidal Stream Array’ (henceforth referred to as “the Project”) is proposed to be situated in the narrow strait between the Isle of Skye and mainland Scotland, known as Kyle Rhea.

1.1.3 Sea Generation (Kyle Rhea) Ltd is a project company established by Marine Current Turbines Ltd (MCT), who are the world’s leading tidal turbine technology developer and part of the Siemens group.

1.1.4 The development of an array represents the next step in the development of tidal energy projects, following the successful commercial demonstration of single devices including MCT’s SeaGen device at Strangford Lough, Northern Ireland. Whilst a tidal array in the Sound of Islay has been consented, there are currently no constructed and operational tidal arrays in the world.

1.1.5 The tidal industry has an important role to play in contributing to the UK Government’s target for renewable energy to provide 15% of the gross annual electricity generation by 2020, and the Scottish Government’s targets of providing the equivalent of 100 % of Scotland's gross annual electricity consumption by 2020 from renewable sources.

1.1.6 This document constitutes the Environmental Statement (ES) under The Electricity Works (EIA)(Scotland) Regulations 2000, and provides details of the project and key findings of the Environmental Impact Assessment (EIA) carried out for the Project. The ES supports an application for a Marine Licence under the Marine Scotland Act 2010, consent under the Section 36 Electricity Act 1989, and consent for the offshore aspects of the Project under the Town and Country (Scotland) Planning Act 1997 (as amended).

1.2 The proposed project

1.2.1 Sea Generation (Kyle Rhea) Ltd secured an Agreement for Lease (AFL) from The Crown Estate in March 31st 2011 to develop a project at Kyle Rhea. The Lease to cover the operation of the Project (a period of 25 years) would be triggered once all of the relevant consents and permissions have been secured. The Project location is shown in Figure 1.1.

1.2.2 This ES will support an application to Marine Scotland for a Marine Licence for the Project. Impacts of the Project are considered over the duration of its likely operational life span, namely 25 years, and includes installation and decommissioning of the array.

1.2.3 The EIA has covered the offshore element of the Project, the export cable and onshore works up to and including the Project substation. As with most renewable energy projects the cable from the Project substation to the local grid will be the responsibility of the Distributed Network Operator (DNO), SSE in this area, and is not considered in the EIA. It is expected that export will be via a combination of new buried cable and upgraded existing overhead cable, routed towards the Broadford area.

1.2.4 The Project comprises the following elements (see also Chapter 5, Project Description):

- Four “SeaGen devices” with an output of up to 2MW per device. Each device has two rotors with three rotor blades (Figure 1.2);
- Inter-array cabling.
- A single 33 kV directionally drilled export cable.
- Cable protection where necessary.
- An onshore project substation.

1.2.5 A detailed description of the SeaGen devices and the Project design is given in Chapter 5, Project Description.

Figure 1.2: The SeaGen device

1.3 The developer

1.3.1 Marine Current Turbines Ltd (MCT), a Siemens business, has established the Project company Sea Generation (Kyle Rhea) Ltd to develop the Project.

1.3.2 As the leader in the development of power systems capable of exploiting tidal and marine currents, MCT has significant experience in the development, installation and operation of tidal stream turbine technology. In 2003 MCT successfully installed and operated a 300 kW single rotor experimental test system off the North Devon coast near Lynmouth. This device, known as 'Seaflow', was the world's first full scale tidal stream device installed in the marine environment .

1.3.3 In 2008, MCT installed a 1.2 MW twin rotor device, known as SeaGen, in Strangford Lough, Northern Ireland (see Figure 1.2). SeaGen is the world's first commercial scale tidal device and has been consistently generating to grid since it was installed. SeaGen recently passed

6 Gigawatt hours (GWh) of generation at Strangford Lough.

1.4 The need for the Project and potential benefits

1.4.1 The UK Government and devolved Scottish Government have committed to reducing the emission of greenhouse gases and under the Climate Change Act 2008 and Climate Change (Scotland) Act 2009 by 80% by 2050. One potential route towards this target is the reduction in dependence on fossil fuels, for electricity generation. In order to deliver this carbon reduction, an increase in renewable energy production is required. The Kyle Rhea Tidal Stream Array and similar marine energy projects will contribute to these targets, generating enough electricity to power over 3750 homes.

1.4.2 Tidal power is a clean and predictable source of renewable energy that does not emit greenhouse gases, and is not dependent on finite reserves of fossil fuels. It is the predictability of the power generation that makes tidal power so attractive as a contribution to the mix of power generation in the UK. The development of sustainable tidal power generation is recognised as part of the UK's renewable energy strategy to achieve this rapid transition and to meet long term carbon reduction targets. The UK Government stated in 2009 that: *". . . much of this [renewable energy] will be from wind power, on and offshore, but biomass, hydro and wave and tidal will also play an important role."* UK Renewable Energy Strategy, 2009.

1.4.3 The SeaGen device in Strangford Lough is one of the only projects providing commercial scale electricity generation from tidal streams. Developments of small tidal arrays are an essential stepping stone towards development of the embryonic tidal energy sector. This project is an important step in the transition from a demonstrator technology to full scale commercial projects.

1.4.4 MCT has also secured an Agreement for Lease (AFL) from The Crown Estate for a larger 100MW project in Pentland Firth. The lessons learnt from the Project will inform the development of larger fully commercial arrays. The Project will also stimulate the development of a robust supply chain to support the emerging marine renewable industry in Scotland and UK.

1.4.5 The 2010 Marine Energy Action Plan (DECC 2010) highlights that the development of a strong marine renewables sector in the UK will help achieve legally binding carbon reduction targets and also secure energy supply, create jobs, and develop skills to be utilised by the global market (see Chapter 21, Socio-economics).

1.4.6 The key renewable energy policy drivers outlined here are explained in more detail in Chapter 2, Policy and Legislation.

1.4.7 The Project has a number of potential benefits for local organisations and businesses. A range of marine and land based construction and engineering services will be required, supported by suitable charter vessels and divers will be required for the installation, and operation and maintenance (O & M) phases of the Project. It is anticipated that environmental scientists will be required for pre and post construction monitoring in addition to the work already undertaken during site characterisation surveys. The intention is to utilise local facilities, firms and people as much as possible. During the SeaGen project in Northern Ireland, MCT spent around £1.3m in the adjacent towns of Portaferry and Strangford from 2005 to 2011 (including both construction and operation phases) and an additional £2.1m elsewhere in Northern Ireland (see Chapter 21, Socioeconomics).

1.4.8 The SeaGen device in Strangford Lough has attracted significant public interest, from the media and scientific communities, as well as the wider public. It is hoped that the Kyle Rhea project will draw similar interest, generating business for local hotels and guest houses, as well as boat operators, as national and international visitors seek to find out more about the Project, the surrounding area and its communities. Potential socio economic impacts of the Project are discussed further in Chapter 21, Socio Economics.

1.5 Project objectives

1.5.1 The key objective of the Project is commercial generation of electricity from tidal flow devices. The electricity generated will contribute to the Scottish Government target of generating 100% of Scotland's electricity demand from renewable sources, and the UK target of 15% by 2020. This is in line with the European Commission's binding legislation, aimed at increasing the average renewable share across the EU to 20% by 2020.

1.5.2 This project will contribute to an 80% reduction in greenhouse gas emissions by 2050 required by the Climate Change (Scotland) Act (2009).

1.5.3 The Project will deliver clean, carbon free emission electricity, from a reliable and predictable resource, and will directly contribute to the development of the UK marine renewables industry. The renewable energy sector is of strategic importance in contributing to emissions reductions and climate change mitigation for the UK.

1.6 Structure of the Environmental Statement

Table 1 provides a list of the chapters of this Environmental Statement. The figures and appendices associated with each chapter are provided in **Volume III, Figures and Appendices**.

Table 1: ES Chapters

Chapter no.	Title
1	Introduction
2	Policy & Legislation
3	Site Selection
4	EIA Methodology
5	Project Description
6	Consultation
7	Marine Physical Environment and Coastal Processes
8	Geology, Hydrogeology and Non-marine Surface Water
9	Marine Water Quality
10	Terrestrial and Intertidal Ecology
11	Ornithology
12	Marine Mammals and Basking sharks
13	Benthic Ecology
14	Fish and Shellfish
15	Commercial Fisheries
16	Seascape Landscape and Visual Impact
17	Shipping and Navigation
18	Traffic and Transport
19	Archaeology and Cultural Heritage
20	Onshore Noise

Chapter no.	Title
21	Socioeconomics
22	Tourism and Recreation
23	Military Activity
24	Summary

1.7 EIA project team

1.7.1 Royal Haskoning has been commissioned to lead the Environmental Impact Assessment (EIA), working closely with Sea Generation (Kyle Rhea) Ltd. Royal Haskoning has extensive experience in Renewables EIA and detailed understanding of the potential impacts of the SeaGen device following their lead role in the EIA and Environmental Monitoring Programme (EMP) for the SeaGen in Strangford Lough. Royal Haskoning has used in-house experts in hydrology, geology, water quality, coastal processes, terrestrial ecology, benthic ecology, marine mammals, traffic, and noise. External expertise have been sourced from following specialist companies commissioned by Sea Generation (Kyle Rhea) Ltd:

- SKM Enviros – Seascape, Landscape and Visual Impact Assessment (SLVIA);
- Natural Research (Projects) Ltd, supported by local resident and ornithologist Andy Law – marine mammal and ornithology surveys and reporting;
- Marico and Anatec – Navigation surveys and Risk Assessment;
- DMP Statistical Solutions – analysis of marine mammal data;
- Hebridean Whale and Dolphin Trust (HWDT) – collation and reporting of existing regional datasets;
- Envision Mapping Ltd – drop down video survey and seabed habitat mapping;
- Headland Archaeology – Archaeology impact assessment;
- Subacoustech – Underwater noise modelling; and
- Tristan Southall – Commercial fisheries assessment and Fisheries Liaison.

1.8 References

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DTI (2005). Guidance on consenting arrangements in England and Wales for a pre-commercial demonstration phase for wave and tidal stream energy devices (marine renewables). London: HM Government.

RenewableUK (2006). Education and Careers: Calculations for wind energy statistics [online]. London: RenewableUK. Available from: http://www.bwea.com/about/contact.html [08/11/2010]

2 POLICY AND LEGISLATION

Page

2 CONTENTS

2.1 Introduction

2.1.1 This chapter identifies the international and European legislative drivers and commitments in the areas of climate change, decarbonisation and renewable energy, and the corresponding United Kingdom (UK) and Scottish policies which set the objectives and targets to meet these legal obligations. This chapter also shows how the proposed Kyle Rhea Tidal Stream Array ('the Project') fits within all relevant policy frameworks and, as such, how it will make a significant contribution to meeting these targets.

2.1.2 This chapter outlines the regulatory and consenting requirements relating to the construction, operation and decommissioning phases of the Project, including the SeaGen devices, associated infrastructure, cables and onshore substation.

2.2 Policy context for energy generation

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

2.2.2 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.

European and International energy context

2.2.3 The UK plays a leading role in tackling climate change at an international level, working through the European Union (EU), G8 and United Nations (UN) Framework Convention on Climate Change.

2.2.4 The 1997 Kyoto Protocol set internationally agreed and binding targets for reducing emissions of greenhouse gases up to 2012. 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.

2.2.5 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.

2.2.6 The EU has 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 carbon dioxide (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.

2.2.7 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.

2.2.8 The EU is focussed on energy security issues (the EU Energy Policy: Engaging with Partners beyond Our Borders), with security and diversity of supply key threads. Renewable energy is one of a number of potential contributors to diversity of supply.

UK energy context

2.2.9 This section summarises significant UK policy developments relevant to renewable energy over the past decade, with the key legislative and policy instruments detailed in Table 2.1.

2.2.10 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.

2.2.11 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 tidal and wave energy.

2.2.12 More recently the UK Government has underpinned its long term support for marine renewables by proposing to increase its support level from the current level of 2 to 5 Renewable Obligation Certificates (ROCs) for tidal stream and wave energy. This is expected to be implemented across the UK from the 1st of April 2013.

Table 2.1: UK energy and climate change policies and legislation

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 (DTI, 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. The white paper identified diversity of supply and energy security as key drivers, in addition to climate drivers.

Policy	Key elements
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 (DECC, 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 Roadmap (DECC, 2011)	The Renewables Roadmap out a comprehensive action plan to accelerate the UK’s deployment and use of renewable energy. It eight technologies that either the greatest potential to help the UK meet the 2020 target in a cost-effective and sustainable way, or offer great potential for the decades that follow. These technologies include marine energy technologies.
Government response to the consultation on proposals for the levels of banded support under the Renewables Obligation for the period 2013-17 and the Renewables Obligation Order 2012	Review of the current system of Renewable Energy Obligation Certificates (ROCs). Decision to increase ROCS for wave and tidal energy from 2 to 5 with a cap on 30MW per project after which 2 ROCs will be issued.

Scottish energy context

2.2.13 The UK is a signatory to the EU Renewable Energy Directive, which includes a UK target of 15% of energy from renewable sources by 2020, with 30% of that energy expected to have to come from renewable electricity generation[1]. Scotland’s potential to produce marine renewable electricity is vast, with the total tidal and wave resource in Scotland estimated at 14 Gigawatt (GW) and 7.5GW respectively (Scottish Government, Undated).

2.2.14 The seas around Scotland have the potential to provide a sustainable, renewable energy source with:

- Up to a 25% of Europe's tidal power and 10% of its wave power; and
- Around 25% of the European offshore wind resource potential[2]

2.2.15 Scotland is estimated at having the resource capacity to produce 12GW of energy from marine renewable and offshore wind sources by 2020.

2.2.16 The Scottish Government is firmly committed to the development of a successful marine renewable energy industry, in Scotland. In 2011 it committed to achieving the EU 2020 target (20% of EU's energy consumption from renewable sources by 2020) through a stated target of meeting the equivalent of 100% of Scotland's electricity demand from renewable sources by 2020. In advance of the UK government (see above), Scottish Ministers

[1] http://www.decc.gov.uk/en/content/cms/meeting_energy/renewable_ener/renewable_ener.aspx

[2] http://www.scotland.gov.uk/Topics/marine/marineenergy

completed a consultation on their proposal to increase the level of ROCs support for tidal stream energy from 3, as it currently is in Scotland, to 5 with a cap on large projects (The Scottish Government, 2011).

2.2.17 In September 2008 The Scottish Government published its future approach to energy policy, recognising that marine renewable energy has a part to play in future energy supply as well as playing a part in its strategy to reduce greenhouse gases and tackle global warming.

2.2.18 In 2007 the Scottish Government commissioned a Strategic Environmental Assessment (SEA) to examine the potential effects on the environment from the development of tidal and wave 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 1,300 Megawatt (MW) 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 1,300MW 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.

2.2.19 The Project 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 larger projects in the future.

The Climate Change (Scotland) Act 2009

2.2.20 The Climate Change (Scotland) Act introduced binding targets on the Scottish Government to reduce net Scottish greenhouse gas emissions by 83% by 2050 from 1990 levels; with an interim target of 42% by 2020. The Scottish Governments' Renewables Action Plan published in July 2009 and most recently updated in March 2011, reiterates the targets set in 2007. Support for renewables development, including tidal energy, is contained in National Planning Framework (NPF) 2 and Scottish Planning Policy (SPP) (further detail is provided in 6.3 below).

2.3 Marine and terrestrial planning in Scotland

2.3.1 The Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 (MCAA) have introduced a marine planning regime for the marine area of Great Britain. The Scottish Government has responsibility for marine planning within both Scottish Territorial Waters (STW) (0 -12 nautical miles (nm) offshore), and within the Scottish Renewable Energy Zone (REZ) (12 – 200nm offshore).

2.3.2 In accordance with the MCAA, a joint Marine Policy Statement has been prepared by the UK Government in conjunction with the Scottish Government and the devolved administrations of Wales and Northern Ireland. In March 2011 the Scottish Government published a draft National Marine Plan which covers both STW and the Scottish REZ. The draft plan is currently being consulted upon and is to be finalised at the end of 2014. It identifies certain key objectives for management of the marine environment and the role offshore renewables can play in promoting economic growth and tackling climate change. The draft plan also identifies the need for offshore renewables developments to be constructed and operated to minimise noise and collision risk to Best Available Technology Not Entailing Excessive Costs (BATNEEC) standards.

2.3.3 The Marine (Scotland) Act 2010 requires the Scottish Government to establish marine regions. The number and extent of the marine regions have yet to be established. Following creation of the marine regions, regional marine plans will be put in place with policies applicable at a local level. The Marine (Scotland) Act 2010 and MCAA also provide for the creation of Marine Protection Areas (MPAs). MPAs will be afforded particular protection on account of their nature conservation, historic or research and development value.

2.3.4 The Scottish Government's Strategic Environmental Assessment (SEA) on Marine Renewables in 2007 concluded that the deployment of new technology, particularly marine renewable devices, would carry a degree of uncertainty regarding potential associated environmental impacts. As a result, a risk-based 'Survey, Deploy and Monitor Policy' is being developed to enable efficient, sustainable deployment of wave and tidal energy devices.

National Planning Framework

2.3.5 The National Planning Framework (NPF) is prepared by the Scottish Government and provides the long term strategy for development in Scotland over a 25 year period. The NPF sits at the top of the policy hierarchy and is the long term strategy for the development of Scotland. The Framework provides an important context for renewable energy development and supporting electricity infrastructure.

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

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

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

2.3.9 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 tidal and wave power, biomass and offshore wind.

Scottish Planning Policy

2.3.10 The NPF is underpinned by Scottish Planning Policy (SPP), Planning Advice Notes (PANs), and a number of Circulars. 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 new SPP supersedes and replaces the previous SPPs and National Planning Policy Guidance (NPPG) series (including SPP 6 Renewable Energy), providing a shorter, clearer and more focused statement of national planning policy.

2.3.11 The new SPP contains the Following:

- Scottish Government's view of the purpose of planning;
- Core principles for the operation of the system and the objectives for key parts of the system;

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

2.3.12 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.”

2.3.13 Such issues are recognised as being likely to include impact on the landscape, historic environment, natural heritage and water environment, amenity and communities, and any cumulative impacts that are likely to arise. The SPP goes on state that:

‘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.’

and

‘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 connective won 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.’

Planning advice notes

2.3.14 PANs provide advice and good practice in relation to the NPF. PAN 51 Planning, environmental protection and regulation aims to support sustainable developments and provides overarching advice which is provided in more detail in the following PANs which are relevant to the Project:

- PAN 1/2011 (superseding PAN 56) Planning and noise;
- PAN 58 Environmental Impact Assessment; and
- PAN 63 Waste management.

Development plans

<u>Marine National (Scotland) level plans</u>

2.3.15 Development plans and statements of policy are a material consideration with regard to the authorisation of electricity generation schemes under Section 36 of the Electricity Act 1989. In addition the draft National Marine Plan also states that legislation is to be brought forward to ensure Marine Plans are a material consideration for land use planning decisions.

2.3.16 The Scottish Ministers are in the process of producing a single Scottish National Marine Plan. The pre-consultation draft was produced for public review in 2011 and the final considerations, adoption and publication of the plan are anticipated in 2014. The plan will be prepared by Marine Scotland on behalf of the Scottish Ministers and will set national economic, social and marine ecosystem objectives alongside objectives relating to the mitigation of, and adaptation to, climate change. The plan may set out specific spatial requirements for particular types of activity or development where these are of national significance.

Regional level plans

2.3.17 These will be prepared for Scottish Marine Regions to take forward policies and priorities defined in the National Marine Plan. No time frame is currently available for this provision however they are unlikely to be produced until 2015. Regions will be defined by Marine Scotland and managed by a Marine Planning Partnership which will comprise someone nominated by the Scottish Ministers as well as one or more public authorities and/or stakeholders. The 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 two years to produce after the finalisation of the National Marine Plan, so consultation on draft plans in 2014 / 2015 is anticipated.

2.3.18 The Highland Structure Plan, which was approved by Scottish Ministers and came into effect on 26 March 2001, together with the West Highland and Islands Local Plan, adopted 9th September 2010 comprises the statutory development plan for the area in which the Project falls. It is used by the council to assess and determine planning applications. The Planning etc. (Scotland) Act 2006 establishes a new development planning system. The Highland-wide Local Development Plan (LDP), which includes Skye and Loch Alsh was adopted on 5 April 2012 and supersedes the General Policies and other related material of this Local Plan including the previous Skye and the Lochalsh LDP. The Project meets the requirements of the Highland-wide LDP Plan regarding renewable energy development.

2.3.19 Development Plan policy currently supports the development of renewable energy projects, including both large and small scale tidal developments.

2.3.20 The Highland Renewable Energy Strategy and Planning Guidelines (2006) identifies Kyle Rhea as a Primary Development Area for tidal stream developments, based on the constraints and cost factors estimated in the resource assessment (Aquatera, 2005).

Local planning

2.3.21 The Local Development Plan (LDP) for an area comprises both the approved structure and the adopted local plan. Table 2.2 below, identifies where relevant aspects of the LDP have been addressed within this ES. The relevance of these policies is considered in each ES chapter.

Table 2.2: Adopted development plan policies

ES chapter	West Highland and Islands Local Plan (adopted 2010)	Highland Wide Local Development Plan (adopted April 2012)
Chapter 7 Marine Physical Environment and Coastal Processes	Policy 10: Physical constraints	Policy 64: Water environment Policy 73: Pollution
Chapter 8 Geology, hydrology and non-marine surface water	Policy 8: Waste management Policy 10: Physical constraints Policy 14: Surface water drainage	Policy 54: Minerals Policy 55: Mineral waste Policy 56: Peat and soils Policy 63: Geodiversity Policy 67: Surface water drainage
Chapter 9 Water Quality	Policy 2: Development objectives and developer requirements	Policy 64: Water environment Policy 66: Waste water treatment Policy 73: Pollution
Chapter 10 Terrestrial and Intertidal Ecology	Policy 4: Natural, built and cultural heritage Policy 11: Protected species Policy 12: Other important species Policy 13: Important habitats	Policy 50: Coastal development Policy 52: Trees and development Policy 58: Natural, built and cultural heritage Policy 59: Protected species Policy 60: Other important species Policy 61: Other important habitats
Chapter 11 Ornithology	Policy 4: Natural, built and cultural heritage Policy 11: Protected species Policy 12: Other important species Policy 13: Important habitats	Policy 58: Natural, built and cultural heritage Policy 59: Protected species Policy 60: Other important species Policy 61: Other important habitats
Chapter 12 Marine Mammal and Basking Sharks	Policy 4: Natural, built and cultural heritage Policy 11: Protected species Policy 12: Other important species Policy 13: Important habitats	Policy 58: Natural, built and cultural heritage Policy 59: Protected species Policy 60: Other important species Policy 61: Other important habitats
Chapter 13 Benthic Ecology	Policy 4: Natural, built and cultural heritage Policy 11: Protected species Policy 12: Other important species Policy 13: Important habitats	Policy 58: Natural, built and cultural heritage Policy 59: Protected species Policy 60: Other important species Policy 61: Other important habitats
Chapter 14 Fish and Shellfish	Policy 4: Natural, built and cultural heritage Policy 11: Protected species Policy 12: Other important species Policy 13: Important habitats	Policy 58: Natural, built and cultural heritage Policy 59: Protected species Policy 60: Other important species Policy 61: Other important habitats

ES chapter	West Highland and Islands Local Plan (adopted 2010)	Highland Wide Local Development Plan (adopted April 2012)
Chapter 15 Commercial Fisheries	Policy 6: designing for sustainability	Policy 51: Aquaculture
Chapter 16 Seascape, Landscape and Visual Impact	Policy 3: Wider countryside Policy 17: Design quality and place-making	Policy 30: Design quality and place-making Policy 37: Wider countryside Policy 62: Landscape Policy 70: Electricity transmission infrastructure
Chapter 17 Shipping and Navigation	Policy 18: Travel	Policy 57: Travel
Chapter 18 Traffic and Transport	Policy 18: Travel	Policy 57: Travel
Chapter 19 Archaeology	Policy 4: Natural, built and cultural heritage	Policy 58: Natural, built and cultural heritage
Chapter 20 Onshore Noise[3]		Policy 73: Pollution
Chapter 21 Socio-economics	Policy 6: designing for sustainability Policy 15: Developer contributions Policy 16: Commerce	Policy 32: Developer contributions Policy 42: Business and industrial land Policy 68: Renewable Energy developments
Chapter 22 Tourism and Recreation	Policy 15: Developer contributions	Policy 44: Tourism Policy 68: Renewable Energy developments Policy 78: Public Access
Chapter 23 Military Activity		Policy 68: Renewable Energy developments

Terrestrial planning in Scotland

2.3.22 Outline consent for the onshore project components associated with the Project will be sought under The Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2008 for more details (see section 6.4 below for further detail on the Town and Country planning Act).

[3] Note that issues relating to underwater noise are discussed within the relevant receptor chapters. For example, underwater noise impacts on marine mammals and on fish are discussed within those chapters respectively.

2.4 Legislative context

Marine (Scotland) Act 2010

2.4.1 In March 2010 the Marine (Scotland) Act received Royal Assent; it provides a framework for the sustainable management of Scotland's seas and one of its key aims is to streamline and simplify the licensing and consenting process for offshore renewable projects.

2.4.2 Projects had historically been required to seek licences and planning consent under several pieces of legislation before development could proceed. With the introduction of the Marine (Scotland) Act, co-ordinated applications for planning consent and associated licenses (including a Marine Licence under the Marine (Scotland) Act and Section 36 Consent under the Electricity Act) can now be made via a single point of access, Marine Scotland's Licensing Operations Team (MS-LOT), as part of a unified licensing and consenting process.

The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000

2.4.3 These Regulations implement the European Environmental Impact Assessment (EIA) Directive 1985 (as amended, 2009), and outline the requirement for assessment of the effects of certain public and private projects on the environment. Such projects include the construction, extension and operation of a power station or overhead electricity lines under Sections 36 and 37 of the Electricity Act.

2.4.4 As the Project is over 1MW and so requires Section 36 consent, it is considered to be a Schedule 2 development under The Electricity Works (EIA)(Scotland) Regulations 2000; defined as "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".

2.4.5 To ensure full compliance with the regulations, Sea Generation (Kyle Rhea) Ltd. will provide an Environmental Statement (ES) detailing the EIA to accompany its Section 36 consent application.

2.4.6 Under Regulation 7, the developer (i.e. Sea Generation (Kyle Rhea) Ltd.) is entitled to ask the Scottish Ministers, before submitting an application for a Section 36 consent under the Act, to state in writing their opinion as to the information to be provided in the Environmental Statement (ES) (i.e. to provide a 'Scoping Opinion').

2.4.7 In accordance with Regulation 7, Sea Generation (Kyle Rhea) Ltd. requested a formal scoping opinion on 1st April 2010 (see Chapter 4 EIA Methodology and Chapter 6, Consultation) and this scoping report provided a summary of relevant information on the proposed development including:

- A plan which identifies the site which is the subject of the proposed development;
- A brief description of the nature and purpose of the proposed development and its possible impacts on the environment; and
- An outline of further information that Sea Generation (Kyle Rhea) Ltd. intends to provide as part of the EIA process.

2.4.8 Once they have all the information they require, the Scottish Ministers are required to consult and obtain the views of the Consultative Bodies defined in the Regulations (the Planning Authorities of the area in which the development is planned, Scottish Natural Heritage (SNH) and the Scottish Environment Protection Agency (SEPA), the developer and other organisations (as they see fit). When the Scottish Ministers issue a Scoping Opinion, they must state what information should be included in the Environmental Statement, giving their reasons why. Marine Scotland provided Sea Generation (Kyle Rhea) Ltd with the Scoping Opinion in 2010 (see Chapters 4, EIA Methodology and 6, Consultation)

2.4.9 Consultation under the Marine Works (EIA) Regulations 2007 (as amended) is undertaken within the consultation for the Electricity Works (EIA) (Scotland) Regulations 2000.

Town and Country Planning (Scotland) Act 1997

2.4.10 The Town and Country Planning (Scotland) Act 1997 is the principal legislation governing the use and development of land within Scotland.

2.4.11 The Act is supported by various pieces of subordinate legislation, including the Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2008, under which an application for outline planning permission would be considered.

2.4.12 The Town and Country Planning (Hierarchy of Developments) (Scotland) Regulations 2009 consider the scale of the Development, which would constitute a 'major development' under the regulations. This classification necessitates pre application consultation as set out in Part 2 of The Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2008.

2.4.13 The Planning etc. (Scotland) Act 2006 amends certain parts of the 1997 Act; including development plan preparation, development control (now known as development management) and enforcement. These changes amend but do not replace the 1997 Act, which remains the principal planning act in Scotland.

2.4.14 The EIA (Scotland) Regulations 2011 must also be considered and the relevant requirements must be satisfied in full, even if the application is for planning in principle.

Energy Act 2004

2.4.15 Sections 105 – 114 of the Energy Act 2004 introduce a decommissioning scheme for offshore wind and marine energy installations. Decommissioning responsibilities are not devolved to Scotland and licensing requirements lie with the Department of Energy and Climate Change (DECC). DECC will be consulted on a decommissioning plan, and Marine Scotland Licence Operating Team (MS-LOT) will also be involved at this stage. Under the terms of the Act, the Secretary of State may require a person who is responsible for one of these installations to submit (and ultimately carry out) a decommissioning programme for the installation. Sea Generation (Kyle Rhea) Ltd will produce a decommissioning programme for the Project to fully comply with DECC guidance.

Water Environment and Water Services Act (WEWS)

2.4.16 The WEWS Act sets out steps for the implementation of the river basin planning process in Scotland. Section 20 of this Act sets out a requirement for control regimes to regulate all activities that pose a risk to the water environment. These arrangements were introduced in 2005 via The Water Environment (Controlled Activities) (Scotland) Regulations 2005 (CAR).

2.4.17 The CAR regulations provide ministers with powers to introduce regulatory controls over activities in order to protect the water environment (freshwater and marine). All point source discharges, abstractions, impoundments and some engineering work require an authorisation under these regulations. Low risk activities, such as those associated with the Project are likely to be subject to General Binding Rules (GBRs) and thus a licence is not required. Where activities are not covered by GBRs, the developer will need to apply to Scottish Environment Protection Agency (SEPA) for authorisation.

2.5 Consents and licensing

2.5.1 In order to permit the construction and operation of all components of the Project, the following consents and agreements will be required for the offshore elements of the project:

- An application to Marine Scotland under Section 36 of the Electricity Act, 1989; and,
- A Marine Licence from Marine Scotland under Section 20 of the Marine (Scotland) Act 2010 (replacing Section 5 Part II of the Food and Environment Protection Act (FEPA), 1985 and Section 34 of Coast Protection Act, 1949[4)].
- Planning permission from the Highland Council under the Town and Country Planning (Scotland) Act 1997.

2.5.2 The offshore elements of the Project will require a decommissioning programme to be developed under Energy Act 2004. Sea Generation (Kyle Rhea) Ltd intends to fully comply with the requirements for an agreed decommissioning plan.

2.5.3 In addition to the above, further consents, which may also be required, include:

- European Protected Species licence for cetaceans and otters under The Conservation (Natural Habitats, & c.) Regulations 1994;
- A licence for disturbance to basking sharks under the Wildlife and Countryside Act, 1981 (as amended) and the Nature Conservation (Scotland) Act 2004

2.5.4 Various guidance documents are being produced for marine renewable energy developers and are due for imminent release. At the time of writing Sea Generation (Kyle Rhea) Ltd is aware of the following:

- Marine Renewable Licensing Manual (final draft available for consultation[5]);
- Guidance on survey and monitoring for marine renewables deployments in Scotland (draft published on SNH website for review[6]);
- A review of the potential impacts of wave and tidal renewable energy developments on Scotland's marine environment (awaiting draft); and
- The SNH Service Level Statement for renewable energy consultants.

Electricity Act 1989 ('S36 Consent')

2.5.5 Section 36 of the Electricity Act 1989 is the primary consent required from the Scottish Ministers (administered by Marine Scotland on their behalf) for the construction and operation of a power generating station situated within the territorial sea with a capacity of 1MW or more. Consent for the construction and operation of the development will therefore be sought under Section 36.

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5 http://www.scotland.gov.uk/Topics/marine/Licensing/marine/LicensingManual

6 http://www.snh.gov.uk/docs/B925810.pdf

Marine Licence

2.5.6 From April 2011, under the Marine (Scotland) Act 2010 a single Marine Licence has replaced the previously separate FEPA and CPA licences required under the Food and Environment Protection Act 1985 (FEPA) the Coastal Protection Act 1949 (CPA).

2.5.7 A Marine Licence will be required for the Project due to the installation of the support structures, devices and associated cabling being considered as a deposit by construction activity both in the sea and or under the seabed as described within the legislation.

2.6 Conservation regulations

Habitats Regulations Appraisal (HRA)

2.6.1 Under the Conservation (Natural Habitats, etc. & C.) Regulations 1994 (as amended in Scotland), where a development is proposed in or near to a Natura 2000 site, or in an area recognised as an important site for marine species which are a feature of a Natura 2000 site, the competent authority should determine, and inform the developer as early as possible, on the requirement to undertake an Appropriate Assessment (AA), prior to granting the relevant consents and licenses for development.

2.6.2 The AA tests whether a plan or a project is likely to have a significant impact on the integrity of a European and/or Ramsar site. The Habitats Regulations also require that, in determining whether a plan or project is likely to have a significant impact on a European site the plan or project should be considered both alone and in-combination with other plans or projects.

2.6.3 The Project development is located within the Lochs Duich, Long and Alsh Reefs SAC and the Kinloch and Kyleakin Hills SAC, (both of which are Natura 2000 sites); Therefore AA will be required for this project. Information to assist the Scottish ministers in the completion of the AA is provided in an HRA report, which accompanies this ES (Royal HaskoningDHV, 2012).

European protected species (EPS)

2.6.4 The Habitats Directive identifies a number of European Protected Species. In the marine environment these include all cetaceans, seals and otters. For any European Protected Species (EPS)[7.] Regulation 39 of the Conservation (Natural Habitats, & C.) Regulations 1994 makes it an offence to deliberately or recklessly capture, kill, injure, harass or disturb any such animal. An EPS Licence is required for any activity that might result in disturbance to EPS.

2.6.5 For any European Protected Species (EPS)[8.] Regulation 39 of the Conservation (Natural Habitats, & C.) Regulations 1994 makes it an offence to deliberately or recklessly capture, kill, injure, harass or disturb any such animal. An EPS Licence is required for any activity that might result in disturbance to EPS.

2.6.6 The Project is located within an area that is heavily used by the European otter and is occasionally used by cetaceans, in particular harbour porpoise (all of which are EPS). One or more EPS licences may be required before work can commence.

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[7] EPS include all cetaceans and otters amongst other species

[8] EPS include all cetaceans and otters amongst other species

2.7 Rochdale envelope approach

2.7.1 The complex nature of the Project and the evolving nature of the tidal energy sector, mean that full details of the proposed development are not available at the time of the application. For example the detailed installation method is dependent on the availability of vessels at the time of installation, and the outcomes of the associated tendering processes. Therefore, the project description and methods upon which this application for consent is based, falls within a range of defined criteria – an envelope of potential development which described the potential extent and nature of the development. This approach allows a degree of flexibility in determining the final specific project detail, while still meeting the requirements of the EIA process.

2.7.2 This approach is termed the 'Rochdale envelope' approach, with associated case law established in R.v Rochdale Metropolitan Borough Council ex p. Milne (2000), where a precedent was set that solely illustrative and indicative sketches and layouts cannot provide a sufficient basis for the determination of applications for outline planning permission for a development requiring EIA. An EIA process which fails to fully take into account of project details may give rise to the grant of consent which may be unlawful because the consented project would then have the potential to give rise to an impact greater than which it has been assessed.

2.7.3 The 'Rochdale envelope' approach defines a series of realistic maximum extents and magnitudes for the description of a development (an envelope), the impacts of which are assessed. In this way a realistic worst case scenario is assessed. Post consent a detailed design of the scheme can vary within that envelope, without rendering the EIA inadequate. By adopting this approach, the ES can conclude that the environmental impact of the Project will be no greater than that set out in the ES and may be less.

2.7.4 The 'Rochdale envelope' approach is now common practice for many offshore renewable projects and has been successfully employed in a number of consented projects. It should be noted that although the associated case law is not directly applicable to Scotland, The National Policy Statement (EN-1) recognises that, some details of a scheme may be unknown at the time of the application and it therefore encourages the flexibility that the 'Rochdale envelope' approach offers in assessing the maximum potential adverse effects (DECC 2011).

2.7.5 Chapter 2: Project Description, sets out the parameters of the project in as much detail as currently possible. Where site specific details have not yet been finalised, then a minimum and maximum number have been presented. Where that specific parameter is relevant to the assessment, the worst case for that element has been identified by the relevant specialist and used as the basis for that assessment.

2.7.6 The final design will be refined in response to technology availability, consultation, environmental sensitivities and economic considerations, although at all times within the envelope assessed by this ES.

2.8 Summary

2.8.1 This chapter identifies relevant legislation and policies for the Project, and shows that Sea Generation (Kyle Rhea) Ltd is cognisant of them and their requirements. The following key consents are required:

- An application to Marine Scotland under Section 36 of the Electricity Act, 1989; and,

- A Marine Licence from Marine Scotland under Section 20 of the Marine (Scotland) Act 2010 (replacing Section 5 Part II of the Food and Environment Protection Act (FEPA), 1985 and Section 34 of Coast Protection Act, 19499).
- Planning permission from the Highland Council under the Town and Country Planning (Scotland) Act 1997.

2.9 References

DECC (2012) Government response to the consultation on proposals for the levels of banded support under the Renewables Obligation for the period 2013-17 and the Renewables Obligation Order 2012

Royal HaskoningDHV (2012). Information to inform Habitat Regulations Appraisal. *Report in support of the Kyle Rhea Tidal Stream Array application*

Scottish Government, (Undated). Marine energy policy Statement available at: http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/17853-1/MEPS (2008) accessed on 20/11/2011

The Scottish Government (2011). Renewable Energy The Renewables Obligation

(Scotland) Order 2011 Consultation on Review of ROC Bands accessed 11/10/2012 available at: http://www.scotland.gov.uk/Resource/Doc/361576/0122199.pdf

Aquatera (2005) Highland Renewable Energy Resource Assessment

3 SITE SELECTION

Page

3.1 Introduction

3.1.1 This chapter summarises the site selection process to identified Kyle Rhea as a suitable site for the deployment of a tidal stream array.

3.2 Broad scale site selection

3.1.2 As discussed in Chapter 1, Introduction, the Scottish Government has ambitious targets to produce 100% of Scotland's electricity demand by 2020, based on the wide range of natural resource including wind, wave and tidal energy around Scotland.

3.1.3 Scotland is an attractive area for the development of a tidal array project both in terms of the available tidal energy resource and the consistent support of the Scottish Government for renewable energy projects. Currently the Scottish Government is offering 5 Renewable Energy Certificates (ROCs) per MWh to support tidal energy projects in order to help develop this industry which will play an important part in meeting renewable energy targets.

3.3 Consideration of Scottish sites

3.1.4 The installation and operational requirements of SeaGen devices (as detailed in Chapter 5, Project Description) were key site selection factors, which were applied to broad development areas to identify suitable sites for an array.

3.1.5 The key site requirement criteria that were applied during the site selection process are listed below in Table 3.1.

Table 3.1: SeaGen device requirements

Factor	Threshold/ comments
Minimum Tidal Resource	2.5m/s at mean spring tides.
Minimum Water Depth	26m LAT. this may vary depending on tidal resource. (e.g. shallow high velocity tidal streams will provide similar power to deeper lower velocity streams.)
Maximum Water Depth	35m LAT, was dependent upon tidal resource. This value may vary with prevailing wave conditions and the limitations associated with current jack up technology.
Grid Connection	The site should have suitable capacity in the nearby grid, with few upgrades required.

Factor	Threshold/ comments
"Constructability"	The site should use existing technologies.

3.1.6 Potentially suitable sites for tidal turbine array development were identified by MCT, and are presented in Table 3.2.

Table 3.2. Sites considered in initial suitability exercise.

Site name		
Bluemull Sound	Gigha and Sound of Jura approaches	Rhinns and Mull of Galloway
Burrow Head	Irish Sea approaches	Shapinsay Sound
Butt of Lewis	**Kyle Rhea**	Sound of Barra
Cape Wrath	Loch Eyenort	Sound of Harris
Corryvreckan	Mull of Kintyre	Sound of Islay
Craignish	North Ronaldsay	Sound of Luing
Eynhallow Sound	Papa Sound	Sound of Mull
Falls of Lora	Pentland Firth east	Sumburgh Head
Firth of Lorn	Pentland Firth west	Yell Sound

3.1.7 Various factors were considered for each site, including accessibility, depth, topography, resource availability, rock strength for foundations, unexploded ordinance (UXO), shipping constraints, and grid connection. Kyle Rhea is the most favoured site for the following reasons:

- **Accessibility**
  - o Good local port facilities at Lochalsh;
  - o Suitable slipway or shore to bring equipment and materials in by sea;
  - o A number of local boat operators for operation and maintenance (O&M) works;
- **Depth, topography and geology**
  - o The Kyle descends steeply at the sides with a basin around 20 to 35m. A sufficient area meets the required depth of 26 to 35m for the SeaGen devices.
  - o The seabed is predominantly bedrock, suitable for drilling foundations in to and with minimal scour potential.
- **Tidal Resource**
  - o An Acoustic Doppler Current Profiling (ADCP) survey recorded maximum current speeds of 3.8m/s. The average flood currents speeds were recorded at 2 to 3.5m/s in the centre of the channel (see Figure 5.2)
- **Grid connection**
  - o Suitable grid connection option expected to be available on the Isle of Skye for the start of the operational phase for the Project.
- **Unexploded ordinance**
  - o Surveys of the seabed have shown no anomalies which could be UXO
- **Navigation**
  - o Navigation represents a challenge for the Project but detailed consultation and modelling suggests a safe channel can be maintained.

3.4 Array location

3.1.8 The array area shown in Chapter 1, Introduction, Figure 1.1 meets the device requirements outlined in Table 3.1. This array area has been identified due to having suitable water depth. In addition, a resource assessment of Kyle Rhea using ADCP found that the southern end of the Kyle (the array area) has sufficient tidal resource. The device locations are constrained by a compromise between the available tidal resource, suitable water depth, and maintaining a suitable shipping channel through the Kyle (see Chapter 17, Shipping and Navigation).

3.5 Onshore location

3.1.9 An assessment of the grid infrastructure in the vicinity of the project has indicated that the connection options suitable for the Project are all on the Skye side rather than on the mainland side.

3.1.10 The grid network in the vicinity of the Project is currently at full capacity, however there is a planned upgrade to the transmission network with a new high voltage direct current (HVDC) link to the Western Isles (SHETL, undated) which will free-up sufficient capacity on Skye in 2015 which ties in the commissioning phase for the Project (see Chapter 5, Project Description).

3.1.11 The Forestry Commission (FC) land (option 1) on Skye adjacent to the project site provides a suitable location for the substation with existing access tracks. The surrounding woodland limits the visual impact of the substation. Transfer of materials and equipment would likely be brought in by sea to the ferry slipway.

3.1.12 An alternative onshore location (option 2) on flat grassland to the east of Kylerhea village has been identified. Equipment and materials could be landed directly at the drilling area transported across the beach to site, if the road from the ferry slipway is found to be unsuitable.

3.6 References

Scottish Hydro Electric Transmission Ltd (SHETL) (undated). Western Isles Link, the upgrade of grid access on the Western Isles. Available at: http://www.sse.com/uploadedFiles/Z_Microsites/Western_Isles/Controls/Lists/Resources/WesternIslesNeedsCaseStakeholderSummary.pdf

4 EIA METHODOLOGY

Page

4 CONTENTS

4.1 Introduction

4.1.1 This chapter of the Environmental Statement (ES) describes the Environmental Impact Assessment (EIA) process. As discussed in Chapter 2, Policy and Legislation, the legislative framework for EIA is set by European Directive 85/337/EEC on the Assessment of the Effects of Certain Public and Private Projects of the Environment, as amended by Directive 97/11/EC ("the EIA Directive"). This Directive has been transposed into UK law, through a number of regulations applicable to different categories of development, which require an EIA to be undertaken to support the consent application. This Project falls under The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000, The Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended), and the Town and Country Planning (Scotland) Act 1997 (as amended), discussed further in Chapter 2, Policy and Legislation. The approach to EIA follows the requirements of these legislations and is described in this chapter.

4.1.2 This chapter has one technical appendix (Appendix 4.1) containing the Scoping Opinion from by Marine Scotland in response to the Scoping Report (Marine Current Turbines, 2010)

Background

4.1.3 The proposed development is considered to be a Schedule 2 development under The Electricity Works (EIA)(Scotland) Regulations 2000 as it is over 1MW; defined as *"a generating station, the construction of which (or the operation of which) will require a Section 36 consent but which is not a Schedule 1 development".* The 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 consent application.

4.1.4 Under the EIA Regulations, an applicant may submit a "Request for Scoping Opinion" from Scottish ministers. Sea Generation (Kyle Rhea) Ltd sought a "scoping opinion" for the installation of a tidal array at Kyle Rhea on 1st April 2010. This request requires Scottish Ministers (particularly Marine Scotland as the development falls within their remit) and their advisors to provide their opinion on the information provided, including identification of predicted impacts and the proposed approach to EIA. This ES has been prepared on the basis of the advice provided. **Appendix 4.1** contains the Scoping Opinion.

4.1.5 Following consultation with both Marine Scotland and the Highland Council through the request for Scoping Opinion (see Marine Current Turbines, 2010 and Appendix 4.1) and during subsequent meetings, it was confirmed that the Project would seek consent through a Marine Licence for offshore components under the Marine (Scotland) Act 2010, and for onshore components through outline planning under the Town and Country (Scotland) Planning Act 1997 (as amended) (see Chapter 2, Policy and Legislation).

EIA overview

4.1.6 As discussed above the consent application will require an EIA. 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 impacts and the identification of a range of suitable mitigation options and management measures.

4.1.7 The assessment is carried out based on the project details supplied by Sea Generation (Kyle Rhea) Ltd and the information gleaned from the Scoping Response (**Appendix 4.1**) and other consultee engagement processes (statutory consultees, stakeholders and public engagement). Various sources of environmental data were used to inform the impact assessment.

4.1.8 The EIA process is designed to be as transparent as is possible, with a number of distinct stages. These include:

1. **Screening** – determines whether the Project is likely to have a significant effect on the environment;

2. **Scoping** – a formal process requesting an opinion on the Project from statutory consultees, coordinated by Marine Scotland. 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** – identify the current status of the receiving environment and carry out further desk and field studies as required and/or identified during Stage 2;

4. **Project definition –** working with Sea Generation (Kyle Rhea) Ltd to define the Rochdale envelope (Chapter 5, Project Description for more information of project definition and Chapter 2, Policy and legislation for more information of the Rochdale envelope approach);

5. **Assessment of impacts** – includes the assessment of the significance of the potential impacts related to the Project, as well as the proposed mitigation and the resulting residual impacts;

6. **Environmental reporting** – compilation of the ES and the supporting documentation (e.g. appendices and technical reports.); and

7. **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. For applications under Section 36 of the Electricity Act, or Marine Licenses under the Marine Scotland Act, the consenting body will be Marine Scotland (through Scottish Ministers), while for works under the Town and Country Planning Act, the local authority would provide consent.

4.1.9 The EIA is designed to be an iterative process rather than a single appraisal of a finalised development design. The EIA can provide information which helps to optimise the final design.

4.1.10 This EIA has been undertaken based on guidance in Planning Circular 3 2011: The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011, with supplementary guidance from Planning Advice Note 58 on Environmental Impact Assessment.

4.1.11 With respect to the EIA carried out for the Kyle Rhea Tidal Stream Array (The Project) the procedure followed is shown in **Table 4.1**.

Table 4.1 EIA process stages undertaken for the Project.

Stage	Date
Request for a Scoping Opinion	April 2010
Receipt of Scoping Opinion	2010
Bird, Marine Mammal and Vessel Observations survey start date	Mid July 2011
Continued consultation	Throughout – see Chapter 6, Consultation
Development and finalisation of project design (see Chapter 5, Project Description).	Throughout
Public exhibitions (see Chapter 6, Consultation)	July 2011 & June 2012
Impact assessments, mitigation and residual impact assessment	March 2012 – November 2012
Meetings with Marine Scotland, SNH, Highland Council	Throughout – see Chapter 6, Consultation
Completion of ES	November 2012
Pre-Application Consultation (PAC) submission	November 2012
Planning	2012
Statutory consultation on the ES	Nov 2012 – July 2013

4.1.12 The ES (which is the document submitted at the end point of the EIA process) is based on, and reports the outputs of, a number of activities including :

- Consultee consultation;
- Consideration of relevant local, regional and national planning policies, guidelines and legislation;
- Development of significance criteria;
- Assessment of alternatives;
- Review of existing available data (not collected directly in relation to this EIA); and
- Field surveys, data analysis and modelling.

4.1.13 The ES not only addresses the direct impacts likely to be caused by the development, but also relevant indirect impacts and cumulative impacts. In addition within each of the assessment chapters there are proposed mitigation measures, which have been designed to avoid, reduce or offset the most significant adverse impacts of the Project.

4.1.14 Additionally a standard approach, wherever possible, has been taken when outlining the geographic 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. For some receptors it has been necessary to define a number of different study areas based on available data and the range of the receptors considered within that chapter.

4.1.15 The EIA process (as listed in paragraph 4.1.8 above) is integrated with the project design process and follows a series of stages, which are outlined below:

- Site selection and project initiation;
- Screening – (determining if is there a requirement for an EIA);
- Pre-application discussions;
- Scoping – consultation on the proposed scope to identify the potential impacts of the Project and the methodology on how these should then be assessed;
- Environmental baseline studies – an establishment of what is present on/in the vicinity of the site;
- Development of the project details under a Rochdale envelope (see Chapter 2, Policy and Legislation)
- Assessment of the potential impacts of the proposed development;
- Mitigation – modify the proposal in order to integrate the mitigation measures and then re-assess the residual impacts;
- Production of an ES;
- Submission of consent applications supported by the ES;
- Consultation by Marine Scotland – Licensing Operations Team (MS-LOT) with the appropriate consultees, stakeholders and members of the public;
- Consent application consideration by the MS-LOT;
- Application decision with or without conditions; and
- Implementation and monitoring as required.

4.1.16 The process of identifying and assessing the environmental impacts of the proposed development is iterative, running in parallel with the project design. If any of the potential impacts are identified as being adverse in nature then the design can be altered to mitigate these impacts. Consultation is ongoing throughout the EIA process and contributes to the identification of both impacts and associated mitigation measures.

4.1.17 The site selection and screening processes are detailed in Chapter 3, Site Selection. The results of the environmental baseline studies, the assessment of impacts and all of the mitigation measures proposed are outlined in Chapters 7 to 23 of this ES, with a summary of all impacts and mitigation outlined in Chapter 24, Summary.

4.2 Scoping and consultation

4.2.1 The purpose of the scoping process is to identify the principal environmental issues at the earliest possible stage of the development process through responses from the regulators and their 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 impacts.

4.2.2 The consultation process may identify mitigation measures and where practicable take account of the view of consultees to alter the Project design, thereby avoiding, reducing or offsetting any environmental impacts. Sea Generation (Kyle Rhea) Ltd identify the consultation process as being crucial to the success of the 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 6, Consultation.

4.2.3 A formal request for a Scoping Opinion from MS-LOT was submitted on the 1st April 2010. This was provided in the form of an official Scoping Report with supporting letter requesting opinions on the proposed scope of work and methodologies related to the Project . The Scoping Report highlighted what, at this early stage in the process, were likely to be the main impacts associated with the Project and how these impacts were to be assessed.

4.2.4 Each technical chapter (Chapters 7 to 23) outlines the key issues pertinent to that chapter which have been identified through the consultation process.

4.2.5 Table 6.1 in Chapter 6, Consultation, lists all of the consultees whose opinion was sought during the scoping process.

Key issues

4.2.6 Following the scoping and consultation process 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 and basking sharks;
- Ornithology (especially diving birds);
- Marine benthic habitats;
- Terrestrial habitats;
- Otters;
- Coastal processes;
- Hydrology, geology and terrestrial surface water;
- Commercial fisheries;
- Underwater noise;
- Maritime navigation;
- Construction traffic;
- Cultural heritage and archaeology;
- Landscape and seascape;
- Fish (especially Elasmobranchs and Anadromous species);
- Tourism; and

- Local community.

4.3 Environmental Statement composition

4.3.1 The Environmental Statement (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 the project design and consultation undertaken to seek the views of statutory, non-statutory stakeholders and the local community.
  - Chapters 7 – 23 contain the individual assessments relating to the environmental (and other) issues that were identified during the scoping process and/or by Sea Generation (Kyle Rhea) Ltd. The likely significant impacts of the Project on these issues are contained within this portion of the document, along with the proposed mitigation and the residual impacts. Residual impacts are the impacts that remain following the implementation of best practice and mitigation measures stipulated by the ES. A summary of impacts, mitigation, good practice and proposed monitoring is provided in Chapter 24, Summary. The contents of the ES are listed in Table 1.1 in Chapter 1, Introduction.

4.4 Structure of technical chapters

4.4.1 As much as practicable, a standard approach has been taken to the structure of each of the technical chapters. However, in all cases the approach to the chapter is driven by good practice guidance principally from professional institutes. For example the LVIA approach adheres to Landscape Institute guidance and the ecology assessment is driven by IEEM (Institute of Ecology and Environmental Management) guidance. As a result of following good practise guidance the structure of some chapters necessarily diverge from the proposed standard approach.

4.5 Impact assessment and mitigation

4.5.1 An impact assessment section within each of the technical chapters (Chapters 7 to 23) considers the potential impacts during construction, operation, maintenance and decommissioning phases of the Project against the baseline conditions. Each technical chapter outlines the methodology used for data collection in order to characterise the baseline conditions.

4.5.2 The significance of each impact is discussed, along with proposed good practice to be followed or additional mitigation measures to be implemented that are appropriate to reduce each significance level. These recommendations aim to avoid, reduce or offset the most significant adverse impacts of the proposed development and there is a commitment from Sea Generation (Kyle Rhea) Ltd that they will be implemented where possible during the appropriate phase (e.g. construction, operation (including maintenance) and decommissioning) of the Project.

4.5.3 Throughout the design process, mitigation measures and good practice guidance have been identified and implemented to avoid, reduce or offset impacts, 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 impacts, but have been included to further reduce the levels of impacts related to the Project.

Significance criteria

4.5.4 The significance of residual impacts 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 impacts they have been assessed qualitatively based on the best available knowledge at the time and professional judgement.

4.5.5 The standardisation of the significance criteria generally leads to a common classification of the significance of impacts. These are classified as major, moderate, minor or negligible. Each chapter provides a description of how the significance has been assessed, providing receptor specific definitions of the impact magnitude and the receptor sensitivity. In all cases the impacts have been assessed using expert judgement.

4.5.6 The potential impacts for each issue related to the Project have been described with regards the following:

- Extent and magnitude of the impact (Table 4.2) incorporating:
    - Duration of the impact (short, medium or long-term);
    - Nature of the impact (direct or indirect; reversible or irreversible);
- Sensitivity of the receptor (Table 4.3);
- The significance of impact, and whether the impact is beneficial or adverse; and
- The mitigation that can be implemented to avoid, reduce or offset the impact (where the significance of effect is noted at being low, medium or high) and the resultant residual effect.

4.5.7 Tables 4.2 and 4.3 provide example definitions of magnitude and sensitivity. For some receptors these have been adapted using expert judgement to ensure they are fitting and relevant.

Table 4.2 Definition of magnitude of an impact upon receptors

Magnitude	Definition
High	Very significant, permanent / irreversible changes, over the whole feature / asset, and / or significant alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact certain or highly likely to occur.
Medium	Significant, permanent / irreversible changes, over the majority of the feature / asset, and / or noticeable alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact likely to occur.
Low	Noticeable, temporary (during the duration of the Project) change, over a minority of the feature / asset, and / or limited but noticeable alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness.

Magnitude	Definition
	Impact will possibly occur.
Negligible	Noticeable, temporary (for part of the duration of the Project) change, or barely discernible change for any length of time, over a small area of the feature or asset, and/or slight alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact unlikely or rarely to occur.

Table 4.3 Definition of terms relating to the sensitivity to an impact

Value / Sensitivity	Definition
High	No capacity to accommodate the proposed form of change.
Medium	Very low capacity to accommodate the proposed form of change.
Low	Low capacity to accommodate the proposed form of change.
Negligible	Receptor has some tolerance to accommodate the proposed change.

4.5.8 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 judgement by specialists.

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

4.5.10 By combining the magnitude of the impact and the sensitivity of the receptor in a matrix (see Table 4.4) the final significance of the impact (prior to the implementation of mitigation measures) can be obtained. It should be noted that any residual impact (the impact after the implementation of mitigation) which remains at the level of 'moderate' or 'major' is regarded by the EIA Regulations as being significant.

Table 4.4 The level of significance of an impact resulting from each combination of sensitivity and magnitude

Sensitivity	Magnitude			
	High	Medium	Low	Negligible
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

4.5.11 Due to the differences between the individual technical assessments throughout this ES there is no specific definition of impact 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 impact. Where it has been possible to do so, this has been based upon accepted criteria (e.g. for onshore noise and vibration impacts and their associated guidelines), as well as by employing expert interpretation and value judgements in order that the extent of any given impact can be established.

Cumulative impacts

4.5.12 The EIA Regulations require that potential cumulative impacts are taken into account within the project EIA. Cumulative impacts may be understood as "incremental effects of an action..." arising "from individually minor but collectively significant actions". The EIA will consider how the Project may interact with other foreseeable projects and activities.

4.5.13 Where projects are already in existence they are deemed to be part of the existing environment, contributing to the baseline conditions and are therefore not considered to provide a further cumulative impact.

4.5.14 In terms of proposed developments in the vicinity of the site, Sea Generation (Kyle Rhea) Ltd is aware of a previous proposal by Pulse Tidal to develop a tidal array in Kyle Rhea. A Scoping Report was submitted for the project but it is understood that no Agreement for Lease (AFL) is in place so it has been assumed that the project is not being progressed. The Pulse Tidal project is therefore not assessed within the cumulative impacts for this project.

4.5.15 The study area for impact assessment varies depending on the range and characteristics of the receptor and so each technical chapter provides information on the relevant foreseeable projects for consideration in the cumulative impact assessment.

Assumptions and limitations

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

4.5.17 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 impacts 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.

4.6 References

MCT (2010). Installation of tidal turbine array at Kyle Rhea, Scotland. Available at: http://www.seagenkylerhea.co.uk/files/MCTKyleRheaScopingReport.pdf

5 PROJECT DESCRIPTION

Page

5 CONTENTS

5.1 Introduction

5.1.1 This chapter provides details of the Kyle Rhea Tidal Stream Array (‘the Project’). Sea Generation (Kyle Rhea) Ltd proposes the installation of an array of four SeaGen tidal devices within Kyle Rhea (see Section 5.2) with a generation capacity of up to 8MW.

5.1.2 A number of potential build options are being considered, the Environmental Impact Assessment (EIA) has therefore appraised a realistic and buildable “worst case” scenario in accordance with an approach known as the “Rochdale envelope”, described further in Chapter 2, Policy and Legislation.

5.2 Site description

5.2.1 Kyle Rhea is a narrow strait of water between the Isle of Skye and the west coast of Scotland. Sea Generation (Kyle Rhea) Ltd secured an Agreement for Lease (AfL) within Kyle Rhea from the Crown Estate (site boundary shown in Figure 5.1 below) on 31st March 2011. The award of the Lease itself is dependent on securing all of the required permissions and consents for the Project.

Exploration of the available tidal resource (requirements discussed later in Section 5.2), as well as navigation constraints, has led to the creation of a more defined, array area which is shown in Figure 5.1. An indicative array layout is shown in Figure 5.1

Offshore

5.2.2 The proposed site lies north of the existing ferry (MV Glenachulish) crossing from Skye to the mainland which operates during the summer months.

5.2.3 SeaGen devices must be deployed at locations with a minimum tidal flow of 2.5m/s, during mean spring tides, to be financially viable. SeaGen devices can be deployed in water depths of 26 to 35m (see Chapter 3, Site selection). The array area (see Figure 5.1), bound by corners with the following positions, meets these requirements:

- 57.23504 -5.66358;
- 57.23500 -5.66099;

- 57.22953 -5.66102;
- 57.22952 -5.66361.

5.2.4 Table 5.1 provides the depths at indicative device locations (shown in Figure 5.1) and Figure 5.2 shows the tidal resource.

Table 5.1: Depths at indicative device locations shown in Figure 5.1

Device Location (see Figure 5.2)	Depth below Chart Datum (m)
1	27
2	26
3	29
4	32

5.2.5 The minimum distance between the devices (devices 3 and 4 to the south) is 60m.

Onshore

5.2.6 The grid connection options identified for the Project are on the Skye side of the Kyle, where a small substation will be required to act as a link between the Project and the existing grid network. The onshore study area shown in Figure 5.1 is intended to encompass likely project substation locations as well as the associated onshore construction works. Installation of the export cable will require Horizontal Directional Drilling (HDD). The substation is anticipated to either be in the vicinity of the existing toilet block (option 1) or in an existing building at the ferry slipway (option 2) (see Figure 5.1). The drilling area is anticipated to be either in the vicinity of the public car park or on flat land to the east of Kylerhea village. A trenched cable will be routed between the HDD pit and the substation, following the road/ track where possible, for both options.

5.2.7 This EIA covers all of the work described above, up to and including the Project's substation.

5.2.8 From the substation, cabling will be taken west to Broadford, however, this aspect is outwith the scope of the EIA. The cable from the substation onwards to the grid will be owned by, and will be the responsibility of, the Distribution Network Operator (DNO), Scottish Hydro-Electric Power Distribution (SHEPD). It is likely that cabling will be buried from the substation up to the nearest 11kV line and from there the existing 11kV line would be re-strung with 33kV cable.

5.3 Project elements

SeaGen devices

5.3.1 SeaGen devices incorporate two pitch controlled axial flow rotors, each of which drives its own generator via a gearbox, much like hydro-electric turbines or a wind turbine. The rotors are situated on either end of a cross beam as shown in Figure 5.3. Each rotor will have either two (as in Strangford) or three rotor blades. The rotors each have a diameter of 20m and will rotate at a maximum speed of 11RPM. This gives a tip speed of 12m/s.

5.3.2 The surface piercing tower of each SeaGen device has a normal maximum exposed height to the parapet of 18m, although Sea Generation (Kyle Rhea) Ltd is committed to reducing this height where possible. The visible height will vary with the tide. The form of the structure and maximum height would change during periods of maintenance with the narrow lift legs rising to approximately 40m when the cross beam and rotors are above raised above the water. The cross beam will be raised only occur occasionally and then for short durations, therefore 18m is used as the maximum height for impact assessment.

5.3.3 The tower supports a self-contained lifting system that raises the cross beam, enabling maintenance and repair, while avoiding the need for large lifting vessels. This lift system reduces disturbance to the local environment during operation and maintenance (O&M), with smaller vessels used to transport technical staff and repair materials to the devices.

5.3.4 The lift system on each device can raise its own cross beam out of the water in under 1 hour, allowing the device to be repaired and become operational as soon as possible. As a result the devices are largely self-contained for most O&M purposes.

5.3.5 The pitch controlled rotors blades on each SeaGen device are patented , The rotor blades can be pitched through 180 degrees, allowing;optimised energy capture and operation during ebb and flood tides. This design features allow SeaGen in Strangford Lough to achieve 48% rotor efficiency averaged over flood and ebb tides, using both rotors. This is close to the theoretical maximum energy for conversion from tidal flows to electricity .

5.3.6 It is anticipated that the rotor tip to surface clearance, i.e. the distance between the highest arc of the rotor and water surface, will be no less than 3.0m at lowest astronomical tide (LAT). Mean Low Water Spring (MLWS) at Kyle Rhea is 0.8m above LAT, meaning that the total clearance at MLWS will be 3.8m. At highest astronomical tide (HAT) this will increase to 9.5m water clearance. The clearance between the lowest arc of the rotor and seabed will be approximately 3m. In all instances these minimum clearance distances will be maintained.

5.3.7 A transformer (oil filled/ water cooled) and the power conditioning equipment required for exporting power to the grid will be housed inside the tower of each SeaGen device. The tower diameter is around 3m. There is a platform on top of the tower and a pod enclosure which will house other electrical and control equipment.

Foundations

5.3.8 Each device will have either a tripod or quadropod foundation structure with each ‘foot' terminating in a pin-pile (up to 2m diameter), drilled and grouted into a rock socket in the seabed. A quadropod structure is considered in the impact assessments throughout this Environmental Statement as a worst case scenario. Each rock socket may be up to 11m deep and up to 2.2m diameter, providing a worst case seabed footprint of up to 15.2m^2 for each quadropod. A quadropod represents the worst case scenario (WCS) in terms of seabed impacts and a tripod may be used, which would have a lesser seabed footprint.

5.3.9 Each device will be supported on foundations secured to the seabed by grouted pin-piles. The foundations will also support access ladders, J-tubes (to prevent export cable damage), corrosion protection equipment and a boat landing platform. The decision on final foundation design will be subject to data derived from: geotechnical and geophysical surveys; metocean conditions; barge availability; installation and operations methodology; and life-cycle cost.

Lighting and markings

5.3.10 The colour and lighting required on the tower for navigation purposes will be defined by the Maritime and Coastguard Agency (MCA) and the Northern Lighthouse Board (NLB), and will be in accordance with International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) standards (see Chapter 17, Shipping and Navigation). It is anticipated that the devices will be required to be painted yellow with navigation lights on each device.

5.3.11 It is anticipated that the devices themselves will serve as cardinal markers, identifying the presence of the rotors below the surface with lighting on the devices.

5.3.12 The positions of the devices, moorings, export cables and ancillary structures, will be conveyed to the UK Hydrographic Office for incorporation into Admiralty Charts and Notice to Mariners procedures.

Scour protection

5.3.13 Scour protection was not required for SeaGen in Strangford Lough, as the seabed was composed of tide swept exposed bedrock, cobble and boulder . The nature of the seabed in the proposed array area at Kyle Rhea is similar to that at Strangford Lough and it is unlikely that scour protection material will be required.

5.3.14 The decision on whether to install scour protection will be made once the detailed design of the support structures has been defined i.e. during the post-consenting phase. If scour protection is required it would be subject to review by regulators and consultees post consent, and would require an additional Marine Licence.

5.3.15 The potential for scour will depend upon the presence or absence of sand/gravel seabed sediments at the array location. This is discussed in more detail in Chapter 8, Marine physical environment and coastal processes.

<u>Corrosion protection</u>

5.3.16 Corrosion protection on the steel structures of the devices will be achieved using an Impressed Current System (ICS), commonly used on ships and sub-sea structures

5.3.17 Sacrificial anodes will also be used as a back-up to the ICS and located on parts of the structure where ICS cannot be used. The anodes are standard products for offshore structures, which are welded onto the steel structures and consist of Aluminium (98- 96%) and zinc . The number and size of anodes will be confirmed during the final design phase.

<u>Antifoulants</u>

5.3.18 Antifoulant will be used on the rotors to prevent marine growth and maintain their efficiency and also on a 3m wide strip of the sub-sea structure to protect against colonisation by marine organisms. An Intersleek 900 teflon based antifoulant is likely to be used, however a decision on what presents the Best Practicable Environmental Option (BPEO) will be made at the installation stage. Intersleek 900 is a non-leaching antifoulant that works by physically preventing species attachment as opposed to having biocidal activity The data sheet is attached in **Appendix 5.1**.

5.3.19 The rest of the structure will be painted using a two pack epoxy, which will be applied during manufacture.

5.3.20 From experience gained with previous MCT devices (SeaFlow and SeaGen), there is unlikely to be a requirement to apply additional anti-fouling materials to the device . The antifoulants will be applied during the manufacturing cycle and further treatments on site will not be necessary.

Cabling

5.3.21 The array will be joined in a daisy chain formation using inter-array cabling. One export cable will be directionally drilled from the array to the onshore substation.

5.3.22 The inter-array cables will be 33kV, typically 3-core copper conductors with insulation/conductor screening and steel wire armouring. The insulation will be either dry type XLPE, wet type XLPE or a combination of both. All cables will contain optical fibres embedded between the cores and will be protected by armouring (two layers of round galvanised steel wire). The inter-array cabling will be approximately 600m of 108mm diameter cabling.

5.3.23 An AC subsea export cable rated at 33kV is required to bring electricity from the array to the Project substation. The export cable will be directionally drilled from the substation location to a ‘break out’ point as close as possible to the array. The 3-core cable being considered comprises copper conductors with integral insulation, core screening, and steel armour (for stiffness and impact resistance). The cable will have a polypropylene outer sleeve with an external diameter of approximately 140mm and will include internal fibre optic communication links for control purposes. The total length of the export cable is up to 500m.

5.3.24 The onshore cable is likely to be 185mm diameter copper core and will be ducted and laid in trefoil formation within a sand bed.

Substation

5.3.25 A small substation containing electrical switchgear (around 6m x 3m footprint by 3m high) will be required for the Project. As previously discussed this will be on the FC track at the site of an existing toilet block (option1) or in an existing building close to the slipway(option 2). A prefabricated container will be used to house the substation. Each SeaGen device contains a separate transformer within its structure, so that the onshore substation size can be kept to a minimum.

5.3.26 Sea Generation (Kyle Rhea) Ltd is working with the FC to ensure that if required the substation design is in keeping with existing buildings such as the visitor centre. A shared building may be constructed which provides an upgrade to the existing public toilets as well as the substation.

5.4 Installation methodology

Offshore

5.4.1 The installation method has not yet been finalised. Two different techniques have been used in the MCT projects installed thus far (for SeaFlow at Lynmouth, Devon and then for SeaGen in Strangford Lough, Northern Ireland). Key elements of the methodologies being considered for the Project are summarised below:

<u>Port and vessels</u>

5.4.2 Kyle of Lochalsh is the main local port that could be used during installation, with no requirement for additional infrastructure construction. A storage barge may be used at the port if additional space is required. Working hours will be 24 hours per day if allowable at that port.

5.4.3 Vessels being considered for the installation of the devices include jack-up barges, moored barges or purpose-built installation vessels using Dynamic Positioning (DP). It is most likely that the foundation and device components will be stored at a nearby port and transported to site by support barge. Ancillary barges, tugs, safety vessels and personnel transfer vessels may also be required.

5.4.4 The types of vessel and installation methods will dictate the level of impact to the environment. Because the installation methods has not yet been finalised a number of different options are presented in Table 5.2 below.

5.4.5 The impact assessment work detailed in Chapters 7 - 23 will consider the worst case elements of these options in relation to the relevant receptors to ensure the impact assessment is appropriately conservative in accordance with a Rochdale envelope approach (see Chapter 2, Policy and Legislation).

Table 5.2: Possible device installation vessel options

	Installation scenario		
Aspect of installation scenario	**Jack up barge scenario**	**Moored barge scenario**	**Dynamic positioning scenario**
Size of vessel	150m x 45m	100m x 30m	155m x 30m
Foot print of mooring system	4 triangular lattice legs with circa 40m^2 foot area	4 to 8 100 tonne gravity blocks (5m x 5m) or drag anchors (3m x 5m) with some anchor chain catenary, estimated at 80m length on seabed at 1m diameter.	Dynamic positioning holding a footprint of +/- 5m
No. of tugs required	Jackup vessel is typically self-propelled, but possible single tug required for initial positioning (30m x 22m)	Possible that barge will have DP for assisting with initial positioning while laying anchors, however possible X2 tugs (30m x 22m)	n/a
Anchoring Handling Vessel (AHV)	n/a	Multicat (c.25m LOA) or small AHV to install gravity blocks and handle moorings	n/a
Flat top barge (to bring out large items	n/a	n/a	n/a

5.4.6 The main installation vessel will move between the Project site and the supporting port (most likely Kyle of Lochalsh) for large components. There will be daily runs of additional support vessels for small materials, plant, equipment and personnel.

5.4.7 Vessel options for cable installation works could potentially include a combination of the following types of vessels:

- Moored barge;
- Jack up vessel;
- Multicat; and
- DP installation vessel.

<u>Foundations</u>

5.4.8 The SeaGen devices will be supported on a foundation structure secured to the seabed with a worst case of four steel pin-piles (up to 2m diameter) to a depth of up to 11m. Percussive pile driving techniques will not be used to install the foundation piles. A much less noisy drilling technique will be used to gradually drill a rock socket (up to a 2.2m diameter) into which the foundation piles can be inserted and grouted into place. Each pile will be drilled one at a time.

5.4.9 Drill cuttings will be produced during the drilling of the rock sockets at each device location. There are a number of different options for managing the disposal of drill cuttings and the specific method of disposal will be dependent on the vessel used for installation and choice of contractors and vessels, which is not yet finalised. Assessments have been based on the worst case method for disposal, which is to continually release drill cuttings during the drilling process, over the course of the tidal cycle. No drilling fluids are required for the foundations as drilling will use seawater flush for lubrication. Drill cuttings are released directly into the water column as cuttings emerge from the drilled rock sockets. Chapter 7, Marine Physical Environment and Coastal Processes provides details regarding the potential for dispersal. The total volume of drill cuttings produced for 4 devices with this foundation type may be approximately 500m^3 over the duration of foundation installation.

5.4.10 After installation of the steel piles, they will then be grouted into place, and will protrude above seabed by approximately 6m. A cementitious underwater grout will be injected into the annular gap between the steel pile and the rock socket, holding the pile securely in place. Seabed preparation works such as the moving of boulders, may be required, this requirement will be defined after the proposed geotechnical site investigation in 2013 . Following detailed geotechnical and geophysical surveys of the array area each foundation will be microsited in order to minimise seabed preparation works at the installation phase.

Device installation

5.4.11 The SeaGen devices are modular and will be assembled onshore using harbour facilities before delivery to site on a floating flat-top barge into the Kyle of Lochalsh (or another local area of shelter suitable for flat top barge storage). Here they will be stored awaiting installation. It is anticipated that the barge will have deck space for two SeaGen devices.

5.4.12 The main installation vessel will collect one SeaGen device at a time from the storage barge and transport it to site for installation onto the foundations. The SeaGen device will then be lowered onto the foundations and grouted in place.

Offshore cable installation

5.4.13 An indicative cable installation methodology is provided in this section, however the final methodology will be determined by Sea Generation (Kyle Rhea) Ltd and the selected contractor prior to installation.

5.4.14 The export cable will be installed by a process known as horizontal directional drilling. Horizontal directional drilling (HDD) is a steerable trenchless method of installing cables underground in a shallow arc along a prescribed bore path, using a surface launched drilling rig. Because of the depth of drill, this method has minimal impact on the surrounding area. HDD was successfully employed in Strangford Lough. Drilling from above the high water mark through the underlying rock strata allows the cable to emerge within close proximity of the array.

5.4.15 Mud and drill cuttings will be released during HDD as the drilled hole is cleared and filled with the cable and its housing (see Section 5.10, Discharges to water and air).

5.4.16 The onshore details of the HDD process are discussed later in this section (Section 5.4).

5.4.17 A winch mounted on the SeaGen platform or mounted on a suitable vessel will be used to connect the inter array cable to the devices. A cable laying vessel (see paragraph 5.4.7) will then be used to take the cable to the next device in the array.

5.4.18 The inter-array cables will connect the SeaGen devices in series, with each inter-array cable providing a link between two adjacent devices. Each end of the inter-array cable will terminate at high voltage (HV) switchgear located within the tower, entering the tower via a J-tube.

5.4.19 The proposed layout for inter-array cabling will ensure the cables lie in line with the direction of flow of water where possible.

Project footprint

5.4.20 Should an anchor barge be used for installation a maximum of eight point anchor spread would be deployed, using "gravity" as well as "drag" anchors, which will require no seabed preparation. The dimensions of gravity anchors are approximately 5x5m (25m^2) and drag anchors of 3x5m (15m^2). To access all of the drilling locations two of the anchors will be repositioned, giving 10 positions in total.

5.4.21 A 5m buffer has been assumed around an anchor's seabed footprint to allow for potential movement of the anchor during manoeuvring and provide a conservative worst case scenario. The worst case seabed footprint of each anchor with the conservative buffer is approximately 170m^2;

5.4.22 There is some potential for abrasion of the seabed by the anchor chain as the barge manoeuvres, with some of the resulting 'slack' or catenary of chain resting on the seabed. This may result in seabed abrasion for approximately 80m of seabed along the line of each chain, in a corridor estimated as 1m wide, resulting in up to 80m^2 of potential abrasion impacts associated with each of the 10 anchor points;

5.4.23 If a jack-up barge is used the worst case footprint would be four legs at 2m diameter each (approximately 12.5m^2 for four legs), during installation of each SeaGen device. Resulting in a total seabed footprint of 50m^2 for all 4 devices.

5.4.24 Should a specialist installation vessel be used, it will manoeuvre onto the device location using Dynamic Positioning (DP).

<u>Discharges to air and water</u>

5.4.25 As previously discussed drill cuttings will be produced during the drilling for the device foundations. The worst case method for disposal of drill cuttings is to continually release drill cuttings into the sea during the drilling process, over the course of the tidal cycle. No drilling fluids are required for drilling the foundations as seawater flush will be used for lubrication. Drill cuttings are released directly into the water column at the seabed as cuttings emerge from drilled socket.

5.4.26 HDD of the export cable has potential to release a limited amount of mud and drill cuttings as the drilled hole is cleared and filled with the cable and its housing. The drilling fluid chosen for use with the HDD would be either Salt Water Drilling Clay (SWDC) or Biodegradable Drilling Fluid. Both of these water-based muds are considered non-toxic. The final decision on which mud to use would be made closer to installation . Drilling mud will be mixed with sea water and used to remove cuttings during the drilling process. During installation (and decommissioning) some emissions to atmosphere would arise from the marine vessels used. There is also a small risk of accidental discharges to water from the array (see Table 5.4) or marine vessels associated with installation (and decommissioning). While these risks are not considered to be significant, they will be addressed in the Environmental Management Plan (EMP) to be produced prior to installation.

5.4.27 Table 5.3 provides an inventory of the key fluids used in the Project and outlines their potential to enter the environment.

Table 5.3 Fluid Inventory for all components per SeaGen device

Location of Fluid	Type of Fluid	Quantity	Pathway to the environment	Risk of Leak/ Discharge
Powertrain Gearbox	BP Energol GR XP100	1000 Litres	All these chemicals are contained within the mechanical components of SeaGen	The risk of these entering the marine environment is highly unlikely
Gearbox seal	Vickers 68 Hydrox Bio	50 Litres		
Powertrain brake	Hydra 32 ISO 32 TEXACO	400 Litres		
Lift System, Crane	Hydra 32 ISO 32 TEXACO	Powertrain Brake tank - 50L Crane and Lift System tank - 400L		
Pitch System gearbox	BP Energol GR XP150	30 Litres		
Blade bearings	Mobilith 460 grease	50 Litres		
Rotor blades and sub-sea tower	Antifouling – e.g. Intersleek 900	Dry coating	Antifoulant will be applied to the relevant parts offsite prior to installation and therefore the paint will only enter the marine environment once it has set.	Anti fouling will be in direct contact with the water column
Export cable route during HDD	Drilling fluid e.g. Salt Water Drilling Clay (SWDC) or Biodegradable Drilling Fluid	Unknown	At breakthrough with either the seabed or the terrestrial environment small quantities of drilling fluid will be lost to the environment.	High likelihood of a small amount entering the marine environment. A non-toxic fluid will be used which is not likely to cause any negative affect to the environment
Annular gap between pile and rock socket	Cement based grout	60 m^3 per device	Small amounts of grout will be lost to the environment during the grouting. Attempts will be made to limit this by monitoring the amount of grout dispensed at each pile.	High risk – low impact. The grout is considered nontoxic.

Noise

5.4.28 The most significant noise levels will be during the drilling for the pin-piles during the foundation installation. It should be noted that noise levels from a drilled pile are significantly lower than those associated with the driven piles used commonly in offshore wind farm projects.

5.4.29 A specialist study to model predicted underwater noise propagation has been commissioned as part of the EIA and is provided in **Appendix 12.6.** The impact of underwater noise on certain receptors is discussed in Chapters 12, Marine mammals and 14, Fish and Shellfish. Onshore noise is discussed in Chapter 20.

Personnel

5.4.30 During installation of the foundations approximately 36 persons will be required on site at any one time, including all crews, project managers and client representatives.

5.4.31 During installation of the devices approximately 30 persons will be required at any one time on site (onshore and offshore based) including all crews, project management and client representatives.

5.4.32 Sea Generation (Kyle Rhea) Ltd intends to employ as many personnel from the local area as possible. Following on from experience in Strangford Lough Sea Generation (Kyle Rhea) Ltd intends to rent local accommodation for the duration of installation and commissioning. Local hotels will be used when additional accommodation is required, especially during installation.

Schedule

5.4.33 The marine installation phase is scheduled to take place during the summer and autumn months when suitable weather conditions are most likely to occur.

5.4.34 Installation of the foundations is expected to take approximately 18 days for each device. This involves the following approximate timeframe per pile although weather delays may extend the programme:

- 24 hours of vessel set up time;
- 12 hours to deploy the drill frame;
- 6 hours to deploy the drill;
- 30 hours of drilling;
- 24 hours to install and grout the pile; and
- 6 hours to remove the drill frame.

5.4.35 The timescale for percussive drilling of the pin-pile sockets has been based on experience of the installation of the SeaGen device at Strangford Lough. A worst case scenario of 30 hours continuous drilling has been assumed and will be assessed in relevant chapters of this ES. This will be interspersed with approximately 78 hours of non-drilling activities.

5.4.36 Each device installation is estimated to take 4 days per unit, including collection of each unit from Kyle of Lochalsh and grouting onto the foundations.

5.4.37 All marine operations are anticipated to run 24 hours per day and this is likely to be a particular requirement of the rock socket drilling operations, which cannot be stopped and restarted easily.

5.4.38 Foundation installation is planned for 2014 and it is anticipated that the devices will be installed the following year in the summer months. It is expected to take approximately 3 months to install all four of the devices.

5.4.39 In the interests of safe working, installation works will be subject to weather conditions. Offshore installation operations are anticipated to continue 24/7 throughout to minimise the overall installation period.

Onshore

Traffic

5.4.40 Installation methodologies have not yet been finalised and different contracting methods will yield varying numbers and extent of land based traffic. Deliveries of major pieces of plant and equipment are likely be made by sea, however, indicative estimates have also been made for land based traffic numbers.

5.4.41 The initial mobilisation phase during installation could see a small increase in the volume of land based traffic. Most personnel are likely to mobilise to the nearest port e.g. Lochalsh. There may occasionally be approximately two cars around Kylerhea or Glenelg during installation and commissioning.

5.4.42 The drilling methodology will be finalised once a contractor has been commissioned. However it is expected that the drilling rig will be brought in by sea to the ferry slipway (option 1) and then transported along the local road a short distance to the FC site or directly on to the shore at Kylerhea (option 2). No required widening of the roads around Kylerhea is anticipated.

5.4.43 The mobilisation and demobilisation traffic for drilling is predicted to involve approximately 20 HGV loads if brought into the slipway. The largest piece of equipment would be the drill rig, at 15m long and weighing 28T this rig would be brought to site on a low loader wagon. Also required at the onshore site would be a suitable mobile crane to offload and position the drilling spread. The crane would be a minimum 50T configuration, but might need to be larger depending on the stability of the ground conditions. A HGV will be required to transport the substation container.

5.4.44 The volume of hard standing material to be transported to the site is not yet known. This material is expected to be brought to the site by sea.

5.4.45 During drilling operations traffic will involve personnel vehicles, likely to be a minibus and one or two cars and a fuel tanker approximately four times per week. A weekly waste disposal vehicle will also be required during the 75 day drilling period.

Onshore cable installation

5.4.46 The onshore HDD area will be situated within the onshore study area shown in Figure 5.1. It is expected to require up to 40x40m of hard standing and may require some levelling works. The drill rig to be used will depend on further site investigation and the contractor. It is anticipated that an 80T drill rig may be appropriate for 355mm diameter borehole.

5.4.47 A 40m x 40m (maximum) area is required for drilling. A launch pit (typically 2.0m wide x 2.0m long x 1.2m deep) will be required inside the onshore drilling area. This pit will control the drilling fluids which will be pumped through a fluid recycling system into the drill head, enabling the drill fluid to be reused. All excavations will be assessed for stability and suitable support will be provided where appropriate. All drilling operations will be secured within a fenced compound. The drilling area (40 x 40m) will include welfare, site office, security, car parking and stores in terms of static infrastructure as well as the drilling rig, the fluid recycler (typically 3m x 9m), the pump and a tooling area. It may be that this infrastructure can be located on existing hardstanding areas (i.e. the carpark) but additional hardstanding may also be required to the east of the existing car park. The actual area needed to facilitate an 80T drill rig is typically around 11m x 3m x 3m). The minimum width of the area will be 20m to accommodate this drilling area.

5.4.48 Once the HDD is complete the hole will be capped and the area will return to its existing use as a car park and picnic area (option 1) or grass land (option 2). Where possible Sea Generation (Kyle Rhea) Ltd will work to provide improvements to the surface and drainage.

5.4.49 The onshore cable is likely to be trenched, following the road/ track between the drilling area and substation. The length of the cable between the drilling area and the substation is approximately 250m (option 1) or 335m (option 2). The cable trench will be up to 2m wide to accommodate the cable and the necessary cable markers. The approach to cable burial will be agreed with the landowner e.g. for option 1 this will follow the FC standard practice for cable burial on FC land, is currently under discussion. The required depth of the cable will depend on information provided by the FC but it is anticipated to be around 1m. A layer of warning tiles would then be buried on top of the cable lay at circa 700mm depth. The final placement of the cables and warning tiles will be agreed with Forestry Commission in line with their standards for cable installation.

Substation

5.4.50 If constructing a new building for the substation a concrete base of approximately 6m x 3m will be created to form the foundations. A prefabricated container will be brought to the site to house the substation. Some levelling works are anticipated to ensure a stable surface for the container. Sea Generation (Kyle Rhea) Ltd will aim to clad and landscape the substation appropriately so as to minimise its visual impact.

Discharges to air and water

5.4.51 There are no fluids or emissions associated with the onshore substation.

5.4.52 As previously discussed HDD of the export cable will involve drilling fluids such as SWDC or BDF. The drilling fluid will be passed through a recycling unit on shore (the drilling direction is from shore to sea). Waste drilling fluid remaining after completion of all HDD operations will be removed from site and disposed of at the nearest appropriate landfill site by an appropriately licensed party. Supasorb may be used to absorb the water and solidify the remaining sludge which can then be excavated and removed. If appropriate some drill cuttings may remain on site to be used for reinstatement or landscaping, otherwise all cuttings will be removed and disposed of appropriately.

5.4.53 A Project Waste Management Plan will be produced prior to installation following appropriate guidelines such as Policy Advice Note 63 Waste Management. .

Personnel

5.4.54 Personnel are likely to travel to the site by car or by sea. Ten personnel will be required for the onshore drilling construction works A small number of additional personnel will be required during substation installation.

Schedule

5.4.55 Mobilisation of materials, equipment and personnel is anticipated to take 30 days in total and only a small proportion of this duration will be within the study area.

5.4.56 The worst case scenario for HDD is anticipated to be 75 days of drilling for 12 hours per day, 7 days per week.

5.4.57 Substation installation will be scheduled during HDD to minimise disturbance. Substation installation is expected to be completed within a 10 week period, up to 4 weeks involves leaving the concrete foundation undisturbed to allow it to solidify.

5.4.58 Where possible, work will be scheduled outside peak visitor times within winter months when visitor numbers to the otter hide are expected to be lowest (see Chapter, 22, Tourism and Recreation). However it will be necessary to balance this with weather risk to ensure suitable conditions for the concrete foundations to set.

5.4.59 Demobilisation of equipment and personnel is anticipated to take 15 days in total with only a small proportion of this within the study area. An overview of the complete project schedule is provided in Table 5.4.

Table 5.4 Schedule summary

	2012				2013				2014				2015				2016				……2042			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Offshore consent application																								
Offshore consent consideration																								
Onshore planning permission																								
Project funding																								
Procurement																								
Installation- Foundation drilling																								
Installation- Substation & HDD																								
Installation- Devices																								
Commissioning																								
Operation - Generation to grid																								

5.5 Commissioning methodology

5.5.1 Once the array has been installed, it will be subjected to a short commissioning phase where various trials will be carried out, including:

- Raising and lowering cross beam;
- Diver assessment to evaluate the sea bed condition following installation;
- Visual inspection of pile and device components to ensure that they were not damaged during installation ;
- Electrical operation checks;
- Commissioning and installation of shore side monitoring and control systems;
- Verification of calibration of instrumentation;
- Grid connectivity tests; and
- Initial operation of the system.

5.5.2 During commissioning each SeaGen device will be tested in turn. When automatic operation is first tested, personnel will be present on the device to ensure that the systems are operating correctly and to monitor the instrumentation. During this phase of testing, the relevant device will be manned daily, and transfers will take place via a small local vessel. The vessel will be present during all manned commissioning operations for rapid egress of the crew. This follows from the practice adopted for SeaFlow at Lynmouth and SeaGen in Strangford Lough.

Personnel

5.5.3 Initially 2 to 3 personnel will be required to commission each device consecutively. Once grid connection has been established, up to 30 personnel will be required to complete the commissioning phase.

Schedule

5.5.4 Sea Generation (Kyle Rhea) Ltd anticipates that commissioning will be conducted over 2 and half months.

5.6 Operation and maintenance (O&M) phase

5.6.1 Following installation and commissioning the Project would then be available to generate electricity for commercial customers. During routine operation, the SeaGen devices will be operated remotely by the Project owners.

Maintenance

5.6.2 The devices will be serviced and maintained throughout the life of the array from a local port or slipway, employing local staff where possible as has been successfully undertaken for the SeaGen project in Strangford Lough. Maintenance involves both scheduled and unscheduled activities and access to site may be required at any time.

5.6.3 Scheduled maintenance of the array applies primarily to inspections and work on minor faults such as parts susceptible to failure or deterioration. The tasks will typically be inspection on faults and minor fault rectification. Scheduled maintenance will be performed using small personnel craft operated from a local harbour.

5.6.4 Unscheduled maintenance will be required on an ad-hoc basis for a range of issues from small defects to breakdown of main components.

5.6.5 Initial inspection of the inter-array cables will be carried out using a Remotely Operated Vehicle (ROV) after installation, and after 6 and 12 months. A long term inspection strategy will then be determined based on the findings in the first year. Any required repairs of the cable will be done by replacement.

5.6.6 There is no planned maintenance of the export cable. In the unlikely event of a failure the cable will be fixed by replacement.

5.6.7 Substation maintenance is expected to require one or two personnel vehicles to access the substation.

Rotor movement

5.6.8 As discussed in Section 5.3, during operation of the SeaGen devices the rotors will rotate up to a maximum of 11RPM, with a maximum tip speed of 12 m/s.

5.6.9 Rotors will also be vertically raised clear of the water and lowered with the cross beam for inspection and maintenance when the device is not operating. The rotors are locked in position when they are not generating

Discharge to air and water

5.6.10 There are no anticipated liquid discharges to the marine environment during normal operation of the device. Potential contaminants are internal lubrication/hydraulic oils and transformer oil, which are appropriately sealed within the rotors, gearboxes and lift system.

5.6.11 There are no anticipated direct discharges to the atmosphere during operation of the Project.

5.6.12 There are no anticipated solid discharges into the marine environment during operation of the devices. Any waste generated during operation, for example associated with maintenance, will be collected and disposed of by licensed waste management contractors to appropriate facilities onshore.

Noise emissions

5.6.13 Onshore noise is assessed in Chapter 20. The potential airborne and groundborne noise from the devices and substation is considered.

Personnel

5.6.14 O&M will typically require less than 5 people on site at a time, and will use local personnel where possible.

Schedule

5.6.15 The Project has an operational life of 25 years. Operation of the offshore array will continue 24 hours per day, 365 days per year.

5.6.16 Scheduled maintenance is likely to be carried out four times year. Only one device will have the crossbeam raised at any one time. The likely maintenance period per device is two days.

5.6.17 Unscheduled maintenance will be undertaken on an ad hoc basis as and when required.

5.6.18 The O&M schedule for the substation will be infrequent:

- The oil in the transformer is sampled annually; and
- HV inspection tested every 2 years.

5.7 Decommissioning

5.7.1 After the planned lifetime of operation of the Project, Sea Generation (Kyle Rhea) Ltd will decommission all of the SeaGen devices and where appropriate, associated infrastructure.

5.7.2 Exact details of the Project design and the installation method are not yet finalised. In due course it is anticipated that a detailed decommissioning plan will be submitted for approval by the regulatory authorities, prior to construction, as required by section 105 of the Energy Act 2004.

Offshore

5.7.3 It is anticipated that prior to the end of the design life (25 years) a thorough review of the capability of the devices to sustain further generation will be investigated and it will be confirmed as to whether the array could, with permissions, remain in place, or needs to be decommissioned and removed. Decommissioning will take place either at the end of 25 years or at an appropriate, agreed extended period beyond that.

5.7.4 The drive trains (gearbox, generator and rotor), pod and internal componentry (e.g. switch gear and control panels) for each device will be removed. It is likely that the method of removing the SeaGen devices will be the reverse of that used to install them and similar vessels will be used.

5.7.5 The device structure will be partially dismantled at site and the components will be transported to shore and recycled in accordance with best working practice at the time. Many of the components of the SeaGen devices can be recycled and this will be done where possible. Any oil will be drained and sent for recycling whilst the steel shells and any internal switchgear, transformers etc will also be recycled. A similar type of floating crane barge or jack-up barge (as used for the installation works) will be used for the decommissioning works. Underwater cutting equipment will be needed to cut the structure from its foundations. The foundations will be cut to a level in accordance with safety and navigational requirements. It is possible to use internal cutting tools to remove the foundation to approximately seabed level.

5.7.6 The quadrapod or similar foundation structure is likely to be colonised by marine species, therefore it may be less environmentally damaging to leave all or parts of the foundation structures in place as artificial reefs. If this is the case then the tower will be cut above the foundation structure.

5.7.7 Sea Generation (Kyle Rhea) Ltd intends to carry out detailed surveys of the array area and cable route prior to commencing any decommissioning work, to identify the exact location and condition of the cables and determine whether or not it is appropriate to remove them or leave them in place.

5.7.8 Due to the possible disturbance to sediment and benthic habitats through the removal of cables it may be preferable to leave all or some sections of the cables *in-situ.*

5.7.9 The directional drilled export cable will either be terminated flush with both ends of the installation hole to assist with filling in, or pulled back through the hole if deemed necessary by the regulatory authorities.

5.7.10 Any surface laid inter array cables may be removed, in which case they would be recovered by a cable-laying vessel. Cable that is recovered and brought ashore will be recycled where possible.

Onshore

5.7.11 The appropriateness of decommissioning the onshore substation may depend on whether the building can be used for an alternative purpose and if it has a lesser environmental impact to leave it *in-situ* so long as it remains structurally sound. This will be reviewed at the time and if decommissioning is required this is likely to be a reverse of the construction process for the substation.

5.1 Summary

Table 5.5 provides a summary of the project details which are taken forward for the impact assessment.

Table 5.5 Project details summary

Project element	Details assessed
Location of devices	A likely indicative layout is provided, however the impact assessment considers that the devices may be located anywhere within the array boundary to allow some room for the array layout to be altered if required.
Design of foundations	The worst case scenario is a quadropod design in terms of the footprint on the seabed and so this is considered in the impact assessment. It is likely, however that this may be a tripod design.
Footprint of devices	Worst case quadropod - 4 x max 2.2m rock sockets (15.2m^2 per device) = 60.8m2 for array A tripod design and/or smaller rock sockets will reduce the footprint.
Height above water	The maximum height is 18m above CD. This is considered the worst case scenario and may be reduced.
Colour of tower	It is expected that the surface piercing portion of the towers will be yellow to mark the subsurface hazard in relation to shipping. This is considered to be the worst case scenario and is considered in the Seascape, landscape and visual impacts assessment.
Surface Lighting	It is expected that navigation lighting will be located on the devices however the detail of this will be determined post consent once in agreement with the MCA and NLB once the array layout has been finalised.
Installation vessels	The type of installation vessels will be determined following procurement, post-consent. The following options are considered and the worst case scenario is different for different receptors: - jack up barge - moored barge (worst case for benthic ecology) - dynamic positioning (worst case for marine mammals)
Footprint of installation vessels	Worst case footprint -anchor barge: 10 anchor positions plus conservative 5m buffer = 1765m^2 (0.0017km2). Estimated catenary of 80m per line (with some overlapping footprint between lines). Estimated total anchor barge footprint 2683m2 without anchor buffer and 4252.5m^2 with anchor buffer. Jack up barge: 4 legs of approximately 2m diameter (12.56m^2 per drilling operation x 4 piles x 4 devices) = 200m^2 Dynamic position = no footprint
Installation approach	The foundations will be installed by drilling for pin-piles. The devices will then be lowered on to the pin-piles. The export cable will be directionally drilled
Inter array cabling	Surface laid Footprint = 600m of 108 mm inter-array cabling = 64.8m^2
Location of onshore drilling platform	2 options are considered throughout the impact assessment: Option 1 - drilling from the FC car park Option 2 - drilling from grassland close to Kyle Rhea village
Footprint of onshore drilling area	A worst case scenario of a drilling area which is approximately 1600m^2 of hard standing is considered in the impact assessment. This encompasses all the facilities required to support the drilling activities. At option 1 this will include an area of existing hard standing. This area will be reinstated following the drilling works.

Project element	Details assessed
Location of substation	2 options are considered throughout the impact assessment: Option 1 - a new building on existing hard standing beside the existing FC public toilets. Sea Generation (Kyle Rhea) Ltd will work with the FC to ensure the substation will be designed to be visually appropriate in the context of the surrounding area. Option 2 - within an existing building at the Kylerhea slipway.
Footprint of onshore substation	Option 1 - a concrete foundation of approximately 6m x 3m will be required to support the substation Option 2 - no new footprint
Design of onshore substation	Option 1 - Sea Generation (Kyle Rhea) Ltd will work with the FC to ensure the substation will be designed to be visually appropriate in the context of the surrounding area. Option 2 - within existing building corrugated iron garage
Onshore cable	Option 1 - Trenched along FC track, approximately 250m in length and 2m wide. The depth may be around 1m but this will be determined by the FC. Option 2 - Trenched along road, approximately 335m in length. Approach to be agreed with landowner

6 CONSULTATION

Page

6.1 Introduction

6.1.1 This Chapter of the Environmental Statement (ES) aims to provide the reader with an overview of the consultations that have been undertaken by Sea Generation (Kyle Rhea) Ltd and the Project team throughout the Environmental Impact Assessment (EIA) process.

6.1.2 Chapters 7 to 23 of this ES describe the key issues raised during consultation in relation to each receptor. This section outlines the consultation which has been undertaken.

6.2 Legislative and policy context

6.2.1 The need for effective public participation is identified throughout the following relevant legislation and planning guidance:

6.2.2 The Public Participation Directive (PPD) makes specific changes to the way in which EIA is undertaken, and the EIA Directive[10] has been amended to incorporate these requirements. The PPD has also amended the Electricity Works (Environmental Impact Assessment) Regulations 2000 (“the Principal Regulations”).

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

6.2.4 The Planning Act (Scotland) 2006 outlines the need for public involvement and consultation in the planning system.The Act requires applicants to undertake pre-consultation with local communities before submission of a planning application.

6.3 Consultation strategy

6.3.1 Sea Generation (Kyle Rhea) Ltd, has a strong commitment to being open with stakeholders. This approach follows on from the success of Sea Generation (Kyle Rhea) Ltd’s consenting strategy for the SeaGen project in Strangford Lough, where regular consultation with Regulators, scientists and public was an on-going process throughout the EIA, licensing

[10] Council Directive 85/337 on the effects of certain public and private projects on the environment as amended by 97/11/EC (and 2003/35/EC)

and post installation monitoring processes.

6.3.2 The consultation strategy for the Project had a number of objectives including:

- A means for informing all interested parties about the proposed project, its location, scale and extent and the work and studies that are being undertaken (where necessary methodologies for studies will have been discussed and agreed with statutory agencies);
- Identification of the needs and benefits of the Project and explanation of the impacts of different phases on particular groups;
- Opportunity for the public and other interests (e.g. fishermen, recreational sailors, local coastal residents) to ask questions and raise issues and concerns; and
- Continued communication throughout the process to both update the public on progress and, more importantly, endeavour to resolve concerns initially voiced.

6.4 Site selection phase

6.4.1 The Project team has undertaken a proactive approach to consultation, with early consultation on a non-statutory basis (with respect to the consenting process) prior to obtaining an Agreement for Lease (AfL) from the Crown Estate. Meetings were held with the Highland Council, Fisheries Research Services (now Marine Scotland) and SNH in September 2009. A further meeting was held with the Highland Council in April 2011 to provide an update on the Project following the award of the AfL.

6.5 Scoping phase

6.5.1 A Scoping Report (Marine Current Turbines, 2010) was submitted to Marine Scotland in April 2010.

6.5.2 Table 6.1 identifies the authorities, groups and organisations that were provided with the Scoping Report for comment.

Table 6.1: Scoping consultees

Consultee
Statutory Consultees
Scottish Environment Protection Agency (SEPA)
The Highland Council
Scottish Natural Heritage (SNH)
Non Statutory Consultees
Maritime & Coastguard Agency
NATS (EN Route) Ltd.
Northern Lighthouse Board
Fisheries Committee
RYA Scotland
Chamber of Shipping
Ports and Harbours
Scottish Government - Planning
Marine Scotland
Historic Scotland
Trunk Road Network Management Directorate

6.5.3 In addition, the Scoping Report (MCT, 2010) was made available to the wider public via the Sea Generation (Kyle Rhea) Ltd website and the Marine Scotland website.

6.5.4 A Scoping Response was issued by Marine Scotland in 2010 and is provided in **Appendix 4.1**. Further consulation with NATS was undertaken on the 31 January 2013 to confirm that their scoping response had not changed in light of the increased height of the turbines.

6.6 Approach to EIA

6.6.1 Meetings were held with Marine Scotland and SNH on the 11th November 2011 and the 20th June 2012, and with the Highland Council on the 18th July 2011, in order to discuss the approach to the EIA and provide progress updates.

6.7 Impact assessment

Field work

6.7.1 SNH and Marine Scotland were provided with the proposed methodologies for site specific surveys in order to be kept abreast of the approaches being taken and to allow advice to be provided at an early stage so that it could be discussed and incorporated as appropriate.

Terrestrial ecology

6.7.2 Initial contact was made with the SNH area officer in August 2011 to source available data for the site.

6.7.3 Survey methodologies for Phase 1 terrestrial habitat mapping, otter survey, and intertidal survey were provided to SNH, Marine Scotland and the Highland Council in August 2012. A response was received from SNH in October 2012.

Ornithology and marine mammals

6.7.4 The survey methodology for a combined marine mammal and bird survey was provided to SNH and Marine Scotland in November 2011. A series of letters were exchanged and agreement was made to the approach during a meeting in Battleby in June 2012.

6.7.5 An update of the survey findings was discussed during the meeting on the 20th June 2012 following the provision of an interim report to SNH and Marine Scotland on the 21st May 2012 which presented the results for the first 6 months of data collection.

6.7.6 A report of the first year of data collection was provided to SNH and copied to Marine Scotland on the 18th September 2012 for ornithology and 11th October 2012 for marine mammals. A response from SNH was provided on the 19th November 2012 and from Marine Scotland on the 22nd November 2012.

6.7.7 A meeting was held with Marine Scotland Science on the 9th October 2012 to discuss collision risk for marine mammals and the use of their collision risk model.

6.7.8 Consultation was held with the Wester Ross, Skye & Lochalsh Conservation Officer for the Royal Society for the Protection of Birds (RSPB) regarding the approach to the assessment of impacts on a breeding pair of white-tailed sea eagles. These discussions are incorporated in Chapter 11, Ornithology.

Benthic ecology

6.7.9 The drop down video survey methodology was provided to Marine Scotland and SNH on 21st May 2012. This approach was discussed and agreed during the meeting on the 20th June 2012.

6.7.10 The survey report, including results of habitat mapping incorporating geophysical data for the site was provided to SNH, Marine Scotland and the Highland Council on the 28th August 2012.

6.7.11 Feedback on the benthic survey report was provided by the Highland Council on 7th September 2012 and by SNH on 31st of October 2012.

Desk based

Hydrogeology

6.7.12 SEPA was contacted in September 2012 to request available data on ground and surface water quality, which has been provided. A draft impact assessment was provided in November 2012 to seek feedback which was provided by SEPA in November 2012.

6.7.13 Discussions were held with SNH in September 2012 to discuss any concerns they had regarding directional drilling in the Kinloch and Kyleakin Hills SSSI, which is designated for geological significance. It was agreed that the Project was not likely to have significant impact on this feature and SNH did not require it to be considered further.

Fish and shellfish

6.7.14 Marine Scotland Science was contacted regarding Salmon data requests on the 8th September and the 9th October 2012. Rod and line data was provided by Marine Scotland Science on the 21st September 2012. Net and coble, and fixed engine data were provided by Marine Scotland Science on the 17th October 2012.

6.7.15 A concern regarding the array forming a barrier across Kyle Rhea was raised by the Wester Ross Fisheries Trust and the Wester Ross Salmon Fisheries Board. Responses were provided directly and the impact is considered in Chapter 14 Fish and Shellfish.

Commercial fisheries

6.7.16 A local Fisheries Liaison Officer was appointed for the Project and a series of consultation meetings and email correspondence was undertaken. These are outlined in Table 6.2

Table 6.2: Fisheries consultation

Organisation	Date	Issues Discussed
Scottish Fishermen's Federation		Questionnaire forwarded to members (see **Appendix 15.1**)
Mallaig and North-West Fishermen's Association	02/03/2012	Existing fishing patterns (all sectors) and transit patterns (all sectors), potential impacts on fishing patters and revenue, navigational constraints, navigational risks, fisheries questionnaire design and distribution.
West of Scotland FPO	02/03/2012	Existing fishing patterns (all sectors) and transit patterns (all sectors), potential impacts on fishing patters and revenue, navigational constraints, navigational risks, fisheries questionnaire design and distribution.
Scallop Association	02/03/2012	Existing fishing patterns (all sectors) and transit patterns (all sectors), potential impacts on fishing patters and revenue, navigational constraints, navigational risks, fisheries questionnaire design and distribution.
North West IFG	11/01/2012	Discussion of role and future plans of IFGs, local fishery management plans, local fishing patterns

Organisation	Date	Issues Discussed
Kyle Harbour	23/02/2012 & 23/07/2012	Existing fishing patterns (all sectors) and transit patterns (all sectors), other marine traffic (non-fishing) potential impacts on fishing patters and revenue, navigational constraints, navigational risks, fisheries questionnaire design and distribution (and subsequently, results).
Mallaig Harbour	11/06/2012 & 23/07/2013	Existing fishing patterns (all sectors) and transit patterns (all sectors), fisheries questionnaire distribution (and subsequently, results).
Small Isles and Mull Inshore Fisheries Group (IFG)	11/01/2012	No response to project introduction.
Lochalsh Fishermen's Association	21/04/2012	Local fisheries management challenges, local fishing patterns, Kyle Rhea transit patterns. Likely impact (on operation and revenue) of project. Questionnaire distribution.
Marine Scotland (Compliance) – Mallaig	02/03/2012	Local fisheries management patterns, fisheries enforcement and monitoring in wider area, local fisheries regulatory restrictions.
Marine Scotland	06/03/2012	Introduction to project and specific request for VMS information.
Seafish	28/02/2012	Discussion of static fishing gear operating constraints in high current areas
Non Affiliated Fishermen's rep.	06/03/2012	Scottish inshore fisheries management arrangements, role of non-affiliated representative, known local fishing boats and patterns, likely consequences of project, questionnaire design and distribution.
Marine Scotland (Compliance) - Oban	06/03/2012	Introduction to project and specific request for VMS information.
Gael Force Marine Equipment	04/09/2012	Typical fishing gear configurations and cost.

Seascape, landscape and visual impact assessment (SLVIA)

6.7.17 The Zone of Theoretical Visibility (ZTV) and the proposed approach to the impact assessment of SLVIA, including proposed viewpoints were provided to SNH, Marine Scotland and the Highland Council on the 12th August 2012. An update to this information was then submitted to stakeholders on the 30th August 2012 following some project design changes. Responses were provided by SNH and the Highland Council on the 20th September 2012.

Shipping and navigation

6.7.18 As part of the Navigational Risk Assessment a series of consultations have occurred, these have taken the form of meetings both local and public, telephone conversations and email correspondence. A detailed and thorough log of all consultation so far has been recorded; a brief summary of the key points from this log is provided in Table 6.3

Table 6.3: Shipping and navigation consultation

Group	Date	Summary of Issues discussed
Statutory bodies consulted with regard to shipping and navigation include: • Marine Scotland Compliance; • Chamber of Shipping; • Kyle of Loch Alsh Harbour Master; • Mallaig Harbour Authority; • Ministry of defence; • The RNLI; • The Maritime and Coastguard Agency; and • The Northern Lighthouse Board.	These bodies were consulted via numerous emails, telephone calls and meetings between the 6th of September 2012 and the 19th of November 2012.	The general issues discussed with these bodies includes: • The importance of Kyle Rhea as a transit route; • The navigational risks associated with installation; • The influence of tide on course heading and vessel control; • Traffic reporting / control system identified as mitigation measure to help prevent head-on encounters; • Fishing vessel usage of Kyle Rhea (transiting); • Potential mitigation measures such as pre-warning vessels, marking and lighting and potential traffic management schemes; • RNLI response times; • The economic impact if vessels have to re-route west of Skye; • Updating of Admiralty Charts using bathymetric and tidal data collected by Sea Generation Ltd; • MoD usage of the site; and • A review of historical accidents.
Recreational organisations consulted include: • The Clyde Cruising Club; • The Cruising Association; • Gordonstoun school; and • RYA Scotland	The organisations were consulted with by email in November 2011 and meetings with the RYA took place during September and October 2012.	The focus of discussions between recreational organisations centred on: the navigation and safety risk posed by the development; possible impacts of vessels having to navigate the sailing route to the west of Skye and potential mitigation measures. Also highlighted was the need to adequately light the array at night, improve the VHF coverage in the area, have guard vessels on hand and the fact that the project may put additional pressure on an already under pressure local coastguard and lifeboat crews
The following businesses that use Kyle Rhea and the surrounding area were consulted with: • Ferguson Transport & Marine Harvest; • Hebridean Princess	These businesses were consulted with via email, telephone and local meetings between the 7th of	The general issues discussed with businesses that make use of Kyle Rhea and the surrounding area included: • The potential navigational hazards associated with the Project. • The risk associated with night passage, reduced visibility, meeting other vessels, towing and strong tidal flow.

Group	Date	Summary of Issues discussed
• Mallaig Marine • Marine Harvest • Skye Ferry • Scottish Salmon • Seahorse Aquaculture	September 2012 and the 15th of October 2012	• The fact that sheer stress pushes vessels toward the array; • Wind strength can also have an effect on ship's steering due to funnelling effect in Kyle Rhea • Marker buoys on eastern shore would be very helpful in marking the safe water. • The potential for collision with other vessels due to the squeeze in sea area and the fact that a one way system may be necessary; • The fact that when fish farm vessels are towing cages they will be lees manoeuvrable; • Potential delays caused if vessels have to make passage to the west of Skye; • The risk if the Skye ferry were to breakdown on an incoming tide;

Traffic and transport

6.7.19 The Highland Council was contacted to provide information about the Project and discuss the approach to consenting. It was agreed that an application for planning under the Town and Country Planning Act will be submitted following the application for a Marine Licence.

Military

6.7.20 On the 8th August 2012 a meeting was held with Lt Cdr RN DSOO FOSNNI[11] to discuss the potential interactions of the Project with military activity.

6.8 Community and wider public consultation

6.8.1 A community Liaison Group was established at a meeting on the 12th November 2011, to provide a structure for regular public consultation with representatives of key groups, including Highlands and Islands Enterprise, the Isle of Skye Ferry Community Interest Company, Glenelg and Arnisdale Development Trust, Glenelg and Arnisdale Community Council, Kylerhea village residents and the Forestry Commission. The group meets quarterly and has had subsequent meetings on the 22nd February 2012, 7th June 2012 and 25th September 2012. The minutes of liaison group meetings are available for download from the Sea Generation (Kyle Rhea) Ltd website[12]

6.8.2 Sea Generation (Kyle Rhea) Ltd part funded a community portal website[13] which is used to provide the public with updates on the Project as well as being available and open for use by the community for other topics.

6.9 References

Marine Current Turbines (2010) Installation of a tidal turbine array at Kyle Rhea, Scotland, Scoping Study. Available at: http://77.68.107.10/Renewables%20Licensing/MCT_Kyle_Rhea_Offshore_Tidal_Array/MCT_Kyle_Rhea_Scoping_Report.pdf

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[11] Lieutenant Commander Royal Navy, Deputy Staff Operations Officer, Flag Officer Scotland, Northern England and Northern Ireland,

[12] http://www.seagenkylerhea.co.uk/downloads.php

[13] http://www.glenelg.co.uk

7 MARINE PHYSICAL ENVIRONMENT AND COASTAL PROCESSES

Page

7.1. Introduction

7.1.1 This chapter of the Environmental Statement (ES) describes the existing physical environment within the Project and associated study area including: surface and sub-surface geology, physical processes (wave and tidal regimes) and sedimentary processes (bathymetry, geomorphology and sediment transport).

7.1.2 This chapter provides a baseline description of the parameters mentioned above, followed by an assessment of potential impacts arising from the construction, operation and decommissioning phases of the Project, as well as those resulting from cumulative interactions with existing or planned projects.

Study area

7.1.3 Kyle Rhea is a narrow strait of water between the Isle of Skye and the west coast of Scotland immediately south of Loch Alsh. The Kyle Rhea passage is approximately 4km long and between 700 and 1300m wide. The site location and an indicative turbine layout are shown in Chapter 5, Project Description, Figure 5.1.

Overview of potential impacts

7.1.4 The development of any coastal or offshore infrastructure may alter hydrodynamic processes and coastal morphology. The construction and operation of an offshore array, seabed cables and coastal infrastructure (if within the coastal zone) at its landfall has the potential to change the physical environment through alteration of existing hydrodynamic processes (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 or seabed).

7.1.5 Wave and tidal characteristics (the hydrodynamic regime) can be modified by the introduction of energy extraction devices within a water body, thereby altering the existing hydrodynamic regime. Such modifications may result in associated change(s) to sedimentary regimes and geomorphological expression of the seabed and coastline.

7.1.6 Effects on the hydrodynamic and sedimentary regime may be localised (in the immediate vicinity of devices), at the near-field scale (in the vicinity of the Project), or at the far-field scale (beyond the area of the Project).

7.1.7 Three potential impacts are considered here:

- Hydrodynamic regime;
- Sediments and sedimentary structures; and
- Geological and geomorphological formations.

Policy, legislation and guidance in relation to the marine physical environment and coastal processes

7.1.8 Legislation under which the Project will be developed are outlined in previous chapters of this ES.

7.1.9 There are two primary pieces of guidance used within this chapter, both of which have an offshore wind farm focus, but are equally applicable to tidal energy devices:

- BERR, (2008) Review of cabling techniques and environmental effects applicable to the offshore wind farm industry. Report for DEFRA.
- CEFAS (2004). Offshore Wind Farms. Guidance note for Environmental Impact Assessment in respect of FEPA and CPA requirements. Version 2. Available from http://www.cefas.co.uk/publications/files/windfarm-guidance.pdf

7.2. Methodology

Approach

7.1.10 The assessment of potential impacts on the marine physical environment and coastal processes of construction, operation and decommissioning of the Project is largely based on Expert Geomorphological Assessment (EGA) supplemented by conceptual understanding of hydrodynamic and sedimentary processes. EGA is a technique which interprets a range of data and applies expert judgment to evaluate the functioning of hydrodynamic and sedimentary regimes, and how regime changes may impact on the environmental receptors, such as geomorphology and sediment distribution.

Consultation in relation to marine physical environment and coastal processes

7.1.11 As part of the ongoing consultation, stakeholders have provided comment on the issues relating to the physical environment through review of the Scoping Report produced as part of the EIA process (MCT, 2010).

7.1.12 A summary of the key issues raised are presented in **Table 7.1**, and have been addressed within this Chapter.

Table 7.1: Summary of consultation relating to Marine Physical Environment and Coastal Processes

Key issues raised	Response
Further assessment will need to be made to rule out any detrimental effects, either permanent or temporary, of installation of the devices and changes in current regime on the reef habitat and species present on the reef, particularly those reliant on strong tidal currents. Smothering is one of the key detrimental effects listed but in Kyle Rhea the sediments are all fairly coarse and therefore re-suspension and smothering should be minimal. The installation, replacement and maintenance of undersea cables have the potential to cause direct loss of reef habitat as well as local deterioration of reef habitats and communities. (Marine Scotland)	This is considered in the impact assessment, Section 7.4 of this Chapter.

Key issues raised	Response
The hydrodynamic regime is process driven and if altered will have an impact on those parameters that are influenced or controlled by the local hydrography e.g. suspended load or habitat alteration. However, the impact significance of the hydrodynamic regime is currently unknown for each phase of the Project. Therefore to scope out those parameters that are influenced by the hydrodynamic regime may be a little premature particularly since the array design is unknown. (Marine Scotland)	This is considered in the impact assessment, Section 7.4 of this Chapter.

Data collection

7.1.13 The principal data sources relevant to the marine physical environment and coastal processes are shown below in **Table 7.2.**

Table 7.2: Data sources to inform the existing environment

Data Source	Spatial coverage	Author	Year
Phase 1 – Kyle Rhea – Review, Revise, validate MCT cable route cost assumptions	Kyle Rhea	Engineering Technology Applications (ETA)	2012
Kyle Rhea Summary of Site Conditions	Kyle Rhea	Marine Current Turbines	2012
Kyle Rhea Benthic Video Survey	Kyle Rhea	Envision Mapping	2012
Kyle Rhea Geotechnical Desk Study Preliminary Report	Kyle Rhea	Cathie Associates	2012
SeaGen Wake Survey – ACDP current monitoring	Strangford Lough	University of Belfast	2011
Doppler Current Profiler Survey	Kyle Rhea	Partrac Ltd	2012

Impact assessment

7.1.14 The significance of the impact is a combination of the sensitivity of the receptor and the magnitude of the impact. The impact assessments are made following guidelines as outlined in paragraphs 7.1.10 and 7.1.11, and using the expert judgement of suitably qualified and experienced specialists.

7.1.15 The sensitivity of the receptor to an impact is categorised into four levels. The definitions of each of these are given in **Table 7.3**.

Table 7.3: Definition of terms relating to the sensitivity to an impact

Value / Sensitivity	Definition
High	No capacity to accommodate the proposed form of change.
Medium	Very low capacity to accommodate the proposed form of change.
Low	Low capacity to accommodate the proposed form of change.
Negligible	Receptor has some tolerance to accommodate the proposed change.

7.1.16 The magnitude of the impact imposed by the Project 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 7.4**.

Table 7.4: Definition of magnitude of an impact upon receptors

Magnitude	Definition
High	Very significant, permanent / irreversible changes, over the whole feature / asset, and / or significant alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact certain or likely to occur.
Medium	Significant, permanent / irreversible changes, over the majority of the feature / asset, and / or noticeable alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact certain or likely to occur.
Low	Noticeable, temporary (during the Project duration) change, over a minority of the feature / asset, and / or limited but noticeable alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact will possibly occur.
Negligible	Noticeable, temporary (for part of the Project duration) change, or barely discernible change for any length of time, over a small area of the feature or asset, and/or slight alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact unlikely or rarely to occur.

7.1.17 The level of significance of an impact resulting from each combination of sensitivity and magnitude is defined as negligible, minor, moderate and major (**Table 7.5**).

Table 7.5: The level of significance of an impact resulting from each combination of sensitivity and magnitude

Sensitivity	Magnitude			
	High	Medium	Low	Negligible
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

7.3. Existing environment

Geology

7.1.18 The Lewisian Gneisses and Torridonian sandstones dominate the solid geology within the study area (Ramsay & Brampton, 2000).

7.1.19 There are three Geological Conservation Review sites within the vicinity of Kyle Rhea:

- Allt Cracaig Coast, Site of Special Scientific Interest (SSSI) lies approximately 2.5 km south of Kyle Rhea on the eastern bank of the Sound of Sleat. Here there is a good example of contact between Moine and Lewisian rocks which has not been deformed or metamorphosed (SNH, SiteLink[14]).
- Avernish SSSI, which lies approximately 3.25 km to the north of Kyle Rhea, is providesan indication of the extent to which the ancient Lewisian basement has been affected by the Caledonian mountain building and provides evidence of the original relationship between the Moine and Lewisian (SNH, SiteLink).
- Ard Hill SSSI, is situated on the northern shore of Loch Alsh, approximately 3 km north of Kyle Rhea. This site provides excellent exposures of the Balmacara Thrust, the overlying Balmacara Nappe, and the underlying Kishorn Nappe, within the Moine Thrust Belt (SNH, SiteLink).

Geomorphology

7.1.20 The geomorphology around Kyle Rhea is primarily controlled by hard rock geology and relative lack of significant quaternary deposits.

7.1.21 Within the Kyle Rhea strait itself geomorphology is particularly inactive, with very little active mobile sediments on the seabed or nearshore zone. In discrete locations within the strait, the coarse sand and gravels are expected to be influenced to a certain extent by waves and tides.

7.1.22 In the immediate area around the proposed device locations, geomorphology is dominated by the exposed bedrock overlain in places with cobbles and boulders. Here there is no evidence of significantly active sediment pathways.

7.1.23 The littoral zone within the Kyle Rhea strait generally consists of exposed bedrock with occasional boulders. The near shore zone adjacent to the proposed device locations comprises exposed bedrock. There is no evidence of significant mobile sediments contributing to nearshore sediment pathways.

7.1.24 Further afield, outside of the Kyle Rhea strait, there are more active littoral zone in discrete locations, where beaches and small deltas have formed. These are associated with fluvial input of sediments at the mouths of rivers and reworking of sediments in locations more exposed to wave activity.

Bathymetry

7.1.25 Water depth within Kyle Rhea is indicated varies between 12m and 36 m with the 15 m bathymetry contour approximately 300 mm from the shoreline which is steep sided and rocky.

7.1.26 The central channel of Kyle Rhea contains deep water reaching a maximum depth of 36 m. At the entrances to the strait the seabed rises to depths of 11.4 m at the southern end and

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[14] http://gateway.snh.gov.uk/sitelink/

16 m at the northern end. The bathymetry across the proposed site extends from the intertidal zone to a maximum depth in excess of 36 m.

7.1.27 The deeper waters toward the southern end of the strait are a suitable depth for device installation. Water depths in the proposed device locations vary between 26 and 31.5 m below CD.

Seabed sediments

7.1.28 British Geological Survey (BGS) data indicate that much of the seabed of of the Kyle is composed of gravel. Wilding *et al*., 2005. indicates that the north end of Kyle Rhea is mainly composed of small cobbles and pebbles that overlay a bed of gravel and shell at 15-16 m depth. At the southern end, broken bedrock extends from 9-22 m depth, with drifts of coarse shell gravel at 12-13 m Emu Ltd, 2006, found the strait to contain a mix of tide swept, gradually sloping bedrock, cobbles, boulders, pebbles and coarse sediment which is more in agreement with the Wilding *et al.* 2005 study than the more general BGS data.

7.1.29 The Kyle Rhea Benthic Video Survey (Envision Mapping, 2012) indicates that the seabed substrate in the immediate vicinity of the four devices is dominated by rugged bedrock and boulders and correlates with the above studies.

Wind

7.1.30 The dominant wind direction in the region shows a moderate bias towards the south-west with mean wind speeds exceeding 3 m/s across Kyle Rhea for 75 % of the time (Barne, *et al*., 1997). Kyle Rhea is sheltered from the dominant winds by the land mass of southern Skye.

Waves

7.1.31 Wave heights in the region are less than 1 m for approximately 75% of the time and only during 10 % of the year do they exceed height of 2.0 m (Barne *et al*., 1997).

7.1.32 Data relating to wave conditions within Kyle Rhea are not yet available but the waters between the eastern most part of Skye and mainland Scotland are considered to be wave sheltered (Wilding *et al*., 2005) and are not exposed to the larger waves generated in the Atlantic.

Tides

7.1.33 The tidal race within Kyle Rhea flows northwards into Lock Alsh on the flood and southwards into the Sound of Raasay on the ebb.

7.1.34 Tidal flows to the north of Kyle Rhea (at 57°16’06”N, 5°44’06”W) are summarised in **Table 7.6** (Source: Admiralty Chart 25441). Admiralty Chart No. 25441 indicates maximum spring flood tide flows of 2.1 knots (0.8 m/s) with flood neap flows of zero knots (3 hours before high water) at the above location.

Table 7.6: Tidal flows to the North of Kyle Rhea (Source: Admiralty Chart 2541)

Hours relative to High Water	Direction of tidal stream	Spring Rate (Knots)	Neap Rate (Knots)
-6	270	1.8	0.7
-5	265	2.1	0.8
-4	258	0.5	0.2
-3	125	0.1	0.0
-2	078	0.2	0.1
-1	079	0.4	0.2
0	98	0.5	0.2

Hours relative to High Water	Direction of tidal stream	Spring Rate (Knots)	Neap Rate (Knots)
1	91	1.4	0.6
2	81	1.2	0.5
3	89	1.0	0.2
4	60	0.5	0.4
5	271	0.9	0.2
6	270	1.6	0.6

7.1.35 As tidal movement is squeezed between Skye and mainland Scotland, tidal streams within Kyle Rhea can exceed 8 knots on both spring ebb and flood tides and 5 knots on neap flood tides (Admiralty Chart 2541). Flow through the strait can form a complex system of currents with an eddy occurring near the eastern edge of the sound where water may flow in the opposite direction of the main flow (Admiralty Chart 2541).

7.1.36 ADCP data from within Kyle Rhea was collected within a complete 13 hour spring tidal cycle for this EIA (Partrac Ltd, 2012). Maximum flow speeds of 4m/s were recorded on the flood tide (northwards) and were approximately 1m/s faster than the peak flow recorded during the ebb tide.

7.1.37 The highest energy flows occurred in the centre of the channel and were separated from much lower-velocity flows at the edges of the channel by sharp boundaries. This pattern correlates with that described on Admiralty Chart 25441, as described above.

7.1.38 The area just south of the proposed device locations (between the southern-most device and the ferry route crossing) experienced the highest velocities for the longest duration.

Global warming and sea level rise

7.1.39 Future sea-level rise will result from the net effect of global change to sea-level and local changes to land levels due to post-glacial isostatic readjustment (rebound or subsidence).

7.1.40 Global warming is predicted to increase storminess, and rising sea levels from thermal expansion of seawater and melting of far-field glaciers. The UK Climate Projections (UKCP) 09 has provided estimates for each decade of relative sea level changes with respect to 1990 levels. Central estimate values and 5th and 95th percentile limits for a medium emissions scenario are provided in **Figure 7.1** for Kyle Rhea. Values for relative sea level rise under a medium emissions scenario indicate 32cm (50th percentile) by the end of the 21st century.

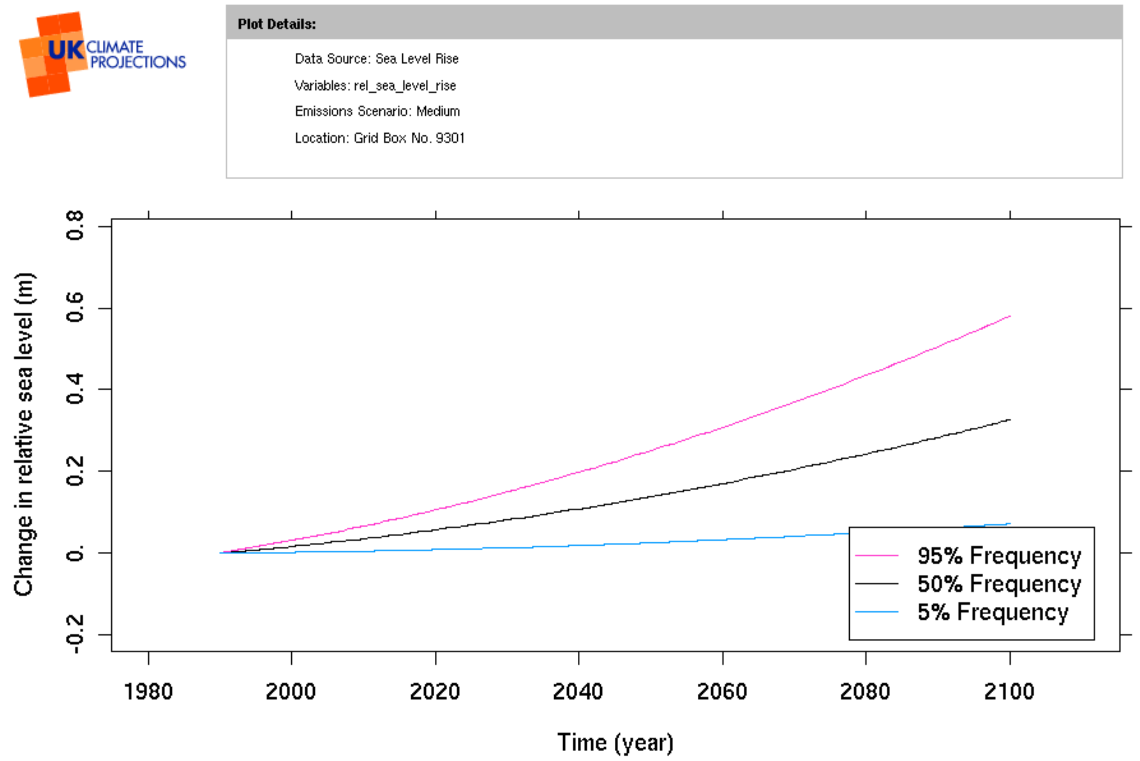

Figure 7.1: Sea Level projections for Kyle Rhea (source: http://ukclimateprojections-ui.defra.gov.uk/ui/start/start.php)

7.1.41 The implications of sea-level rise over the coming century require consideration with regard to the Project, to ensure that the Project is 'future-proofed'.

7.4. Impact Assessment

Potential impacts during the construction phase

Impact 1: Effects on hydrodynamic regime

7.1.42 Localised changes to wave heights and periods, tidal current velocity and vectors from foundation installation, cable laying and working vessels.

7.1.43 Installation plant and working vessels have the potential to impact the wave regime. Any installation plant operating on the seabed will be at such a depth that it will not impact on surface waves. Vessels working on the surface will, however, cause localised and short term dampening of waves, although installation is not expected to occur during significant wave conditions and therefore the impact of installation activities on the wave regime will be negligible.

7.1.44 Tides may also be impacted by installation plant and working vessels. This is expected to be minimal due to the small proportion of the water column occupied and the temporary nature of the works.

7.1.45 Sensitivity of the marine physical environment and coastal processes is considered **negligible** as the receptor is able to accommodate these hydrodynamic changes, that are within the bounds of natural variation. Impacts are considered **negligible** magnitude localised and temporary and will not result in the significant alteration of the existing hydrodynamic regime. It is anticipated that the proposed installation works will be of

negligible significance to the hydrodynamic regime within the Project area, its immediate surrounds, and further afield.

Impact 1: Suggested Mitigation
No mitigation is proposed. The installation activities are temporary in nature and will not have a lasting impact on the hydrodynamic regime.

Residual impact:

7.1.46 The significance of any impacts remains **negligible**.

Impact 2: Effects on sediments and sediment structures

Effects upon seabed sediment distribution patterns

7.1.47 Seabed works have the potential to alter the seabed sediment distribution pattern. Within the vicinity of the proposed device locations and across the inter-array cable route) there are no significant 'soft' sediments comprising active or mobile formations. It is therefore unlikely that the physical disturbance to the seabed will have any significant impact on sediment distribution patterns. Impacts will be limited to local disturbance of the exposed bedrock within the immediate confines of the seabed works.

7.1.48 The proposed cable lay methodology comprises directional drilling for the export cable, and surface lay cabling for the inter–array cables. The subsurface nature of the export cable construction method will not cause any impacts to the seabed nor will it cause an increase in suspended sediments, as activities will be undertaken below the surface.

7.1.49 Disturbance to the seabed will occur at the emergence of the location of HDD on the seabed where the export cable terminate offshore (approx. 5m from the most shoreward turbine).

7.1.50 The landfall works are located away from the coastal zone (i.e. above Mean High Water Springs (MHWS)) therefore there is no potential for impacts on coastal sediment transport.

7.1.51 Effects to sediment transport patterns (incl. suspended sediment).

7.1.52 Seabed working, pile drilling and cable lay (surface lay and directional drilling) all have the potential to disturb seabed sediment and increase the amount of suspended sediment in the water column. However due to the course nature of seabed sediments, increase in suspended sediment will be minimal and any disturbed coarse sediment will settle quickly. This will add to the relatively low ambient suspended sediment load in the waters of Kyle Rhea.

7.1.53 Intrusive activities such as pile drilling and directional drilling will create drill risings, which will be released into the water column. The high velocity tidal currents will rapidly disperse fine suspended sediments and reduce the risk of sediment plumes forming.

7.1.54 Computational modelling of drilling plume dispersion for Strangford Lough SeaGen installation correlate with the above. Modelling demonstrated that the Strangford Lough narrows (similar in scale and energy to Kyle Rhea) are highly dispersive and that the depth of sediment deposited after completion of the drilling operation was less than 0.1mm and therefore not detectable (RPS, 2005). During the drilling operations, measurable deposition was expected to occur close to the pile for a short period of time around the time of slack water. Peak suspended sediment concentrations in the water column during drilling were generally less than 12mg/l, but only expected for a relatively short duration (RPS, 2005).

7.1.55 Surface-laying inter array cables is the least disturbing to seabed sediments Surface lay techniques are not even considered by BERR (2008) when comparing the impact of different cable lay methods such as ploughing and dredging.. Furthermore, the bedrock, cobble and course gravel material along the inter-array cable route, if disturbed, will not be released into suspension.

7.1.56 During cable laying and foundation installation there will be minimal sediment displacement around the foundation and inter-array cable route. The course sediment will settle in close proximity to their source following disturbance. Finer material will remain in suspension for longer, however the high current velocities will disperse sediment rapidly.

7.1.57 There will be an area of seabed that will be temporarily directly disturbed by the installation of the Project. Activities that will directly disturb seedbed sediments include the methods used to hold construction vessels in place during installation. Of the methods currently under consideration (Chapter 5, Project description), the scenario which will cause the largest area of disturbance (and is therefore the worst case scenario) is using an anchored barge.

7.1.58 It is likely that if the anchored method is used the barge will maintain its position using between four and eight anchors (an eight point anchor spread is therefore considered to provide the worst case for seabed disturbance). Repositioning of two of the anchors is likely to be required in order to access the four device locations therefore 10 anchor footprints are considered. Anchor options include gravity anchors, each of approximately 5x5m ($25m^2$) or drag anchors of 3x5m ($15m^2$). A 5m buffer has also been assumed to allow for potential movement of the anchor during manoeuvring. This is estimated to result in seabed abrasion for approximately 80m of seabed along the line of each of the chains in a corridor 1m wide. The total estimated maximum footprint of the seabed impact for all anchors and chain catenary of a large anchor barge installing all four devices is approximately $4171m^2$ with the conservative 5m buffer around the anchors and a 1m buffer around the chains.

7.1.59 During anchorage some of the seabed surface sediment in contact with moving anchor parts will become mobilised. Given the coarse nature of the seabed the majority of bed sediment will only be displaced, however finer fractions will become suspended. This will cause a temporary increase in suspended sediment locally, sourced around the moving anchor. Mobilisation of suspended sediments is not expected to have significant effects for the following reasons:

- Moving anchor parts are not likely to cause significant amounts of suspended sediment due to the coarse nature of the seabed sediments in the area;
- sediment released into suspension is likely to be dispersed by the strong tidal currents; and
- anchors are spaced apart sufficiently (minimum distance of approximately 40m) not to create cumulative impacts;

7.1.60 Both the sensitivity of the receptor and the magnitude of impacts on sediment transport patterns and distribution are considered to be **negligible**, therefore the impact is considered to be of **negligible** significance.

Impact 2: Suggested Mitigation
None.

Residual impact:

7.1.61 The significance of any impacts remains **negligible**.

Impact 3: Effects on geological and geomorphological formations

Effects on bedrock platform from cable and foundation works

7.1.62 The export cable lay will be underground and therefore have no impact on geological or geomorphological formations along the majority of the route. Where the directional drilling duct exits / enters the seabed offshore, there will be small scale (meters) impact on the bedrock formations associated with the drill hole.

7.1.63 It is expected that small scale (meters) disturbance to the bedrock formation will occur during foundation installation. Installation will include drilling into bedrock resulting in permanent local change to the geological formation. The impacts in relation to the bedrock reef habitat are discussed in Chapter 13 of this ES.

7.1.64 The inter array cables will be laid on the seabed and not include any intrusive works, therefore will have no impact on geological formations.

7.1.65 The cable landfall works will include the creation of Horizontal Directional Drill (HDD) ducts. Historically this installation method has provided minimal disturbance to the coastlines on which it has been employed and as such will not affect littoral processes and geological formations (ABPmer and HR Wallingford, 2009).

Effects to seabed formations from foundation and cable works

7.1.66 Placement of the surface laid inter array cables may disturb geological and geomorphological formations on the seabed. The non-intrusive surface lay techniques will have little impact on geological formations.

7.1.67 There is little in terms of geomorphological formations along the inter-array cable route, therefore any changes in hydrodynamic regime (discussed above) will not result in significant change to geomorphological formations.

7.1.68 The magnitude of impact on the bedrock platform and seabed formations caused by the installation activities is expected to be **negligible**. The sensitivity of the receptor is also **negligible**, therefore the impact is considered to be of **negligible significance**.

Impact 3: Suggested Mitigation
None. The techniques currently proposed are already using minimal impact techniques

Residual impact:

7.1.69 The significance of any impacts remains **negligible**.

Potential impacts during the operation phase

Impact 4: Effects on hydrodynamic regime

7.1.70 Impacts on tidal current velocity and vectors from foundation, cable lay and monopole (incl. rotors).

7.1.71 When a structure, such as the device foundations, monopole and rotors, is introduced to the water column, the flow may undergo substantial changes.

7.1.72 The presence of static structures within the marine environment has the potential to affect the tidal currents due to the interaction of tidal flows with these structures. Such effects may include changes to tidal current speed which manifest as flow separation and downstream (in the direction of tidal current flow) turbulence, as well as reduced flows through energy extraction. Such changes have the ability to impact on sedimentary processes.

7.1.73 With regards to structure on or close to the seabed, the oncoming (tidal) flow is forced around the structure creating a down flow in front of the structure and a horseshoe vortex near the seabed (Zaaijer & Tempel, 2005).

7.1.74 The export cable is proposed to be directionally drilled and will not be exposed on the seabed. The export cable will therefore not impact on the hydrodynamic regime during operation.

7.1.75 Conversely, the inter array cables will sit on the seabed surface. The cable has a diameter of 108 mm and will protrude from the seabed surface. The inter-array cable may impact tidal flows, accelerating flows locally. However, inter array cables are to be aligned generally north to south, parallel to the dominant tidal flow direction, therefore the impact on the tidal flow is expected to be limited.

7.1.76 The inter-array cables and the device foundations will therefore cause localised accelerated tidal flows, however this will be limited to the immediate area of the structures.

7.1.77 Recent data from Strangford Lough, where a single, similar tidal device was installed, has demonstrated that a foundation and tower structure within the water column had a small but measurable impact on tidal flows (Queen's University Belfast, 2011). Studies demonstrated that although a surface wake was visible further afield (beyond 300m), a discernible wake (increased flow turbulence) was only apparent up to a maximum of 300 meters downstream of the device, which is caused largely by the tower. The wake reduced rapidly downstream of the device. The data presented was for the highest flows in the Lough (during spring tides), hence presenting periods of greatest wake generation.. Data from Strangford Lough did not produce any evidence of a downstream wake created by the rotors. These findings correlated with findings of laboratory experiments, testing flow effects and wake properties of marine current turbines rotors (Maganga, *et al*, 2009).

7.1.78 With regards to the ambient velocity of the flow within Strangford Lough, there is no evidence of any significant deviation after the device was installed.

7.1.79 The above evidence suggests that the Project will have minor near-field impacts on tidal flow disturbance and increased turbulence. However, impacts are expected to reduce rapidly with distance away from the turbines and not extend further than the near-field (300m from the device). in the worst case scenario. Furthermore, the environment of Kyle Rhea experiences relatively high ambient flow turbulence, reducing the effects of the devices.

7.1.80 The impacts of energy extraction on flow velocities expected to be negligible. The subsequent impact on sediment regime is discussed below in Impact 5.

7.1.81 The ferry crossing, approximately 150m south of the southern-most device is a potentially sensitive receptor to changes in hydrodynamics. Although the wake is anticipated to dissipate rapidly downstream of the devices, the impacts on navigation is considered in Chapter 17 Shipping and Navigation.

7.1.82 Impacts on wave heights and period from foundation installation, cable lay and monopole (incl. rotors).

7.1.83 The presence of static structures within the marine environment also has the potential to affect the wave regime (height and period) due to the interaction of waves with these structures. Such interactions can have important implications on the hydrodynamic regime, and resultant sediment transport and seabed morphology by directly extracting energy from waves.

7.1.84 The depth of water in the location of the devices (between 26 and 32m), indicates there is little impact expected on the wave regime by the inter-array cables or device foundations.

7.1.85 Waves are disrupted (e.g. partial scattering/ reflection/ defraction) by the presence of any obstacle within the water column. A wave is reflected when it interacts with a static structure which affects its incident path. On the sheltered (lee) side of the static structure a shadow zone is created where waves are bent (diffracted) around the static structure.

7.1.86 Minor alteration to the wave regime can be expected in the near-field of the devices. This is not expected to be significant further afield due to a number of factors, including:

1. Kyle Rhea is not a wave sensitive environment, with few sedimentary processes beingdependent on wave energy;
2. the devices are far enough offshore allowing waves to regroup;
3. the devices will be deployed in a water depth sufficient that waves will not interact with the seabed;
4. devices have a slender profile, and:
5. the wave climate around Kyle Rhea experiences relatively low magnitude waves.

7.1.87 The changes to the wave regime and tidal currents are anticipated to be **negligible** magnitude. The marine physical environment is considered to have a **negligible** sensitivity to these changes, therefore it is expected that the impact to hydrodynamic regime is of **negligible** significance.

Impact 4: Suggested Mitigation
1. None suggested

Residual impact:

7.1.88 The significance of any impacts remains **negligible**.

Impact 5: Effects on sediments and sediment structures

Effects upon seabed sediment distribution patterns

7.1.89 The Project has the potential to affect sediments and sedimentary structures via scour development due to the interaction with static foundation structures, and changes to sediment transport processes.

7.1.90 The main impacts of the operational phase on sediments and sedimentary structures relates to changes in seabed and littoral processes and the development of scour around the base of the foundations and cables. The extent (depth, length) of scour will depend on the local physical conditions and the thickness of the mobile sediment layer, if present.

7.1.91 Where a channel bed feature (such as cable or device foundation) creates an obstacle to flow, there is the potential for local scour to occur. However scour can also occur naturally through sediment mobilisation and degradation of the seabed.

7.1.92 Local scour is associated with particularr local features that obstruct and deviate the flow and occurs in their immediate locality. The structures increase the local flow velocities and turbulence levels and, depending on their shape, can give rise to vortices that exert increased erosive forces on the surrounding material (CIRIA, 2002). The overall effect of these changes is an increase in bottom shear stress, which in the case of an erodable bed leads to an increase in local sediment transport and local scour around the structure, also known as a scour pit (De Vos, 2004). For a given set of environmental conditions the scouring of sediment structures initially occurs rapidly but then approaches its maximum at a slower rate (HR Wallingford, 1998)

7.1.93 The process of scour while typically significant in areas of mobile substrates and unconsolidated sediments is deemed to be insubstantial in Kyle Rhea due to the bedrock and boulder nature of the seabed in the proposed location of the turbines.

7.1.94 The depth of water that the inter-array cables and device foundations exist in will limit the potential influence of scour by the acceleration of wave energy. The local alteration of tidal forces however remains a potential source of scour.

7.1.95 The potential for scour around the inter-array cables is reduced due to two factors: (1) the seabed material along the inter-array cable route comprises bedrock and boulders; and (2) the inter array cables will be aligned parallel to the main tidal flows.

7.1.96 Scour at the device foundations is primarily limited by the seabed material. The peak tidal currents (4m/s) are not sufficient to mobilise the majority of seabed material in the proposed location of the turbines, which comprises cobbles and boulders or bedrock. This is most simply demonstrated by the classic Hjulstrom Curve (Hjulstrom, 1935) which suggests that only the material smaller than cobbles will be mobilised by the peak (4m/s) tidal currents.

7.1.97 It is therefore not anticipated that significant scour will develop in the immediate vicinity of the monopiles (‘pin’ piles) or the inter-array cables.

Effects to sediment transport patterns (incl. suspended sediment).

7.1.98 Reductions in tidal energy in the lee of the devices (bi-directional, generally north and south) may result in localised changes to the nature of the seabed via the deposition of suspended sediments. Impact 4 above discusses the likelihood of significant tidal energy extraction , and concludes that changes to tidal velocities will be negligible. Furthermore, within the high tidal energy environment of the study area there is little suspended sediment, therefore any localised impacts of energy extraction are unlikely to result in significant changes in sediment distribution patterns.

7.1.99 Where energy (wave, tide) extraction is located within close proximity to soft-coastlines it is considered that the potential to alter the sediment dynamics is increased. However, due to the bedrock dominated nature of the coastline along the study area, the potential for any changes to coastal geomorphology are greatly reduced.

7.1.100 In addition to scour, cables laid on the seabed (inter array cables) have the potential to act as a barrier to sediment transport. Such interruption to processes will result in the accretion of sediment around the cable and housing until such time as sediment accretion attains sufficient elevation to bypass the structure on the seabed. The seabed material in the proposed device locationsbedrock and cobbles suggests that transport of sediment is not significant, therefore the impact of cables to impede sediment will be minor. Furthermore, inter array cables will be laid from north to south (parallel with the driving forces, primarily tidal currents, hence sediment transport) which will limit the ability of the cables to impede sediment transport.

7.1.101 The potential effects upon sediment processes and sedimentary structures resulting from the operational phase the Project is anticipated to be of **low** magnitude with small localised impacts expected.

7.1.102 The receptor (marine physical environment and coastal processes) has a **low** sensitivity to such potential changes. The impact of the Project on sediment processes and sedimentary structures is therefore expected to be of **minor adverse** significance.

Impact 5: Suggested Mitigation
1. Significant scour around the foundations is not expected, however if scour does become an issue then scour protection may be required.

Residual impact:

7.1.103 The significance of any impacts remains **minor adverse**.

Impact 6: Effects on geological and geomorphological formations

7.1.104 The main effects of the operational phase on geological and geomorphological formations relates to changes in littoral and seabed processes and subsequent effects upon exposed bedrock seabed and coastal geomorphology via the disruption or change to existing processes.

7.1.105 The seabed is comprised predominantly of exposed Lewisian Gneiss overlain by patchy coarse grained sediments, cobbles and boulders. Where inter-array cables are exposed and stand proud from the seabed, there is the potential for any mobile sediment to accrete against the up-drift side of the exposed infrastructure. Such changes in seabed substrate are not expected to be permanent and their spatial extent and duration of persistence shall vary in response to the natural variance of the hydrodynamic and sedimentary regime. The magnitude of the potential impact upon the bedrock platform is considered to be negligible.

7.1.106 The existing coastal geomorphology along the Kyle Rhea coastline is relatively inactive. However, where quaternary deposits exist, these are likely to be in a state of dynamic equilibrium with hydrodynamic and sedimentary processes and therefore any changes in hydrodynamic regime and sedimentary patterns have the potential to change the geomorphological formations.

7.1.107 The geological and coastal geomorphology of the study area is controlled by the geological structure of the Lewisian Gneiss. The operational changes to the wave climate and tidal currents are unlikely to affect this hard rock. Where the Lewisian Gneiss is overlain with Quaternary deposits, there can be no expected change in the rate of coastal processes as a direct consequence of alterations to wave and tidal energy caused by the Project.

7.1.108 The potential impacts on geological and geomorphological formations resulting from the operational phase of the Project are anticipated to be of **negligible** magnitude. The receptor also has a **low** sensitivity to changes, therefore the impact upon the marine physical environment and coastal processes is therefore assessed to have **negligible** significance.

Impact 6: Suggested Mitigation
None

Residual impact:

7.1.109 The significance of any impacts remains **negligible**.

Potential impacts during the decommissioning phase

7.1.110 At the current time, no specific proposals have been set out for the decommissioning of the Project. The directionally drilled export cable(s) may either be left in place or removed, and it is expected that inter array cables will be removed. Devices will be removed and support structures (foundations) would be cut down to an agreed level.

7.1.111 Impacts during the decommissioning phase would be similar to those identified during the installation phase and will be informed via a detailed decommissioning plan.

7.1.112 The long term impacts of the residual structures (buried cables, cut down foundations) are not expected to be of greater significance than the operational phase, therefore under this situation there would be no broad scale or long term impacts on seabed or coastal processes.

Potential cumulative impacts

7.1.113 At present there are no known consented or planned projects in the study area, therefore no cumulative impacts are anticipated.

7.5. Summary

7.1.114 The Project has the potential to impact on three elements of the marine physical environment and coastal processes, namely:

- Hydrodynamic regime;
- Sediments and sedimentary processes; and
- Geological and geomorphological formations.

7.1.115 Anticipated effects within the study area are expected to be relatively localised to the device foundations, and the infrastructure that links the devices. It is considered that any disturbance to the seabed will manifest over a spatially limited area, and be of a low magnitude. Tidal and wave energy extraction is anticipated to result in low magnitude near-field changes to the wave energy regime and tidal currents. This has been informed by recent data obtained from Strangford Lough following the installation of a similar device .

7.1.116 The potential for the foundations and cabling to change the sedimentary processes are restricted by the lack of mobile sediment (bedrock and cobble seabed).

7.1.117 The geological and coastal geomorphology of the study area is controlled by the exposed geological structure of the Lewisian Gneiss. The operational changes to the hydrodynamic and sedimentary regimes are unlikely to affect the geological and geomorphological formations.

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8 GEOLOGY, HYDROGEOLOGY AND SURFACE WATER (NON-MARINE)

8.1 Introduction

8.1.1 This chapter of the Environmental Statement (ES) describes the existing on-shore environment within the proposed Kyle Rhea Tidal Stream Array (‘the Project’) and associated study area. Subsequently, it presents the findings of an assessment of the potential impacts arising from the construction, operation and decommissioning of the Project.

8.1.2 This chapter assesses the potential direct and indirect impacts of the onshore elements of the Project, including the construction, operation and decommissioning with respect to geology, hydrogeology and non-marine surface water.

8.1.3 Potential impacts arising from the construction, operation and decommissioning of the Project are identified and their significance is assessed taking into account the anticipated magnitude of the impacts from the Project and the sensitivity of the environmental baseline of the area.

8.1.4 Where potentially significant impacts are predicted, appropriate mitigation measures are proposed. Good practice relating to the protection of geology, hydrogeology and non-marine surface water during construction and operational phases are also outlined in order to minimise or avoid any impacts.

8.1.5 This chapter has links with Chapters 7 (Marine Physical Environment and Coastal Processes), 9 (Water Quality) and 10 (Terrestrial and Intertidal Ecology).

8.1.6 The proposed onshore elements (see Chapter 5: Project Description) include the following components which are shown on Figure 5.1.

Option 1

- A small amount of quarrying into the hillside may be required to establish a flat surface upon which to operate the drilling rig. This will be partly located in an existing car park and will cover an area of approximately 40m x 40m;
- Construction of a small substation, with an approximate footprint of 6m x 3m, located adjacent to the existing public toilets building, approximately 250m north west of the slipway for the Kylerhea Ferry Terminal. It is intended that this will have a concrete slab foundation and will require trenching for the onshore cable;
- No fluids will be used in the operation of the substation;
- Directional drilling of the export cable from the array to the substation; and
- Open trenching for approximately 250m between the drilling pad and the substation along the existing Forestry Commission (FC) access track. This is expected to be typically 2m wide and 1m deep but will be confirmed with the FC.

8.1.7 The construction works are planned to take place off the FC access track and car park with the cable trench routed along the track. It is not expected that any alterations will be needed to the road drainage ditches or any other watercourses.

8.1.8 The existing public toilets at the site are understood to drain to an underground septic tank located immediately across the track from the toilet block (on the lower side of, and adjacent to, the track).

Option 2

- A small amount of levelling of soils to form the drilling rig pad (within the Drilling Study Area show on Figure 5.1);
- Installation of a small substation within an existing building, located at the Kylerhea ferry slipway and shown in Figure 5.1, including trenching for a cable;
- No fluids will be used in the operation of the substation;
- Directional drilling of the export cable from the array to the substation; and
- Open trenching for approximately 335m between the drilling pad and the substation.

It is not expected that any alterations will be needed to the road drainage ditches or watercourses. Should crossing be required the approach will be agreed with the Regulators and will aim to avoid any significant alteration.

Study area

8.1.9 The study area for the assessment of potential geological, hydrogeological and surface water impacts has been defined by a 1km radius around the proposed locations of the onshore export cable route and substation. This area is considered sufficient to encompass the groundwater and surface water catchments within which the proposed onshore works are located, as inferred from the topography of the surrounding area and presence and flow directions of nearby surface watercourses. Land to the south of the Kylerhea River is not considered to be in hydraulic continuity with surface water or shallow groundwater in the locations of the proposed onshore works. For the purposes of the surface water and groundwater impact assessments this has therefore not been assessed further as a sensitive receptor.

8.1.10 The geology impact assessment makes reference to a wider area to ensure that any impacts on geologically sensitive areas within the Kinloch and Kyleakin Hills (Mondach Chaol Acainn Is Cheann Loch) Site of Special Scientific Interest are considered.

Overview of potential impacts

8.1.11 The potential impacts on the geology, hydrogeology and non-marine surface water, from the onshore elements of this development, are:

- Removal of rock by directional drilling;
- Loss of structure and/or erosion of site soils;
- Changes to surface water runoff patterns;
- Pollution caused by accidental spills, leaks of potentially polluting substances or suspension of sediment;
- Changes to groundwater water flow patterns; and
- Flooding or surface ponding.

Policy, legislation and guidance in relation to geology, hydrogeology and non-marine surface water

8.1.12 The assessment has been undertaken with reference to statutory and general guidance and relevant legislation comprising:

8.1.13 Legislative context:

- The European Union (EU) Water Framework Directive 2000/60/EC;
- Water Environment and Water Services (Scotland) Act 2003 (WEWS Act);
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011; and

8.1.14 Policy context

- The Highland Council West Highland and Islands Local Plan Policy 14: Surface Water Drainage, requires that proposed developments are drained using Sustainable Drainage Systems and, where necessary, identification of drainage discharges which are separate to the public sewers.
- Scottish Planning Policy (SPP), February 2010.

8.1.15 Scottish Executive Policy Advice Notes (PANs):

- PAN 69: Planning and Building Standards Advice on Flooding
- PAN 79: Water and Drainage

8.1.16 DEFRA publications:

- Code of Practice for the Sustainable Use of Soils on Construction Sites

8.1.17 SEPA Pollution Prevention Guidance (PPG) Notes:

- PPG1 General Guide to prevention of water pollution;
- PPG2 Above ground oil storage tanks;
- PPG5 Works and maintenance in or near water;
- PPG6 Working at construction and demolition sites;
- PPG7 Safe Storage – The safe operation of refuelling facilities;
- PPG20 - Dewatering underground ducts and chambers;
- PPG21 Pollution incident response planning; and
- PPG 22 Incident response – dealing with spills.

8.1.18 Construction Industry Research and Information Association (CIRIA) publications:

- C532 Control of water pollution from construction sites (2001); and
- C650 Environmental good practice on site (2006).

8.2 Methodology

Consultation in relation to geology, hydrogeology and non-marine surface water

A scoping opinion was sought from both statutory and non-statutory consultees (Appendix 4.1) in March 2010 (MCT (2010)

Responses are detailed in Chapter 6, Consultation and a summary of the points relevant to this Chapter is provided below (Table 8.1), along with an explanation of how they were addressed.

Table 8.1: Summary of consultation relating to geology, hydrogeology and non-marine surface water

Key issues raised	Response
Scottish Ministers: SEPA produces a series of Pollution Prevention Guidelines, several of which should be utilised in preparation of an ES and during development. These include SEPA's guidance note PPG6: Working at Construction and Demolition Sites, PPG5: Works in, near or liable to affect Watercourses, PPG2 Above ground storage tanks, and others, all of which are available on SEPA's website at http://www.sepa.org.uk/guidance/ppg/index.htm.	Paragraphs 8.1.17, 8.4.22, 8.4.26, 8.4.49, 8.4.52 and 8.4.61
Scottish Ministers: SEPA would look to see specific principles contained within PPG notes to be incorporated within mitigation measures identified within the ES rather than general reference to adherence to the notes.	Paragraph 8.4.22, 8.4.26, 8.4.49, 8.4.52 and 8.4.61
Scottish Ministers: The ES should identify location of and protective/mitigation measures in relation to all private water supplies within the catchments impacted by the scheme, including modifications to site design and layout.	Paragraph 8.3.26
Scottish Ministers: Developers should also be aware of available CIRIA guidance on the control of water pollution from construction sites and environmental good practice (www.ciria.org)	Paragraphs 8.4.22, 8.4.26, 8.4.49, 8.4.52 and 8.4.61
SEPA: We request that the ES address The River Basin management Planning (RBMP) Web Mapping Application available on SEPA's website (http://gis.sepa.org.uk/rbmp/) shows the Water Framework Directive (WFD) water body boundaries for transitional and coastal waters and provides further water body information.	Table 8,2; paragraph 8.34, 8.3.22 and 8.3.23
SEPA: The ES should demonstrate that the proposals will not compromise WFD objectives. A methodology to assess cumulative impacts in line with WFD objectives has been developed. The methodology uses a concept of 'system capacity' to measure impacts upon geomorphological conditions. Please contact us for further guidance on the assessment methodology.	Paragraph 8.1.7, 8.1.8 8.3.4, 8.3.21 - 8.3.26 and 8.4.22 - 8.4.23 In line with guidance requested from SEPA, a site layout description and consideration of the development in the marine environment putting this into context of the surrounding water body have been included. Addressed further in Chapter 9: Water Quality
SEPA: In order to meet the objectives of the Water Framework Directive, developments should be designed wherever possible to avoid engineering activities in the water environment. The water environment includes burns, rivers, lochs, wetlands, groundwater and reservoirs.	Paragraph 8.1.7, 8.1.8, 8.4.22 and 8.4.49
SEPA: A site survey of existing water features and a map of the location of all proposed engineering activities in the water environment should be included in the ES or planning submission.	Paragraph 8.3.6

Key issues raised	Response
SEPA: A systematic table detailing the justification for the activity and how any adverse impact will be mitigated should also be included. The table should be accompanied by a photograph of each affected water body along with its dimensions. Justification for the location of any proposed activity is a key issue for us to assess at the planning stage. The detailed design of engineered structures in the water environment will be considered under regulations administered by us. Where flood risk may be an issue, this will need to be addressed at the planning stage.	Paragraph 8.1.7 and 8.1.8; Section 8.4 ; and Figures 5.1 and 8.1
SEPA: The impact of borrow pits (including dust, blasting and impact on water) should be appraised as part of the overall impact of the scheme. Information should cover, in relation to water, at least the information set out in PAN 50 controlling the environmental effects of surface mineral workings (Paragraph 53) and, where relevant, in relation to groundwater (Paragraph 52).	No borrow pits are planned as part of the development
SEPA: Details of the proposed depth of the excavation of any borrow pits compared to the actual topography, the proposed restoration profile, proposed drainage and settlement traps, turf and overburden removal and storage for reinstatement should be submitted. The reinstatement of borrow pits can raise significant waste management issues and it is essential that any proposals are discussed with our regulatory teams as part of the development of the Project to ensure that such proposals are feasible in terms of cost and regulatory requirements.	No borrow pits are planned as part of the development
SNH: In principle, we support proposals for directional drilling for cables because this offers an opportunity to minimise benthic impacts through cable laying. Providing best practise is followed and a pollution prevention package is drawn up, the effects from potential pollutants may be minimised. We advise that environmental practices and management for hydraulic fluids and potential pollutants are detailed within the ES.	Paragraph 8.4.19 to 8.4.23

Data collection

8.2.1 The principal data sources relevant to water quality are shown below in Table 8.2.

Table 8.2: Data sources to inform the existing environment

Data Source	Spatial coverage	Author	Year
1:50,000 Geological Map series Scotland Sheet 71E Kyle of Lochalsh Drift Edition	East Skye, Loch Alsh and Loch Hourn	British Geological Survey	1976
Map of Groundwater Vulnerability in the Uppermost Aquifer	Scotland	SEPA/SNIFFER/BGS/ Macaulay Institute	2004
Indicative River & Coastal Flood Map (SEPA Website)	Scotland	SEPA	Accessed 2012
River Basin Management Plan Interactive Map (SEPA Website)	West Highland	SEPA	2012
Kyle Rhea Extended Phase 1 Habitat Survey	Onshore Study Area (Figure 1.1)	Royal Haskoning	2012

Data Source	Spatial coverage	Author	Year
Report (Appendix 10.1 to this ES)			
Kyle Rhea Tidal Array Geotechnical Desk Study Preliminary Report	Kyle Rhea channel, shoreline and immediately inland of the shoreline on both the mainland and Skye coasts	Cathie Associates Ltd	2010
UK Hydrological Review 2010	UK	Center for Ecology and Hydrology	2011
Kinloch and Kyleakin Hills (Mondach Chaol Acainn Is Cheann Loch) SSSI Citation	SSSI	Scottish Natural Heritage	2009

Impact assessment

8.2.2 This section outlines the methodology used to assess the significance of potential environmental impacts of the onshore elements of the Project upon geology, hydrogeology and non-marine surface water. There are currently no published criteria for assessing or evaluating impacts on geology and hydrogeology and non-marine surface water. This assessment is based on methodology derived from Institute of Environmental Management and Assessment (IEMA, 2004) and has been undertaken by a specialist with relevant experience.

8.2.3 Table 8.3 presents the definition of the sensitivity of receptors.

Table 8.3: Definition of terms relating to the sensitivity to an effect

Value / Sensitivity	Definition
High	No capacity to accommodate the proposed form of change.
Medium	Very low capacity to accommodate the proposed form of change.
Low	Low capacity to accommodate the proposed form of change.
Negligible	Receptor has some tolerance to accommodate the proposed change.

8.2.4 Significance can be categorised into four levels of magnitude as described in Table 8.4.

Table 8.4: Definition of magnitude of an effect upon receptors

Magnitude	Definition
High	Very significant, permanent / irreversible changes, over the whole feature / asset, and / or significant alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact certain or likely to occur.
Medium	Significant, permanent / irreversible changes, over the significant proportion of the feature / asset, and / or noticeable alteration to key characteristics or features of the

Magnitude	Definition
	particular environmental aspect's character or distinctiveness. Impact certain or likely to occur.
Low	Noticeable, temporary (during the project duration) change, over a small proportion of the feature / asset, and / or limited but noticeable alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact will possibly occur.
Negligible	Noticeable, temporary (for part of the project duration) change, or barely discernible change for any length of time, over a small area of the feature or asset, and/or slight alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact unlikely or rarely to occur.

8.2.5 Table 8.5 combines the definitions of magnitude with the level of sensitivity/value/importance of receptor to provide a prediction of overall significance of the effect. The boxes shaded red and orange represent those impacts which may be considered significant within an EIA.

Table 8.5: The level of significance of an impact resulting from each combination of sensitivity and magnitude

Sensitivity	Magnitude			
	High	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

8.3 Existing environment

Topography and hydrology

8.3.1 The onshore study area is situated on the eastern coast of the Isle of Skye, as shown in Figure 8.1. The coastline in the area of the proposed onshore works for Option 1 is characterised by steep slopes from peaks of approximately 490m above ordinance datum (AOD) at Beinn Bhuidhe and 730m AOD at Beinn na Caillich respectively, which lie approximately 1km and 2km respectively from the proposed substation under Option 1. The shoreline is characterised by cliffs and rocky outcrops (Cathie Associates, 2010).

8.3.2 The existing building proposed in Option 2 to house the substation is located on flat land at the foot of a steep slope and the Drilling Study Area proposed in Option 2 is characterised by more gently sloping and flat land close to the mouth of the Kylerhea River.

8.3.3 Rainfall for the area is estimated to be in the order of 1300mm (CEH, 2011 based on 2010 rainfall for the Highlands). Due to the steep slopes, rainfall falling on the Option 1 site will generally drain in an easterly direction towards the coast. The proposed onshore works under Option 1do not lie within a fluvial or coastal floodplain (SEPA Indicative River & Coastal Flood

Map) and are therefore at very low probability of flooding from rivers or the sea. The most easterly part of the Drilling Study Area under Option 2 is indicated to lie within a coastal indicative floodplain (defined as an area with an estimated risk of flooding in any given year of greater than 1 in 200). However the actual proposed substation location under Option 2 is indicated to lie outside the floodplain.

8.3.4 According to the SEPA River Basin Management Plan interactive map, no freshwater surface water bodies within the onshore study area have been classified under the Water Framework Directive.

8.3.5 The topography indicates that rain falling within the Option 2 Proposed Drilling Area will drain generally towards the south and east, Surface water in the north and west of the site is likely to drain into a watercourse which crosses the centre of the site.

8.3.6 Watercourses were mapped as part of the Phase I Habitat Survey, completed in support of this ES (see Appendix 10.1 and Figures 10.3, 10.4 and 10.5). During the survey, a number of stream channels were identified which contained running water. These were located:

<u>Northern section of study area</u>

- Allt Grionach and its tributaries in the north on the study area (references 6, 13,14 in Figure 10.3) flowing west to east; and
- Un-named watercourse immediately to the south of Allt Grionach (reference 8 in Figure 10.3) flowing west to east.

<u>Option 1 Substation</u>

- There is a drainage ditch parallel to the access track. Immediately south of the toilet block several small burns were present in the November site visit flowing west to east down the steep heath hillside and into the ditch, where the water depth was approximately 5 cm with large pebble and broken rock bottom. Water was observed flowing north along the ditch and culverted under the exiting toilet block to a dip, approximately 10m to the north of the proposed substation. Water was also observed running within the ditch from the north southwards towards the dip (see Figure 10.4). From the dip, the water in the drainage dip is culverted under the track and flows steeply towards the coast west to east (reference 11 in Figure 10.4). This was noted to contain very low water at the time of the site surveys;

<u>Option 1 Drilling rig</u>

- A dry drainage ditch on west side of access track. This was dry in both May and November site visits.
- Between the option 1 drilling rig and substation proposed locations, there is a watercourse flowing west to east under the access track. This was described as a very small burn which is not marked on the OS survey 1:10000 map (reference 2 in Figure 10.4), and had water during the May survey but not the November survey;

<u>Option 2 substation</u>

- No further water courses were recorded at this location, however in the November survey the surrounding area was noted to be dark and damp.

Option 2 Drilling rig study area

- Within the Drilling Study Area land to the west of the road was marshy, with groundwater seepage through the marsh culverted under the north of the road. Groundwater was noted to be at the ground surface across this side of the road and the ground was boggy and soft to the east of the road (see Figure 10.5);

- A stream was noted (as marked on the Ordnance Survey base map) in the south of the Drilling Study Area, which separates this land from the occupied buildings and the surrounding crofting land (see Figure 10.4). This stream was shallow <5cm deep, with pebble substrate andfairly fast-flowing. Upstream, towards the village of Kylerhea, the watercourse widens (approx 1m) and has grassy banks and splits into tributaries which broadly follow the village road and several croft field boundaries. A tributary of this stream was noted to run south through marshy grassland to the south of the main road north of the village (see Figure 10.5):

8.3.7 Although additional watercourses are shown on the OS 1:10,000 map, these were not encountered during the site survey and were to be considered ephemeral. It was noted, however, that the survey of the Option 1 area was undertaken during a very dry summer. Drainage ditches were also observed alongside the track to the wildlife hide between the proposed locations of the Option 1 substation and drilling rig (Appendix 10.1, reference 2 and 3 in Figure 3.3 of the Phase I Habitat Survey).

8.3.8 The Kylerhea River flows from west to east approximately 280m south of the nearest proposed onshore works (the Option 2 Proposed Drilling Area) and discharges into the sea south of Kyle Rhea.

Geology

8.3.9 Geological value is listed in the citation for the Kinloch and Kyleakin Hills (Mondach Chaol Acainn Is Cheann Loch) Site of Special Scientific Interest Highland (Skye and Lochalsh) which states that:

8.3.10 *"Two complementary sites of geological significance are found within the SSSI: one is situated at the head of Glen Arroch and the other follows the north-east coast of Loch na Dal round into the Sound of Sleat.*

8.3.11 *"The Loch na Dal location contains a cross-section through a continuous series of three formations, the Rubha Guail, the Loch na Dal and the lower part of the Beinn na Seamraig, relating to the Sleat Group, a subdivision of the Torridonian, and is the type locality for the Rubha Guail and the Loch na Dal formations. In Glen Arroch, at Bealach Udal a series of rocky bluffs show the upper part of the Beinn na Seamraig formation.*

8.3.12 *"At both Loch na Dal and Bealach Udal the sedimentary structures that characterise the three formations are well preserved and clearly exhibited. Elsewhere, outcrops of the Sleat Group are considerably more deformed and metamorphosed, with partial or complete destruction of the sedimentary features."*

8.3.13 The boundaries of these two areas within the SSSI are not defined in the citation; however, from the Ordnance Survey map, Glen Arroch is located approximately 3km to the west of the proposed onshore works and Loch na Dal approximately 9.5km to the south west.

Bedrock geology

8.3.14 The geological map indicates that the majority of the onshore study area is underlain by the Beinn Na Seamraig Formation sandstones, which form part of the Sleat Group. This formation is shown to outcrop in the centre of the study area, and also in small areas in the north and south, The Sleat Group is described (by the British Geological Survey Lexicon of Rock Units) as "slightly metamorphosed cross-bedded grey sandstones and shaly mudstones. The sandstones are poorly sorted and resemble feldspathic greywackes[15]". In the far south of the study area the Beinn Na Seamraig Formation is indicated to be absent and the site is shown as underlain by the Loch Na Dal Formation of the Sleat Group.

8.3.15 In the north of the study area, a dolerite and basalt dyke (orientated approximately east to west) and a felsitic and granophyre dyke (orientated approximately south east to north west) intrude through the sedimentary bedrock geology. Two further dykes are shown in the south of the study area intruding through the Loch Na Dal Formation and indicate also to comprise dolerite and basalt. These dykes are orientated approximately east to west,

8.3.16 In the far north of the study area, in an excavation pit at the base of a pylon, a narrow quartzofeldspathic dyke[16] was observed which intruded through the Psammites. The dyke was approximately 200-250mm wide (Cathie Associates, 2010).

8.3.17 Adjacent to the slipway, Psammite, comprising light grey and light pinkish grey, thinly bedded and foliated sandstone with quartzofeldspathic veining was observed (Cathie Associates, 2010) .

Superficial geology and soils

8.3.18 In the north and south of the onshore study area, the Beinn Na Seamraig Formation is overlain by superficial recent deposits of till and morainic material (sands and gravels). In the south of the study area, and also in a small area in the north of the study area, raised beach deposits (marine alluvium) overlie the undifferentiated drift deposits.

8.3.19 The shoreline sediments are very similar to those observed on the mainland comprising; gravel, pebbles and boulders. Sparse quaternary deposits were observed inland, none were observed on the shoreline (Cathie Associates, April 2010).

8.3.20 The Phase I Habitat Survey (Appendix 10.1) identified wet heath vegetation on steep hillside in the vicinity of the Option 1 proposed drilling pad and substation. These habitats are indicative of thin soil deposits overlying the bedrock. Bedrock was observed where the existing track to the otter hide has been cut into the hillside. In the area of the option 2 proposed substation location, the ground was noted to be rocky with very little soil covering the bedrock. In the Option 2 Drilling Study Area, the vegetation was noted to be mainly marshy or grassy, indicating the presence of deeper soil deposits on the flatter land.

Hydrogeology

8.3.21 According to the SEPA RBMP water body information sheet for water body 150042 (Isle of Skye groundwater) in the West Highlands, SEPA have classified groundwater beneath the site in 2008 as having an overall status of '*Good with High confidence'*. The quality of the groundwater was classified as Good with High confidenceand the quantity of groundwater has been classified as Good with High confidence.. No trend for pollutants was identified for this water body.

8.3.22 SEPA has set environmental objectives for the Isle of Skye groundwater, for future river basin planning cycles. These objectives aim to facilitate sustainable status improvements or prevent status deterioration, unless this deterioration is caused by a new activity that provides significant specified benefits to society or to the wider environment.

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[15] A variety of sandstone rich in feldspar minerals

[16] An igneous intrusion rich in quartz and feldspar minerals.

8.3.23 For the Isle of Skye groundwater water body SEPA has set the overall environmental objectives for the first, second and third River Basin Management Planning (RBMP) cycles as:

- Overall Status: Good
- Chemistry Status: Good
- Quantitative Status: Good

8.3.24 No groundwater monitoring information was available from SEPA within 1km of the of the originally proposed substation location (Option1[17]).

8.3.25 The SEPA map of Groundwater Vulnerability in the Uppermost Aquifer, indicates that the shallow geology (inferred as referring to the Beinn na Seamraig Formation) is classed as Category 4a to 5 (highly vulnerable).

8.3.26 The Phase I terrestrial habitat survey identified groundwater dependent terrestrial ecosystems within the study area comprising wet heathland on the south eastern slopes of Beinn Bhuidhe and between the Kylerhea Road and the village of Kylerhea (see Chapter 10). This suggests the presence of shallow groundwater or surface water in these areas.

8.3.27 According to records held by SEPA and the Highland Council, no Consents to Discharge are present within 1km of the originally proposed substation location. According to information provided by SEPA[18], one surface water abstraction/return is located approximately 1km north-north east of the originally proposed substation location. The proposed onshore works are located down-gradient and are not likely to affect the abstraction.

8.4 Impact assessment

8.4.1 This section considers potential impacts on geology, hydrogeology and non-marine surface waters within the study area (a radius of 1km from the site boundary).

Do nothing scenario

8.4.2 Under the 'do nothing' scenario, it is considered unlikely that there would be any significant change to the current condition of the underlying geology, drainage of the site or hydrogeological conditions.

Potential impacts during construction – Option 1

Impact 1: Impact of drilling pad, substation and cable tunnels/trench on geology

8.4.3 Directional drilling of the cables between the substation and the devices will result in the removal of a small volume of rock from within the Beinn na Seamraig Formation. The proposed directional drilling technique for the installation of the export cables will cause the least impact on the rock structure and the visual appearance of the rock outcrop (when compared to open trenching). The lengths of the cables have been kept as far as possible to a minimum which will minimise the volume of rock affected.

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17 The request for information submitted to SEPA was based on the Option 1 onshore works locations and covers the majority of the study area to the north of the Kylerhea River (see Section 8.1.9) for both Option 1 and Option 2. There is a small area North of the Kyle Rhea River and in the South West of the study area which does not fall within the SEPA search area. However based on an assessment of land use, no additional significant information is anticipated to be available.

18 Pers. Comm. L Henderson, SEPA, 26th September 2012

8.4.4 A small amount of quarrying into the top of the geology may also be necessary in order to provide a flat surface for the drill rig. Construction works for the drill pad will cover approximately 40m x 40m. Construction of the substation will involve levelling to form a suitable area for a concrete slab foundation and cable trench. Construction of the substation will be within a footprint of approximately 6m x 3m. A trench will be required in order to install the cable between the drilling pad and the substation. Given the location of this cable route, the trench is expected to extend into the bedrock.

8.4.5 According to the SSSI citation, the identified areas of national geological importance lie outside the study area (to the west and south west). Site geology is therefore considered to be of **low** sensitivity.

8.4.6 Given the scale and nature of drilling and levelling works they are expected to result in a localised effect of **negligible** magnitude to the receptor, producing a **negligible i**mpact on geology.

Impact 1: Suggested Mitigation
No further mitigation is proposed.

Residual impact:

8.4.7 Directional drilling and surface levelling are expected to result in a **negligible** impact on the geology of the site.

Impact 2: Impact of drilling pad and substation construction on soils

8.4.8 Construction of the drill pad and substation will involve the removal of soils within the footprints of these areas. Where soils are stockpiled, permanently or temporarily, erosion can occur through contact with precipitation and site runoff. The structure of soils may also be affected by handling, storage, replacement and through compaction caused by movements of heavy machinery or storage of construction equipment on site. Where deep soils are present, handling can result in the loss of characteristic soil horizons. Site soils are considered to be of **low** sensitivity due to the thin deposits likely to be present within the construction footprint.

8.4.9 Given the scale and short timescale of the onshore works they are expected to result in a localised effect of **negligible** magnitude to the receptor, producing a **negligible** impact on soils.

Impact 2: Suggested Mitigation
In order to reduce the impacts to soil quality through stockpiling: • The small amounts of soil requiring removal and stockpiling will be stored separately and away from the main areas of traffic and construction; • Where possible, the stockpiles will be protected by covering with the excavated turf; • The soil will be stored at an appropriate height and width to minimise erosion of soil; • The contractor will adhere to the DEFRA guidance (construction Code of Practice for the Sustainable Use of Soils on Construction Sites) to ensure that damage to soil is minimised. This code of practice deals with measures to reduce the risk associated with excavated soils as well as compaction of those left in-situ. • Detailed method statements will be provided setting out how any waste materials will be dealt with; and a Site Waste Management Plan (SWMP) will be completed to identify the waste management option for each waste.

Residual impact:

8.4.10 With implementation of the mitigation detailed above, the onshore construction works are expected to continue to have a **negligible**, though further reduced, impact on soils.

Impact 3: Change in surface water runoff patterns

8.4.11 The surface water runoff and drainage patterns are likely to be altered within the construction footprint and possibly in a small area of the onshore study area immediately down-gradient as a result of levelling, to provide a flat surface for operation of the drilling rig and the foundations for the new substation.

8.4.12 Surface water (hydrology) is considered to be a **low** sensitivity receptor given the small scale and location of the onshore works towards the lower end of the surface water catchment and the resulting small area of the catchment downgradient of the onshore works which could be affected. The footprint of the area for operation of the drill rig is up to 40m x 40m (see Chapter 5, Project Description), a large proportion of which will be hard standing (porous quarry run material) and will require some levelling works. The substation will be situated in an existing car park and will have a footprint of 6m x 3m.

8.4.13 Given the small scale of levelling works for the drill pad and substation compared to the area of the surface water catchment the works are expected to result in a localised effect of **low** magnitude to the receptor on a receptor of **low** sensitivity, producing a **minor adverse** impact on surface water.

Impact 3: Suggested Mitigation
The onshore works will be undertaken in accordance with good site practice (including C650 Environmental good practice on site) and with reference to planning guidance PAN69 and PAN 79, including measures to prevent water from entering excavations and the use of temporary Sustainable Drainage Systems, where necessary. These may include features such as: • Use of gravel instead of tarmac wherever possible to promote infiltration; • Filter strips (vegetated slopes) designed to enable even water drainage; or • Small attenuation ponds.

Residual Impact:

8.4.14 Since the areas of excavation and levelling are very small in comparison to the total catchment area and areas will have a porous surface finish, changes in surface water drainage patterns is expected to result in a **negligible** impact with the use of good site management practice.

Impact 4: Mobilisation of sediment in surface water runoff

8.4.15 Given the high average annual rainfall on the Isle of Skye, disturbance of the ground within the footprints of the pad for the drilling equipment and the substation may temporarily result in surface water runoff entraining a small amount of sediment as it passes across these sites. Sediment may be transported off site and towards Kyle Rhea.

8.4.16 Although the duration of the works is expected to be short, given the potential for high rainfall in the area (depending on season) and the proximity of the works to downgradient surface water receptors, an impact magnitude of **low** has been adopted.

8.4.17 Despite its high ecological importance, the surface water receptor is considered to be of **low** sensitivity with respect to sediment loading due to its already naturally high sediment load indicating a **minor adverse** impact from mobilisation of sediment.

Impact 4: Suggested Mitigation
The construction contractor will develop and implement a construction method statement which adheres to the relevant best practice including: • The area of disturbed ground will be kept to a minimum • Silt traps will be used to capture suspended solids where necessary, especially where excavation is taking place on steep slopes.

Residual Impact:

8.4.18 With use of site best practice, mobilisation of sediment is expected to have a **negligible** impact on surface water quality.

Impact 5: Drilling fluids causing contamination of water bodies

8.4.19 The directional drilling activity will result in arisings of drilling fluids or drilling cuttings, which could lead to contamination of groundwater or, if allowed to migrate, to nearby surface waters.

8.4.20 The drill fluid used will be non-toxic and biodegradable (either Salt Water Drilling Clay (SWDC) or Biodegradable Drilling Fluid (BDF)).

8.4.21 A closed loop recycling system will separate drill cuttings from reusable drilling fluids, limiting the quantity of drilling fluid and cuttings lost to the environment. The drilling fluid will be passed through a recycling unit onshore (the drilling direction is from shore to sea) and virtually all solids will be removed and disposed of by a licensed waste carrier (to be identified in the Project Waste Management Plan prior to construction) It is anticipated that the dewatering process will be contained within the recycling unit.

8.4.22 Groundwater beneath the site has been assigned good status and there is a likelihood of shallow groundwater being present at the site. The site lies in proximity to surface water receptors; however, due to the site location there is only a small groundwater and surface water catchment area which could potentially be affected. Groundwater and surface waters are therefore considered to be receptors of **low** sensitivity. Given the nature of the drilling fluids involved, the potential impact of a significant loss of drilling fluid is considered to constitute an impact of **negligible** magnitude, producing a **negligible** impact.

Impact 5: Suggested Mitigation
• SEPA Guidance (PPG) will be followed to reduce the likelihood and magnitude of any spills and leaks. Specifically PPG) 1: General guide to the prevention of pollution, 5: Works and maintenance in or near water, 6: Working at construction and demolition sites and 21: Pollution incidence response planning and Construction Industry Research and Information Association (CIRIA) C532 will be followed. • Any construction work will be undertaken in accordance with the Environmental Management Plan which will be developed in conjunction with the contractor and SEPA.

Residual Impact:

8.4.23 Implementation of the mitigation measures outlined above is expected to reduce the potential impact of potential contamination by drilling fluids to **negligible**.

Impact 6: Spills and leaks of oil, fuel or other potentially polluting substance

8.4.24 Accidental spills and leaks can occur during any construction activities, particularly where vehicle movements are necessary and where oil and fuel are stored. Such spills or leaks could then potentially pollute the ground surface or migrate to surface water in Kyle Rhea.

8.4.25 The location of the existing septic tank for the Forestry Commission public toilets will be confirmed prior to commencement of directional drilling to ensure that it will be avoided.

8.4.26 Given the small scale of the works and the low volumes of potentially polluting materials anticipated to be used on site, an accidental release is considered to constitute a potential effect of **negligible** magnitude on a receptor of **low** sensitivity (due to the site location there is only a small groundwater and surface water catchment area which could potentially be affected), producing a **negligible** impact.

Impact 6: Suggested Mitigation
• SEPA Guidance (PPG) will be followed to reduce the likelihood and magnitude of any spills and leaks. Specifically PPG) 1: General guide to the prevention of pollution, 2: Above ground oil storage, 5: Works and maintenance in or near water, 6: Working at construction and demolition sites, 7: Safe Storage – the safe operation of refuelling activities and 21: Pollution incidence response planning and Construction Industry Research and Information Association (CIRIA) C532 will be followed. • Oil, fuel and any other potentially polluting substances will be stored in a designated storage area on site situated away from any sensitive receptors such as watercourses and will be stored within impervious bunds with 110% capacity to ensure complete spill / leak retention. • Oil, fuel and any other potentially polluting substances will be stored >10m from all watercourses • Machinery and equipment will be routinely inspected to ensure they are in good working order and to detect any leakage at an early stage. • Spill kits will be available on site at all times. • Where appropriate wheel washing will be used to prevent excess soil being transferred to public roads. • Any construction work will be undertaken in accordance with the Environmental Management Plan which will be developed in conjunction with the contractor and SEPA.

Residual Impact:

8.4.27 Given the small volumes used or stored on site, after mitigation, release of potentially polluting substances would continue to have a **negligible** impact.

Potential impacts during construction – Option 2

Impact 1: Impact of drilling pad, substation and cable tunnels/trench on geology

8.4.28 Directional drilling of the cables between the substation and the devices will result in the removal of a small volume of rock from within the Sleat Group. The proposed directional drilling technique for the installation of the export cables will cause the least impact on the rock structure and the visual appearance of the rock outcrop (when compared to open trenching). The lengths of the cables have been kept as far as possible to a minimum, which will minimise the volume of rock affected.

8.4.29 The excavation of only a small volume of soils is expected to be necessary in order to provide a flat surface for the drill rig as the proposed drilling location is on relatively flat land. Construction works for the drill pad will cover approximately 40m x 40m.

8.4.30 The substation will be located within an existing building, although a cable trench will be required in order to install the cable between the drilling pad and the substation. Given the location of this cable route, the trench is expected to extend into the bedrock for at least part of its length.

8.4.31 According to the SSSI citation, the identified areas of national geological importance lie outside the study area (to the west and south west). Site geology is therefore considered to be of **low** sensitivity.

8.4.32 Given the scale and nature of drilling and levelling works they are expected to result in a localised effect of **negligible** magnitude to the receptor, producing a **negligible i**mpact on geology.

Impact 1: Suggested Mitigation
No further mitigation is proposed.

Residual impact:

8.4.33 Directional drilling and surface levelling are expected to result in a **negligible** impact on the geology of the site.

Impact 2: Impact of drilling pad and substation construction on soils

8.4.34 Construction of the drill pad will involve the removal of soils within the construction footprint. Where soils are stockpiled, permanently or temporarily, erosion can occur through contact with precipitation and site runoff. The structure of soils may also be affected by handling, storage, replacement and through compaction caused by movements of heavy machinery or storage of construction equipment on site. Where deep soils are present, handling can result in the loss of characteristic soil horizons. Site soils are considered to be of **medium** sensitivity due to the potentially thicker deposits present within the construction footprint of Option 2.

8.4.35 Given the scale and short timescale of the onshore works they are expected to result in a localised effect of **negligible** magnitude to the receptor, producing a **minor** impact on soils.

Impact 2: Suggested Mitigation
In order to reduce the impacts to soil quality through stockpiling: • The small amounts of soil requiring removal and stockpiling will be stored separately and away from the main areas of traffic and construction; • Where possible, the stockpiles will be protected by covering with the excavated turf; • The soil will be stored at an appropriate height and width to minimise erosion of soil; • The contractor will adhere to the DEFRA guidance (construction Code of Practice for the Sustainable Use of Soils on Construction Sites) to ensure that damage to soil is minimised. This code of practice deals with measures to reduce the risk associated with excavated soils as well as compaction of those left in-situ. • Detailed method statements will be provided setting out how any waste materials will be dealt with; and a Site Waste Management Plan (SWMP) will be completed to identify the waste management option for each waste.

Residual impact:

8.4.36 With implementation of the mitigation detailed above, the onshore construction works are expected to have a **negligible**, impact on soils.

Impact 3: Change in surface water runoff patterns

8.4.37 The surface water runoff and drainage patterns are likely to be altered within the construction footprint.

8.4.38 Surface water (hydrology) is considered to be a **low** sensitivity receptor given the small scale and location of the Option 2 onshore works towards the lower end of the surface water catchment and the resulting small area of the catchment downgradient of the onshore works which could be affected. The footprint of the area for operation of the drill rig is up to 40m x 40m (see Chapter 5, Project Description) and will require some minor levelling works. The substation will be situated in an existing building and is therefore not expected to alter surface water runoff patterns.

8.4.39 Given the small scale of levelling works for the drill pad compared to the area of the surface water catchment, the works are expected to result in a localised effect of **low** magnitude to the receptor on a receptor of **low** sensitivity, producing a **minor adverse** impact on surface water.

Impact 3: Suggested Mitigation
The onshore works will be undertaken in accordance with good site practice (including C650 Environmental good practice on site) including measures to prevent water from entering excavations and the use of temporary Sustainable Drainage Systems, where necessary. These may include features such as: • Use of gravel instead of tarmac wherever possible to promote infiltration; • Filter strips (vegetated slopes) designed to enable even water drainage; or • Small attenuation ponds.

Residual Impact:

8.4.40 Since the areas of excavation and levelling are very small in comparison to the total catchment area and areas will have a porous surface finish, changes in surface water drainage patterns is expected to result in a **negligible** impact with the use of good site management practice.

Impact 4: Mobilisation of sediment in surface water runoff

8.4.41 Given the high average annual rainfall on the Isle of Skye, disturbance of the ground within the footprint of the pad for the drilling equipment and when excavating the cable trench for the substation may temporarily result in surface water runoff entraining a small amount of sediment as it passes across these sites. Sediment may be transported off site and towards Kyle Rhea.

8.4.42 Although the duration of the works is expected to be short, given the potential for high rainfall in the area (depending on season) and the proximity of the works to downgradient surface water receptors, an impact magnitude of **low** has been adopted.

8.4.43 Despite its ecological importance, the Kyle Rhea channel is considered to be a **low** sensitivity surface water receptor with respect to sediment loading due to its existing naturally high sediment load, resulting in a **minor adverse** impact.

8.4.44 If the drilling pad is located in the west of the Drilling Study Area, runoff may flow into the small surface water drain running through this area. The drain was noted, during the site habitat survey, to be highly vegetated with very little open water and is therefore considered to have **low** sensitivity receptor to mobilised sediment in runoff, resulting in a **minor adverse** impact.

Impact 4: Suggested Mitigation
The construction contractor will develop and implement a construction method statement which adheres to the relevant best practice including: • The area of disturbed ground will be kept to a minimum; and • Silt traps will be used to capture suspended solids, where necessary.

Residual Impact:

8.4.45 With use of site best practice, mobilisation of sediment is expected to have a **negligible** impact on surface water quality.

Impact 5: Drilling fluids causing contamination of water bodies

8.4.46 The directional drilling activity will result in arisings of drilling fluids or drilling cuttings, which could lead to contamination of groundwater or (if allowed to migrate) to nearby surface waters.

8.4.47 The drill fluid used will be non-toxic and biodegradable (either Salt Water Drilling Clay (SWDC) or Biodegradable Drilling Fluid (BDF)).

8.4.48 A closed loop recycling system will separate drill cuttings from reusable drilling fluids, limiting the quantity of drilling fluid and cuttings lost to the environment. The drilling fluid will be passed through a recycling unit onshore (the drilling direction is from shore to sea) and virtually all solids will be removed and disposed of by a licensed waste carrier (to be identified in the Project Waste Management Plan prior to construction). Dewatering is expected to be contained within the recycling unit.

8.4.49 Groundwater beneath the site has been assigned good status and there is a likelihood of shallow groundwater being present at the site. The site lies in proximity to surface water receptors; however, due to the site location there is a small groundwater and surface water catchment area which could potentially be affected. Groundwater and non-marine surface waters are therefore considered to be receptors of **low** sensitivity. Given the nature of the drilling fluids involved, the potential impact of a significant loss of drilling fluid is considered to constitute an effect of **negligible** magnitude, producing a negligible impact.

Impact 5: Suggested Mitigation
• SEPA Guidance (PPG) will be followed to reduce the likelihood and magnitude of any spills and leaks. Specifically PPG) 1: General guide to the prevention of pollution, 5: Works and maintenance in or near water, 6: Working at construction and demolition sites and 21: Pollution incidence response planning and Construction Industry Research and Information Association (CIRIA) C532 will be followed. • Any construction work will be undertaken in accordance with the Environmental Management Plan which will be developed in conjunction with the contractor and SEPA.

Residual Impact:

8.4.50 Implementation of the mitigation measures outlined above is expected to reduce the potential impact to **negligible**.

Impact 6: Spills and leaks of oil, fuel or other potentially polluting substance

8.4.51 Accidental spills and leaks can occur during any construction activities, particularly where vehicle movements are necessary and where oil and fuel are stored. Such spills or leaks could then potentially pollute the ground surface or migrate to surface water in the drainage ditch running through the Option 2 Drilling Study Area and/or in the Kyle Rhea channel.

8.4.52 Given the small scale of the works and the low volumes of potentially polluting materials to be used on site, an accidental release is considered to constitute a potential effect of **negligible** magnitude on a receptor of **low** sensitivity (groundwater and/or surface water since the locations of the proposed onshore works means that only a small are of the groundwater and non-marine surface water catchments could be affected), producing a **negligible** impact.

Impact 6: Suggested Mitigation
• SEPA Guidance (PPG) will be followed to reduce the likelihood and magnitude of any spills and leaks. Specifically PPG) 1: General guide to the prevention of pollution, 2: Above ground oil storage, 5: Works and maintenance in or near water, 6: Working at construction and demolition sites, 7: Safe Storage – the safe operation of refuelling activities and 21: Pollution incidence response planning and Construction Industry Research and Information Association (CIRIA) C532 will be followed. • Oil, fuel and any other potentially polluting substances will be stored in a designated storage area on site situated away from any sensitive receptors such as watercourses and will be stored within impervious bunds with 110% capacity to ensure complete spill / leak retention. • Oil, fuel and any other potentially polluting substances will be stored >10m from all watercourses • Machinery and equipment will be routinely inspected to ensure they are in good working order and to detect any leakage at an early stage. • Spill kits will be available on site at all times. • Where appropriate wheel washing will be used to prevent excess soil being transferred to public roads. • Any construction work will be undertaken in accordance with the Environmental Management Plan which will be developed in conjunction with the contractor and SEPA.

Residual Impact:

8.4.53 Given the small volumes used or stored on site, after mitigation, release of potentially polluting substances would continue to have a **negligible** impact.

Potential impacts during the operation phase

8.4.54 **Impact 7: Impact of directional drilling and trenching on groundwater flow patterns**

8.4.55 Directional drilling through the sandstones of the Sleat Group may have the potential to alter groundwater flow patterns. Changes in groundwater flow direction could affect the groundwater dependent ecosystems identified in the Phase I terrestrial habitat survey.

8.4.56 The length of cable has been kept to a minimum which will minimise the volume of rock affected. The drill hole will be filled with a drill fluid which is designed to seal the surrounding rock to avoid losses of drill fluid into the surrounding formation and will therefore seal the hole against inflow of groundwater. The drill fluid will remain in the hole following completion of the drilling. A slow discharge of groundwater in to the drill hole is expected, with a small flow of water generally from the drill entry point towards the drill exit point.

8.4.57 Where cable trenching intercepts the groundwater, the trench could act as a preferential pathway for groundwater flow.

8.4.58 Given the small scale of the proposed drilling, and the position of the site approximately 200m from the coastline, this is considered likely to affect only a small area of the groundwater catchment and is therefore considered to constitute a potential **negligible** magnitude effect on the groundwater flow patterns. T Given current groundwater baseline conditions groundwater flow patterns are considered to constitute a **low** sensitivity receptor, producing a **negligible** impact.

Impact 7: Suggested Mitigation
• Where necessary, low permeability seals (e.g. bentonite seals) will be incorporated at intervals to prevent preferential flow of groundwater flow along the cable trench.

Residual Impact:

8.4.59 Directional drilling is expected to have a **negligible** impact on groundwater flow patterns.

Impact 8: Spills and leaks of oil, fuel or any other potentially polluting substance

8.4.60 Accidental spills and leaks can occur during any maintenance activities, particularly where vehicle movements are necessary and where oil and fuel are stored. Any spills and leaks could potentially pollute the ground surface or migrate to surface water in Kyle Rhea. Scheduled maintenance is expected to be annual and is likely to require only one or two vehicles.

8.4.61 Given the small scale of proposed maintenance (and therefore low volumes of polluting materials likely to be used on site during maintenance works) and low risk of occurrence. A release is considered to constitute a potential effect of **negligible** magnitude on a receptor of **low** significance (due to the site location there is only a small groundwater and surface water catchment area which could potentially be affected), producing a **negligible** impact.

Impact 8: Suggested Mitigation
• SEPA Guidance (PPG) will be followed to reduce the likelihood and magnitude of any spills and leaks. Specifically PPG) 1: General guide to the prevention of pollution, 2: Above ground oil storage, 5: Works and maintenance in or near water, 6: Working at construction and demolition sites, 7: Safe Storage – the safe operation of refuelling activities and 21: Pollution incidence response planning and Construction Industry Research and Information Association (CIRIA) C532 will be followed. • Oil, fuel and any other potentially polluting substances will be stored in a designated storage area on site situated away from any sensitive receptors such as watercourses and will be stored within impervious bunds with 110% capacity to ensure complete spill / leak retention. • Oil, fuel and any other potentially polluting substances will be stored >10m from watercourses • Machinery and equipment will be routinely inspected to ensure they are in good working order and to detect any leakage at an early stage. • Spill kits will be available on site at all times. • Where appropriate wheel washing will be used to prevent excess soil being transferred to public roads. • Any maintenance work will be undertaken in accordance with the Environmental Management Plan which will be developed in conjunction with the contractor and SEPA.

Residual Impact:

8.4.62 Given the small volumes to be used or stored on site release of potentially polluting substances is expected to continue to have a **negligible** impact after mitigation.

Impact 9: Flooding of the site or increased risk of flooding on downstream land

8.4.63 Given the small footprint of the operational phase structure, the location of the proposed substation locations outside the fluvial and coastal floodplains and the slope of the terrain in which the onshore works will be located, the likelihood of flooding by rivers, sea or due to precipitation is considered to be very low.

8.4.64 Under Option 1, the surface water runoff and drainage patterns may to be altered within the onshore study area as a result new substation structure. Given that the footprint of the substation is small, approximately 6m x 3m, the magnitude of the impact of this change is considered to be **negligible**. It is intended that, post-construction, the drill pad will be restored. The Option 1 drill pad would be used as a car parking and picnicking area. Drainage on this site would be restored to its current standard or better (in consultation with the Forestry Commission). The drill pad under Option 2 would be restored to its current agricultural use.

8.4.65 Given the location of the site, close to the shoreline and on relatively steep land, the sensitivity of downstream land to increased runoff is considered to be **negligible** and the potential impact is therefore considered to be **negligible**.

Impact 9: Suggested Mitigation
No further mitigation is proposed.

Residual Impact:

8.4.66 Since the footprint of the Option 1 substation is very small in comparison to the total catchment area, and under Option 2 an existing building would house the substation, changes in surface water drainage patterns is expected to continue to be of **negligible** impact.

Potential impacts during the decommissioning phase

8.4.67 The potential impacts during decommissioning of the onshore elements of the Project are considered to be similar to those during the construction phase. As such, similar mitigation measures to those described for the construction phase are likely to be required to prevent impacts to the water and soil environment. Any updates to legislation or guidance will be incorporated, as appropriate, into the mitigation design prior to decommissioning.

Potential cumulative impacts

8.4.68 No proposed developments have been identified within the vicinity of the Project which could have cumulative impacts.

8.5 Summary

8.5.1 The potential impacts posed by the Project relate to removal of rock by directional drilling, changes to surface water or groundwater flow patterns, potential releases of polluting materials and flooding.

8.5.2 Due to the small scale of the onshore works and adherence to best practice on site, these impacts are expected to be minor adverse or negligible which is not significant according to EIA regulations.

8.6 References

British Geological Survey (1976), Scotland Sheet 71E Kyle of Lochalsh Drift Edition 1:50,000 Geological Map

Cathie Associates (2010), Geotechnical Desk Study Preliminary Report

Centre for Ecology and Hydrology (CEH) (2011), UK Hydrological Review 2010

CIRIA (2001), Report C53, Control of water pollution from construction sites

CIRIA (2006), Report C650, Environmental good practice on site

DEFRA (2009), Code of Practice for the Sustainable Use of Soils on Construction Sites

Marine Current Turbines (MCT) (2010). Installation of tidal turbine array at Kyle Rhea, Scotland; Scoping Study. Available at: http://www.seagenkylerhea.co.uk/files/MCTKyleRheaScopingReport.pdf).

Royal Haskoning (2012), Kyle Rhea Extended Phase 1 Habitat Survey Report

SEPA/SNIFFER/BGS/Macaulay Institute (2004), Groundwater Vulnerability in the Uppermost Aquifer

SEPA (accessed 2012), Indicative River & Coastal Flood Map

SEPA (2012), River Basin Management Plan Interactive Map

SEPA (2001), PPG 1 General Guide to prevention of water pollution

SEPA (2011), PPG2 Above ground oil storage tanks

SEPA (2007), PPG5 Works and maintenance in or near water

SEPA (2012), PPG6 Working at construction and demolition sites

SEPA (2011), PPG7 Safe Storage – The safe operation of refuelling facilities

SEPA (2001), PPG 20 - Dewatering underground ducts and chambers

SEPA (2009), PPG 21 Pollution incident response planning

SEPA (2012), PPG 22 Incident response – dealing with spills

9 MARINE WATER QUALITY

Page

9.1 Introduction

9.1.1 This chapter of the Environmental Statement (ES) describes the water quality of coastal and marine water features, and bathing and shellfish water existing environment within the proposed study area.

9.1.2 It presents the findings of an assessment of potential impacts arising from the installation, operation and decommissioning phases of the Project.

9.1.3 The impact assessment for terrestrial water bodies is considered in Chapter 8, Geology, hydrology and non-marine surface water. This chapter considers the impacts on the marine environment.

9.1.4 This chapter has links with Chapter 7 Marine physical environment and coastal processes and Chapter 8, Geology, hydrology and non-marine surface water.

Study area

9.1.5 Water quality is considered over the coastal area surrounding the Project site, over which remote impacts may occur and interact with other activities. The study area for this chapter is presented in Figure 9.1 and includes the water bodies 'Loch Alsh' and 'Sound of Sleat' that are in proximity to Kyle Rhea.

Overview of potential impacts

9.1.6 The potential impacts that wave and tidal energy developments may have on water quality have been identified in the guidance produced to aid the consenting process for marine renewables in Scotland (EMEC and Xodus Aurora, 2010); these are:

1. Direct or indirect impacts on ecology;
2. Pollution from routine and accidental discharges;
3. Alteration of groundwater flows and levels, e.g., through alteration of drainage;
4. Alteration of natural stream flows, i.e., through the construction of tracks;
5. Alteration to site permeability once the onshore buildings are in place;
6. Water crossings impacting the flow and sediment transport of surface streams;
7. Hard standing of buildings could impede existing drainage;
8. Increase of surface runoff and change in speed of response in rainfall events; and
9. Disruption of potable groundwater.

9.1.7 Points (1) and (2) are considered in this chapter in addition to pollution from routine and accidental discharge to the marine environment. The remaining impacts are considered in

Chapter 8 Geology, hydrology and non-marine surface water and Chapter 2, Policy, legislation and guidance.

Policy, legislation and guidance

9.1.8 The following legislation, guidance and policy relevant to water quality in Scotland are identified below.

Legislation

- EU Water Framework Directive (WFD, 2000/60/EC);
- Water Environment and Water Services (Scotland) Act, 2003 (WEWS); and
- Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2011.

Water Framework Directive

9.1.9 The Water Framework Directive (WFD) puts a legal requirement upon member states to manage the water environment with regard to the directive. Key aims of the Directive are as follows:

- *'expanding the scope of water protection to all waters, surface waters and groundwater';*
- *achieving "good status" for all waters (by 2015)';*
- *water management based on river basins ; and*
- *"combined approach" of emission limit values and quality standards'.*

Water Environment and Water Services (Scotland) Act, 2003 (WEWS)

9.1.10 The WFD was transposed into Scots law in 2003 by the Water Environment and Water Services (Scotland) Act (WEWS) 2003. The Act aims to achieve improvements to the water environment through River Basin Management Planning (RBMP). The act makes provision for the introduction of regulations to control activities with a potential adverse impact on the water environment. It also defines the roles of SEPA and Scottish Ministers in the implementation of the Act.

Marine (Scotland) Act 2010

As detailed in Chapter 2, Policy, Legislation and Guidance an application for a Marine Licence will be made under the Marine (Scotland) Act. This will include the use of chemicals including antifoulants and supersedes the need for a Controlled Activities Regulations (CAR) licence under the Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2011, for potential discharges in the marine environment

Guidance

- SEPA Pollution Prevention Guidance (PPG) Notes:
    - PPG 1 General Guide to prevention of water pollution;
    - PPG 2 Above ground oil storage tanks;
    - PPG 5 Works and maintenance in or near water;
    - PPG 6 Working at construction and demolition sites;
    - PPG 7 Safe Storage – The safe operation of refuelling facilities;
    - PPG 21 Pollution incident response planning; and
    - PPG 22 Incident response – dealing with spills.

- Construction Industry Research and Information Association (CIRIA) publications:
    - C 532 Control of water pollution from construction sites (2001);
    - C 584 Coastal and Marine Environmental Site Guide (2003); and
    - C 650 Environmental good practice on site (2006).

- Control and Management of Ships' Ballast Water and Sediment (MCA, 2008)

Policy

Highland Wide Local Development Plan – Policy 64: Water Environment

9.1.11 The Local Authority works alongside SEPA with a presumption against developments that result in the degradation of any water bodies below the status required by the WFD.

9.2 Methodology

Consultation in relation to water quality

9.2.1 A Scoping Opinion was sought from statutory and non-statutory consultees (MCT, 2010) in March 2010. Responses are provided in **Appendix 4.1** and a summary of the points relevant to water quality along with an explanation of how they were addressed is provided below (Table 9.1).

Table 9.1: Summary of consultation relating to water quality

Key issues raised	Response
Scottish Ministers advise developers to consult with SEPA at an early stage, as the regulatory body responsible for the implementation of the Controlled Activities Regulations (CAR), to identify 1) if a CAR license is necessary and 2) clarify the extent of the information required by SEPA to fully assess any license application.	A draft impact assessment along with the project description was provided to SEPA and the feedback has been incorporated in this chapter. Advice was sought on the need for a CAR licence and it was advised that this not required and would be covered under the Marine Licence.
Scottish Ministers recommended consulting their Pollution Prevention Guidelines particularly: PPG6: Working at Construction and Demolition Sites, PPG5: Works in, near or liable to affect Watercourses, PPG2 Above ground storage tanks, and drawing specific principles in these notes into mitigation measures.	Adherence to PPG guidelines is emphasised throughout the chapter. A more detailed pollution prevention plan will be produced prior to construction.
Scottish Ministers recommended guidance from CIRIA on the control of water pollution from construction sites and environmental good practice and from SE on river crossings and migratory fish (Scottish Executive consultation paper, 2000)	This guidance, along with others identified in the 'Policy, legislation and guidance' under section 9.1 above is considered in the impact assessment process in will be considered further during production of a detailed pollution prevention plan prior to construction.
SEPA welcomed consultation at an early stage and considered that the following key issues (in relation to water quality) should be addressed in the EIA process: •Potential pollution risks •Water Framework Directive •Flood risk to proposed buildings such as the substation	Potential pollution risks are discussed in the impact assessment (section 9.4) of this chapter. Potential pollution risks are also discussed, with regard to the water environment, in Chapter 10 Terrestrial and Intertidal Ecology, Chapter 12 Marine Mammals, Chapter 13 Benthic Ecology and Chapter 14 Fish and Shellfish.

Key issues raised	Response
Impoundments and tidal barrages are considered to have the biggest impact upon coastal processes and hydromorphology and the habitats and species that they support. There is, therefore, likely to be a need to carry out hydrodynamic modelling to predict the impacts of the structure(s) on water quality during construction and coastal processes in the longer term.	This project is neither an impoundment nor a tidal barrage, and a small array of SeaGen devices is expected to have significantly less impact than a barrage or impoundment. A full assessment of the effects on the hydrodynamic regime and changes to coastal processes caused by the Project is presented in Chapter 7 Marine Physical Environment and Coastal Processes. Given the low level of potential impacts, modelling was not deemed appropriate for this project.
In order to meet the objectives of the Water Framework Directive, developments should be designed, where possible, to avoid engineering activities in the water environment.	Engineering activities will be limited in Kyle Rhea. The devices will be fabricated off-site, and brought to site for installation. There are few parts required to assemble the devices, therefore time spent engineering in the water environment is further reduced. Further information is provided in Chapter 5, Project Description.
Sensitive water uses, such as fish farms, bathing waters and shellfish growing waters, and associated potential impacts should be assessed. The proximity to existing discharges and designated areas i.e. estuarine abstractions and cooling water discharges (where relevant), should also be assessed.	Kyle Rhea was a designated Shellfish Water but has since been declassified, see sections 9.3.3 – 9.3.5. Fish and shellfish are assessed separately in Chapter 14, Fish and Shellfish. Impacts to commercial fisheries are assessed in Chapter 15, Commercial Fisheries. Kyle Rhea is not a designated Bathing Water – see section 9.3.8.
Where a proposal involves shipping or port developments, it may be necessary to submit a detailed description of the actions to be taken to prevent the introduction of non-native marine species from ballast water transfers or hull-fouling. The introduction of non-native species can result in a deterioration of a water body under the Water Framework Directive. Ships should carry and implement a ballast water management plan. Further guidance that is based on IMO (www.imo.org/index.htm) and OSPAR guidance is available at www.mcga.gov.uk/c4mca/mgn_363.pdf.	The potential risk of spread of non-native invasive species is assessed in section 9.4: impact assessment below.
It might be useful for the developer to refer to the joint SOAEFD, DoT/MSA and SNH collaborative project which sampled ballast water docking at Scottish Ports (Macdonald, E. and Davidson, R. 1997. Ballast water project - final report, spring 1997. Fisheries Research Services Report No. 3/97. Aberdeen: MLA).	The recommendations section of this report was reviewed and taken into account during the impact assessment (see section 9.4) and will be considered in more detail during procurement and prior to construction.
SEPA advised cumulative impacts be considered if other development projects are present or proposed within the same water catchment.	The potential for cumulative impacts has been considered. There are no foreseeable projects in the study area which have potential to contribute to cumulative impacts.
SNH advised following best practise is followed and drawing up a pollution prevention package to minimise the impacts from potential pollutants. They advised that environmental practices and management for hydraulic fluids and potential pollutants are detailed within the ES.	Where possible data sheets for key fluids that are proposed to be used in the Project are provided in **Appendix 5.1**. More datasheets will be available following procurement and a detailed pollution prevention plan will be produced prior to construction.

9.2.2 Email correspondence with SEPA in November 2012 provided feedback on a draft impact assessment for marine water quality and provided the following updated guidance on non-native species from that given in the scoping opinion:

Given that the accidental introduction of Marine Non-Native Species has been highlighted as a risk for water body degradation, we recommend that controls should be included in development and operation planning, as well as the conditions within marine licensing for Marine Non-Native Species. These recommendations are in line with Nature Conservation (Scotland) Act 2004 (as amended by Wildlife and Natural Environment (Scotland) Act 2011), Water Framework Directive and Marine Strategy Framework Directive objectives, and EU Biodiversity Strategy targets.

A second pathway is introduction via attachment to construction plant. We recommend that the ecological management plan within the construction environmental management plan should also include measures that will be adopted to minimise the risks of introducing marine non-native species that are attached to marine plant and specialised equipment transported to the area before the constructional phase of the project begins and before any maintenance works commence during the operation of the new development. Guidance that may be drawn upon includes:-

- *Scottish Government Code of Practice on non-natives (www.scotland.gov.uk/Topics/Environment/Wildlife-Habitats/InvasiveSpecies/legislation/CodeofPracticeonNonNativeSpecies)*
- *The alien invasive species and the oil and gas industry guidance produced by the Oil & Gas industry (www.ogp.org.uk/pubs/436.pdf).*
- *SNH web-based advice on marine non-native species (www.snh.gov.uk/land-and-sea/managing-coasts-and-sea/marine-nonnatives/)*
- *Marine Non-Native guidance from the GreenBlue (recreation advice) (www.thegreenblue.org.uk/clubs_and_training_centres/antifoul_and_invasive_species/best_practice_invasive_species.aspx).*

We recommend that measures to minimise the risks of introducing of MNNS into the Loch Alsh water body (WB ID 200352) be included in the ES and EMP.

9.2.3 This advice has been included in Section 9.4, Impact Assessment.

Data collection

9.2.4 The principal data sources relevant to water quality are shown below in Table 9.2.

Table 9.2: Data sources to inform the existing environment

Data Source	Spatial coverage	Author	Year
Map of water bodies	Scotland	SEPA	2012
Water bodies Data Sheets	Scotland	SEPA	2012

Impact assessment

9.2.5 The significance of the impact imposed by the Project 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 9.3.

9.2.6 The approach to assessing the potential impacts on water quality arising from the Project is based on a comparison of the predicted changes to the relevant water quality parameters against the environmental quality standards (EQS) within the relevant European Directives (discussed above in Section 9.1). Where EQS do not exist, the impact is assessed with reference to background conditions.

9.2.7 Impacts have been assessed in line with the guidance presented in Chapter 4, EIA Methodology. Impacts have been assigned a level of significance of impact (from major to negligible). 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 impacts of the Project upon water and sediment quality. Where applicable the qualitative assessment is backed up by previously gathered empirical data, alongside tidal resource modelling (as discussed previously within Chapter 7: Marine Physical Environment and Coastal Processes) within the study area.

9.2.8 The sensitivity/value/importance of the receptor for each impact is characterised as one of four levels: high, medium, low or negligible. The definition of each level is given below in Table 9.3.

Table 9.3: Definition of terms relating to the sensitivity to an impact

Value / Sensitivity	Definition
High	• Water body, or sites dependent on water body, designated under international or national legislation (e.g. Ramsar Sites, SPA, SAC, SSSI). • Water body, or sites dependent on water body, containing Habitats Directive Annex 1 water dependent habitats, or sites supporting populations of internationally important water dependent species. • Water body with “excellent [A] "“water quality. • Water body of significant recreational or amenity value.
Medium	• Water body with “good” water quality. • Water body of moderate recreational or amenity value.
Low	• Locally designated sites of varied quality containing water dependent habitats/species. • Water body has an unnatural sedimentary/morphological regime. • Drainage channel or ditch with poor water quality. • Water body of low recreational or amenity value.
Negligible	• Undesignated sites of varied quality containing water dependent habitats/species. • Seriously polluted water system. • Water body of no recreational or amenity value.

9.2.9 The magnitude of the impact is characterised as one of four levels, high, medium, low or negligible. The definition of each level is given below in Table 9.4.

Table 9.4: Definition of magnitude of an impact upon receptors

Magnitude	Definition
High	Prolonged / widespread disturbance or pollution of marine ,coastal, ground or surface waters resulting in temporary or permanent consequential changes to water quality (as defined by toxicity level, time scale and persistency in the marine or coastal environment).
Medium	Short-term disturbance or pollution of marine, coastal, ground or surface waters resulting in temporary consequential changes to water quality.
Low	Detectable disturbance or pollution of a section of marine, coastal, ground or surface waters of very short duration, but with no consequential changes to water quality.
Negligible	An imperceptible and/ or no change to the baseline water quality.

9.2.10 Table 9.5 combines the definitions of magnitude with the level of sensitivity/value/importance of receptor to provide a prediction of overall significance of the impact. The boxes shaded red represent those impacts which may be considered significant within an EIA.

Table 9.5: The level of significance of an impact resulting from each combination of sensitivity and magnitude

Sensitivity	Magnitude			
	High	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

9.3 Existing environment

Coastal water bodies

9.3.1 Kyle Rhea is part of the Loch Alsh water body and adjacent to the Sound of Sleat. The water quality in both of these water bodies has been classified as good (SEPA, 2010a,b). The complete classification is presented in Table 9.6.

Table 9.6: Complete classification for water bodies Loch Alsh and the Sound of Sleat (SEPA, 2010)

	Loch Alsh		Sound of Sleat	
Parameter	**Status (2010)**	**Confidence**	**Status**	**Confidence**
Overall status	Good	Medium	Good	High

	Loch Alsh		Sound of Sleat	
Parameter	**Status (2010)**	**Confidence**	**Status**	**Confidence**
Pre-HMWB status	Good	Medium	Good	High
Overall chemistry	Pass	Low	Pass	Low
Priority substances	Pass	Low	Pass	Low
Overall ecology	Good	Medium	Good	High
Physico-chem	High	Low	High	High
Dissolved oxygen	High	Low	High	High
Dissolved inorganic nitrogen	High	Low	High	High
DIN (field salinity)	High	Low	High	High
DIN(laboratory salinity)	High	Low	High	Low
Biological elements	Good	Medium	Good	High
Benthic invertebrates	Good	Medium	Good	Medium
Imposex assessment	Good	Medium	Good	Medium
Benthic invertebrates (IQI)	High	Low	High	Low
Alien species	High	Low	High	Low
Phytoplankton	High	Medium	High	Medium
Macroalgae	High	Low	Good	High
Macroalgae (FSL)	High	Low	High	Low
Macroalgae (RSL)	High	Low	Good	High
Specific pollutants	Pass	Low	Pass	High
Hydromorphology	High	Medium	High	Medium
Morphology	High	Medium	High	Medium
Water quality	Good		Good	

9.3.2 In other areas close to the Project site, water quality has decreased. A small stretch of water adjacent to Isle of Ornsay (south of Kyle Rhea in the Sound of Sleat) deteriorated in quality in 2006 as did the waters around the Dornie, Loch Long (approximately 7km northeast of Kyle

Rhea). This deterioration in water quality was attributed to the discharge of untreated sewage (SEPA, 2006).

Designated shellfish waters

9.3.3 Kyle Rhea became a “designated shellfish water” in 2002 due to the presence of the mussels *Mytilus edulis*. SEPA introduced a water and sediment monitoring program which commenced in 2003. During 2006 and 2007 no mussels were found at the site and the site was declassified.

9.3.4 There are likely to be a small number of point source discharges from septic tanks into the Kyle from single houses on the shore, and from the settlement of Kylerhea. There is also a discharge from the Glenelg public septic tank (SEPA, 2009). A small vehicle ferry operates across the Kyle Rhea channel during summer months which will have associated emissions.

9.3.5 During five years of monitoring in compliance with the Shellfish Waters Directive – 2006/113/EC the Kyle Rhea site’s overall result was a “pass” (Table 9.7) on each occasion. This demonstrates that the site complied with strict physical, chemical and microbiological requirements set out by the Directive.

Table 9.7 Compliance History of Shellfish water number 57 Kyle Rhea. Source: SEPA 2009.

	Compliance History for Waters and Biota, Excluding Faecal Coliforms Data			**Compliance History for Faecal Coliforms**
Year	**Overall result**	**Imperative**	**Guideline**	**Guideline**
2003	Pass	Pass	Fail	Fail
2004	Pass	Pass	Pass	Pass
2005	Pass	Pass	Pass	Pass
2006	Pass	Pass	Pass	No mussels found
2007	Pass	Pass	Pass	Pass

9.3.6 In 2003 silver concentrations found within mussel tissue exceeded safe levels set out in the Directive. In 2003 and 2004, two of the six mussel tissue samples contained faecal coliform levels that exceeded safe levels. The unsafe levels of silver and faecal coliforms found in 2003 resulted in failure of the Kyle Rhea shellfish water to meet the standards set out in the Directive. Since 2004 results for all parameters set out in the directive have been good, demonstrating that the overall water and sediment quality within Kyle Rhea is high.

9.3.7 Two other areas, currently classified as designated shellfish waters, exist approximately 7km to the north of Kyle Rhea.

Designated bathing waters

9.3.8 The Kyle Rhea site is not classified as a Bathing Water.

9.4 Impact assessment

Do nothing scenario

9.4.1 If the Project is not realised it can be assumed that water quality within the vicinity of the Project will remain as described in Section 9.3 Existing Environment.

Potential impacts during the construction phase

Impact 1: Marine pollution from installation

9.4.2 There is potential for pollution to occur from spills or leaks of fuel, oil and lubricants during installation, from installation materials that may enter the water column during drilling and grouting during installation, and from the vessels used.

9.4.3 Installation vessels have the potential to affect marine water quality through spills or leaks of oil and fuel. The potential impacts will be localised to the immediate vicinity of the spill.

9.4.4 The risk of pollution events will be minimised by following standard good practice, such as the Pollution Prevention Guidelines (PPG) issued by SEPA (e.g. PPG 5: Works and maintenance in or near water). Additionally all vessels associated with the Project will comply with International Maritime Organisation (IMO)/Maritime Coastguard Agency (MCA) codes for prevention of oil pollution and, where appropriate, will have onboard Ship Oil Pollution Emergency Plans (SOPEPs) (i.e. vessels over 400GT).

9.4.5 Best practice measures will be adopted during installation to minimise risk of pollution of the marine environment.

9.4.6 Prior to construction works commencing, site Environmental Management Plans (EMP) and Pollution Control and Spillage Response Plans that will be developed and agreed with the relevant statutory bodies. With respect to potential pollution from vessels, the site specific EMP will augment each vessels own Environmental Management Plan. These plans aim to reduce the potential for accidental pollution and in the unlikely event of a pollution incident, will ensure a rapid and appropriate response

9.4.7 Given these management strategies and controls, it is expected that even should a spill occur, the scale and the nature of the contaminant will result in a temporary and localised impact of **low** magnitude to the receptor of **medium** sensitivity value. The impact of contamination by accidental spillages will be of **minor adverse** significance to water quality.

Impact 1: Suggested Mitigation
1. All vessels associated with the Project will comply with IMO/MCA codes for prevention of oil pollution and, where appropriate, will have onboard SOPEPs (i.e. vessels over 400 Gross tonnes (GT)). 2. All contracted vessels will carry oil and chemical spill mop up kits. 3. Vessels with an established track record of operating in waters where the conditions can become severe over a short period of time will be used where possible. These vessels will be made aware of local operating conditions and will adhere to the appropriate navigational standards and practices. 4. Installation and major routine (planned) maintenance activities will only occur when Sea Generation (Kyle Rhea) Ltd is confident there is limited risk associated with bad weather, avoiding activities with an increased risk of accidental/non routine contamination.

Residual impact:

9.4.8 Following mitigation the residual impact will be reduced to **negligible** significance.

Impact 2: Introduction of marine non-native species

9.4.9 Invasive marine non-native species pose a significant threat to biodiversity as they may have negative impacts on native species and threaten regional ecosystems (SNH, 2011). The risk of introduction of marine non-native species is greatest with the use of installation vessels, such as jack-up barges. These vessels may be used worldwide, increasing the risk of potential contamination from species introduced from foreign waters that may impact indigenous species at the Project site.

9.4.10 Potential invasive species would need to be tolerant of the environmental conditions of the Kyle e.g. temperature, salinity, suspended sediment, and current speed, existing food sources, (e.g. organic content of sediment, prey species), and be able to outcompete the native species. Non-native fish species are unlikely to establish a viable population, due to the extreme and tidal environment that characterises Kyle Rhea.

9.4.11 The impact of invasive marine non-native species could extend, in the long term, over a large area leading to a high theoretical ranking for magnitude of impact. However information from the recommendations section of the Ballast Water Project (Macdonald & Davidson, 1997) states '*vessels travelling between continental Europe and Scotland do not travel through oceanic water, but through regional seas in which the origin and discharge areas are not sufficiently different in terms of species composition of water to make a significant difference*'. Therefore it is deemed unlikely that the vessels used in the Project will transmit non-native species and as discussed above it is unlikely that non-native species would establish in the extreme conditions at Kyle Rhea. The magnitude of the impact is therefore predicted to be **negligible**.

9.4.12 The introduction of non-native species could result in a deterioration of the Loch Alsh water body under the Water Framework Directive.

9.4.13 The sensitivity of receptor is considered to be high, as the Project is located within the Lochs Duich, Long and Alsh Special Area of Conservation (SAC). A **negligible** magnitude and a **high** sensitivity results in an impact of **minor adverse** significance.

Impact 2: Suggested Mitigation
1. Once the installation vessels are confirmed, a risk assessment will consider; vessel activities, previous locations, and planned routes that could introduce marine non-native species. The assessment will recommend proactive management measures to minimise risk of introduction of alien species. The approach and measures will be developed with the contractors and agreed with Marine Scotland prior to works commencing. If the risk assessment identifies a concern, further consultation with be undertaken with SNH and SEPA, with the aim of compliance with Water Framework and Marine Strategy Framework Directive objectives. 2. Guidance will be taken from other industries within the marine environment, such as those produced by the Oil & Gas industry (IPIECA 2010) 3. Vessels will adhere to Marine Guidance Note 363: The Control and Management of Ships' Ballast Water and Sediments, where applicable.

Residual impact:

9.4.14 If the suggested mitigation is implemented the chance of marine non-native species becoming established within the Kyle Rhea area is reduced and therefore the impact is likely to be of **negligible** significance.

Potential impacts during the operation phase

Impact 1: Marine pollution due to accidental spillage

9.4.15 During the operational phase of the Project, there is a small chance of a potential impact on water quality as a result of accidental spillages of materials during maintenance. Paints, resins and lubricants selected for use in installation and during operation will preferentially be low in Volatile Organic Compounds (VOCs). Wherever possible external coatings of offshore elements will be surface tolerant epoxy coatings which have low toxicity to the marine environment.

9.4.16 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 and commitment to best practice, the risk of pollution during maintenance is expected to be low.

9.4.17 During installation and commissioning all contractors will be required to adhere to standard good practice guidance such as Construction Industry Research and Information Association (CIRIA) Guidance note C692 (good practice on site) and SEPA PPG 5.

9.4.18 Any use and discharge of chemicals during maintenance will be subject to controls as part of consent requirements. It is expected that should a spill occur, the scale and nature of the contaminant will result in a temporary, localised **negligible** magnitude impact to the **medium** value receptor, resulting in an impact of **minor adverse** significance. In a high energy marine environment, contaminants can be expected to rapidly disperse.

Impact 1: Suggested Mitigation
1. An Environmental Management Plan will be produced which will incorporate operation and maintenance (O&M) activities.

Residual impact:

9.4.19 As no mitigation is required, the residual impact will remain of **minor adverse** significance.

Impact 2: Introduction of marine non-native species

9.4.20 It is unlikely that jack-up barges, sourced from global locations, will be required during O&M. Vessels used for operation and maintenance will be locally or regionally sourced. The risk of transporting marine non-native species to the site, during O&M is therefore considered negligible.

9.4.21 As previously discussed non-native species would need to be tolerant of the strong tidal flow in Kyle Rhea to become established and are not expected to be able to out-compete the existing specialist species in this environment to colonise either the seabed or the devices. As a result of the improbability of transporting non-native species and the unlikelihood of non-native species becoming established, the magnitude of this impact is predicted to be **negligible**.

9.4.22 The coastal waters around the Project site are considered to be of **high** sensitivity. This constitutes an anticipated impact of **minor** significance.

Impact 2: Suggested Mitigation
1. Antifouling on the pile and rotor blades is proposed to prevent colonisation of the device and prevent the structure forming a stepping stone for non-native species.

Residual impact:

9.4.23 Following the suggested mitigation, the residual impact will be of **negligible** significance.

Potential impacts during the decommissioning phase

9.4.24 The potential impacts experienced during decommissioning are anticipated to be of similar significance to those predicted during the installation phase.

9.4.25 A full Decommissioning Plan will be produced and agreed with the Regulatory Authority prior to decommissioning activities commencing.

Potential cumulative impacts

9.4.26 No cumulative impacts are anticipated to water quality as a result of the Project

9.5 Summary

9.5.1 The existing water bodies within the vicinity of the Project are all considered by SEPA to be in good condition and therefore must be considered to be of medium sensitivity to impacts caused by the Project. Anticipated impacts include pollution to freshwater (see Chapter 8, Geology, hydrology and non-marine surface water) and marine environments. These impacts have been assessed as of minor adverse significance. Once details on vessels are confirmed, a risk assessment will be conducted to minimise the risk of transporting marine non-native species to the site. With appropriate mitigation it is anticipated that all impacts can be reduced enough to become non-significant.

9.6 References

CIRIA (2001) C 532 Control of water pollution from construction sites. Available at ciria.org

CIRIA (2006) C 650 Environmental good practice on site. Available at ciria.org

EMEC and Xodus (2010) Consenting, EIA and HRA Guidance for Marine Renewable Energy Developments in Scotland. Part four wave and tidal annex.

Environment Agency (2007) Pollution Prevention Guidelines. Works and maintenance in or near water : PPG 5. Available at http://publications.environment-agency.gov.uk/

Environment Agency (2010) Pollution Prevention Guidelines. Working at construction and demolition sites: PPG 6. Available at http://publications.environment-agency.gov.uk/

IPIECA (2010) Alien invasive species and the oil and gas industry: Guidance for prevention and management www.ogp.org.uk/pubs/436.pdf.

Macdonald E., and Davidson R., 1997. Ballast Water Project, Final Report March 1997. Report to SOAEFD, Marine Safety Agency and Scottish Natural Heritage. Fisheries Research Services Report Number 3/97. Available at: http://www.scotland.gov.uk/Uploads/Documents/Coll0397.pdf.

Marine Current Turbine (MCT) (2010). Installation of tidal turbine array at Kyle Rhea, Scotland; Scoping Study.

SEPA RBMP Interactive Map. Available via: http://gis.sepa.org.uk/rbmp.

SEPA (2010a) Water body information sheet for Loch Alsh. Available at http://apps.sepa.org.uk/rbmp/pdf/200352.pdf

SEPA (2010b) Water body information sheet for Sound of Sleat. Available at

http://apps.sepa.org.uk/rbmp/pdf/200109.pdf

10 TERRESTRIAL AND INTERTIDAL ECOLOGY

Page

10.1 Introduction

10.1.1 This chapter of the Environmental Statement (ES) describes the existing environment within the proposed Kyle Rhea Tidal Stream Array ("the Project") and associated study area, in relation to terrestrial and intertidal ecology.

10.1.2 Subsequently, it presents the findings of an assessment of potential impacts arising from the construction, operation and decommissioning phases of the Project, with particular reference to the drilling platform, substation and associated onshore infrastructure. Full details of the onshore works are discussed Chapter 5, Project Description.

10.1.3 Related chapters include Chapter 11, Ornithology, Chapter 12, Marine Mammals and Basking Sharks and Chapter 13, Benthic Ecology.

Study area

10.1.4 The onshore study area is shown on **Figure 1.1** in Chapter 1, Introduction.

10.1.5 Statutory designated nature conservation sites within 5km of the onshore study area (see **Figure 10.1**) and locally designated sites within 1km have been considered in the assessment.

10.1.6 The study areas for the desk based assessment and surveys vary according to what is appropriate for the habitat of species being considered and is therefore discussed within the baseline environment for each species (Section 10.3).

10.1.7 The limit of the assessment with respect to the coastline is the Mean Low Water Spring (MLWS), i.e. where the Project footprint terminates. Species and habitats within the intertidal zone are therefore included.

Overview of potential impacts

10.1.8 The following potential impacts have been identified:

- Permanent physical loss and temporary disturbance of important terrestrial habitats and species;
- Pollution to water bodies;
- Pollution and change of composition of intertidal habitat;
- Damage, destruction, obstruction, of resting and breeding sites, reckless killing, injury and / or disturbance of protected species; and
- Potential spread of non-native invasive species.

Policy, legislation and guidance in relation to terrestrial and intertidal ecology

10.1.9 For an overview of policy, legislation and guidance please refer to Chapter 2, Policy and Legislation. Specific policies and legislation relevant to the Project are outlined in the **Table 10.1**.

Table 10.1 Relevant legislation, policy or plan – terrestrial and intertidal ecology

Legislation, Policy or Plan
Legislation
Habitats Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora) as transposed into Scots law by the Conservation (Natural Habitats &c.) Regulations 1994 (the "Habitats Regulations");(as amended)
Water Framework Directive (Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy), as transposed into Scots Law by the Water Environment and Water Services (Scotland) Act (WEWS) 2003 and the Water Environment (Controlled Activities)(Scotland) Regulations 2011
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))
Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000
Marine Works (EIA) Regulations 2007
The Electricity Act 1989;
The Environmental Impact Assessment (Scotland) Regulations 1999
Marine (Scotland) Act 2010
Plans & Policies
UK Biodiversity Action Plan (UK BAP)
Highland Biodiversity Plan
Skye and Lochalsh Local Biodiversity Action Plan (LBAP)
Scottish Government's Scottish Planning Policy (SPP) 2010
Scottish Government's National Planning Framework (NPF2) 2009 specifically: • Restoration of vacant land to green space; • Expansion and improvement of woodlands; • Reduction in loss of woodlands; and • Increase in green networks and movement towards national ecological networks.

Legislation, Policy or Plan
West Highland and Islands Local Plan, specifically: • Policy 4: Natural, built and cultural heritage • Policy 11: Protected species • Policy 12: Other important species • Policy 13: Important habitats
Highland Wide Local Development Plan (proposed plan 2010), specifically: • Policy 50: Coastal development • Policy 52: Trees and development • Policy 58: Natural, built and cultural heritage • Policy 59: Protected species • Policy 60: Other important species • Policy 61: Other important habitats
SEPA Policy 21 – Strategy for implementing actions under the UK Biodiversity Action Plan (UK BAP)
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)
PAN 58 (Environmental Impact Assessment)
SNH, 2002a, A Handbook on Environmental Impact Assessment, Guidance for Competent Authorities, Consultees and others

Special Areas of Conservation

10.1.10 Article 3 of the Habitats Directive allows the designation of important areas for conservation as SACs, and affords them a strict level of protection. Annex I and II of the Directive lists the most important habitats and species in need of conservation. The UK has 78 of 189 habitats identified in Annex I and 43 of 788 species of Annex II.

European Protected Species

10.1.11 The Habitats Directive required the protection of EPS from:

- deliberate or reckless capture, injury or killing of an EPS;
- deliberate or reckless destruction or taking of EPS eggs;
- from obstruction, damage or destruction of a breeding site or resting place;
- deliberate or reckless harassment of an EPS or group of EPS, and
- offences in relation to disturbance of an EPS.

Sites of Special Scientific Interest

10.1.12 SSSIs are designated in the Wildlife and Countryside Act 1981 (as amended) and are sites considered to be valuable at a national scale for their biological, geological and physical features. Sites may extend to Mean Low Water of Spring tides in Scotland, covering the intertidal area. The Acts mentioned above protect these sites from intentional or reckless damage.

UK Biodiversity Action Plan

10.1.13 The UK Biodiversity Action Plan (UKBAP) is the response of the UK Government to the Convention on Biological Diversity (CBD) 1992, in Rio de Janeiro, of which the UK is a signatory. The UK BAP contains national strategies and associated action plans to identify, conserve, protect and enhance existing biological diversity.

Local Biodiversity Action Plan

10.1.14 The Skye and Lochalsh Local Biodiversity Action Plan was published in 2003, and was prepared by the Highland Biodiversity Project. It is one of a suite of local action plans for the Highlands Council area. The action plan lists a series of habitats and species of particular concern for Management on the Isle of Skye and surrounding area. European otter and upland heathland are included within the document.

Scottish Natural Heritage (SNH) Priority Marine Features

10.1.15 The recommended Priority Marine Features (PMFs) list [19]contains habitats and species which SNH consider to be of greatest conservation importance in Scottish territorial waters. Otter and the intertidal biotope *Fucoids in tide-swept conditions* LR.HLR.FT are priority marine features.

Guidance

10.1.16 The following guidance has been considered within this chapter. Where relevant to this development, wind farm guidance has been included. Full details of all references used for field surveys are provided in **Appendices 10.1 - 10.3**.

- SNH, 2002a: A Handbook on Environmental Impact Assessment, Guidance for Competent Authorities, Consultees and others;
- Institute of Ecology and Environmental Management (2006) Guidelines for Ecological Impact Assessment in the United Kingdom (version 7 July 2006). http://www.ieem.org.uk/ecia/index.html;
- Institute of Ecology and Environmental Management (2006) Guidelines for Ecological Impact Assessment in the United Kingdom – Marine and Coastal (Final version 5 Aug 2010). http://www.ieem.net/ecia.asp;
- JNCC, (2010), Handbook for Phase 1 habitat survey - a technique for environmental audit, ISBN 0 86139 636 7;
- SEPA (2010) Land use planning system SEPA guidance note 4: Planning Guidance on wind farm developments (including guidelines for groundwater unit staff and ecologists when assessing the impacts of wind farms on groundwater and associated receptors);

[19] http://www.snh.gov.uk/protecting-scotlands-nature/safeguarding-biodiversity/priority-marine-features/priority-marine-features/

- SR, SNH, SEPA & FC (2010): Good practice during wind farm construction (version 1);
- SNH Scottish Wildlife Series: Otters and Development. Available from: http://www.snh.org.uk/publications/on-line/wildlife/otters/default.asp;
- Department for Transport's Design Manual for Roads and Bridges; Available from: http://www.dft.gov.uk/ha/standards/dmrb/index.htm;
- SNIFFER (2009) WFD95 – A Functional Wetland Typology for Scotland;
- CIRIA C692 (2010). Environmental good practice on site (third edition)
- CIRIA C584 (2003). Coastal and marine environmental site guide
- SEPA PPG 5 Works and maintenance in or near water.

10.2 Methodology

10.2.1 This section reports the consultation, data collection, including review of existing information as well as commissioned surveys, approach and rationale behind the impact assessment.

Consultation in relation to the Project details

10.2.2 The following stakeholders were consulted in regard to potential impacts of the Project upon terrestrial and intertidal ecological receptors.

- Scottish Natural Heritage (SNH);
- Marine Scotland (MS); and
- Scottish Environment Protection Agency (SEPA).

10.2.3 **Table 10.2** presents the relevant issues raised below (and originally detailed in the Scoping Opinion – see **Appendix 4.1** and Chapter 6: Consultation) along with the response from the consultee.

Table 10.2: Summary of consultation relating to terrestrial and intertidal ecology

Key issues raised	Response
Consultation in relation to Statutory Nature Conservation Designations:	
SNH noted that the location and extent of the Project and its proximity to the Kinloch and Kyleakin Hills SAC and Site of Special Scientific Interest (SSSI) and the Lochs Duich, Long and Alsh Reefs Special Area of Conservation (SAC) was a concern. SNH recommended siting the Project outwith the sites.	Issues relating to site selection are detailed in Chapter 1: Introduction. In summary, the required exploitable tidal resource is not sufficient at locations outside the Loch Duich Long and Alsh Reefs SAC. The Project is situated outwith (adjacent to) the Kinloch and Kyleakin Hills SAC and Site of Special Scientific Interest (SSSI) Potential impacts are discussed in section 10.4: Impact Assessment.
SNH noted the prevalence of otter in the coastal area, its mobility and ability to move outside of designated areas raised the concern that otter could be affected by the Project. SNH reminded the applicants that otter is a qualifying feature of the Kinloch and Kyleakin Hills SAC.	A full otter survey was conducted by Royal Haskoning ecologists and is provided in **Appendix 10.2**. A detailed assessment of the potential impacts of the Project on otter has been made in section 10.4: Impact Assessment.

Key issues raised	Response
SNH noted that SAC qualifying features (of woodland and heathland) could be affected by the Project.	Potential impacts are discussed and assessed in section 10.4: Impact Assessment.
SNH - Advised that if the Project is located within the Kinloch and Kyleakin Hills SAC, then the following report should be consulted to inform the siting of onshore developments: Averis, B & James, P (2002). A Botanical assessment for the Kinloch Hills Wilderness Forest Project, Isle of Skye, Scotland. Forestry Commission commissioned report contract 02/17 (unpublished report).	Report has been considered and potential impacts are discussed in section 10.4: Impact Assessment. .
SNH suggested that 'the EIA include all of the terrestrial aspects of the proposals, such as grid connection, sub-station, construction compound, laydown areas and access tracks, because these may also be key aspects, particularly if development takes place within Kinloch and Kyleakin Hills SAC'.	These are considered in impact assessment section (10.4) below.
SNH noted that The Kinloch and Kyleakin Hills (Monadh Chaol Acainn is Cheann Loch) SSSI boundary is contiguous with the boundary of Kinloch and Kyleakin Hills SAC, however, in addition to the SAC features, the SSSI is designated for its bryophytes and lichens associated with ancient deciduous woodlands. Should these be affected by the terrestrial development of the Project, then the ES should consider them.	Potential impacts discussed in section 10.4: Impact Assessment. There will be no impact to ancient deciduous woodland or associated bryophytes and lichens.
Consultation in relation to EPS:	
SNH stated that coastal areas within 250m of significant disturbance (such as the substation, construction compounds, and SeaGen devices) should be surveyed for otter, to update the Cottis, R (2000) Kinloch otter *Lutra lutra* survey and to follow SWT guidance 'Otters and Development'. SNH also noted that mapping and identification of suitable otter foraging habitat was required during the EIA.	Full otter survey including maps undertaken by Royal Haskoning is provided in **Appendix 10.2**. The location of sensitive otter habitat has been considered in Section 10.4, Impact Assessment.
SNH stated that the Project "is likely to affect otter, as a qualifying feature of the Kinloch and Kyleakin Hills SAC, and is therefore likely to require an appropriate assessment by Marine Scotland".	Information to support and Appropriate Assessment by Marine Scotland is provided by Royal HaskoningDHV (2012).

Key issues raised	Response
SNH recommended that the following impacts be considered as they may arise as a result of the Project: • Disturbance to otters caused by the installation, maintenance, operation and decommissioning of the Project; • Damage to otter breeding and resting sites from the terrestrial development; • Direct and indirect loss of otter foraging habitat and prey species; • Collision risk to otters caused by the device (we suggest the assessment in section 4.4.2 of the scoping report should be reconsidered).	These impacts are considered in section 10.4: Impact Assessment.
SNH commented that all species of bats are EPS and consideration should be given to whether a bat survey is required, in relation to the terrestrial development aspects, as part of the proposed walkover surveys	Potential bat roosts and habitat were searched for as part of the Extended Phase 1 Habitat Survey report undertaken for this EIA (**Appendix 10.1**).
Consultation in relation to cumulative impacts:	
Cumulative impact assessment should engage Marine Scotland, SNH, marine developers and other relevant stakeholders. (SNH)	No cumulative impacts were identified, see section 10.4: Cumulative impacts.
SNH noted that although other SSSIs and GCR sites are listed in the scoping document and they agree that no further consideration is required in the ES.	Other SSSIs and GCR have undergone no further consideration in this ES.
SNH noted that Phase 1 habitat survey is sufficient for areas outside the SAC.	Phase 1 Habitat Survey undertaken by Royal Haskoning (**Appendix 10.1**)
SEPA advised that the cumulative impact assessment should "consider the footprint of the cabling and onshore works alongside the existing coastal development and activities already present within the water body in which landfall occurs".	See section 10.4 potential cumulative impacts.
SEPA requested information and a map showing the intertidal area likely to be affected by shoreline infrastructure development in the cumulative impact assessment.	Intertidal zone unlikely to be affected by this development see section 10.4, Impact Assessment.
SEPA – recommended that the Project be designed as far as possible, to avoid development within the water environment, in order to meet the objectives of the Water Framework Directive (WFD).	The tidal array is located within coastal waters. Impacts in relation to the WFD are discussed in Chapter 8, Geology, hydrology and non-marine surface water, and Chapter 9, Marine water quality.
Consultation in relation to pollution prevention:	
SNH recommended that a pollution prevention package be drawn up in addition to following best practice guidance.	The development of an Environmental Management Plan (EMP) is recommended; see section 10.4, Impact Assessment.

Key issues raised	Response
SEPA recommended that 'All potential pollution risks associated with the proposals and all aspects of site work that might impact on the environment should be systematically identified, as well as preventative measures and mitigation… This information can also usefully provide the basis for a more detailed environmental management plan and construction method statements'	Potential pollution risks identified and assessed in section 10.4 and Chapter 7, Water Quality. The development of an Environmental Management Plan (EMP) is recommended, see section 10.4, Impact Assessment.
Consultation in relation to the project description	
SNH advised that a number of details should be provided about the Project, particularly the amount and type of maintenance and how this will be undertaken (number/type of vessels, vehicles, number of days, etc.): and Details of the construction process and timing, including duration of the key stages.	See Chapter 5 Project Description

Data collection

10.2.4 The following data sets were used to inform this chapter of the ES (**Table 10.3**).

Table 10.3: Data sources to inform the existing environment

Data Source	Spatial coverage	Author	Year
Kinloch otter *Lutra lutra* survey	The study area covers approximately 70 square kilometres with 25 kilometres of coastline. The boundary extends from the north to south, from the southern shore of Loch na Béiste to the northern shore of Camus nam Mult, and passes along the shores of Kyle Rhea, the Sound of Sleat and Loch na Dal.	Cottis, R	2000
A botanical assessment for the Kinloch Hills Wilderness Forest Project, Isle of Skye, Scotland	The study area covers the Kinloch hills, approximately 73.84 square kilometres in the eastern part of the island of Skye, Scotland.	Averis, B & James, P	2002
National Biodiversity Network (NBN) Gateway	UK coverage	Various, principally comprised of records from local biological records centres	Accessed 2012
Highland Biological Recording Group	A one kilometre search area for existing records of protected and notable species, as well as local wildlife sites was undertaken.	MacDonald M. (HBRG)	2012
Extended Phase 1 Habitat Survey and Otter Survey	Approximately 94ha. See **Figure 1.1** of Extended Phase 1 Habitat Survey Report (**Appendix 10.1**)	Royal Haskoning	2012
Intertidal survey	Approximately 1.8km. See **Figure 1.1**	Royal Haskoning	2012

Data Source	Spatial coverage	Author	Year
	of Intertidal Survey Report (**Appendix 10.1**)		
Scottish Wildlife Trust (SWT)	Information on Local Nature Conservation Sites within 1km of the onshore study area.	SWT	2012

Nature Conservation Designations

10.2.5 A desk study was undertaken using SNH Sitelink (http://gateway.snh.gov.uk/sitelink/) to locate any nature conservation designations and their level of importance. The sites searched for are given in **Table 10.4** below.

Table 10.4. Nature Conservation Designations of international, national and local importance.

Statutory designations		Non statutory designations
International Importance	**National Importance**	**Local Importance**
Special Area of Conservation (SAC)	Site of Special Scientific Interest (SSSI)	Local Wildlife Site (LWS) / Local Nature Conservation Site (LNCS)
Special Protection Area (SPA)	National Nature Reserve (NNR)	
RAMSAR sites.	Local Nature Reserve (LNR)	

10.2.6 Statutory nature conservation designations are sites protected by international, European or UK law or treaties (see section 10.1), and include SACs, SPAs, Ramsar sites, SSSIs, NNRs and LNRs.

10.2.7 Non-statutory designated sites have a lower level of protection than statutory sites, with protection at the local planning authority level. Non statutory sites for nature conservation include Local Wildlife Sites, which are briefly described below.

10.2.8 Local Wildlife Sites (LWS) and Local Nature Conservation Sites (LNCS) are of local or community scale importance. They have previously been known as Sites of Importance to Nature Conservation (SINCS), Sites of Nature Conservation Importance (SNCIs) and include County Wildlife Sites (CWS). These sites are designated usually jointly through the local planning authority and the local Wildlife Trust. They aim to protect locally or nationally threatened habitats or species, with priority UK Biodiversity Action Plan habitats and species being influential.

Species Records

10.2.9 Species records were provided on request from the Highland Biological Recording Group (HBRG), as well as the National Biodiversity Network (NBN) Gateway website[20] for records of protected and notable species within 1km of the Project.

10.2.10 Species records are an indication of which species may occur in an area, but should not be taken as a definitive list of the species that are actually present.

[20] http://www.nbngateway.co.uk/

Survey

10.2.11 In addition to the data gathering described above, a number of surveys were undertaken for the onshore element of the Project, and are briefly described below. All surveyors involved were professional experienced ecologists. The full technical reports of all the surveys can be read in **Appendices 10.1** – **10.3**. The results of these surveys are summarised in Section 10.3: Existing Environment of this chapter. The following surveys were undertaken:

Extended Phase 1 Habitat Survey and Otter Survey

10.2.12 The Extended Phase 1 Habitat Survey used the JNCC methodology for the mapping of habitats, invasive species and includes the assessment of habitats for the presence of protected species (Figures 10.2 – 10.5). This survey was undertaken by two Royal Haskoning ecologists between the 7th and 8th of May 2012 and again on the 27th November 2012. Details of the Extended Phase 1 Habitat Survey can be found in Appendix 10.1.

10.2.13 An Otter Survey was undertaken concurrently with the Extended Phase 1 Habitat Survey. The methodology used conformed to SNH guidance (Scottish Wildlife Series: Otters and Development) and was designed to inspect potential resting site locations (i.e. coastal fringe, burn banks, exposed peat faces or rock piles) throughout the survey area. Details of the Otter Survey can be found in Confidential Appendix 10.2[21].

Intertidal Phase 1

10.2.14 An Intertidal Phase 1 survey was undertaken based upon techniques specified in the Countryside Council for Wales (CCW) report 'CCW Handbook for marine intertidal Phase 1 mapping' (Wyn *et al* ., 2000) and the 'Marine Nature Conservation Review: Rationale and methods' (Hiscock, 1996). The survey includes the assessment of important habitats, communities, rare or protected species including non-native species and biotopes are characterised and described.

10.2.15 The survey was completed by two experienced Royal Haskoning ecologists during low water spring tides on the 7th and 8th of May 2012. The full report with figures can be found in **Appendix 10.3**.

Vantage point surveys

10.2.16 The one year vantage point survey was conducted from two vantage points. These were chosen for the optimal view they gave of Kyle Rhea. The vantage points fully encompassed the proposed development area (lease boundary in Figure 3.4). A detailed survey methodology is given in the full report by NRP (2012).

Survey Limitations

10.2.17 The surveys described provide adequate baseline data on which to base a robust Impact Assessment; however, they are subject to certain limitations as outlined in the following paragraphs.

10.2.18 The Extended Phase 1 Habitat Survey was composed of two separate site visits to assess options 1 and 2 respectively. While the first survey for option 1 was conducted at the optimal time of year, i.e. between the months of April to September, the second survey for option 2 was conducted at a sub-optimal time of year. As the first survey was undertaken within the optimal period, the species list recorded for this survey is more comprehensive, and is

[21] This document will only be made available to Marine Scotland and Scottish Natural Heritage

anticipated as being representative of the study area. The second survey, later in the year, has meant that some later flowering species where identified where they were not apparent earlier in earlier survey.

10.2.19 Part of the study area was inaccessible for the extended phase 1 and otter surveys, as access was not permitted; the area was Kylerhea village south of the Option 2 proposed drilling area. There were no restrictions to access for the intertidal survey.

Impact assessment

10.2.20 The methodology used to ascertain the significance of impacts upon ecological receptors is discussed below.

Evaluation of receptors

10.2.21 Each key ecological receptor is described in terms of its nature conservation importance. In addition an assessment of the likely sensitivity of the feature / resource is also made. These methods are based on professional judgement and best practice guidance.

10.2.22 The assessment of impact significance methods draws on published guidance, where applicable (e.g. IEEM Guidelines for Ecological Impact Assessment in the UK, 2006, IEEM Guidelines for Ecological Impact Assessment in Britain and Ireland Marine and Coastal, 2010 and SNH's 'A Handbook on EIA', 2009), and expert judgement of suitably qualified terrestrial and intertidal ecologists. Once identified, the ecological impacts are ranked according to the comparative severity of their impact on the ecological feature / receptor. In defining and predicting impact significance, consideration is given to a range of parameters including whether the impact is adverse or beneficial, along with receptor sensitivity / value, impact magnitude, extent, duration, reversibility and timing / frequency. The degree of confidence of the predicted impacts (pre-mitigation and residual) is also discussed in the assessment where appropriate.

Valuation of receptors

10.2.23 Each key ecological receptor is described in terms of its nature conservation importance. In addition an assessment of the likely sensitivity of the feature / resource is also made. These methods are based on professional judgement and best practice guidance.

10.2.24 Examples of the criteria used to define the sensitivity of nature conservation receptors relevant to the Project are outlined in **Table 10.5** below.

Table 10.5: Definition of terms relating to the sensitivity and value of ecological receptors

Value / Sensitivity	Definition
High	Habitats or species that form part of the cited interest within an internationally protected site or candidate site (e.g. SAC, cSAC, SPA, pSPA, Ramsar site etc.). A feature (e.g. habitat or population) which is either unique or sufficiently unusual to be considered as being one of the highest quality examples in a international / national context that the site is likely to be designated as an SAC / SPA. Species designated as European Protected Species (EPS), e.g. otter. No capacity to accommodate the proposed form of change.
	Habitats or species that form part of the cited interest within a nationally designated site (e.g. SSSI, NNR).

Value / Sensitivity	Definition
	A feature (e.g. habitat or population) which is either unique or sufficiently unusual to be considered as being one of the highest quality examples in a national / regional context for which the site could potentially be designated as an SSSI.
Medium	Habitats or species that form part of the cited interest of a Local Nature Reserve, or some local-level designated sites depending on specific site conditions. Viable areas of internationally or nationally important habitats (e.g. Annex I habitats, priority BAP habitats) or Annex II species present in quality and extent at a regional or relevant biogeoclimatic zone (i.e. SNH natural heritage zone), level of importance. Population of a species which is either unique or sufficiently unusual to be considered as being of nature conservation value at up to a county context (e.g. Nationally Scarce). Sites supporting critical habitats for a regularly occurring, regionally significant number of a nationally important species (e.g. priority UK BAP). Very low capacity to accommodate the proposed form of change.
Low	Sites meeting the criteria for Scottish Council area designation, Wildlife Sites, which may include amenity and educational criteria in urban areas. Sites containing viable areas of any priority habitat identified in the Local Authority LBAPs. Sites supporting viable breeding populations of species known to be Scottish LA rarities (e.g. included in the LBAP), and / or supplying critical elements of their habitat requirements. Any regularly occurring, locally significant population. Features / habitats or species which are not considered to qualify for non-statutory designation but which provide locally important semi-natural habitats in the context of the immediate surrounding area (e.g. species-rich hedgerows, small ponds, etc.). Populations of any species of conservation importance in the context of the immediate surrounding area. Low capacity to accommodate the proposed form of change.
Negligible	Commonplace feature of little or no habitat / historical significance and with less than local importance. Loss of such a feature would not be seen as detrimental to the ecology of the area. Receptor has some tolerance to accommodate the proposed change.

Nature and magnitude of impact

10.2.25 The impacts (both adverse and beneficial) of the construction and operation of the Project, and any potential cumulative impacts associated with other proposals for the wider area, are assessed for their potential impact on the ecological interests. The impact magnitude is determined by the interaction between the scale of the impact in time, area and intensity and the sensitivity of the species being impacted. Guideline criteria for different levels of impact magnitude are given in **Table 10.6** below, including a definition of the duration of impacts considered.

Table 10.6: Definition of terms relating to the magnitude of ecological receptors

Magnitude	Definition
High	Major impacts on the feature / population, which would have a sufficient effect to alter the nature of the feature in the short-long term and affect its long-term viability. Impact certain or likely to occur.
	Major impacts on the feature / population, which would have a sufficient effect to alter the nature of the feature in the short-long term and affect its long-term viability. For example, more than 20% habitat loss or damage. Impact certain or likely to occur.
Medium	Impacts that are detectable in short and long-term, but which should not alter the long-term viability of the feature / population. For example, between 10 - 20% habitat loss or damage. Impact certain or likely to occur.
Low	Minor impacts, either of sufficiently small-scale or of short duration to cause no long-term harm to the feature / population. For example, less than 10% habitat loss or damage. Impact will possibly occur.
Negligible	A potential impact that is not expected to affect the feature / population in any way, therefore no impacts are predicted. Impact unlikely or rarely to occur.
Duration definitions:	
Long-term (more than 15 years) Medium-term (5 - 15 years) Short-term (< 5 years)	

Significance of impacts

10.2.26 Following the determination of nature conservation value and impact magnitude, the significance of the impact is determined by combining the two. **Table 10.7** illustrates the relationship between impact magnitude and nature conservation value. This table is for guidance only as in practice the assessment of impact significance involves judgment based on the nature of the potential impacts and detailed understanding of the sensitivity of the ecological features affected.

10.2.27 Significance is assessed factoring in the implementation of all mitigation by design and other mitigation measures identified to reduce predicted impacts, creating the residual impact significance. Only those impacts of moderate to major level are considered to be significant (i.e. considered to be “significant impacts” in terms of the EIA Regulations). Although only significant impacts require mitigation, lesser impacts may also need to be addressed depending on specific circumstances.

Table 10.7: The level of significance of an impact resulting from each combination of sensitivity and magnitude

Sensitivity	Magnitude			
	High	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

10.3 Existing environment

General overview

10.3.1 The onshore study area and the Project area are depicted in **Figure 1.1**, Chapter 1: Introduction. The onshore study area is the area which has been used to conduct desk studies and field surveys to inform the assessment of the potential impacts of the Project. The Project area is where the potential drilling rig and substation are be located.

10.3.2 The onshore works are likely to be located in either of two options. The options. Option 1 is to locate the substation and potential drilling area along an existing track within the Forestry Commission Scotland (FC)'s Kylerhea site, and near to an existing car park and picnic site. The predominant habitats across the onshore study area are immature conifer plantation, wet heathland and exposed bedrock and boulders coastland.

10.3.3 Option 2 is to locate the substation within an existing building next to the ferry slipway in the east of the onshore study area, and to locate the potential drilling area just north of Kylerhea village in the south of the onshore study area. The substation will be located next to exposed bedrock and the road leading to the slipway, whilst the potential drilling area is likely to be located within an area of acid grassland.

Statutory nature conservation designations

10.3.4 Two statutory designated sites are considered within this ES, as agreed with SNH during the consultation process of the EIA. These are Kinloch and Kyleakin Hills, which is an SAC and an SSSI, and Lochs Duich, Long and Alsh Reefs SAC. No NNRs or LNRs were found within 5km of the onshore study area.

10.3.5 Kinloch and Kyleakin Hills SAC and SSSI have an area of 5267ha hectares. The site is located immediately to the west of the Project area, as well as running north to south along the coastal edge of the onshore study area.

10.3.6 The Kinloch and Kyleakin Hills SAC qualifying features are old sessile woodlands with Ilex (holly) and *Blechnum* (a fern), northern Atlantic wet heaths with *Erica tetralix*. Priority habitats include European dry heaths, alpine and boreal heaths, blanket bogs and Tilio- Acerion forests of slopes, screes and ravines. Otter are another important qualifying feature, and is likely to be the reason for the designation covering the coastal area and overlapping the Lochs Duich, Long and Alsh Reefs SAC.

10.3.7 The SSSI qualifying features include; otters, blanket bog, bryophyte assemblage, lichen assemblage, alpine heath, subalpine dry heath, sub alpine wet heath, Torridonian geology and upland oak woodland.

10.3.8 The location of the Kinloch and Kyleakin Hills SAC and SSSI in relation to the Project can be seen in **Figure 10.1**.

10.3.9 Lochs Duich, Long and Alsh Reefs SAC is located to the east of the onshore study area. This SAC is 2377 hectares and reefs (including overlap with the intertidal area) are the sole qualifying feature of this SAC.

Non statutory nature conservation designations

10.3.10 The Scottish Wildlife Trust was contacted with regard to information about Local Nature Conservation Sites (LNCSs) and none are located within 1km of the Project.

Terrestrial habitats

Desk study

10.3.11 The study area covers a very steep hillside sloping from Beinn Bhuidhe in the north and west, down to the western shore of Kyle Rhea. Several short streams drain the steep topography from both sides of the Kyle.

10.3.12 The south of the study area has a different composition of habitats being dominated by marshy grassland followed by frequent bracken and acid grassland. Small pockets of heath are interspersed throughout this area.

10.3.13 The Highland Local Biodiversity Action Plan identifies the coasts of Kyle Rhea as a complex of heather moorland, coniferous woodland and broadleaved mixed woodland.

Field survey

General study area

10.3.14 The northern part of the study area (**Figure 10.2**) was on a very steep hillside sloping from Bheinn Bhuidhe in the west, down to the western shore of Kyle Rhea. A number of small burns flow down the slope. At the time of the first survey, water levels in these burns were low. An access track runs north – south approximately through the middle of the study area, and provides access for the public through Forestry Commission land to a wildlife hide. A small car park and public toilets are located along this track. Benches and information boards are located at regular intervals along the track.

10.3.15 The southern part of the study area was on a relatively flatter area in comparison to the northern part of the onshore study area. Here there was a gentler slope going south towards Kylerhea village and west towards Kyle Rhea. The village is small and the houses scattered. The predominant land use in the village appeared to be for crofting. A small road passes east to west towards the slipway and another small track runs south into the main part of Kylerhea village. A number of shallow drains run east to west and into a small stream flowing out into Kyle Rhea.

10.3.16 The Extended Phase 1 Habitat Survey found several dominant habitat types across the proposed study area (**Figures 10.3 – 10.5**). These were wet heath, conifer plantation marshy grassland and dry heath acid grassland mosaic, and semi-improved to poor semi-improved acid grassland. The conifer plantation and wet heath was located in the central and northern areas. The conifer plantation is activity managed, and is a modified and changing landscape. Dry heath and acid grassland mosaic were located between the forestry and the coastline. Marshy grassland and semi-improved and poor-semi-improved acid grassland was present in the southern part of the study area in and around the settlement village of Kylerhea. This habitat was confined to fenced areas that are used for agricultural purposes. Scattered deciduous trees were also present. Accompanying target notes can be read in the **Appendix 10.1**.

Coniferous plantation

10.3.17 Much of the study area (terrestrial habitats north of the road to the Skye Ferry slipway) is owned by FC and contains a plantation that is mostly pine species Pinus sp. but also includes spruces Picea sp. and larch Larix sp with a number of different deciduous species such as silver birch Betula pendula, goat willow Salix caprea and rowan Sorbus acuparia growing on the periphery of the main plantation (Figures 10.3 – 10.4). Trees line the existing access track to the wildlife hide and small burns flow down towards the coastline.

10.3.18 The trees are tightly packed and planted on a relatively steep hillside, which made access difficult; however, from a number of vantage points it was observed that no significant understory was present. This was attributed to the lack of light penetrating down to ground level.

10.3.19 Much of the habitat between the plantation and the coastline is characterised as dry heath, with mosaic of bracken and scattered deciduous trees present throughout. Due to the steep nature of the terrain this habitat was well drained and a number of small burns crossed it. Many of the burns were found to have dried up, despite the survey following a period of heavy rain.

Marshy grasslands

10.3.20 In the north of study area, which is owned by the FC, the watercourses were being managed, particularly the Allt Grainach burn which had been diverted to direct water away from a recently dried out pond to a newer pond.

10.3.21 Across parts of this habitat clumps of deciduous trees were clustered loosely together. Beneath the trees, grasses and wild flowers were common amongst an acid grassland habitat.

10.3.22 This habitat also occurred in narrow strip along either side of the track to the otter hide. It was more evident on the western side of the track.

10.3.23 In the southern part of the study area marshy grassland was the dominant habitat. Across this habitat a couple of drains appear to converge and run into the stream near the coast which runs into Kyle Rhea (**Figure 10.5**).

Wet heath with scattered trees

10.3.24 The remainder of the study area north of the road on the slopes of Beinn Bhuidhe was a wet heathland habitat that was scattered with young rowan, silver birch and willow trees; the steep slopes of the hillside provided good drainage. Heathers (mainly bell *Erica cinerea* and ling *Calluna vulgaris* with *Erica Tetrilix* also present) dominated this habitat but many other species were also present including purple moor grass *Molina caerulea* and bog asphodel *Narthecium ossifragum*. Areas of bracken were also present across the wet heath area.

Watercourses

10.3.25 Two main running water bodies, were present within the study area. These were the Allt Grianach and the Allt a'Choire Bhidhe, which both cross the study area in the north of the site. Additionally, several smaller drains, many of which were dry at the time of the survey, flow across the site in a west to east direction.

10.3.26 The topography of the study area is characterised by the steep slopes of Beinn Bhuidhe with areas of flatter ground in the most southern parts of the study area.

Summary

10.3.27 A summary of the habitats found, alongside the varying levels of protection they have, are provided in **Table 10.8** below.

10.3.28 The survey identified UK BAP habitat of lowland heathland within the study area.

Table 10.8 Summary of habitats within the study area and associated relevant information.

Community type	Phase 1 classification (JNCC, 2010)	EC Habitats Directive (JNCC, undated)[22]	UK BAP (Brig 2008)	LBAP	Potential groundwater Dependant Terrestrial Ecosystem (SNIFFER 2009)
Marshy grassland/ rush and pasture	Marshy grassland	N/A	N/A	Rough pasture, wet pasture, dry pasture	*Yes*
Wet heath communities	Wet heath	4010 Northern Atlantic wet heaths with *Erica tetralix*	Priority UK BAP habitat (lowland heathland)	Heath	*Yes*
Woodland and scrub	Coniferous plantation	N/A	N/A	Coastal woods	*No*
Bracken	Bracken	N/A	N/A	N/A	*No*
Acid grassland communities	Semi improved acid grassland, coastal grassland	N/A	N/A	Acid grassland	*No*
Tall herb and fern	Tall ruderal	N/A	N/A	Field margins and boundaries	*No*
Rock exposure	Basic exposed rock	N/A	N/A	Rocky shore	*No*
Running water	Running water	N/A	Rivers	Upland streams	*No*
Standing open water	Standing open water	N/A	UK BAP broad habitat (standing open waters and canals)	Temporary ponds,	*No*

10.3.29 The survey concluded that the habitats of most importance within the site were the wet heath of Beinn Buidhe, running water bodies and the standing open water bodies. The running water bodies provide a wildlife corridor for mobile terrestrial species. The standing open water bodies in the north of the site are surrounded by an acid grassland/wet heathland

[22] http://jncc.defra.gov.uk/page-1523

complex that supports a wide variety of flowering plants and a number of different micro habitats in a small area.

Groundwater dependent terrestrial ecosystems (GWDTEs).

10.3.30 GWDTEs are types of wetland as defined by SNIFFER (2009) WFD95, A Functional Wetland Typology for Scotland. SEPA is required to monitor and regulate any activities which may affect GWDTEs, which originates from the Water Framework Directive (WFD).

10.3.31 The following National Vegetation Classification (NVC) communities, as determined in the 2002 FC report by Averis & James were identified within the onshore study area during the Extended Phase 1 Survey. These communities do not represent all the NVC communities found within the onshore study area, as no NVC survey has been commissioned for this assessment. These communities are of note because they are likely to be GWDTEs.

- M15a *Scirpus cespitosus – Erica tetralix* wet heath *Carex panacea* sub-community
- M15b *Scirpus cespitosus – Erica tetralix* wet heath Typical sub-community
- M15c *Scirpus cespitosus – Erica tetralix* wet heath *Cladonia spp*. Sub community
- U20 *Pteridium aquilinum – Galium saxatile* community
- H10a *Calluna vulgaris – Erica cinerea* heath

Intertidal habitats and species

Desk study

10.3.32 The intertidal study area overlaps with the Lochs Duich, Long and Alsh Reefs Special Area of Conservation (SAC) and the Kinloch and Kyleakin Hills SAC (which is also a Site of Special Scientific Interest (SSSI)) (see **Figure 10.1**).

10.3.33 The LBAP identifies a small area of Machair-like habitat at Glenelg, approximately 1km south of the proposed study area (http://www.magic.gov.uk). Machair is an Annex I habitat and UK BAP habitat; however this area of Machair is not mentioned in the citations for the SAC. Approximately 5km to the south of the proposed scheme, the BAP species *Ascophyllum nodosum ecad mackaii* has also been recorded (SNH 2010); however, this species has strong preference for very sheltered locations and is not expected to be present in the Kyle.

Field survey

10.3.34 The shores of Kyle Rhea are predominantly comprised of bedrock and boulders, with occasional small gravelly embayments. The coastline is steep-sided, leading up to a series of small vegetated coastal cliffs above the intertidal zone.

10.3.35 The intertidal zone within the study area was found to be relatively uniform throughout the site, with no features or habitats regarded as being rare or particularly sensitive. The substrates ranged from solid bedrock in the more exposed locations through to cobbles and pebbles in more sheltered areas. The most common substrate was a mixture of boulders and bedrock.

10.3.36 Where algal communities were present, clear biological rocky shore zonation was observed, typically comprising of a lichen zone at the top of the shore followed by *Pelvetia canaliculata*, and then fucoid zones in the mid shore, with a kelp zone in the lower shore. This zonation was present across much of the study area and was only absent where the substrate was exposed bedrock or mobile gravel and/ or shingle.

10.3.37 In the southern section of the site the shore opens out to wide beaches of mobile pebble and cobble substrata, with fins of exposed bedrock. Bedrock was dominated by faunal communities, with on the shore limited algae communities were established of larger substrata in the mid – lower shore.

Terrestrial plants

Desk study

10.3.38 HBRG provided no records of protected or notable plant species within 1km of the Project. NBN provided one record for eyebright *Euphrasia ostenfeldii,* a UK BAP and LBAP priority species within 2km of the Project.

Field survey

10.3.39 A number of protected species were identified during the survey, including native bluebell, *Hyacinthoides non-scripta* (Schedule 8, WCA) and yellow flag iris *Iris pseudacorus*, and eyebright (LBAP priority species, though the latter was not identified to species level in the field). However, only bluebell was located in the vicinity of the proposed drilling area or substation.

Invasive non-native species

Desk study

10.3.40 The LBAP identifies terrestrial invasive species present within the region, including Japanese knotweed *Fallopia japonica*, rhododendron *Rhododendron ponticum* and American mink *Neovison vison*.

10.3.41 HBRG did not provide any records for vascular plants within 1km the onshore study area and records from NBN for Japanese knotweed, giant hogweed, *Rhododendron ponticum* and Himalayan balsam were greater than 10km from the proposed site.

10.3.42 *Rhododendron ponticum* has been identified in the LBAP as an invasive species. The plan states that "The spread of invasive species such as *Rhododendron ponticum* presents a threat to biodiversity, and rhododendrons should be controlled where they are found in the natural environment."

10.3.43 The HBRG provided 5 records of American mink within 1km of the Project. The records can be seen in **Table 10.9** below.

Table 10.9. American mink records provided by HBRG.

Location	Grid reference	Date
Kylerhea	NG789212	10/06/2001
Kylerhea	NG789211	16/06/2003
Kylerhea	NG789212	July 2002
Kylerhea	NG789212	July 2000
Kylerhea	NG789207	October 2002

Field survey

10.3.44 During the Extended Phase 1 Habitat Survey a small number of isolated *Rhododendron ponticum* bushes were recorded at number of locations within the study area.

Terrestrial mammals

Otter

10.3.45 In addition to being an EPS and on schedule 5 of the Wildlife and Countryside Act 1981, as outlined in the Legislation section, the otter is also a:

- UK BAP priority species;
- LBAP priority species, and
- Listed in the UK Red Data Book.

10.3.46 Otters are also protected by:

- Appendix II of the Bern Convention; and
- The Wild Mammals Protection Bill, 1996.

10.3.47 UK otter populations are internationally important, especially since their widespread decline across much of their western European range (JNCC, 2004). Populations in coastal areas utilise shallow, inshore marine areas for feeding but also require fresh water for bathing along with suitable terrestrial habitats for resting and breeding holts (JNCC, 2004). Otters living in coastal areas (particularly in Scotland) tend to have a diurnal habit, live in group territories, and have home ranges below 5 km (Kruuk, 1996).

10.3.48 Otters are listed as Annex II species (present but not the primary feature for designation) for the Kinloch and Kyleakin Hills SAC, and are a qualifying feature of the Kinloch and Kyleakin Hills SSSI.

Desk study

10.3.49 The National Biodiversity Network (2008) identifies Kyle Rhea as a noted location for otter sightings in the region on both shores, particularly between the ferry crossing and the lighthouse. Otters are recorded in Kyle Rhea on the following databases:

- Mammal records from Britain for the Atlas of Mammals (1993) with subsequent records, Scotland
- Otter Survey Database and HBRG Vertebrates (not badger) datasets (SNH, 2010).

10.3.50 A Forestry Commission owned otter hide is present on the Isle of Skye (shown by a red cross on **Figures 10.2 – 10.3**) and overlooks Kyle Rhea from an elevated viewing platform.

10.3.51 HBRG provided multiple records of otter from the dedicated 1km records search, which is detailed in **Table 10.10** below.

Table 10.10. Otter records within 1km of the Project

Location	Grid reference	Date
Mudalach	NG72	09/03/1998
Sron an Tairbh	NG72	09/03/1998
Lochan na Saile	NG72	12/04/2000
Kylerhea	NG7820	12/05/2000
Mudalach	NG72	14/07/1998
Kyle Rhea	NG790213	15/02/2001

Location	Grid reference	Date
Highland	NG72	1913 - 1939
Highland	NG72	1940 - 1970
Kylerhea Minor Light	NG789222	20/03/1997
Kyleakin	NG72	2004
Kylerhea	NG789222	21/05/2002
Kylerhea otter hide	NG789222	26/07/2002
Allt an Daraich	NG72	28/06/2000
Kylerhea	NG7820	28/07/2002
Kylerhea	NG789218	01/07/2005
Kylerhea	NG789218	14/07/2005
Kylerhea	NG789218	21/04/2005
Kylerhea	NG789218	22/10/2004
Kylerhea	NG789218	24/10/2004
Kylerhea	NG789218	25/08/2005
Kylerhea	NG789218	28/10/2004
Kylerhea	NG7821	29/08/2005
Kylerhea	NG7820	03/10/2005
Kylerhea	NG7821	03/10/2005
Kylerhea Hide	NG789218	03/09/2005
Kylerhea	NG7821	04/09/2005
Kylerhea	NG789218	05/04/2005
Kylerhea	NG789218	05/07/2005
Kylerhea	NG789218	09/10/2004
Kyle Rhea	NG790213	09/01/2003
Kylerhea	NG72	18/05/2008
Kylerhea	NG72	10/10/2010

10.3.52 The Isle of Skye together with the Western Isles provides an important stronghold for otters in the British Isles (Barne *et al* ., 1997), and the otter is a qualifying feature of the Kinloch and Kyleakin Hills SAC and a notified feature of the Kinloch and Kyleakin Hills (Monadh Chaol Acainn Is Cheann Loch) SSSI, both of which overlap the study area.

10.3.53 A study was commissioned by SNH for otters within the Kinloch and Kyleakin Hills SAC (Cottis, R (2000) Kinloch otter *Lutra lutra* survey, SNH unpublished report). The survey was undertaken in 2000, and identified 135 holt sites within the SAC. This included 1 natal holt; 9

nursery holts; 6 high use holts; 35 moderate use holts; 59 low use holts; 1 disused holt; 1 high use rest site; 2 moderate use rest sites; 21 low use rest sites. The study estimated a population of 20 – 25 adult otters in this area.

Field survey

10.3.54 A large number of otter signs were recorded within the study area during the Otter Survey indicating extensive use of the site by otters. Signs included faeces (spraint), prints, pathways, feeding remains, resting places (lie-ups or holts). All recorded signs are displayed in a confidential annex of the Extended Phase 1 and Otter Report (**Appendix 10.1** & **10.2**).

10.3.55 All of the otter signs were located in coastal parts of the study area, less than 50m from the mean high water mark. The survey obtained results that may indicate a small movement north in terms of otter use of the site, in comparison to the study made in Cottis in 2000. However, this could not be ratified without substantial further work.

10.3.56 The watercourses and area around the proposed drilling rig location for option 1, were searched for signs of otter. However, at the time of search no evidence was found of otters coming up this section of the hillside.

10.3.57 No signs of otters were recorded south of the ferry slipway, and habitat potential (suitable locations for holts or freshwater sources) was limited in this section of coast.

10.3.58 A one year survey of marine mammals was conducted to support the Kyle Rhea Tidal Array EIA. The survey was undertaken by Natural Research Projects (NRP) Ltd, using a fully trained surveyor and local resident of Kyle Rhea and included observations of otters sighted in the water.

10.3.59 Otters were mostly recorded along the shore, with a very small number recorded towards the centre of the strait. No otters were recorded in the area of peak currents around the proposed development site (see Figure 2.2). Studies have found that otters tend to feed within 100m of the coast (Conroy & Jenkins 1986 cited by MacCafferty, 2004).

10.3.60 Otter were recorded regularly, throughout the year, with 105 individuals recorded during 91 sighting events. 88.5% of individuals were adults, with 3% immature and 8.5% juveniles. Otter were recorded along the western shore with most sightings to the north of the proposed array. A small number of otters were also recorded towards the centre and east side of the strait. Most of the sightings were of otter swimming slowly, but other behaviours recorded were of fast swimming, dives and being on land. All sighting of otter crossing the strait were considerably north of the proposed development

10.3.61 Several sightings were made of otter cubs.

10.3.62 One mink was recorded close to the otter hide.

Pine marten

10.3.63 Pine martens *Martes martes* are listed on Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). Various methods of capturing or killing pine martens are also listed in the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). The pine marten is also a LBAP priority species.

Desk study

10.3.64 From the desk study, pine marten have been recorded within the Kinloch and Kyleakin Hills SAC & SSSI (SNH 2002b). One record from NBN for grid square NG72 to resolution of 100m on the eastern bank of Kyle Rhea, in 2005-6, this record was provided by the HBRG. No further records were provided by HBRG in the dedicated 1km records search.

Field survey

10.3.65 During the Extended Phase 1 Habitat Survey, pine marten scat was recorded along a track to an existing wildlife hide. The coniferous plantation that covered a large area of the onshore study area was also considered to provide suitable habitat for pine marten. Pine marten are known to be present in the Forestry Commission plantation within the study area.

Bats

10.3.66 All bat species found in Scotland are classed as European protected species and are fully protected under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). The common pipistrelle *Pipistrellus pipistrellus* is a UK BAP priority species and is found in the area encompassed by the LBAP. Additionally all bats are LBAP priority species.

Desk study

10.3.67 NBN and HBRG provided no records of bats within the 1km search area. The nearest record for bat was provided by NBN and approximately 4km from the Project.

Field survey

10.3.68 Pipistrelle bats and possibly brown long-eared bats have been observed in the area (NRP pers comm); however, no potential bat roosts were found during the Extended Phase 1 Habitat Survey.

Badger

Desk study

10.3.69 Badgers *Meles meles* are protected under the Protection of Badgers Act 1992 and are also listed on Schedule 6 of the Wildlife and Countryside Act 1981 (as amended).

10.3.70 NBN provided two records of badger more than 10km east of proposed development, on the Scottish mainland.

Field survey

10.1.1 The Extended Phase 1 Habitat Survey did not find any evidence of badger activity and this species is not considered further in the impact assessment as no impact is anticipated

Wildcat

10.3.71 Wildcat *Felis sylvestris* is listed on Schedule 5 of the Wildlife and Countryside Act 1981 (as amended), and schedule 2 of the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). It is a UK BAP priority species and is listed on the Scottish Biodiversity List. It is also of least concern on the IUCN Red List of Threatened Species.

Desk study

10.3.72 The nearest record of wildcat from NBN was over 8km from the onshore study area. Records of wildcat were provided by HBRG (**Table 10.11**):

10.3.73 The Scottish Wildcat Association suggests the number of individuals may be as low as 35 throughout Scotland (www.scottishwildcats.co.uk/index.html).

10.3.74 Additionally, wildcat are known to be very elusive, and the Project is located along an existing track with regular visitors to the otter hide as well as FC activities. Therefore it this species is not considered further in the impact assessment as no impact is anticipated.

Table 10.11. Records provided by HBRG of wildcat

Date	Location	Grid reference
1913 - 1939	Highland	NG72
1940 - 1970	Highland	NG72

Field survey

10.3.75 No evidence for wildcat was recorded during the Extended Phase 1 Habitat Survey.

Other mammals

10.3.76 The records search performed by HBRG found other records for mammals. They are provided in **Table 10.12** below.

Table 10.12. Other mammal records within 1km of the onshore study area.

Scientific name	Common name	Date	Location	Grid reference
Mustela erminea	Stoat	1960 - 1993	Highland	NG72
Mustela nivalis	Weasel	1960 - 1993	Highland	NG72
Sorex minutus	Pygmy Shrew	31/07/2005	Kylerhea	NG78852118
Sorex minutus	Pygmy Shrew	31/05/2000	Kylerhea	NG78902115
Cervus elaphus	Red Deer	04/08/2004	Kylerhea	NG7821
Cervus elaphus	Red Deer	09/03/1998	Mudalach	NG72
Cervus elaphus	Red Deer	12/04/2000	Lochan na Saile	NG72
Cervus elaphus	Red Deer	14/07/1998	Mudalach	NG72
Cervus elaphus	Red Deer	18/05/2000	Kyle Rhea	NG7922
Cervus elaphus	Red Deer	28/06/2000	Allt an Daraich	NG72
Cervus elaphus	Red Deer	25/06/2003	Mudalach	NG72
Cervus elaphus	Red Deer	21/06/2006	Kylerhea	NG783217
Cervus elaphus	Red Deer	30/09/2009	Kylerhea	NG7821
Capreolus capreolus	Roe Deer	21/07/2011	Kyle side road/Skye Bridge	NG72

Scientific name	Common name	Date	Location	Grid reference
Capreolus capreolus	Roe Deer	12/04/2000	Lochan na Saile	NG72
Vulpes vulpes	Fox	12/04/2000	Lochan na Saile	NG72
Vulpes vulpes	Fox	1913 - 1939	Highland	NG72
Vulpes vulpes	Fox	1940 - 1969	Highland	NG72
Vulpes vulpes	Fox	28/06/2000	Allt an Daraich	NG72

Amphibians

10.3.77 Great crested newts *Triturus cristatus* are fully protected under the Wildlife and Countryside Act 1981 (as amended) and the Conservation of Habitats and Species Regulations (2010), whereas other amphibians are only partially protected by the Wildlife and Countryside Act 1981 (as amended). No amphibians are present within Skye and Lochalsh of UK BAP priority. Common toad *Bufo bufo*, palmate newt *Lissotriton helveticus* and common frog *Rana temporaria* are local priority species.

Desk study

10.3.78 The NBN gateway does not identify the area to be important for EPS great crested newts, SNH advised that great crested newt were unlikely to be present. NBN provided records for common frog and common toad, the nearest records being within 5km and 6km of the onshore study area respectively.

Field survey

10.3.79 No amphibians were recorded during the Extended Phase 1 Habitat Survey.

Reptiles

10.3.80 Reptiles are partially protected under section 9(5) of the Wildlife and Countryside Act (1981). All reptile species are listed as priority species for conservation on the UK BAP. Adder *Vipera berus*, slow worm *Anguis fragilis* and common lizard *Zootoca vivipara* are also listed on the Skye and Lochalsh LBAP.

Desk study

10.3.81 NBN provided the nearest record of common lizard within 1km, slow worm within 2km and adder within 6km of the Project.

10.3.82 Records for within 1km for adder were provided by the HBRC (**Table 10.14**). Adder is protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended).

Table 10.14. Adder record provided by HBRG.

Scientific name	Common name	Date	Location	Grid reference
Vipera berus	Adder	18/05/2008	Kylerhea	NG72

Field survey

10.3.83 The Extended Phase 1 Habitat Survey did not record any reptiles. However the immature coniferous plantation is likely to provide suitable habitat to adders since they have cover as well as clearings in which to warm themselves. The woodland edges are also likely to be suitable for the same reason (Forestry Commission website[23]). Edges of tracks are often suitable as well as open moorland and heathland habitat (Natural England website[24]).

Invertebrates

10.3.84 Certain species of invertebrates have full or partial protection under the Wildlife and Countryside Act (1981). Many invertebrates are also UK BAP or LBAP priority species.

Desk study

10.3.85 HBRG provided the following records for invertebrates (**Table 10.15**); which are partially protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) as well as being UK BAP priority species.

Table 10.15. Records of invertebrates found within 1km of the onshore study area

Scientific name	Common name	Date	Location	Grid reference
Boloria selene	Small Pearl-bordered Fritillary	12/06/1992	Easan Dubh,Kyle of Lochalsh	NG72
Coenonympha tullia	Large Heath	11/06/1992	Easan Dubh,Kyle of Lochalsh	NG72
Coenonympha tullia	Large Heath	12/06/1992	Easan Dubh,Kyle of Lochalsh	NG72
Coenonympha tullia subsp. scotica	Large Heath	1970 - 1988	10km square NG72	NG72

Field survey

10.3.86 No protected invertebrate species were recorded during the Extended Phase 1 Habitat Survey.

23 http://www.forestry.gov.uk/forestry/Adder

24 http://www.naturalengland.org.uk/ourwork/conservation/biodiversity/iyb/adder.aspx

10.4 Impact assessment

10.4.1 The impact assessment presented below considers the potential impacts the onshore component of the Project may have on terrestrial and intertidal ecological receptors.

Do nothing scenario

10.4.2 Intertidal habitats are unlikely to change from existing conditions, as outlined above, in the absence of the Project.

10.4.3 Terrestrial habitat within the Project area is currently being managed by the FCS's Kylerhea site. There are some features of the Kinloch and Kyleakin Hills SAC & SSSI within this area, and it is expected that the site is being managed to maintain these features.

Potential impacts during the construction phase

10.4.4 Pollution from drilling fluids or spills and leaks of oil, fuel or other potentially polluting substances are addressed in Chapter 8 Geology, hydrology and non-marine surface water, which, following mitigation, are assessed to be of negligible significance on groundwater or nearby surface waters. With adherence to these mitigation measures, an adverse impact on terrestrial or intertidal ecology receptors is not anticipated.

10.4.5 Pollution events in the marine environment arising from the devices themselves or construction vessels are fully assessed within Chapter 9 Marine Water Quality.

Impact 1: destruction or damage to sensitive terrestrial habitats

10.4.6 An Appropriate Assessment will be undertaken to provide further detail on the potential impacts of the Project upon otters and reef (including intertidal reef), as SAC qualifying features.

OPTION 1

10.4.7 As discussed in Chapter 5: Project Description, the onshore works may require a small amount of levelling to provide sufficient angle for the directional drilling (see **Figure 5.1**).

10.4.8 The SAC and SSSI includes the qualifying features particularly northern Atlantic wet heaths with *Erica tetralix*, which was identified during the Extended Phase 1 Habitat Survey, and is located around the Project. To avoid impacts to the features within the SAC and SSSI, the substation and the footprint for the drilling rig are anticipated to be located outside of the SAC and SSSI boundary, using the existing car park hardstanding and access track, wherever possible . An Appropriate Assessment is not deemed to be required for the northern Atlantic wet heath as the Project development will not occur within the footprint of this SAC.

10.4.9 Northern Atlantic wet heath is a EC Habitats Directive, UK BAP and LBAP priority habitat and outside the SAC boundary is considered to be of **medium** value and sensitivity.

10.4.10 The drilling area is estimated to require 40m^2 of land, the majority of which will be situated upon the existing car park hard standing, however some additional hardstanding may be required to the east around an existing picnic table area onto wet heath, acid grassland and scattered scrub habitat / deciduous saplings. Given the small size of this footprint of extension, the magnitude is considered to be **low**.

10.4.11 The substation will be located within an existing access track area adjacent to the SAC / SSSI. It is presumed that the existing amount of hardstanding will be sufficient, however, a worst case scenario of permanent loss of a small area of habitat outside the designated area is assessed. The impact of the construction footprint is predicted to be localised, temporary and *short-term*, where vegetation is disturbed but is able to re-colonise the area following construction. Habitats that fall within the footprint of the substation will be permanently lost and will experience a *long-term* impact. This is assessed to be of **low** magnitude due to the small area of the habitat potentially lost.

10.4.12 Dust and pollution from construction activities have the potential to affect plants and invertebrates, since the onshore works are likely to occur within 100m of these receptors (technical guidance suggests this distance as a threshold distance within which ecological receptors may be affected by dust raising activities (IAQM, 2012)). This would be a temporary impact of **low** magnitude, *localised* and of *short duration*.

10.4.13 Hydrological impacts may affect species and qualifying feature of wet heath if local drainage is altered. Hydrological impacts are considered further in Chapter 8, Geology, hydrology and non-marine surface water. The zone of influence for impacts to groundwater flow is assessed to be very limited with a small localised area of groundwater catchment likely to be affected. Overall the risk of impact to hydrological function is assessed to be of **low** magnitude.

10.4.14 Otters are considered further in subsequent potential impacts.

10.4.15 An overall **low** magnitude impact is predicted for sensitive terrestrial habitats based on the small area affected. Therefore, based on the medium sensitivity of some receptors, the level of impact significance is considered to be **minor adverse**.

10.4.16 A licence will be obtained from FCS where felling of trees is unavoidable; and compensatory planting of trees undertaken where necessary (usually required as a condition of the felling licence).

OPTION 2

10.4.17 It is anticipated that the drilling equipment will be located on the flat acid grassland adjacent to the coast, avoiding the marshy grassland habitat further west which would lead to constraints from both environmental and engineering perspectives. It is likely that drilling plant will access the site from the sea, allowing direct access to the acid grassland habitat.

10.4.18 There will be direct habitat loss in the footprint of the drilling activities of approximately 40m^2 of land. The acid grassland is common habitat of **low** value, and the magnitude is assessed to be low given the small footprint involved.

10.4.19 The substation will be located within an existing shed by the ferry slipway and no further works are anticipated at the substation. There will be 403m of cable required between the drilling area and substation. This will be in a trenched cable, approximately 2 metres wide following the road. The habitat beside the road is a matrix of wet heath continuation from the hillside, which is of **medium** value and sensitivity, plus acid grassland of **low** value. This is assessed to be of **low** magnitude due to the small area of the habitat being temporarily disturbed.

10.4.20 Hydrological impacts may affect species associated with sensitive habitats if local drainage is altered. Hydrological impacts are considered further in Chapter 8, Geology, hydrology and non-marine surface water. There is potential for slow seepage into the directional drill so the activities are unlikely to act as a preferential pathway for groundwater flow. Overall, the risk of impact to hydrological function is assessed to be of **low** magnitude.

Overall, impacts are assessed to be of **minor adverse** significance.

Impact 1: Mitigation
5. An Environmental Management Plan will be prepared and approved by SNH and the Local Authority prior to construction activities commence.

Impact 1: Mitigation
6. The construction footprint will be minimised, by using existing hard-standing and path as much as possible to minimise impacts on heath habitats. 7. Construction activities, materials, machinery and vehicles will be limited to defined routes and construction areas (path and hard standing), minimising the footprint and preventing disturbance of adjacent habitat. 8. Felling of trees and shrubs should take place outside of the nesting bird season (mid-February to August inclusive). 9. A secure tight boundary will be made around the construction footprint, including fencing off the boundary of the SAC & SSSI (Option 1 only) to avoid disturbance of this area, with exclusion zones clearly marked by weather proof signs at regular intervals. 10. During construction, good working practices and SEPA protocols should eliminate risk of exposure to oil, chemicals and other harmful materials. (see Chapter 9 Marine Water Quality). 11. Soils storage mounds and dry materials that may be a source of dust will be stored away from the SAC boundary as far as practicable and consideration given to wind direction and shelter when siting storage mounds. 12. The construction contractor shall provide and implement a construction method statement taking best practice guidance into account, including CIRIA The coastal and marine environmental site guide (C584) and CIRIA Guidance note C692 Environmental Good Practice on Site Guide (3rd edition). 13. An Ecological Clerk of Works will be appointed to act as watching brief as appropriate to ensure mitigation is complied with. 14. Habitats affected by the construction works will be re-instated to their current condition or better, using plants of local provenance. If in a worst case scenario works involve the removal/disturbance of heath habitat outside of the SAC (Option 1 only), the following will be committed to: 15. Piles of peat/heath turves will be bladed and kept moist to avoid drying out 16. Peat turves will be stored within the construction footprint, a minimum 200m from the watercourses and sensitive (heathland) habitats. 17. Excavated peat/heath turf will be removed as intact as possible, and disturbance and movement of the turves will be minimised. 18. Best practice measures to encourage rapid stabilisation and re-vegetation of exposed peat will be implemented where required (e.g. using an appropriate nurse seed mix to stabilise the peat).

Residual impact

10.4.21 Following the application of the mitigation measures given above, the residual magnitude of these impacts will remain **low** since permanent habitat loss may occur. Therefore the impact will remain of **minor adverse** significance.

Impact 2:– impacts to wild plants

OPTION 1

10.4.22 Eyebright, as recorded in the desk study and during the Phase 1 Habitat Survey, is a UKBAP priority species, a LBAP priority species and is thus of **medium** sensitivity. This plant was recorded within 160m of the Project area. There is potential for this species to be within the Project area and be affected by the Project.

10.4.23 The native bluebell is partially protected by Schedule 8 of the Wildlife and Countryside Act 1981, and is on the Scottish Biodiversity List and LBAP. Therefore this species is of national, regional and local importance and considered to be of **medium** sensitivity.

10.4.24 A healthy population of native bluebell was present across the surveyed area, including the vicinity of the proposed drilling pad and substation. The proposed drilling rig and substation are within areas of man-made ground and track; however, (depending on the area required for construction), the periphery of the footprint may overlap with ground supporting bluebell and impact this species.

10.4.25 Disturbance from the construction works will be short-term and temporary; however, some permanent or long term habitat loss may occur from within the footprint of the substation. The footprint of the substation is very small and the overall magnitude is considered to be **low.** Low magnitude and medium sensitivity suggest a **minor adverse** impact significance.

OPTION 2

10.4.26 No plants of sensitivity were recorded surrounding the Option 2 substation location and the plants are considered to be of **negligible** sensitivity.

10.4.27 Disturbance from the construction works will be short-term and temporary; however, some permanent or long term habitat loss may occur from within the footprint of the substation. The footprint of the substation is very small and the overall magnitude is considered to be **low**. Low magnitude and negligible sensitivity suggest a **negligible** impact significance.

Impact 2: Suggested Mitigation
1. The Option 1 construction footprint including materials, machinery and vehicles will be limited to defined routes, and construction areas will be minimised as far as practicable, to reduce the risk of affecting areas with bluebell. 2. It is recommended that native species of local provenance (including bluebell at Option 1) are replanted following construction in areas outside the permanent development footprint.

Residual impact

10.4.28 Following the application of the mitigation measures given above, the residual impact significance will be reduced to **negligible**. This is not significant in EIA terms.

Impact 3: potential spread of invasive, non-native species.

OPTION 1

10.4.29 *Rhododendron ponticum* was identified by the LBAP as being present in the area of the Project, and the Extended Phase 1 Habitat Survey also identified a small number of isolated bushes within 50m south of the proposed substation.

10.4.30 Non-native invasive species are of concern for the negative impact they have on the ecological environment, and may be sensitive to disturbance. Therefore, construction activities related to the onshore transmission works may indirectly cause these species to spread. *Rhododendron ponticum* is not identified on schedule 9 of the Wildlife and Countryside Act 1981 (as amended). However, it is identified on the LBAP as being a non-native species of concern. These plants can be considered to be of **medium** sensitivity.

10.4.31 This impact is considered to be of **low** magnitude due to the small isolated area of the species. This impact is predicted to be of **minor adverse** significance.

OPTION 2

10.4.32 No non native species were identified in the vicinity of the Option 2 footprint. Non native plants can be considered to be of medium sensitivity. This impact is considered to be of **negligible** magnitude due to absence of the species currently at the Option 2 development location. This impact is predicted to be of **minor** adverse significance.

Impact 3: Suggested Mitigation
1. A terrestrial invasive species survey will be required prior to construction, to assess the extent of *Rhododendron ponticum* within the construction footprint area of Option 1 and identify any other invasive species established in the study area. 2. Management of non-native invasive species should follow guidance as laid out in the Environment Agency's Managing Invasive Non-native Plants (2010). Chemical control of non-native invasive species will require written permission from SEPA. The removal strategy for any invasive species within the construction footprint will be included within an Environment Management Plan (EMP) and agreed with SNH prior to construction. 3. Invasive plants within the construction footprint will be removed and disposed of appropriately in accordance with relevant waste regulations, following current best practice. 4. Native species of local provenance will be replanted where possible. 5. Additional information, providing detailed guidance for the management of non-native invasive plant species is provided on the Business Gateway website: http://www.business.scotland.gov.uk/

Residual impact:

10.4.33 Following the application of the mitigation measures given above, the residual impact significance will remain **negligible**.

Impact 4: Direct impacts to otter and resting sites from onshore activities

10.4.34 As a European Protected Species, otters (and their habitat) are considered of high sensitivity. Otter activity at the coast was high and lies within 200m of the Project. This included resting sites from the 2012 survey found within 500m and a potential nursery holt identified on the 2000 survey (**Appendix 10.3**) within 200m. All otter signs recorded were within 50m of the coast.

10.4.35 Given the high level of otter activity in the vicinity of the Project it is likely that the construction activities will negatively affect otters.

10.4.36 For option 1, damage or destruction to resting places is unlikely, as directional drilling will be used to avoid disturbance of the coastal area. This area has been identified as the Forestry Commission car park which is of little or no functional value as an otter habitat.

10.4.37 For option 2, otter habitat in the vicinity of option 2 HDD option is also limited (see **Appendix 10.2**). This area was acid grassland, with a small stream running to the south of it which borders the drilling study area. There is potential for otters to use this stream as a freshwater source. This area was not fully accessible during the dedicated otter survey, however no resting places were located along the area that was accessible. Some natural screening is provided by a natural bank of bedrock and vegetation which exists between the stream and the acid grassland. Altogether, damage or destruction of resting places here is also considered unlikely.

10.4.38 Construction of the onshore infrastructure will bring additional volume of traffic to the area for a temporary period (weeks). Whilst the nature of the site would tend to result in slow moving vehicles. There remains some potential for otters to be hit by construction vehicles. In addition, there is potential for animals to be injured through falling into open excavations or underneath the drilling, exposed drains, pipe systems and electrical equipment; and becoming trapped. However, vehicles will be travelling slowly as this road is single track, and once vehicles have travelled along the existing road from the ferry landing slip to the construction area, construction activity will occur away from otter habitat or foraging grounds and away from suitable freshwater source, and therefore the importance of the construction footprint area as a habitat for otters is considered to be **low** in value. The potential for this impact to occur is considered to be of **low** magnitude, and unlikely to affect the long-term status of the otter population. The potential impact is anticipated to be of **minor adverse** significance.

10.4.39 Otters The potential impact of a pollution event to fish (otter prey) has been assessed in Chapter 14, Fish and Shellfish as being of **minor adverse** significance following mitigation. However, this is highly unlikely to occur. Should a pollution event occur it is likely to be localised, short-term, temporary, and potentially reversible. This impact could have a secondary effect on otters and may result in an impact of **low** magnitude. Given the unlikeliness of the impact occurring, an impact of **minor adverse** significance is predicted.

Impact 4: Suggested Mitigation
1. Firstly all otter mitigation measures for the site will be agreed with SNH prior to construction. 2. A European Protected Species (EPS) Licence is likely to be required to undertake work on this site. 3. Given otters are very mobile species, a pre-construction survey 8 weeks before construction commences should be undertaken, to re-assess otter activity. Prior to the commencement of operations an otter survey should be undertaken, within the proposed footprint of construction plus a 250m buffer zone., to determine current use at the time of construction (otters may increase their use of the site in the interim period between the current survey and the commencement of construction). 4. The surveys should be undertaken in appropriate weather conditions and following guidance in the ‘New Rivers and Wildlife Handbook’ (RSPB, NRA & RNSC, 1994), Chanin (2003) and Strachan & Jefferies (1996), and SNH Scottish Wildlife Series: Otters and Development. 5. Construction works should maintain a strict footprint of works, and construction vehicles and equipment should not be active on, or stored by, the coastline for longer than is essential. It is appreciated that equipment may need to travel to site by sea and may require the slipway used by the Skye Ferry but if possible the equipment should be stored further up the hill. This will minimise disturbance to the shore. 6. A ‘no build’ buffer of 50m will be placed either side of the two small burns and the drain, to the north and south of the onshore works (Option 1), and 25m north of the watercourse at the south of the footprint (Option 2) in order to minimise risk of pollution to the watercourses or disturbance to otters using the burn to transit the hillside. The watercourse at Option 2 7. It may be necessary to install otter fencing around the construction area; this will be dependent on the final location and design of the works. 8. A pollution management plan will be included in the Environmental Management Plan and will be developed in consultation with SEPA and SNH in accordance with SEPA’s PPC guidelines PPG 5 (Works in, near or liable to affect watercourses) and PPG 6 (working at construction and demolition sites). Both

Impact 4: Suggested Mitigation
plans will be incorporated within the Construction Method Statement. 9. The risks can be further reduced by following best practice and guidance including SNH Scottish Wildlife Series: Otters and Development, as well as guidance produced by Design Manual for Roads and Bridges (DMRB Volume 10 section 4). 10. If any otter fatalities occur during construction, carcases should be retained and SNH should be notified, if non-fatal injuries occur as a result of construction then SNH should be notified immediately. 11. Where artificial light is required, lights should be directed away from the coastal area and watercourses to allow otters to migrate through the area undisturbed. 12. Environmental or ecological clerk of works is recommended to be present during the works. Work should stop should an otter holt or resting place be found within 250m (SNH 2007), and SNH consulted, as a licence may be necessary before works can continue. 13. There is limited potential for otter shelters along the coast line south of the ferry slip and around the village of Kylerhea. It has been highlighted that otters are creating holts under upturned boats and in sheds and that artificial otter habitat along this stretch of coastline could be of benefit. This will not only provide shelter for otters away from construction noises so the otters could move along the coastline, but will also draw the otters away from the village where they are at potential risk of injury from road traffic or machinery.

Residual impact

10.4.40 Following the application of the mitigation measures given above, the residual magnitude of these impacts is predicted to be low and the impact will be of **minor-adverse** significance. In regard to the EIA regulations, this impact is not considered significant.

Impact 5 Air borne noise and vibration disturbance to otter

10.4.41 Otters are mobile species and should be able to move away from areas of disturbance as the wider area provides abundant shelter. However, resting sites and natal holts are of greater sensitivity, as an otter and/or otter cubs may be disturbed from rest, and an offence under the Habitats Directive may be committed.

OPTION 1

10.4.42 Air borne noise disturbance will occur during onshore construction activities. At its closest point, the drilling rig is located 195m from the coastline, whilst the substation (including a 10m construction buffer) is located 180m from the coastline. The holts identified in the otter field survey are located a distance of greater than 250m from the footprint of the drilling rig, however a 321m stretch of coastline will be effected by noise disturbance. The proposed footprint for the substation is located 144m from the historic otter holt recorded in 2000. There will be some noise disturbance occurring from construction activities, including some levelling activities. Construction will take place over a ten week period and will coincide with works at the drilling rig. Works affecting the coastline are considered to be of low magnitude given the temporary and short term nature. Sensitivity of the coastline is considered to be high for otters, including historic holt sites, and therefore an impact of moderate adverse significance is anticipated during the period of drilling and substation construction.

OPTION 2

10.4.43 The location of the drilling rig for Option 2 is adjacent to the coastline, however the habitat potential for otter in this location is limited, with one small watercourse and few other opportunities of fresh water. In addition there is limited potential for holts along this stretch of the coastline compared with further north, where rock and trees provide abundant shelter opportunities. Works affecting the coastline are considered to be of medium magnitude given the temporary and short term nature. Sensitivity of the coastline is considered to be medium for otters, as there is less potential for supporting habitat and therefore an impact of **moderate** adverse significance is anticipated during the period of drilling.

Both Options

10.4.44 Increased vessel traffic, including some vessels using dynamic positioning (DP), may be a source of additional airborne noise during installation (see chapter 20) . However, due to the existing comparatively high levels of background noise and the relatively limited duration of installation, the magnitude of impact is expected to be **low**. Vessel noise can be reduced by maintaining a consistent speed and slowing down/ accelerating gradually. The otter holts recorded on the coastline are in excess of 250m from the offshore development, and there is therefore not anticipated to be an adverse noise impact on cubs who may be present in the holts.

10.4.45 The presence of ecological receptors was a considered factor in choosing the method of bringing cables ashore HDD is generally accepted as a less intrusive and disturbing method of installing cables The use of HDD is considered to be the most favourable method for export cable installation. The indicative export cable route is the shortest pathway between the devices and the drilling rig. The indicative export cable route for Option 1 is 170m away from the otter holt identified by Cottis 2000 and 394m metres away from the otter holt identified by Royal HaskoningDHV 2012, with the indicative export cable route for Option 2 further south (241m from the nearest nursery holt). . There is not anticipated to be a potential impact of vibration through the rock disturbing otter holts. The magnitude of this potential impact is considered to be **negligible**. As the coastline is considered to be of high importance for otters, this gives an overall impact significance of **minor adverse**.

10.4.46 Noise and disturbance to otters using the offshore area of Kyle Rhea may occur as a result of the offshore installation works. Vessel options currently being considered for the installation of the SeaGen devices may include the following types of vessels (although not all of them) (Chapter 5, Project Description):

- Moored barge;
- Jack up vessel;
- Multicat; and
- Small installation DP vessel.

10.4.47 Underwater drilling operations for the offshore works have limited potential to generate noise above the surface. The drilling operations will be hydraulically driven and will operate in such a way as to reduce the duration of the period that the rig is on site. The main sources of noise will be the drilling head and the two operating generators required to power equipment and lights aboard the drilling area. The indicative locations of the devices (and offshore therefore works) are approximately 170 from the coastline.

10.4.48 The works to install the devices will take place in two periods, most likely in 2 consecutive years. The installation of the piles are likely to take 12 days per installation and the installation of the devices on to the pin piles is likely to take approximately 4 days per device. No percussive pile driving will be required however the installation can be expected to result in increased noise and disturbance in the Kyle Rhea channel. The magnitude of potential impact is considered to be **low**, since the work will take place in a small number of phases and noise and vibration disturbance will be limited and of short-term duration. This results in a **moderate adverse** impact, when considered alongside the **high** sensitivity of otters at the coastline.

Impact 5: Suggested Mitigation
1. Firstly all otter mitigation measures for the site will be agreed with SNH prior to construction. 2. A European Protected Species (EPS) Licence is likely to be required to undertake work on this site. 3. Given otters are very mobile species, a pre-construction survey 8 weeks before construction commences should be undertaken, to re-assess otter activity. Prior to the commencement of operations an otter survey should be undertaken, within the proposed footprint of construction plus a 250m buffer zone., to determine current use at the time of construction (otters may increase their use of the site in the interim period between the current survey and the commencement of construction). 4. The surveys should be undertaken in appropriate weather conditions and following guidance in the 'New Rivers and Wildlife Handbook' (RSPB, NRA & RNSC, 1994), Chanin (2003) and Strachan & Jefferies (1996), and SNH Scottish Wildlife Series: Otters and Development. 5. Environmental or ecological clerk of works is recommended to be present during the works. Work should stop should an otter holt or resting place be found within 250m (SNH 2007), and SNH consulted, as a licence may be necessary before works can continue. 6. The creation of artificial holts as mentioned above is also appropriate as a mitigation measure for this potential impact.

Residual impact

10.4.49 Following the application of the mitigation measures given above, the residual magnitude of these impacts remains **low** however the potential physical impact will remain **moderate** adverse. However, in regards to the EIA regulations and acknowledging the additional management measures, the very short duration of the impact, the mobility of the species and the abundant habitat resource available, combined with the additional scrutiny associated with the EPS licence process the significance in terms of EIA regulations has been reduced to **minor** adverse. In regard to the EIA regulations, this impact is not considered significant.

Impact 6: underwater noise disturbance to otter

10.4.50 Considering impact of underwater noise arising from construction works, otters have ears designed for airborne sound and chase and catch fish under water and rely on vision and touch (vibrissae) (Amundin, 1998). They lack the adaptations of marine mammals with acute underwater hearing.

10.4.51 Kyle Rhea has a very fast flow, and subsequently background underwater noise levels can be very high (**Appendix 12.5**). This high level of background noise including the noise generated by existing vessel traffic in Kyle Rhea may allow animals to become habituated to the type of underwater noise associated with installation.

10.4.52 Experience from similar tidal device installations in the Falls of Warness, Orkney (**Appendix 12.6**) suggest that it can be anticipated that the levels of underwater noise from the drilling activity at Kyle Rhea will not be of a sufficiently high level to cause physical injury to marine mammal species. It is estimated that a strong avoidance response for harbour seals to the drilling activities would occur within 20m of each device location (**Appendix 12.6**). The underwater hearing sensitivity for otter is significantly lower than the hearing sensitivity of pinnipeds, consequently drilling activities are not anticipated to cause disturbance to otters foraging in shallower waters of Kyle Rhea. The magnitude is considered to be **negligible**, with a precautionary impact significance assessed to be **minor adverse**.

Impact 6: Suggested Mitigation
7. No mitigation is proposed.

Residual impact

10.4.54 As no mitigation is proposed, the residual magnitude of these impacts is predicted to be low and the impact will be of **minor-adverse** significance. In regard to the EIA regulations, this impact is not considered significant.

Impact 7: adverse impacts to pine marten

OPTION 1

10.4.55 Pine marten was identified during the desk study. Evidence of pine marten (scat) was recorded on numerous occasions during the Extended Phase 1 Habitat Survey.

10.4.56 Pine martens are fully protected under schedule 5 of the Wildlife and Countryside Act 1981 (as amended) and thus are of **high** sensitivity.

10.4.57 The substation and HDD footprint are likely to utilise existing areas of hard-standing and are likely only to affect vegetation in the immediate vicinity of any excavation works required. The Project may affect a small area of heathland immediately adjacent to the existing track to the wildlife hide, however no plantation woodland is anticipated to be impacted. Pine martens are known to prefer woodland (Harris and Yalden 2008) and it is highly unlikely the footprint of the works will impact habitat of importance for breeding or resting. Therefore the risk of impacting pine marten in this way is low. The impact is predicted to be temporary, of short-duration of **low** magnitude, and of **minor adverse** significance.

10.4.58 Reckless killing and injury is possible in a similar way to otter as reported above. The impact is predicted to be unlikely due to the very small footprint of the substation and drilling pad which will be located on the existing track. The magnitude is considered to be **low**. As a result the potential impact is anticipated to be of **minor adverse** significance.

10.4.59 Disturbance could arise from increased noise, vibration and odours from machinery and personnel. Pine martens are a mobile species and should be able to move away from areas of disturbance as the wider area provides abundant shelter. Therefore the impact is predicted to be temporary, of short-duration and of **low** magnitude, and thus of **minor adverse** significance.

OPTION 2

10.4.60 The development footprint for Option 2 is not adjacent or within pine marten habitat, therefore **no impact** is anticipated.

Impact 7: Suggested Mitigation
1. OPTION 1 2. An 8 week pre-construction survey should be undertaken, to re-assess pine marten activity within the proposed footprint of construction plus a buffer zone to be agreed in consultation with SNH. 3. The surveys should be undertaken in appropriate weather conditions and the methodology agreed in advance with SNH. 4. Should pine marten resting or breeding places be found within or nearby the construction works footprint during the pre-construction survey, a species

Impact 7: Suggested Mitigation
licence may be required from SNH. 5. Construction activities should maintain a strict footprint of works, including access roads and lay-down areas. 6. If any pine marten fatalities occur during construction, carcases should be retained and SNH should be notified, if non-fatal injuries occur as a result of construction than SNH should be notified immediately. 7. Where artificial light is required, lights should be directed away from the woodland areas. 8. Environmental or ecological clerk of works is recommended to be present during the works. Should a pine marten resting place or breeding place be found, and SNH consulted, as a licence may be necessary before works can continue. 9. OPTION 2 10. Non required

Residual impact

10.4.61 Following the application of the mitigation measures given above, the residual magnitude of these impacts is predicted to be **negligible** and the impact will be of **negligible** significance. In regard to the EIA regulations, this impact is not considered significant.

Impact 8 – adverse impacts to bats.

10.4.62 Bats are protected by international and national legislation as mentioned earlier and therefore are of **high** sensitivity.

10.4.63 The desk study and Extended Phase 1 Habitat Survey showed that no potential bat roosts were found, although bats have been known in the area, the area is considered to be of **low** value for bats. Therefore impacts to bats are expected to be unlikely, and thus of **low** magnitude. This results in an impact of **minor adverse** significance.

Impact 8: Suggested Mitigation
1. As a precautionary measure, branches with splits, cracks, loose bark or holes should be inspected prior to felling or pruning, to exclude the presence of concealed bats (considered unlikely). Section felling should be implemented with soft fall techniques. Any larger sections should be left on the ground overnight to allow any concealed bats that may be present to leave (considered unlikely). 2. At any stage, if bats or any evidence of bats are detected, all works in the area should cease and advice should be sought from an Ecologist. 3. Environmental or ecological clerk of works is recommended to be present during the works. Should bat roosts be found SNH should be consulted, as a licence may be necessary before works can continue.

Residual impact

10.4.64 Following the application of the mitigation measures given above, the residual magnitude of these impacts is predicted to be **negligible** and therefore the impact will be of **negligible** significance. In regard to the EIA regulations, the impact upon bats is not considered significant.

Impact 9 – adverse impacts to reptiles.

10.4.65 Common species of amphibians are partially protected by UK legislation through the Wildlife and Countryside Act 1981 (as amended) and are considered to be of **medium** sensitivity.

10.4.66 Reptiles were not observed during the Extended Phase 1 habitat, but suitable habitat (see section 10.3) was found and it was considered that common species may be present in the study area.

10.4.67 Recent records for slow worm and adder were found on NBN gateway within the vicinity of the Project, therefore there is a risk of injury or death for these species, especially during clearance of vegetation prior to construction.

10.4.68 The magnitude of potential impact is predicted to be **low** and therefore the impact significance predicted is **minor adverse**.

Impact 9: Suggested Mitigation
1. A pre-construction survey immediately preceding construction works shall be undertaken by a suitably qualified ecologist if any suitable habitat is to be removed (i.e. heathland, woodland). 2. If works are to be undertaken in winter, then a reptile survey will be required prior to vegetation clearance to determine presence/absence. This is because reptiles are less likely to be displaced if in hibernation and may require re-locating as an additional measure. 3. Environmental or ecological clerk of works is recommended to be present during the works.

Residual impact

10.4.69 Following the application of the mitigation measures given above, the residual magnitude of this impact is considered **negligible** and the impact significance is **negligible**. In regard to the EIA regulations, this impact is not considered significant.

Impact 10: adverse impacts to invertebrates

OPTION 1

10.4.70 Records were provided of small pearl-bordered fritillary and large heath butterflies within 1km of the Project by HBRC. These records are ten years old.

10.4.71 These butterflies are of partially protected by UK legislation through the Wildlife and Countryside Act 1981 (as amended). They are also UKBAP priority species. They are therefore considered to be of **medium** sensitivity.

10.4.72 The Project has the potential to affect the surrounding heathland which provide foraging, commuting, resting and breeding sites for these butterflies. Even in the worst-case scenario, the construction of substation would result in a very small area of permanent habitat loss, and temporary disturbance for construction activities of the substation and drilling rig. Butterflies are mobile species and suitable habitat for the butterflies is abundant in the immediate surrounding area.

10.4.73 Larval food plants for small pearl-bordered fritillary are: common dog-violet (*Viola riviniana*) and marsh violet (*Viola palustris*). For the large heath butterfly, primary larval foodplants are hare's-tail cottongrass (*Eriophorum vaginatum*). common cottongrass (*Eriophorum angustifolium*) and jointed rush (*Juncus articulatus*) are also used (www.ukbutterflies.co.uk/species). Violets were identified within 150m of the Project during the Extended Phase 1 Habitat Survey. No larval plants for large heath were recorded within the onshore study area.

10.4.74 Due to larval plants being located nearby for the small pearl-bordered fritillary, a precautionary assumption has been made that small pearl fritillary may still be present on site. However, the potential impact will be small scale, localised and therefore of **low** magnitude. This results in a **minor adverse** impact significance.

OPTION 2

10.4.75 The development footprint for Option 2 (acid grassland) is of **low** importance for insects, whilst the magnitude remains **low**. This results in a **minor** adverse impact significance.

Impact 10: Suggested Mitigation
1. Construction activities should be maintained within a strict footprint of works, including access roads and lay-down areas. 2. An environmental or ecological clerk of works is recommended to be present during the works.

Residual impact

10.4.76 Following the application of the mitigation measures given above, the residual magnitude of this impact is considered **negligible** and thus the impact significance **negligible**. In regard to the EIA regulations, this impact is not considered significant.

Impact 11: Disturbance to intertidal habitats

OPTION 1

10.4.77 There will be **no** interaction with the intertidal habitat for Option 1.

OPTION 2

10.4.78 If equipment for the drilling rig is brought to the site by sea, there is possibility of landing at the beach in front of the proposed drilling area. This beach consists of mobile pebble and supported a limited amount of flora and fauna, mainly fucoids present rarely in the lower shore on larger substrata, and occasional grey top shells and common periwinkle, particularly at the southern end close to a small watercourse.

10.4.79 The habitat is considered to be of **low** value and quick to recover, whilst any activity on the beach will be temporary and short term in nature. The magnitude of this impact is therefore considered to below, with an overall significance of **minor** adverse.

Impact 10: Suggested Mitigation
1. Construction activities should be maintained within a strict footprint of works, 2. An environmental or ecological clerk of works is recommended to be present during the works. 3. Activities on the beach should take place more than 25m from the stream at the southern end.

Residual impact

10.4.80 Following the application of the mitigation measures given above, the residual magnitude of this impact is considered to remain **low** and thus the impact significance **minor adverse**. In regard to the EIA regulations, this impact is not considered significant.

Potential impacts during the operation phase

10.4.81 The onshore export cable will be installed within the HDD borehole . Therefore no further direct impacts are envisaged and there is no planned schedule for maintenance. Access to the substation during operation is unlikely to bring a significant increase in traffic or personnel, than already exists from Forestry Commission activities local residents and tourists. Access will be made along the existing track to the wildlife hide.

10.4.82 The following assessments assume a scenario whereby unplanned maintenance is required. And consider the operation of the offshore devices, inter-array cables, export cable and terrestrial substation.

10.4.83 If, due to cable failure there is a need to replace the export cable. The cables would need to be pulled through the HDD borehole and replaced. In the unlikely event that this operation needs to take place it can be conservatively assumed that would not exceed those already considered for cable installation.

Impact 12: disturbance to sensitive terrestrial habitats.

10.4.84 Should non-scheduled maintenance be required, whereby the cables need to be extracted, heavy vehicles would need to access the area. Access will also be required for any O&M to the small length of buried cable linking the HDD site and the substation. The drilling rig footprint would be sufficient and no further landtake would be required for extracting the HDD inserted cables, and the small length of buried cable is underneath the existing track. Therefore **no** impact on sensitive terrestrial habitats is anticipated during this non-scheduled emergency repair operation. This is not considered significant according to the EIA regulations.

Impact 13: change to intertidal habitat.

10.4.85 The presence and operation of the devices is predicted to cause limited, near-field impacts of low magnitude on benthic species close to the devices (see Chapter 13, Benthic Ecology), which is not anticipated to extend to the intertidal area and therefore the magnitude of impact on the intertidal environment is **negligible**.

10.4.86 The intertidal habitat of Kyle Rhea is characteristic of a tide swept area, and includes the Marine Priority Feature, the intertidal biotope *Fucoids in tide-swept conditions LR.HLR.FT*. It is also a feature of the Lochs Duich, Long and Alsh Reefs SAC and is therefore of high value but given the negligible magnitude, this ecosystem is expected to have **low** sensitivity to this change. Although just the western shore was surveyed, it is assumed similar biotopes are also present on the eastern intertidal area, where a similar arrangement of substrata is present. Although the SeaGen devices will remove a small amount of the available energy from the tidal stream, they will be located in areas of greatest velocity and the residual tidal energy in Kyle Rhea will remain very high. Chapter 7, Marine Physical Environment and Coastal Processes describes the predicted changes to hydrodynamic regime and sediment distribution. There is no change outwith natural variation anticipated in composition of intertidal habitats anticipated as a result of the operation of the devices. As a result the impact on intertidal habitats is predicted to be of **negligible** significance.

Impact 14: Collision of otter with devices

10.4.87 The potential impact of otter colliding with the SeaGen devices themselves, and risking injury or death has been considered with this ES. A number of factors combine to indicate that direct interaction with the devices is highly unlikely, including the highly tidal environment at Kyle Rhea, the depth of water required for device installation, the depth at which the rotors operate, and the preference of otters to feed in shallower waters where water velocities are slower.

10.4.88 Otters in Scottish coastal waters generally feed on small benthic (bottom dwelling) fish and crustaceans such as crabs, and have a strong preference for hunting in areas with dense seaweed cover in shallow inshore rocky areas (SNH 2008). Studies have found that otters tend to feed within 100m of the coast, and dive around the 10m depth contour, and to an average dive depth of 10m (Conroy & Jenkins 1986 cited by MacCafferty, 2004). 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). Although otters occasionally swim in deeper water, and have been noted transiting straits and narrows such as Kyle Rhea, the behavioural observations outlined above suggest that they are less likely to attempt to dive to hunt on the seabed in areas where the water depth exceeds 10m.

10.4.89 As discussed in Chapter 5: Project Description, the indicative location of the devices will be in depths of 25.5 to 31.5m below Chart Datum, where it is anticipated that the rotor arm to surface clearance, i.e. the distance between the highest arc of the rotor arm and water surface, will be no less than 3.0m at lowest astronomical tide (LAT). Mean Low Water Spring (MLWS) at Kyle Rhea is 0.8m above LAT, meaning that the total clearance from rotor arm to surface at MLWS is 3.8m. At highest astronomical tide (HAT) this will increase to 9.5m clearance. As a result of their position in the deeper water of Kyle Rhea the devices are in an area where otter are unlikely to be diving to feed and any otter activity in this area is most likely to be the animals transiting the Kyle on the surface. At their shallowest point, whilst stopped due to lower tidal velocities as the tide turns the rotor tips will be beyond the preferred depth for multiple short dives by otter. .

10.4.90 The Project requires a fast flowing tidal stream, and the parts of the tidal cycle exploited during power generation are the least favoured by otters to potentially cross Kyle Rhea, or forage within the main channel. Otters attempting to hunt within the main tidal stream would consume energy reserves for little gain. Therefore otters are not expected to hunt in the main in such fast flowing and deep water, preferring shallow subtidal foraging areas.

10.4.91 Evidence from the vantage point surveys indicates otters are transiting the strait to the north of the proposed locations of the devices. Analysis of Acoustic Doppler Current Profile (ADCP) data (Partrac, 2010) shows the current flow profile at the preferred location for the devices is highest around the proposed location of the devices, and otters were not observed within this area. All otters observed transiting the strait were to the north of the area of highest flow, were the effort required to swim across the current would be less.

10.4.92 In summary, although otters may cross Kyle Rhea, it is unlikely they would dive in the deeper water where the devices are installed when the tide is fast flowing. This means that otters are unlikely to interact with the rotors.

10.4.93 Any interaction with SeaGen devices is considered highly unlikely and of **low** magnitude. Otters are of **high** value and the surrounding coastal habitat is also a stronghold for otters, however, the main channel during energetic tidal flow is considered to be of **low** value to otters due to the speed of tidal flow and unsuitable depth for foraging. The significance of this impact is considered to be **minor adverse**.

Impact 14: Suggested Mitigation
1. It maybe be necessary to monitor otters, this will be agreed with SNH.

Residual impact

10.4.94 As no mitigation is recommended, the residual magnitude of this impact is considered to remain **low** and thus the impact significance is **minor adverse**. In regard to the EIA regulations, this impact is not considered significant.

Impact 15: impacts to protected species due to onshore maintenance

10.4.95 A number of sites for protected species were identified during desk studies and surveys undertaken for this assessment. Those species protected under the legislation outlined in the legislation (Section 10.2). These include: bluebell, otter, pine marten, bat, adder, slow worm, small pearl-bordered fritillary, large heath as identified by the desk study and Extended Phase 1 Habitat surveys.

10.4.96 The habitats within the Project footprint are considered to be of **medium** value for flora species, and **low** value for fauna. The Project has been designed, as far as possible, to avoid direct impacts on protected species habitat during operation and maintenance. It is therefore considered unlikely that there will be any direct impacts on protected species works will be temporary of short-term duration and of **low** magnitude. This will result in a **minor adverse** impact, depending on the works required and their location.

Impact 15: Suggested Mitigation
1. Should any necessary maintenance be required, including the extraction of cables, then this will result in potential impacts similar to the construction phase. Therefore, the mitigation associated with construction applies here also. This may include the necessity for walkover surveys prior to construction.

Residual impact

10.4.97 Following the implementation of these mitigation measures the impact magnitude is considered to be **low** and therefore the impact significance is assessed as **minor adverse**. This is not significant under EIA regulations.

Impact 16: impacts to otters due to offshore maintenance

10.4.98 Offshore maintenance activities will most likely be undertaken by small personal vessel, deploying from existing slipways. The number of personnel required to maintain the coastal/offshore elements of the Project will be limited, and Kyle Rhea is regularly transited by vessels, to which the otter population is habituated.

10.4.99 As previously discussed, the habitat around the devices is considered to be of **low** value for otters, whilst the area around the existing ferry slipway is of **medium** value. It is considered unlikely that there will be any direct impacts on otters as the slipway is regularly used during the seasons when the ferry is operational and a small vessel will constitute a small increase to the existing disturbance. There are no records of otter interactions with any vessel at the site, and risk of vessel collision or significant disturbance due to human presence during operation and maintenance is assessed to be unlikely and therefore low magnitude. This will result in a minor adverse impact, depending on the works required and their location.

Impact 16: Suggested Mitigation
No mitigation suggested

Residual impact

10.4.100 As no mitigation is proposed, the magnitude remains **low** and therefore the impact significance is assessed as **minor adverse**. This is not significant under EIA regulations.

Potential impacts during the decommissioning phase

10.4.101 After the planned lifetime of operation of the Project (25 years), SeaGeneration (Kyle Rhea) Ltd will decommission all 4 SeaGen devices and where appropriate, associated infrastructure.

10.4.102 As the exact details of the project design and the installation method are not yet finalised, a detailed decommissioning plan will be submitted for approval by the regulatory authorities prior to construction as required by section 105 of the Energy Act 2004 and will comply with all relevant guidance and best practice of the time.

10.4.103 Should the onshore export cables require removal, then the impacts associated with this removal are anticipated to be the similar as those of construction.

10.4.104 Should the export cables remain in-situ, then no further impacts are predicted to terrestrial and intertidal receptors.

Potential cumulative impacts

10.4.105 No projects have been identified within the vicinity of the Project which could have cumulative impacts with this proposed development.

10.4.106 Existing activities of the FCS in Kylerhea and visitors to the otter hide may add to the levels of traffic and disturbance during construction. These impacts will be minor and only occur for the duration of the construction. Therefore no significant impacts are predicted.

10.5 Summary

10.5.1 The main potential impacts posed by the Project relate to otters, due to their high activity in the vicinity of the Project and their very high sensitivity as an EPS and a designated feature of the nearby Kinloch and Kyleakin SAC. Information to inform an Appropriate Assessment is provided in Royal HaskoningDHV (2012).

10.5.2 Otters resting places and holts were found at the coast, informed by otter walk over, vantage point and intertidal surveys undertaken to inform the EIA, and from the historical report undertaken by Cottis (2000). Otter activity was recorded predominantly north of the ferry slipway. Since directional drilling will be used to avoid the coastal area north of the ferry slipway, the potential for direct habitat loss or destruction of holts or resting sites across this sensitive stretch is greatly reduced. Construction activities will cause temporary noise disturbance in the short term, and if drilling activities take place at Option 2, this will take place adjacent to the coastline. There potential impact to otters is assessed to be of moderate adverse significance for noise disturbance, however given the short term nature of the work and the mobility of otters, and the scrutiny required for an EPS licence, this can be reduced to minor adverse significance in EIA terms.

10.5.3 The Project has been situated outwith the Kinloch and Kyleakin SAC & SSSI, to avoid adverse impacts to the wet heath, a qualifying feature of the SAC.

10.5.4 Where hard-standing is created, there will be permanent habitat loss of and small footprint of wet heath, acid grassland and scrub at Option 1 footprint, or acid grassland at the Option 2 footprint. All other disturbance impacts will be short term and temporary during the period of construction.

10.5.5 Following the mitigation measures outlined in this impact assessment, the residual impacts to these receptors will be minor adverse, which is not significant according to EIA regulations.

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11 ORNITHOLOGY

Page

11.1 Introduction

11.1.1 This chapter of the Environmental Statement (ES) describes the existing bird interests within the proposed Kyle Rhea Tidal Stream Array ('the Project') area and adjacent marine buffer area and shorelines. This Chapter compliments the separate evaluation of potential ecological effects in Chapter 10, Terrestrial and Intertidal Ecology, Chapter 12, Marine Mammals and Basking Shark, Chapter 13, Benthic Ecology and Chapter 14, Fish and Shellfish and has been completed by Natural Research Projects Limited (NRP).

11.1.2 It presents the findings of an assessment of potential impacts arising from the installation, operation and decommissioning phases of the Project. The process used to determine the Nature Conservation Importance of the bird species present is described and the ways in which birds might be affected by the installation, operation, decommissioning of the Project are explained. The magnitude of potential impacts of the Project and the significance of those potential impacts is assessed.

11.1.3 This chapter is supported by the following technical appendix:

- Appendix 11.1: Year 1 Bird surveys technical report.
- Appendix 11.2: Theoretical connectivity to SPAs using generic foraging range metrics.

Study area

11.1.4 The study area consists of the area surveyed. This was contiguous with the array area (an area measuring 110m x 615m that will contain the devices, indicative layout shown in Figure 5.1), plus a surrounding buffer. The buffer extends to include the rest of Kyle Rhea sound and measures approximately 700m wide (east–west) by 3km long, orientated approximately north-south (see Figure 2 in Appendix 11.1). To the east and west the buffer extends to the shorelines. To the south, the area extends to opposite Kylerhea village, where the sound widens out into Glenelg Bay, while to the north it extends to Garbhan Còsach, where the sounds joins Loch Alsh. The results of the survey (**Appendix 11.1**) are considered for baseline characterisation studies.

Overview of potential impacts

11.1.5 The Project will comprise four 2MW devices, each with 20m diameter rotor . The devices will be secured to the sea bed near the deepest part of the sound (see Figure 5.1). A detailed project description, including indicative device layout and installation and operational procedures, is presented in Chapter 5, Project Description of this ES.

11.1.6 Ornithological interests have the potential to be affected by the following elements of the Project:

- Installation activities;
- Operational activities, including device function and maintenance works;
- Decommissioning; and,
- Cumulative effects of the Project alongside other marine renewable power developments in the region, whether operational or in application.

11.1.7 The evaluated potential impacts of the Project on birds include:

- Direct sea-bed habitat loss due to the placement of the devices;
- Indirect habitat loss due to the displacement of birds, in particular due to disturbance from vessels and operation of the devices;
- Habitat modification due to the placement of the devices in the Project site;
- Collision with the devices;
- Accidental pollution and contamination;
- Disturbance and habitat change on land; and
- The beneficial contribution made by the Project towards countering climate change, although uncertainties regarding climate change predictions mean that it is not currently possible to quantitatively assess these effects on birds. However, climate change is widely perceived as an important long-term threat to the global environment, particularly to biodiversity and to birds. Thus, in the UK, the continued rise in mean global temperatures is predicted to affect the size, distribution, survival and breeding productivity of many bird species (Leech 2010).

11.1.8 Potential for collision of seabirds with the rotors during operation is poorly understood, as tidal technology has not yet been deployed in large scale field situations where potential for bird interactions may occur. Therefore, collision risk are assessed only semi-quantitatively.

11.1.9 Not all of the potential impacts identified are relevant to all types of bird which may be affected by the Project. Notably, impacts to terrestrial bird species are likely to be limited to land-based activities. In addition, seabirds that restrict their activities to the sea surface and air will not be at risk of collision with the submerged infrastructure.

Potential impacts on SPA interests

11.1.10 The level of connectivity by birds using the survey area to SPA populations is considered to be either zero or extremely low for all species that regularly use the site and could be plausibly affected by the Project (Appendix 11.2). A screening exercise is presented in Appendix 11.2 which concludes that there is no potential for a LSE on any qualifying feature from any SPA and therefore that HRA assessment is not required for the Project.

Policy, legislation and guidance in relation to ornithology

11.1.11 The following guidance and legislation was taken into account during this assessment:

Legislation

- Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000
- 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) ;
- Marine Scotland Act 2010;
- Wildlife and Natural Environment (Scotland) Act 2011;

Guidance

- EMEC and Xodus AURORA. Report Scottish Government (2010). DRAFT Consenting, EIA and HRA Guidance for Marine Renewable Energy Developments in Scotland. Part 3 - EIA & HRA guidance.
- Jackson and Whitfield (2011). Guidance on survey and monitoring in relation to marine renewables deployments in Scotland. Volume 4. Birds. Unpublished draft report to Scottish Natural Heritage and Marine Scotland
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Conservation listings

- UK Biodiversity Action Plan (BAP);
- Birds of Conservation Concern (BoCC3) 'Red List' (Eaton *et al*. 2009); and
- IUCN threatened species list.

11.2 Methodology

Consultation in relation to ornithology

11.2.1 Scoping responses were received from SNH and RSPB (provided in Appendix 4.1) and these are summarised in Table 11.1.

Table 11.1. Issues in the scoping opinion (Appendix 4.1).

Comment	Response
The ES needs to show that the applicants have taken account of the relevant wildlife legislation and guidance. (Scottish Ministers)	Legislation and guidance that is relevant to birds has been taken fully into account. The relevant legislation and guidance taken into consideration is listed in Section 11.4
The presence of protected species such as Schedule 1 Birds or European Protected Species must be included and considered as part of the application process. (Scottish Ministers)	Noted. All Schedule 1 and Annex 1 bird species occurring on or near the Project are fully considered in this chapter. In particular, Schedule 1 species are all considered to have high Nature Conservation Importance (Table 11.2).
The list of sites of European importance potentially affected by the Project and shown in Table 4.1 of the Scoping Report is incomplete. (SNH and RSPB Scotland)	Results of screening for theoretical connectivity between Kyle Rhea and seabird breeding colonies designated as SPAs has been revised. The results are presented in Appendix 11.2 and summarised in section 11.13
The Project could impact birds in the following ways: indirect loss of habitat through displacement/disturbance; collision mortality, potential contamination and pollutants; lighting effects; indirect effects (e.g. reef effects).	The potential impacts on birds of habitat loss, collision mortality and pollution/contamination are each addressed in the assessment of impacts in section 11.4. The surveys collected data on where and when birds dived, with respect to tide cycle, location and bathymetry and these data are used, as far as possible,

Comment	Response
Cumulative aspects will also be important. (SNH)	estimate collision risk to diving birds. The possible impacts arising from operational disturbance, lighting and artificial reef are all considered. The potential of cumulative impacts is addressed in section 11.4.
The methods proposed have not been agreed with SNH. The survey should record bird species, numbers, and behaviour in order to characterise the use of the site. Particular attention should be paid to diving behaviour and where and when (state and flow speed of tide) it occurs and for which species. (SNH)	The methods were further discussed in meetings with SNH and Marine Scotland on 11/11/11 and 26/06/12, and an interim report provided on 21/05/12.
The assessment should consider how the Project would be likely to impact upon diving species at different times of the year (SNH and RSPB Scotland)	Year 1 survey work quantified season changes in abundance for all birds species using Kyle Rhea. The seasonal abundance of diving birds is presented in Appendix 11.1 and summarised in the species summary accounts in section 11.3 for medium and high priority species. Where there is a plausible concern for collision risks to a diving bird species, this is considered in the assessment of impacts presented in section 11.4
Suggestion to contact RSPB and Highland Bird Recorder to obtain any historical data. (RSPB Scotland)	Both RSPB and Highland Bird Recorder were contacted for historical data.
Consideration of interactions between devices and diving birds is novel. The principle variables will be marine currents and distribution of food resource within an area, which will determine their diving depth, location and period. (RSPB Scotland)	It is correct that there is no recognised method to model the collision risk to diving birds posed by the rotors. The analysis of collision risk presented in section 11.4 includes bird behaviour and current speed variables as far as possible.
The indirectly via effects of noise on prey species should not be scoped out at an early stage, albeit they will most likely be of a temporary nature and unlikely to lead to a significant impact. (RSPB Scotland)	The impacts of noise on fish species is considered in Chapter 14, Fish and Shellfish. The impact of changes to prey species on birds is considered in Section 11.4.
Species identified so far seem relevant, although scoping out terns at this stage may or may not be appropriate, subject to confirmation of the tern species present, given the minimum of 3m beneath the water surface for the rotors. (RSPB Scotland)	Survey work shows that Kyle Rhea is of negligible importance for all tern species as detailed in Appendix 11.1
The claim that birds use vision for prey capture and therefore will see and so avoid underwater	The point is noted and agreed. The whole subject of avoidance of underwater hazards by

Comment	Response
devices may be flawed as their field of vision may be short-range, and focus on prey may lead to failure to "see" or react to a device (G. Martin pers. comm). (RSPB Scotland)	birds is poorly understood and this is acknowledged in the assessment of collision risk. Nevertheless vision appears to be the most likely mechanism that diving bird would use. The uncertainty is over how effectively and at what range they can use vision to detect hazards such as turbines.

11.2.2 The following key field survey requirements were identified:

- Year-round vantage point (VP) surveys to assess the use of the sea and shorelines in the study area by seabirds, waterfowl and waders;
- Walkover surveys of terrestrial habitats along the Kyle Rhea coastline;

11.2.3 The scoping study also identified that the site is not part of, or immediately adjacent to, any international or national site designated for ornithological features. However, because of the ranging behaviour of some bird species it is possible that there is connectivity between the array area and some designated sites in the region (see, ‘Designated Sites’ under Section 11.3.)

Data collection

11.2.4 The field survey and data analysis methods are fully described in **Appendix 11.1**: Year 1 Birds Technical Report and are summarised below.

11.2.5 Pilot work undertaken in July 2011 showed that shore-based survey methods were most appropriate to baseline characterisation surveys of the array area. Shore-based methods were chosen in preference to boat-based or aerial methods because, where practical, they have significant advantages in terms of the quality and quantity of data collected, organisational logistics and generally lower costs. The pilot work showed that from elevated vantage points (VPs) under reasonable conditions (sea state 4 or less) and, with the aid of x10 binoculars, it is practical to detect, identify and accurately map the location of birds seen up to at least 1km from the vantage points. The width of Kyle Rhea sound is approximately 750 m and thus these methods allow birds to be surveyed across the sound from a location on one shore.

11.2.6 Regular VP observations assessed in this chapter were made from July 2011 to July 2012, with data collection continuing at ti`me of writing. Two VPs on the Skye side of the sound were selected to give optimal views. VP1 overlooked the southern part of the sound, including the array area. VP 2 overlooked the northern part of the sound. Together, these two VPs gave almost total coverage of Kyle Rhea sound (Figure 2. in **Appendix 11.1**).

11.2.7 The planned watch effort was 12 hours of observations each month from each VP. This was undertaken in a series of 3 hour watch sessions on different dates. Watches were only conducted in good conditions for detecting and identifying birds and marine mammals, which in practice meant restricting surveys to condition of sea state 4 or below, and avoiding heavy rain. In some months poor survey conditions prevented the target effort being fully achieved, in which case the shortfall was made up for the following month when conditions allowed. As far as possible watch effort was evenly spread between VPs, and across the day light hours and tidal conditions (**Appendix 11.1**).

11.2.8 The VP survey programme was designed to collect data on the distribution, abundance and behaviour of marine mammals as well as birds. Assessment of marine mammal results is covered in **Appendix 12.2** and Chapter 12, Marine Mammals and Basking Sharks. VP surveys consisted of repeated alternating short bouts of three activities; snapshot scans (SSS) of birds and marine mammals (ca. 15 - 20 minutes); timed marine mammal watches

(MMW) (15 minutes); and timed flying bird watches (FBW) (5 minutes).

11.2.9 The snap-shot scans were designed to give instantaneous samples of the distribution, abundance and behaviour of all birds (and marine mammals) using the sea and coastlines within approximately 1km of the VPs. The position of birds was recorded in terms of a compass bearing and an estimated distance.

11.2.10 The timed 5 minute flying bird watches were designed to systematically quantify the numbers of birds flying through the VP survey areas.

11.2.11 The shorelines adjacent to the marine survey area were surveyed by walkover surveys for scarce breeding birds, non-breeding birds of conservation concern and waders (Figure 3 in **Appendix 11.1**). Walkover surveys were conducted on six occasions at approximately bi-monthly intervals through the year, with three visits made within the breeding season. All incidental records of scarce species seen at other times were also recorded.

11.2.12 Data on vessel activity were systematically collected during VP watches to provide information on baseline vessel disturbance levels, as a source of reference for any subsequent monitoring.

11.2.13 The collection of baseline data is on-going and is planned to continue until two full years of data has been collected.

Impact assessment

11.2.14 Evaluation follows the process set out in the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000 ("the EIA Regulations") and guidance on the implementation of the Birds and Habitats Directives (SERAD 2000).

11.2.15 Judgement is made against the general expectation that the Project would not have a significant adverse effect on the overall population, range or distribution of bird species; and that it would not interfere significantly with the flight paths of migratory birds. In assessing the impacts, consideration is given to the relevant populations of the species. Trivial or inconsequential impacts are excluded.

11.2.16 The assessment determines the potential impacts of the Project and the likelihood of their occurrence. In judging whether a potential impact is significant or not, two factors are taken into account:

- The magnitude of the likely impact;
- The Nature Conservation Importance (NCI) of the species involved.

11.2.17 The significance of potential impacts is determined by integrating the assessments of Nature Conservation Importance, magnitude and vulnerability of impacts in a reasoned way (Institute of Ecology and Environmental Management, 2010). In judging significance, consideration is given to the population status and trend of the potentially affected species. If a potential impact is determined to be significant, mitigation measures to avoid, reduce or remedy the impact are suggested wherever possible.

Methods used to evaluate Nature Conservation Importance (NCI)

11.2.18 The Nature Conservation Importance (NCI) of the bird species potentially affected by the Project is defined according to Table 11.2.

Table 11.2: Determining factors for Nature Conservation Importance (NCI)

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). Species present (and in the case of seabird species making use of the area) in nationally important numbers (>1% national population).
Moderate NCI	Other species listed in the UK Biodiversity Action Plan (BAP) Other species listed on the Birds of Conservation Concern (BOCC) 'Red' list Other species listed on the IUCN threatened 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 Project. Species present (and in the case of seabird species making use of the area) in regionally important numbers (>1% regional population).
Low NCI	All other species not covered above.

Methods used to evaluate the magnitude of impacts

11.2.19 Impact is defined as a change in the population of bird species present as a result of the Project, with change occurring either during or beyond the life of the Project. Where the response of a population has varying degrees of likelihood, the probability of these differing outcomes is considered. Note that impacts can be adverse, neutral or favourable.

11.2.20 Magnitude of impact is assessed in respect of an appropriate ecological unit. In the present case for non-seabird species the appropriate regional ecological unit is taken to be Natural Heritage Zone (NHZ) 8 'Western Highlands' (Scottish Natural Heritage, 2001). For seabirds other than gannet, the appropriate regional ecological unit is considered to be north-west mainland Scotland. This is defined as the north-west coast of Sutherland, the west coast of Ross, Skye and Lochalsh and Lochaber. For gannet, a species with a very large foraging range, north western Scotland and the Outer Hebrides is considered to be the appropriate regional ecological unit.

11.2.21 Impacts are categorised in terms of their temporal magnitude (four categories) as detailed in Table 11.3.

Table 11.3: Definitions of temporal scale a factor in magnitude.

Temporal scale	Definition
Permanent	Impacts 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.

11.2.22 Impacts are also categorised in terms of their predicted magnitude on the bird population under consideration (four categories, Table 11.4), and the sensitivity of the receptor population in terms of its capacity to accommodate changes caused by the impact (four categories, Tables 11.5).

Table 11.4: Criteria for assessing the magnitude of impacts on bird populations

Magnitude	Definition
High	Major reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: >20% of population affected, >20% change in mortality or productivity rate.
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, 6-20% change in mortality or productivity rate.
Low	Small but discernible reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 1-5% of population affected, 1-5% change in mortality or productivity rate
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, <1% change in mortality or productivity rate.

Evaluating the sensitivity of impacts

11.2.23 Sensitivity and vulnerability are related but different concepts. Sensitivity as used here is a characteristic of a receptor population under consideration and is a measure of how sensitive it is to a particular impact. Sensitivity is a measure of likely size of change to a population in terms of its size, reproductive output or geographical range that would result as a consequence of it experiencing a given impact. It can also be thought of as a measure of the capacity of a population to absorb an impact. The term vulnerability as used here is a characteristic of a species, and is a measure of how likely a species is to experience a given impact or a collection of impacts.

11.2.24 The question of how vulnerable seabird species are to impacts caused by tidal devices has recently been reviewed by Furness *et al*. 2012. As part of this review species were rated on a number of criteria and the scores combined to give an overall vulnerability score, with a higher score indicating a greater level of vulnerability. These scores were then used as the basis for categorising each species into one of five generic vulnerability categories ranging from very low to very high. The criteria used included the potential for collision, response to vessel disturbance and flexibility of their foraging behaviour.

11.2.25 The methods used by Furness *et al.* (2012) and their resulting generic vulnerability scores are considered to be entirely appropriate with respect to the Project and are therefore adopted. However, it should be noted that these are scores of generic vulnerability to tidal stream devices and the actual vulnerability of a species to the proposed devices at Kyle Rhea may be lower. For example, if a species has a high generic vulnerability score but does not use the tidal array area at Kyle Rhea, then its vulnerability to the devices at Kyle Rhea will be negligible.The generic vulnerability scores and categories are presented for relevant species in Table 11.5.

Table 11.5. Species generic vulnerability to tidal turbine impacts ordered by vulnerability score. Based on Furness *et al* . 2012.

Species	Generic vulnerability score	Generic vulnerability category
Black guillemot	9.9	High
Razorbill	9.6	High
Shag	9.6	High
Common guillemot	9.0	High
Cormorant	7.0	High
Red-throated diver (also surrogate for goosander)	3.8	Moderate
Black-throated diver	3.6	Moderate
Slavonian grebe (surrogate for little grebe)	2.0	Low
Gannet	1.4	Low
Great black-backed gull	1.0	Very low
Kittiwake	0.9	Very low
Herring gull	0.8	Very low
Common gull	0.7	Very low
Lesser black-backed gull	0.7	Very low
White-tailed eagle	0.6	Very low

Species	Generic vulnerability score	Generic vulnerability category
Common tern	0.6	Very low

11.2.26 In determining the significance of impacts (Table 11.7), the sensitivity and ability to recover from temporary adverse conditions is considered in respect of each potentially affected population. Sensitivity is determined according to each species populations' ecological function and behaviour, using the broad criteria set out in Table 11.6. The assessment takes account of information available on the responses of birds to various stimuli (e.g. existing marine developments such as wind farms, noise and disturbance by humans). Note, however, 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 that 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 type of activity of the bird, with, for example, a species likely to be less tolerant of disturbance whilst breeding than at other times in its life. Seabirds at sea are likely to be more vulnerable to the impacts of disturbance, displacement and barriers when they are subject to particular time and energy stresses, such as when provisioning young and during moulting. Some species, notably auk and duck species, are particularly vulnerable to disturbance during the period of annual wing moult when they are temporally flightless.

Table 11.6: Criteria for assessment of sensitivity of bird populations

Receptor Sensitivity	Definition
High	No capacity to accommodate the proposed form of change.
Medium	Low capacity to accommodate the proposed form of change.
Low	Some capacity to accommodate the proposed form of change.
Negligible	Receptor is likely to have tolerance to accommodate the proposed change.

Evaluating the level of significance of impacts

11.2.27 The significance of an impact on a receptor population is judged by combining the category of magnitude with the category for sensitivity (Table 11.6).

Table 11.7: The level of significance of an impact resulting from each combination of sensitivity and magnitude

Sensitivity	Magnitude			
	High	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

11.2.28 Where the available data allow, the conservation status of each potentially affected bird species is evaluated within the appropriate regional ecological unit (as defined above). 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. Where information on regional conservation status are unavailable, information on conservation status at a wider geographic scale is used, e.g., Forrester and Andrews *et al* 2007, Eaton *et al*. 2011.

11.2.29 Potential impacts are evaluated in respect of all species of high or moderate Nature Conservation Importance (see Table 11.2) that regularly use the study area and could be plausibly affected by the Project.

11.2.30 In considering the Nature Conservation Importance (NCI) of potentially affected species, consideration has been given to the criteria in Table 11.2. As explained in the species accounts that follow, a number of high or moderate NCI species were screened out on the basis that they only overfly the site and therefore could not be plausibly affected. These species were: golden eagle, common tern, peregrine and merlin. A few other high or moderate NCI species were screened out on the basis that numbers recorded were very small in comparison to the regional population sizes (<0.5%) and/or they were not regularly present. These included black-throated diver, starling and twite.

11.2.31 Common seabird species that do not merit a NCI categorisation of moderate or high on the basis of listing on Annex 1 of EU Birds Directive, Schedule 1 of WCA, BoCC Red List or UK BAP list, were only considered to merit moderate NCI if more than 1% of the regional population regularly used the survey area in at least one season of the year. Further, species that only exceeded the 1% threshold on account of birds flying through the site, were not considered to qualify as moderate NCI, as such transiting flying birds could not plausibly be adversely affected (i.e. they were categorised as low NCI). This meant that fulmar, gannet, kittiwake, razorbill, great-black-backed gull were all categorised as low NCI even though relatively large numbers overflew the survey area.

Methods used to evaluate species priority in assessment

11.2.32 So that the EIA process can focus on relevant species and issues, each species was rated as high, medium or low priority for the EIA. If there was uncertainty as to which category was most appropriate for a species a more conservative (higher) category was chosen.

11.2.33 High priority species are those that merit the greatest level of scrutiny because the impacts on these could potentially lead to significant changes to their regional population status.

11.2.34 Medium priority species for EIA also merit detailed consideration, nevertheless it is clear that any impacts are unlikely to have potential to lead to significant change of regional populations even under pessimistic scenarios because the numbers using the site or their vulnerability to the impacts of tidal arrays are too low. Nevertheless, impacts on these species should be assessed and any adverse impacts reduced where possible through mitigation.

11.2.35 Low priority species are all species that do not merit categorisation as either high or medium priority. By definition these are species that occur at Kyle Rhea but for which Kyle Rhea has negligible importance because the numbers occurring are small in the context of their regional populations and/or they are not recognised as having particular conservation value or priority.

11.2.36 The criteria used to determine the assessment priority of species are summarised in Table 11.8, below.

Table 11.8. Criteria used to categorise species priority for EIA

Category	Criteria
High	Species for which >1% of the assumed regional population uses the survey area in at least one season of the year. And that fulfil at least one of the following criteria: • Species listed on Annex 1 of EU Birds Directive or on Schedule 1 of WCA that were regularly recorded using the Array area in reasonable numbers in the context of the regional population size. • Species that have at least moderate vulnerability to the impacts of tidal arrays. • Species with at least Moderate theoretical connectivity to one or more SPA and that at times use the Array area in reasonable numbers in the context of the population size.
Medium	Species for which >0.1% of the assumed regional population uses the survey area in at least one season. And that fulfil at least one of the following criteria: • Species that have at least moderate vulnerability to the impacts of tidal arrays. • Species with low theoretical connectivity to one or more SPA and at times use the Array area in reasonable numbers (>0.1% of the regional population) in the context of the population size. • Species with High or Medium theoretical connectivity to one or more Ramsar site or SSSI that is not otherwise designated SPA for the species, and at times use the Array area in reasonable numbers (>0.1% of the regional population) in the context of the population size. Or, • Species for which >1% of the assumed regional population uses the survey area in at least one season of the year and that have a Low or Very Low vulnerability to the impacts of tidal arrays.
Low	All other species

11.2.37 All high and medium priority species are considered in the assessment of predicted effects arising from the Project (i.e., the EIA). Low priority species are not thought to be plausibly affected by the Project thus obviating any further consideration under the subsequent EIA assessment process.

11.3 Existing environment

Site description and bird habitats

11.3.1 Kyle Rhea sound is a sea channel approximately 3km long and 0.7km wide between the northern-eastern part of the Isle of Skye and the Scottish mainland (see Figure 1.1). The land either side rises steeply to several hundred metres and as a result the Sound is relatively sheltered from prevailing westerly winds (see photos in Appendix 11.1). The shorelines are mostly rocky. There are occasional steep-sided streams entering along the shores. The small stream that enters approximately half way along the west side by the small lighthouse is notable as it has an associated area of intertidal sand and gravels where it enters the Sound, providing important habitats for some bird species. A series of low intertidal skerries occur close to the western shores north of the same small lighthouse and these too are notable for their wildlife importance, as resting sites for seabirds and seals. The land adjacent to the shores is a mix of rough moorland with heather and bracken and commercial conifer plantations.

11.3.2 A detailed description of the terrestrial and marine (benthic) habitats in the vicinity of the Project is provided in Chapters 10 and 13, respectively.

Designated sites

11.3.3 No part of the Project area lies within a site designated as a SPA, a SSSI or Ramsar site. However, there are several SPAs, SSSIs and Ramsar sites in the wider region designated for their breeding seabird populations. A Screening exercise was undertaken determine the extent of connectivity that is likely between SPAs designated for seabirds and Kyle Rhea (Appendix 11.2).

11.3.4 Information on the typical size of foraging ranges of breeding seabirds (e.g., Thaxter *et al*. 2012) gives a good indication of whether there is likely to be connectivity during the breeding season between a particular seabird SPA colony and a development site for given species, and if so approximately how strong it is likely to be (see Appendix 11.2).

11.3.5 Kyle Rhea sound is potentially within the foraging range of several qualifying seabird species breeding at SPAs within the region. Four SPAs are of particular relevance because Kyle Rhea is both within range for at least one of their qualifying species and this species also regularly uses the sound. The relevant SPAs are: Rum SPA (closest part 46km away), Canna and Sanday SPA (61km away), Shiant Isles SPA (86km away) and St Kilda SPA (202km away).

11.3.6 The closest SPA gannet colonies are located at Flannan Islands SPA (188km), St Kilda SPA (208km), North Rona and Sula Sgeir SPA (217km). These three SPAs lie within, but close to, the upper limit of the 'mean maximum foraging range (MMFR) for gannet (229km, Thaxter *et al* 2011). The two closest designated seabird colony SPAs to Kyle Rhea are Canna and Sanday SPA (61km) and Shiant Isles SPA (86km), however, the distance to these SPAs is greater than the foraging range of the other seabird species that regularly occur in Kyle Rhea during the breeding season (Appendices 11.1 and 11.2).

Summary of ornithological interest

11.3.7 The following summary of the ornithological observations is based on the results of baseline studies at the Project area and adjacent buffer areas made from July 2011 to July 2012. Full details of survey methods, effort and results are given in **Appendix 11.1**, together with relevant contextual information (e.g., regional population size and conservation status) for each species.

11.3.8 The area covered by the baseline survey work included the array area (described in Chapter 5, Project Description) and a surrounding buffer area that extended over almost the whole of the rest of Kyle Rhea sound and adjacent shorelines. The locations and coverage of the two vantage points used for watches and the coastal walkover survey routes are illustrated in Figure 2 in **Appendix 11.1**.

11.3.9 The program of year-round survey work was completed as planned and no serious problems were encountered. The results provide high quality data on the abundance, distribution, seasonal occurrence and behaviour of birds using the survey area (**Appendix 11.1**).

11.3.10 Twenty one species of seabirds and other water birds were regularly recorded (seen on more than three occasions) in the vantage point survey area during baseline surveys. A number of less common species were also recorded (Appendix 11.1). The status and importance of the species recorded during Year 1 baseline surveys is summarised in Table 11.9.

11.3.11 Only two species merit categorisation as high priority for the EIA under the criteria in Table 11.8, namely cormorant and white-tailed eagle. Four species merit categorisation as medium priority for the EIA, namely red-throated diver, shag, goosander and grey heron.

11.3.12 Individual species summaries are provided below for the six species that were rated as having either high or medium priority for EIA of the Project. Species rated as low priority are not given individual summarises below because, by definition, these have low relevance for the Project. Full details of Year 1 surveys results for all species, including low priority species, are presented in **Appendix 11.1**.

Cormorant

11.3.13 The regular presence of relatively large numbers of feeding and roosting cormorant in is arguably the most important ornithological feature of the survey area. For this reason cormorant is the only seabird rated as high priority for the EIA. Cormorant is rated as having a high generic vulnerability (generic vulnerability score 7.0) to the potential impacts of tidal arrays (Furness *et al*., 2012). The high generic vulnerability score of this species is mainly due to the combination of the potential for collision and the species' relatively small foraging range. Cormorant is rated as moderate Nature Conservation Importance because the survey area regularly supports >1% of the regional population.

11.3.14 Cormorants are a large diving seabird of coastal marine habitats and inland water. They have with an obligate requirement for terrestrial roosts sites (including solid structures at sea), where they spending a high proportion of their time perched. They dive from the water surface in search of fish using a combination of visual and tactile methods to locate prey, both from mid-water and the sea bed (Grémillet *et al*.,1998). Typically dives to water depths of less than 10 m though they are capable of diving to greater depths.

11.3.15 The distance from the survey area to the nearest SPA with cormorant as a qualifying interest (Sheep Island, Northern Ireland, 235km away) is much greater than the maximum foraging distance estimate for cormorant (35km, Thaxter *et al*., 2012). Therefore, it is concluded that the cormorants seen in the survey area are not from SPAs where cormorant is a qualifying feature.

11.3.16 Cormorant was recorded throughout the year in the survey area. They showed a marked seasonal variation in abundance; numbers were much greater in the non-breeding part of the year (September to February) when numbers in the study area peaked at 74 birds (Fig. 1 in **Appendix 11.1**). Up to approximately 10 birds were present during the breeding season (March to August). Almost all the cormorants recorded in the breeding seasons were in adult summer plumage, however, there was no evidence that these individuals were breeding birds.

11.3.17 All cormorant roost sites were located on the west shore of Kyle Rhea (both shores received equal coverage), almost entirely on the skerries between the two VPs (see Map 7 in **Appendix 11.1**). The large skerry at grid reference NG79250/22700 was by far the most important, accounting for 97% (2253 out of 2323 birds) of all the roosting cormorants recorded in baseline surveys. This skerry is over 600m from the closest part of the array area and over 1km from the closest device location. The most southerly skerry (closest the lighthouse) is only occasionally used by roosting cormorants and is approximately 150m from the closest part of the array area and over 600m from the closest device location. Unlike shag, cormorant were not recorded roosting on the shore rocks about 100m south of the ferry terminal on the east side, possibly suggesting they are more sensitive to human disturbance, or that they prefer skerries over shorelines for roosting.

11.3.18 Cormorants were recorded on the sea (n = 576) throughout the survey area but not uniformly so, with nearly a third of records in the Western Side Zone (WSZ). This part of the sound is closest to the regular roost sites (Map 5 in **Appendix 11.1**). Diving cormorant showed an almost complete avoidance of the deepest parts of the sound (areas that are approximately >25m deep) including most of the array area (Map 5 in **Appendix 11.1**). Out of 382 actively diving cormorants recorded during baseline surveys, only 3 individuals (0.8%) were estimated to be inside the array area boundary. The array area occupies 4.5% of the area of VP coverage. Therefore diving cormorants used the array area approximately six times less than would be expected if diving activity was spread evenly across the survey area. It is concluded that there will be very low exposure to potential collision risk from the devices, i.e., the vulnerability of cormorants to collision impacts in Kyle Rhea is very low.

11.3.19 Cormorant is a relatively uncommon breeding species on the north-west coast of Scotland and Inner Hebrides. They are also a relatively sedentary species (Wernham *et al.* 2002). The regional population for north-west Scotland (Sutherland to Lochaber and excluding the Outer Hebrides) is approximately 347 pairs breeding at sixteen colonies (Seabird 2000 count, Mitchel *et al*. 2004). Assuming that about one third of birds in the region are non-breeding immature birds, this would give a regional population of around 1000 individuals. Further assuming that this population remains in the region through the year and is not joined by individuals from other regions, this would mean that in autumn and winter Kyle Rhea survey area on average supports around 5% of the regional population, and approximately 7% when peak numbers are present.

Shag

11.3.20 Shag is rated as medium priority for the EIA. Shag is considered to have a high generic vulnerability (vulnerability score 9.6) to the impacts of tidal stream devices (Furness *et al*., 2012). The high generic vulnerability score of this species is mainly due the combination of the potential for collision and the species' relatively small foraging range. Shag is rated as low NCI because the survey area supports <1% of the regional population and the species has no special protection.

11.3.21 Shags are a large diving seabird of rocky coastal marine habitats. They have an obligate requirement for terrestrial roosts sites (including solid structures at sea such as buoys), where they spending a high proportion of their time perched. They dive from the water surface in search of fish using a combination of visual and tactile methods to locate prey, both from mid-water and the sea bed (Grémillet *et al*.,1998). Typically dives are to water depths of less than 30 m though they are capable of diving to greater depths.

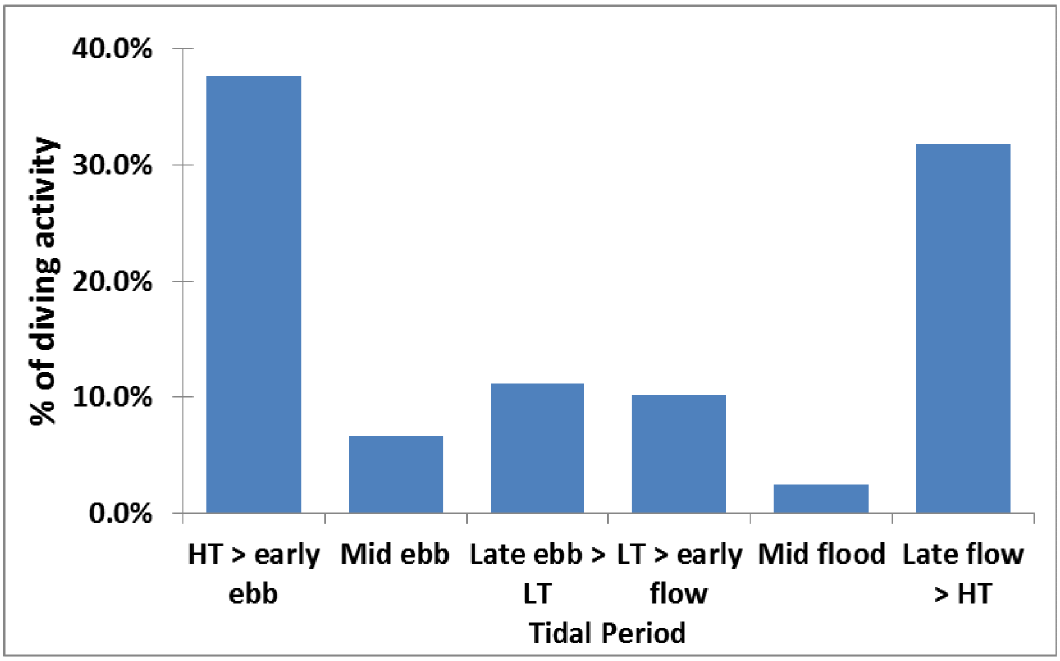
11.3.22 The distance from the survey area to the nearest designated site with shag as a qualifying interest is greater than the maximum foraging distance estimate for shag (17km, Thaxter *et al.* 2012). Therefore, it is concluded that the shags seen in the survey area are not from designated sites where shag is a qualifying feature.

11.3.23 Shags were commonly recorded in all months of the year feeding and roosting in the survey area (Appendix 11.1). The maximum count was 54 birds in February, and at least 25 individuals were present in most months. There was no clear seasonal pattern in abundance. There was no evidence of reduced abundance during the breeding season (April to mid-July); however, many individuals present in the breeding season were in immature plumage. There was no evidence that birds present in the breeding period that were in adult summer plumage were breeding birds.

11.3.24 Shags were seen both on the sea, where they were commonly seen foraging, and on roost sites such as rocky skerries along the Kyle Rhea shores (Appendix 11.1, Maps 6, Photos 6 and 7). The large skerry at grid reference NG79250/22700 was by far the most important, accounting for 93% (2922 out of 3146 birds) of all the roosting shag recorded in baseline surveys. This skerry is over 600m from the closet part of the Array area and over 1km from the closet device location. The skerry closest the lighthouse and the shore rocks approximately 100m south of the east ferry landing were also regularly used by roosting shag.

11.3.25 Diving shags (n = 779) were not uniformly distributed across Kyle Rhea channel (see Appendix 11.1 Figure 2). These results suggest that shags showed a preference for foraging in the shallow parts of the sound along the west and eastern sides of the channel. However, in contrast to cormorant, shags were also seen on several occasions diving in the deepest part of the channel including sometimes in the vicinity of the proposed Array area (see Appendix 11.1 Map 6). Out of 824 actively diving shags recorded during baseline surveys, 28 individuals (3.4%) were estimated to be inside the array area. The array area occupies 4.5% of the area of VP coverage. Therefore it appears that shags used the array area about a quarter less (24% less) than might be expected if diving activity was spread evenly across the survey area. It is concluded that there will be a small potential for collision risk from the devices, i.e., the vulnerability of shags to collision impacts in Kyle Rhea is low to moderate.

11.3.26 Baseline survey observations show that diving activity by shag in parts of Kyle Rhea sound greater than 20m depth (chart datum) was least around mid-tide (9% of total in the 'mid-tide' third of the cycle), intermediate around low tide (21% of total in 'low-tide' third of the cycle) and greatest around high tide (70% of total in 'high-tide' thirds of the cycle) (Graph 1). The minimum current speeds are experienced around high tide and low tide.



Graph 1. Variation in diving activity by shag in parts of Kyle Rhea sound greater than 20m depth in relation to tidal cycle. Tidal cycle is divided into six equal periods each of approximately two hours duration. Values

are corrected for variation in effort between tidal periods. Based on 161 observations of diving shags seen during 356 snapshot scans undertaken in Year 1 of baseline surveys.

11.3.27 The shag is a relatively common breeding species on the north-west coast of Scotland and Inner Hebrides. They are also a relatively sedentary species (Wernham *et al*. 2002). The regional population for north-west Scotland (Sutherland to Lochaber and excluding the Outer Hebrides) is approximately 3224 pairs (Seabird 2000 count, Mitchel *et al.* 2004). Assuming that about one third of birds in the region are non-breeding immature birds, this would give a regional population of around 10,000 individuals. Further assuming that this population remains in the region through the year and is not joined by individuals from other regions, this would mean that that the Kyle Rhea survey area on average supports around 0.4% of the regional population, and around 0.5% when peak numbers are present. On this basis, the numbers of shag present at Kyle Rhea is clearly well below 1% of the assumed regional population (by convention 1% is the threshold used to determine if a site has regional importance).

Red-throated diver

11.3.28 Red-throated diver is categorised as high NCI because it is listed on Annex 1 of the Birds Directive and on Schedule 1 of the Wildlife and Countryside Act. Red-throated diver is rated as having moderate generic vulnerability to the impacts of tidal arrays (Furness *et al*. 2012). As this species occurred regularly during the winter and is specially protected it is rated as medium priority for the EIA.

11.3.29 A single red-throated diver (probably the same individual) was occasionally seen during baseline surveys during the winter months. Almost all diving activity observed occurred in the relatively shallow side zones of the channel (i.e., the WSZ and ESZ habitat zones as defined in Appendix 11.1). Of the 13 records of red-throated diver obtained during baseline surveys, none were within the array area. The closest record was approximately 150m of a proposed device location. Therefore it is concluded that there is little potential for this species to interact with devices and i.e., the vulnerability of birds present in Kyle Rhea to the impacts the devices is low.

11.3.30 The numbers of red-throated divers wintering in north-west Scotland is imprecisely known. O'Brien *et al.* (2008) estimated the number wintering in the north-west Scotland (excluding the Outer Hebrides) to be in the region of 50 individuals, but this may be an underestimate because there has been no systematic survey work undertaken in the region. However the occasional presence of a single red-throated diver in Kyle Rhea is likely to indicate that this area is no more than locally important for the species.

11.3.31 Red-throated divers wintering in western Scotland are likely to be from sub-arctic and arctic breeding grounds such as Greenland, rather than from Scottish breeding population which winters further south (Wernham *et al*. 2002). Although, small numbers of red-throated divers breed in Skye and Lochalsh and could theoretically forage in Kyle Rhea during the breeding season, the baseline survey work provided no evidence that they do so.

Goosander

11.3.32 In view of the numbers present in July and their assumed moderate vulnerability, goosander is rated as a medium priority species for EIA.

11.3.33 Goosander was generally scarce during baseline surveys but a relatively large number (28) was intermittently present for at least ten days in mid-July 2012, shortly after the breeding season. These 28 birds comprised a mix adult females (the minority) and juveniles and probably represented the amalgamation of several broods of local breeding origin. Goosander is a relatively scarce, but probably increasing, breeding species in north-west Scotland and mainly occurs on freshwater (Forrester and Andrews, 2007). The Scottish population is estimated to be at least 2000 – 3000 pairs (Forrester and Andrews, 2007). There is no recent assessment of the numbers breeding in individual Natural Heritage Zones, but probably less than 10% of Scottish total breed in north-west Scotland (based on density maps in Gibbons *et al*. 1993). The occurrence of a moderate-sized flock in the survey area was unexpected and may not be a regular occurrence. Nevertheless, even if the juvenile birds are disregarded (because breeding population size is measured in number of pairs of adults), the numbers at times present in the survey area are likely to approach 1% of the regional breeding population.

11.3.34 All the goosander diving activity observed occurred in the relatively shallow side zones of the channel (i.e., the WSZ and ESZ habitat zones as defined in Appendix 11.1), away from the deeper water where devices are proposed. All records of goosanders diving were well outside (at least 200m) the array area and in relatively shallow parts of the sound. Only one of the 17 records of goosander was within the array area but these birds were not diving; they were seen to fly in and land within the array area and then swim north to outside it and closer the shore without diving. It is concluded that there is little potential for this species to interact with devices and i.e., the vulnerability of birds present in Kyle Rhea to the impacts the devices is low.

11.3.35 Goosander was not considered in the review of vulnerability to impacts of tidal arrays by Furness *et al.* (2012), presumably because this species does not typically occur in marine areas with strong tidal currents. Its vulnerability can be inferred from other species with similar behaviour. Goosander is a fish eating duck that preys on small fish by pursuit diving in relatively shallow (typically <10m deep) water. On this basis the vulnerability of goosander is likely to be similar to that of diver species; these are categorised as having moderate vulnerability by Furness *et al.* (2012).The sea duck species considered by Furness *et al*. (all categorised as low vulnerability) are not likely to be good predictors of goosander vulnerability because they are not pursuit divers.

Grey heron

11.3.36 Even though grey heron almost certainly has a very low vulnerability to tidal arrays it is categorised as medium priority for the EIA because the survey area is assumed to support >1% of the regional breeding population.

11.3.37 Small numbers of grey heron were regularly present feeding along both shorelines throughout the year with up to eight individuals present at times. They were slightly more abundant in the winter (October to February), when the resident population is augmented by migrants from Scandinavia. A small heronry (at least six nests in 2012) is located in conifer trees close to the western shore in the southern part of the survey area at grid reference NG 7870 2156 (see also Kyle Rhea Extended Phase 1 Survey Report, August 2012).

11.3.38 Although grey heron is a common and widespread species across Scotland, the total Scottish population size is modest; it is estimated to be 4200 pairs (Forrester and Andrews 2007). There has been no assessment of regional populations but the densities in north-west Scotland are generally lower than in the lowlands (Gibbons *et al.* 1993). On the basis of the number of birds regularly feeding in the sound and the presence of the small heronry, it is concluded that Kyle Rhea is likely to be regularly used by >1% of the regional population.

11.3.39 Grey heron was not considered in the review of vulnerability to impacts of tidal arrays by Furness *et al.* (2012). The appropriate vulnerability category is almost certainly very low; based on the category assigned by Furness *et al*. to other species that they considered also mainly use terrestrial and littoral zone habitats, in particular white-tailed eagle and common gull.

White-tailed eagle

11.3.40 White-tailed eagle is categorised as of high Nature Conservation Importance because it is listed on Annex 1 of the Birds Directive and on Schedule 1 of the Wildlife and Countryside Act. However, white-tailed eagle is rated as having very low vulnerability to the impacts of tidal arrays (Furness *et al.* 2012) as they do not dive. White-tailed eagle is rated as high priority for the EIA because it has special protection and because of the regular presence of >1% of the UK breeding population in the survey area.

11.3.41 Single adult white-tailed eagles were seen during baseline surveys, hunting and flying over the study area on several occasions through the year, particularly during the breeding season. All the birds seen are almost certainly of the pair that breeds locally (a few km away). This pair is closely monitored by RSPB and is known to have bred successfully in 2012, rearing a single chick.

11.3.42 It is also know that this pair regularly forages in Kyle Rhea sound and Glenelg Bay. White-tailed eagles mostly forage in Kyle Rhea sound during certain flood tide conditions, when it appears that fish are brought closer to the surface on the flood tide and that seals chasing them push the fish to the surface and into shallower water where the gulls and white-tailed eagle are able to catch them with relative ease. The general area at Kyle Rhea where white-tailed eagles are observed foraging and catching prey for themselves is limited to about 200 metres south of the ferry to around the 1.2km further north to approximately level with the small lighthouse. This wide area includes the device locations. However, within this area observations suggest that fish prey is mostly taken away from the deepest parts, probably because fish are pushed up into the shallower areas by a currents and seals, especially near the route of the ferry. A high proportion of the fish seen eaten by white-tailed eagles at Kyle Rhea are kleptoparisitised (stolen) from great-black-backed gulls.

11.3.43 In 2010 (when they also bred successfully (Alison MacLennan RSPB, personal communication)) and 2012 they were observed by local residents and the ferrymen feeding in the sound almost daily during the summer, mostly on the flood tide. It is reported that at times an adult would take fish thrown from boats.

11.3.44 White-tailed eagle is a rare breeding species in Scotland with a total population of around 66 breeding pairs in 2012 (Alison MacLennan RSPB, personal communication). Thus even a single pair represents over 1% of the national breeding population. This population is the result of the successful re-introduction campaign (Bainbridge *et al*. 2003). Kyle Rhea is clearly an important breeding season feeding area for one of the productive breeding pairs.

Table 11.9: Summary of EIA priority, Nature Conservation Importance (NCI), vulnerability to tidal arrays and status of bird species regularly recorded using the survey area during Year 1 baseline surveys.

Species	EIA priority	NCI category	Generic vulnerability category (Furness *et al*. 2012)	Importance of Kyle Rhea to foraging, breeding birds	Importance of Kyle Rhea to foraging, non-breeding birds
Red-throated diver	Medium	High (A1, S1)	Moderate	None (not recorded)	Low single bird wintered)
Little grebe	Low	Low	Low (assumed)	None	Low
Gannet	Low	Low	Low	Very low	Very low
Cormorant	High	Moderate (>1% reg. pop.)	High	None or Very low	Moderate (5% of reg. pop.)
Shag	Medium	Low	High	None or Very low	Low (locally important)
Herring gull	Low	Moderate (BOCC Red List)	Very low	Very low	Low
Lesser black-backed gull	Low	Low	Very low	None or Very low	Very low
Great black-backed gull	Low	Low	Very low	Very low	Low
Common gull	Low	Low	Very low	Very low	Low
Kittiwake	Low	Low	Very low	None	Very low

Table 11.9: Summary of EIA priority, Nature Conservation Importance (NCI), vulnerability to tidal arrays and status of bird species regularly recorded using the survey area during Year 1 baseline surveys.

Species	EIA priority	NCI category	Generic vulnerability category (Furness *et al*. 2012)	Importance of Kyle Rhea to foraging, breeding birds	Importance of Kyle Rhea to foraging, non-breeding birds
Great skua	Low	Low	Very low	None	Very low
Common tern	Low	High (A1)	Very low	None	Very low
Common guillemot	Low	Low	High	None	Very low
Razorbill	Low	Low	High	None or Very low	Very low
Black guillemot	Low	Low	High	None	Very low
White-tailed eagle	High	High (A1, S1, >1% reg. pop.)	Very Low	Moderate	Low
Grey heron	Medium	Moderate (prob. >1% reg. pop.)	Very low (assumed)	Moderate, small heronry present	Low
Wigeon	Low	Low	Very low (assumed)	None	Low
Red-breasted merganser	Low	Low	Moderate (assumed)	None	Very low
Goosander	Medium	Moderate (prob. >1% reg. pop.)	Moderate (assumed)	None	Moderate

Table 11.9: Summary of EIA priority, Nature Conservation Importance (NCI), vulnerability to tidal arrays and status of bird species regularly recorded using the survey area during Year 1 baseline surveys.

Species	EIA priority	NCI category	Generic vulnerability category (Furness *et al*. 2012)	Importance of Kyle Rhea to foraging, breeding birds	Importance of Kyle Rhea to foraging, non-breeding birds
Oystercatcher	Low	Low	Very low (assumed)	Low	Low
Curlew	Low	Low	Very low (assumed)	None	Low
Common sandpiper	Low	Low	Very low (assumed)	Low	Low

11.4 Impact assessment

Do nothing scenario

11.4.1 In a 'do nothing' scenario the range of bird species and their abundance in the areas potentially affected by the Project would not be expected to remain constant over the next 20 years for a number of reasons. However, the range of bird species and their abundance are expected to remain broadly similar to that recorded in baseline surveys. There is a wealth of long term monitoring data on bird populations in the UK (e.g. JNCC seabird colony monitoring programme, Mitchell *et al.* 2004), and these show populations can fluctuate markedly and ranges change in their extent. Seabird foraging distribution is influenced by prey availability, and this will vary, sometimes considerably, from year-to-year and season-to-season in response to natural changes in the marine environment such as sea temperature, currents, and plankton density. Similarly, on land, the areas chosen by birds for breeding and feeding will vary from year-to-year and season-to-season in response to vegetation structure and food availability (amongst other factors), which in turn reflect natural and man induced changes to the environment.

Potential impacts during the installation phase

Impact 1: Disturbance of breeding birds

11.4.2 No birds species listed on Schedule 1 of the Wildlife and Country Act was located during baseline surveys breeding within the survey area, including within 500m of the areas where onshore works are proposed. Nevertheless the possibility that a Schedule 1 species may in future settle to breed within 500m of the areas where shore works are proposed cannot be ruled out.

11.4.3 The small heronry located at grid reference NG 7870 2156 is potentially vulnerable to disturbance during the breeding season (April to August) as it is located close to the shore station and access track. Grey heron is not listed on Schedule 1 of the WCA. The Kyle Rhea heronry is likely to have a few per cent of the regional breeding population, therefore the potential disturbance is rated as an impact of low magnitude.

11.4.4 Assuming no Schedule 1 species have settled to breed within 500m of onshore installation works, the potential impacts of disturbance on breeding terrestrial bird species will non-Schedule 1 species. Grey heron is the only species identified as potentially affected. The impact on this species would be of **low magnitude** and short term. The regional grey heron population is considered to have a **low sensitivity** to disturbance impacts. The impact of disturbance on grey heron is therefore of **minor significance** under the terms of the EIA Regulations.

Impact 1: Suggested Mitigation
19. No specific mitigation is required for any species. 20. Should onshore construction works (currently expected to be during winter months) occur during the bird breeding period (April to August), surveys to locate the nests of birds listed in Schedule 1 of the WCA will be undertaken prior to installation (and prior to decommissioning) works in the areas affected by shore works buffered to 500m. If an active nest of a Schedule 1 species is discovered, then, to comply with WCA legislation, shore activities within a distance of the nest that could lead to disturbance (following recommendations in Whitfield *et al.* 2008) would be halted immediately. A disturbance risk assessment would be prepared under a Breeding Bird Protection Plan (BBPP)

Impact 1: Suggested Mitigation
for the site that would identify measures considered necessary to safeguard breeding attempt of Schedule 1 species (e.g. exclusion zones or restrictions on timing of works) and would be submitted to SNH for agreement before recommencing work. 21. Good practice - to prevent disturbance to breeding grey herons there would be a no-stopping rule for vehicles within 250m of the heronry during the breeding season. To reduce the chance of disturbance to the heronry, the BBPP will advise installation workers to keep themselves and machinery more than 250m away from the heronry during the breeding season.

Residual impact:

11.4.5 The BBPP, if required, will ensure there will be no infringement of the legislation concerning the disturbance of Schedule 1 species. The mitigation measures to reduce disturbance impacts at the heronry would lower the magnitude of the potential impact on this species to negligible and this would then mean this impact was of **negligible significance** under the terms of the EIA Regulations.

Impact 2: disturbance from marine habitats

11.4.6 It is likely that noise and disturbance foraging or resting seabirds from marine habitats and shorelines. The potential for adverse impacts from vessels associated with installation activities would temporarily displace some is greatest in the vicinity of the lighthouse skerries situated along the western side of the sound, particularly the large skerry at grid reference NG79250/22700 located approximately 650m north of the cormorant and shag. These same skerries are also important haul-out sites for seals and these too are potentially vulnerable to disturbance (Chapter 12, Marine Mammals array area, due to the high importance of these skerries for roosting birds, particularly and Basking Shark).

11.4.7 Disturbance effects on seabirds during installation would be confined to routes travelled by installation and survey vessels, and the vicinity of devices. Installation is anticipated to last for up to three months for the foundations and a up to three months the following year for the devices, as described in Chapter 5, Project Description. The proposed route for vessels moving to and from the array area is the middle of the Kyle Rhea channel, i.e., following the line of deep water (Chapter 17, Shipping and Navigation and **Appendix 17.1**). This route passes more than 200m from the lighthouse skerries and is therefore unlikely to lead to disturbance of birds on the skerries. Observations of vessels of many types transiting Kyle Rhea sound during baseline surveys showed that seabirds (in particular shags, cormorant and gulls) roosting on the lighthouse skerries are not disturbed by slow moving (approximately <10 knots) vessels transiting mid channel.

11.4.8 There are no breeding seabird colonies in or close to the areas that will be potentially affected by installation vessel disturbance. Therefore the effects at seabird breeding sites due to vessels during the installation period are likely to be nil. The impact of disturbance on breeding seabirds (low to medium sensitivity depending on species) is judged to be an impact of negligible magnitude and short term duration. It is therefore of minor significance under the terms of the EIA Regulations.

11.4.9 A review paper of vulnerability to effects of windfarms by Garthe and Huppop (2004) gave red-throated diver, cormorant scores of 4 out of 5 for vulnerability to vessels disturbance. This suggests that the high and medium priority seabird species (red-throated diver, cormorant and shag) that forage in the areas likely to be affected by installation vessel disturbance have a relatively high vulnerability to vessel disturbance. However, numerous incidental observations of the response of these species to approaching vessels during baseline survey work, and similar observations at other similar sites elsewhere in Scotland, suggests that actual vulnerability of these species to vessel disturbance is not particularly high. This is probably because birds using Kyle Rhea already commonly experience transiting vessels and ferries, and are therefore likely to be partially habituated to vessel disturbance. The observations at Kyle Rhea and elsewhere show that, provided vessels are travelling relatively slowly, the normal response by foraging birds is to respond when vessels are relatively close (<250m away), typically relocating no more than a few hundred metres away.

11.4.10 It is concluded that provided vessels are travelling relatively slowly and that as far as possible vessels take a mid-channel route, installation disturbance would affect only a minority of birds present in the sound and then only temporarily. Furthermore, the birds present in Kyle Rhea comprise a small proportion only of the regional populations of each species. It is concluded that the disturbance (including by noise) would be an impact of **negligible magnitude** and short term duration on regional populations of seabirds. The species of seabird occurring in Kyle Rhea are all considered to have **low sensitivity** to disturbance. Therefore, for all species the predicted impacts are of **negligible significance** under the terms of the EIA Regulations.

Impact 2: Suggested Mitigation
1. No specific mitigation is required for any species. 2. Good practice - aim to minimise disturbance to seabirds using Kyle Rhea and approach routes associated with the Project by avoiding where possible preferred feeding and resting areas and adopting voluntary speed restrictions. 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. A maximum vessel speed of 15km/hr (approximately 8 knots) is likely to give most seabird species time to move away from an approaching vessel without resorting to flight. 3. Good practice - installation and survey vessels to stick to the defined routes as far as possible, between ports and the Project areas as a means of reducing disturbance of seabirds. Studies have shown that disturbance is reduced if birds can predict where the disturbance will occur (Schwemmer *et al.* 2010).

Residual impact

11.4.11 The good practicemeasures will reduce vessel disturbance, the residual impact will, as initially, remain of **negligible significance** for all species.

Impact 3: habitat loss

11.4.12 The land take due to the Project will result in negligible loss of terrestrial habitat, and restricted to a temporary HDD footprint of up to 40m x 40m and of approximately 6m x 3m coinciding with the footprint of the substation (option 1). The option 2 substation will be in an existing building (see Chapter 5, Project Description). The area lost is of low value to birds and is not part of the breeding territories of any high or medium priority species.

11.4.13 The loss of seabed habitat caused by the installation of devices is considered in detail in Chapter 13, Benthic Ecology. The overall area of seabed occupied by the array, including the four devices and inter-array cabling, amounts to approximately 115m^2 (see Chapter 5, Project Description). This represents approximately 0.01% of Kyle Rhea seabed.

11.4.14 Direct habitat loss, both terrestrial and marine sea bed, will be long term, but an impact of negligible magnitude to all regional populations of terrestrial and seabird species regularly using Kyle Rhea. All species are considered to have negligible sensitivity to the scale of habitat loss predicted. Therefore the impacts of direct habitat loss due to sea-bed take and land take are deemed of negligible significance for all species under the terms of the EIA Regulations.

Impact 3: Suggested Mitigation
1. No mitigation is required for any species.

Residual impact:

11.4.15 Impacts of habitat loss will remain of **negligible significance** for all species.

Potential impacts during the operation phase

Impact 4: vessel disturbance of seabirds

11.4.16 For all medium and high priority species there is potential for operational activities to cause disturbance of foraging and resting individuals in the array area and immediate vicinity, principally by maintenance and vessel activity. The frequency and duration of disturbance caused during the operation will be much less than during installation. Based on the same reasoning used to assess the impacts of vessel disturbance during the installation phase (Impact 2), it is predicted that likely impacts of vessel disturbance on medium and high priority species during the operation will be of **negligible magnitude** and long-term. The species of seabird occurring in Kyle Rhea are all considered to have **low sensitivity** to disturbance. Therefore, for all species the predicted impacts are of **negligible significance** under the terms of the EIA Regulations.

Impact 4: Suggested Mitigation
1. No specific mitigation is required for any species. 2. Good practice measure - see Impact 2 for good practice protocols aimed at minimising vessel disturbance.

Residual impact

11.4.17 The good practice measures will reduce vessel disturbance, the residual impact will, as initially, remain of **negligible significance** for all species

Impact 5: displacement of seabirds from marine habitats

11.4.18 There is a paucity of studies on how seabirds will respond to the presence of operational devices of the design proposed for Kyle Rhea. Studies of birds in the vicinity of the SeaGeneration device installed in Strangford Lough, Northern Ireland, found that seabird there showed only small or indiscernible displacement effects (Marine Current Turbines 2011).

11.4.19 There is, of course, a wealth of experience on how seabirds respond to static man-made marine structures such as fixed lights, buoys, fish cages and moored vessels. The proposed device design will have a surface piercing tower extending to approximately 18m above chart datum. The devices will be highly visible to birds when on the water and flying. The devices will create a wake when there is a current running in the Sound. The visibility of the devices could cause some bird species to avoid the immediate vicinity . Observations of cormorants and shags show they commonly forage very close to man-made structures in the marine environment, and as these species commonly perch on man-made structures hence no avoidance of the vicinity of the devices is considered likely. There is less evidence available for red-throated diver, it is possible that individuals would avoid areas close to the towers. However, even if all seabird species were entirely displaced from an area extending to 100m around the devices this would amount to the loss of <5% of the area of Kyle Rhea Sound. Furthermore, the baseline surveys show that all the high and medium priority seabird species preferentially forage in the shallower parts of the sound, yet the devices are located in areas within deep water, which is relatively unattractive to foraging seabirds. It is concluded that displacement could occur at a small scale but the only high or medium priority species likely to be affected is red-throated diver. It is predicted that the likely impacts of displacement caused by the presence of the operational devices on all seabird receptor populations will be of negligible magnitude and long term.

11.4.20 The device towers will be fitted with appropriate lighting to comply with rules for marking navigation hazards. The specifications for this lighting have not been finalised. Although lighting can potentially cause displacement (including disorientation) of nocturnal birds. The extent to which this is likely and lead to adverse effects will depend on the intensity and amount of lighting, and whether or not the birds are already use to lighting from other sources. There are already several navigation lights along Kyle Rhea sound, including a small lighthouse, channel markers and hazard lights on electricity pylons. In addition there is shore-based lighting at the ferry terminals and Kyle Rhea village. It is concluded that the birds using Kyle Rhea already experience multiple sources of a range of lighting types. Furthermore, there is no evidence or expectation that the existing lighting causes any adverse effects to birds (indeed it may have beneficial effects on some species). For the purposes of assessment it is assumed that the choice of lighting for towers and other infrastructure will be commensurate with existing lighting in terms of its brightness and number of sources. Therefore, although differing in its detail, the overall affect perceived by birds will be one of a modest increment to what they already experience rather than something that is well outside their current experience. The sea birds using Kyle Rhea are predominantly diurnal species, though some such as gulls and ducks may be active at night also, with the numbers of seabirds present in Kyle Rhea forming a small proportion of species' regional populations. Thus the impacts on seabirds of displacement would be negligible in magnitude and long term.

11.4.21 It is concluded that the predicted impact of displacement (including that caused by lighting) on seabirds in the operational phase are of **negligible magnitude** and long term. The regional populations of the seabird species potentially affected are all considered to have either **negligible or low sensitivity** to displacement impacts. Therefore the impact of disturbance is of **negligible significance** under the terms of the EIA Regulations.

11.4.22 The presence of the towers could attract birds, either because the wake provides new foraging opportunities or because the towers provide elevated safe perches. Cormorant, shag, gull and tern species and white-tailed eagle are all likely to be attracted to towers. Thus the towers are likely to lead to beneficial impacts for some high and medium priority species. Nevertheless these beneficial impacts are likely to be of negligible magnitude to receptor populations.

Impact 5: Suggested Mitigation
1. No mitigation is required for any species. 2. Good practice - it is inevitable that birds will perch on the towers. Therefore, good practice measures will be taken to ensure that all potential perching locations are safe for birds. 3. The potential adverse effects of lighting on birds will be taken into consideration in the

Impact 5: Suggested Mitigation
design and final choice of lighting used on towers and other infrastructure.

Residual impact:

11.4.23 The residual impact will remain of **negligible significance** for all species.

Impact 6: displacement of foraging white-tailed eagle

11.4.24 The Project consists of four 18m surface piercing towers within the relatively restricted area at Kyle Rhea regularly used by foraging white-tailed eagles. It is possible that the presence of these towers could displace foraging eagles from this foraging area, and, in a worst case scenario cause them to have insufficient prey resource. There is no evidence from other sites concerning the likely reaction of white-tailed eagle to the presence of the devices , and in any case the response is likely to vary between individuals. However, white-tailed eagles are clearly used to, and closely approach, other structures of similar or greater height, for example trees. In the specific case of Kyle Rhea, the regularly used foraging area contains a small lighthouse (approximately 12m tall) and there are large pylons carrying cables across the sound only a few hundred metres to the north. The fact that the eagles use Kyle Rhea despite these structures suggests that the local pair is not especially sensitive to tall man-made structures and that the risk of these birds becoming totally displaced from their preferred foraging area and undergoing a shortage of food as a result is low. Nevertheless, it is recognised that there is uncertainty about how the local pair may respond to the towers, and that should displacement occur then this could lead to reduced feeding opportunities. Erring on the side of caution, it is concluded that the predicted impacts of displacement on foraging white-tailed eagle during operation are likely to be of **low magnitude**. White-tailed eagle has **low sensitivity** to displacement and therefore the impact is of **minor significance** under the terms of the EIA Regulations.

Impact 6: Suggested Mitigation
1. No specific mitigation is required for any species. 2. Good practice - although the likelihood of it occurring is considered very low, the worst case scenario for this impact is that displacement leads to food shortage for the local breeding pair of white-tailed eagles. This impact could be prevented by a programme of supplementary feeding. Supplementary feeding would only be instigated if RSPB monitoring of the eagles showed that displacement had occurred and was causing a shortage of food, for example as shown by chick provisioning rates. It is known that this particular pair of eagles accepts fish thrown out by fishing boats, so it is entirely reasonable to conclude that this pair would probably take well to supplementary feeding, especially if they were genuinely short of food. 3. Good practice - if monitoring does show that supplementary feeding is merited, the protocols to be used will be developed in consultation with statutory authorities and white-tailed eagle experts at RSPB and NRP.

Residual impact:

11.4.25 The residual impact of displacement on white-tailed eagles after mitigation is of **negligible significance.**

Impact 7: collision risk to diving seabirds

11.4.26 Tidal devices pose a theoretical collision risk to actively diving seabirds, potentially leading to death or injury. However, there is currently no empirical evidence to indicate whether tidal devices pose a real and significant collision risk to seabirds. This information gap requires investigation (Shields, 2009).

11.4.27 Year 1 survey results (Appendix 11.1) show that the array area is relatively little used by diving seabirds and underutilised compared to other parts of Kyle Rhea survey area. In the case of cormorant, the only high priority seabird species, the array area was proportionally underutilised by a factor of approximately six, compared to the rest of the Kyle Rhea survey area. Less than 1% of all cormorant diving activity was within the array area boundary. Goosander was not recorded in the array area, and red-throated diver was only recorded once. By far the greatest potential for collision is for shag. This species was commonly seen diving in the array area, with 3.4% of all records of diving individuals within the boundary. Furthermore, shags typically forage on or near the seabed (Harris & Wanless 1991, Wanless, Burger & Harris 1991, Grémillet *et al*. 1998) so birds diving within the array area were likely to be diving to depths that will be occupied by rotors. It is concluded therefore that the potential for collision is very low for all high and medium priority species, except for shag for which there is a significant theoretical risk of collision, that merits more detailed consideration.

11.4.28 Until devices are deployed the risk to shags cannot be precisely quantified. However, some basic calculations are presented in Appendix 11.3 that give an approximate indication of the number of dives that might be at risk of collision per year. The calculations are based on eight 20m-diameter rotors operating in the array area. The calculations in Appendix 11.3 are necessarily basic, however, until there is a better understanding of dive paths in the array area, rotor avoidance behaviour, strike rates and effects of collisions strike there is little point in over-refining the values used and assumptions made.

11.4.29 The results of the collision risk calculations undertaken in Appendix 11.3 are presented for a combination of avoidance rates and collision 'harm rates' (the proportion of collisions resulting in death or serious injury) Table 11.10.

Table 11.10 The predicted number of shag collisions per year resulting in death or serious injury for a range of combinations of avoidance rate and harm rate (this is a copy of Table A11.3.2, see Appendix 11.3 for full details).

Avoidance rate	100% of collisions harmful	75% of collisions harmful	50% of collisions harmful	25% of collisions harmful
No avoidance	96	72	48	24
90%	9.6	7.2	4.8	2.4
95%	4.8	3.6	2.4	1.3
98%	1.9	1.4	0.96	0.48
99%	0.96	0.72	0.48	0.24

11.4.30 The lack of experience of operating rotors in marine environments means there is currently no empirical evidence concerning actual avoidance rates and collision harm rates for diving birds. The likely magnitude of these parameters for diving seabirds is discussed briefly in Appendix 11.3 and this concludes that avoidance rates are likely be lower than for flying birds encountering wind turbines and that it is likely that a substantial proportion of collisions will not be harmful. Recognising the desire for additional caution where there is significant uncertainty it is judged that the most appropriate scenario for assessment purposes is to assume an avoidance rate of 90% and a harm rate of 75%. Under these assumptions it is predicted that approximately seven adult shags might be killed or seriously injured each year (Table 11.10).

11.4.31 The death of seven adult shags per year would equate to the loss of approximately 0.11% of the regional population of approximately 6448 adults. This would cause the assumed adult mortality rate of 12.20% p.a. to increase to 12.31%, an increase of around 1.0% in the baseline rate. On this basis the impact of collision mortality is cautiously evaluated as an impact of **low magnitude** and long term. The regional shag population has **low sensitivity** to additional mortality and therefore the impact is of **minor significance** under the terms of the EIA Regulations.

11.4.32 It is further concluded that for all other species of diving seabird collision mortality will be an impact of **negligible magnitude** and long term and that these species have **low sensitivity** to additional mortality. It is judged this impact is of **negligible significance** under the terms of the EIA Regulations.

Impact 7: Suggested Mitigation
1. No specific mitigation is required for any species. 2. Results of research related to collision will be followed. If evidence of mortality/injury is observed at Kyle Rhea mitigation measures will be investigated. 3. Good practice - Sea Generation (Kyle Rhea) Ltd will share collision risk data with stakeholders to promote greater understanding of the collision risk to diving birds with tidal devices.

Residual impact:

11.4.33 Unless new methods are found to reduce collision risk or studies show that the collision risk is different to that predicted, the impacts of collision will remain of minor significance for shag and **negligible significance** for all species.

Impact 8: marine pollution and contamination

11.4.34 The release of oil and other marine pollutants could have lethal and sub-lethal effects on seabirds and their prey. It is well known that oil slicks can kill seabirds. The 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 risk of marine contamination will be limited to accidental release. The Project will adopt an explicit policy to deal rapidly and effectively with any accidental release of pollutants.

11.4.35 When combining the contingency policy, with the following factors:

- that the potential quantities of any oil or chemicals accidentally released is relatively small (Chapter 9, Marine Water Quality);
- wave and tidal action would quickly disperse and dilute any contaminants (Chapter 9, Marine Water Quality); and
- numbers of seabird using Kyle Rhea are small in the context of species' regional population size.

11.4.36 The impact of the project on regional seabird populations is assessed as negligible spatial magnitude and short term. The species of seabird occurring in Kyle Rhea are all considered to have low sensitivity to pollution and contamination. It is judged that this impact is negligible significance under the terms of the EIA Regulations.

Impact 8: Suggested Mitigation
1. No specific mitigation is required for any species. 2. Good practice - 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 installation will require prior approval through the licensing process. Lubricants will be non-toxic, biodegradable and capable of dispersal in seawater.

Residual impact:

11.4.37 Provided good practice guidelines are adhered to, the impacts of pollution and contamination on marine birds populations will remain of **negligible significance** for all species.

Impact 9: Indirect effects on prey

11.4.38 The distribution and abundance of seabirds, especially diving species, is strongly influenced by the availability of their prey, in particular small fish of a variety of species. White-tailed eagle (high priority) and gull species (low priority) are known to exploit the flow dynamics of the existing tidal regime during flood tide, as these appear to facilitate feeding by concentrating fish prey in certain relatively shallow areas. If the Project changed prey availability, this would affect the use of the site by birds. Changes to prey availability could be caused by changes in;

- flow dynamics (e.g. the velocity and distribution of tidal currents)
- underwater noise
- submerged infrastructure acting as artificial reef habitat

11.4.39 Changes to flow dynamic will be limited in scale (see Chapter 7 Marine Physical Environment and Coastal Processes) and may have limited neutral, adverse or beneficial effects on prey availability. Underwater noise is likely to have negligible impacts on fish and shellfish. Colonisation may lead to neutral or beneficial effects.

11.4.40 Chapter 7, Marine Physical Environment and Coastal Processes, considers the likely magnitude of changes to the hydrodynamic regime during operation and finds that "*evidence suggests that the Project will have minor near-field impacts on tidal flow disturbance and increased turbulence. Impacts are expected to reduce rapidly with distance away from the devices and not extend further than the near-field (300m from the device). The impacts of energy extraction on flow velocities will be negligible*." Chapter 7 concludes that changes to the wave regime and tidal currents are anticipated to be low magnitude and of negligible significance.

11.4.41 The impact of the potential changes to prey resource on regional seabird populations is assessed as of negligible spatial magnitude and long term. All regional populations of seabird species using Kyle Rhea are considered to have negligible sensitivity to local effects on prey availability. It is judged that this impact is of negligible significance under the terms of the EIA Regulations.

11.4.42 The impact of the potential changes to prey resource on regional white-tailed eagle population is assessed as of minor spatial magnitude and long term. Although the white-tailed eagle that regularly uses Kyle Rhea is considered to have low to moderate sensitivity to local changes in prey availability within their foraging range, the sensitivity of the regional population as a whole to this potential impact is low. It is judged that the impact on the regional white-tailed eagle population is of minor significance under the terms of the EIA Regulations.

Impact 9: Suggested Mitigation
1. No specific mitigation is required for any species. 2. Good practice - although considered very unlikely, the predicted localised impacts on flow regimes could potentially have an adverse impact on food

Impact 9: Suggested Mitigation
availability for white-tailed eagle, and in a worst case scenario lead to food shortage. If RSPB monitoring demonstrates an impact that leads to food shortage for white-tailed eagle a supplementary feeding programme will be considered.

Residual impact:

11.4.43 The adoption of the good practice measures designed for white-tailed eagle would result in the potential impact of changes in prey availability on this species being revised to **negligible significance.**

Potential impacts during the decommissioning phase

Impact 10: Vessel disturbance

11.4.44 Disturbance effects during decommissioning are anticipated to be of lower intensity than during installation. Decommissioning effects are anticipated to be similar in nature but lower magnitude than those associated with installation.

11.4.45 The decommissioning phase is predicted to be of similar duration to the installation phase. It is predicted that the effects of any disturbance will be will be medium term and of negligible spatial magnitude. All the species potentially affected have either negligible or low sensitivity to disturbance. Therefore, the impact is predicted to be of negligible significance for all bird species under the terms of the EIA Regulations.

Impact 10: Suggested Mitigation
1. No mitigation is required for any bird species. 2. Good practice - the same good practice methods proposed for Impact 2 (vessel disturbance in the installation phase) will be followed during decommissioning .

Residual impact:

11.4.46 The good practice measures will reduce vessel disturbance, the residual impact will remain **not significant** for all bird species.

Impact 11: habitat reinstatement

11.4.47 Habitat (marine and terrestrial) reinstatement requirements would be set out in consultation with the statutory authorities at the time of decommissioning. It is anticipated that devices would be decommissioned after 25 years). The magnitude of the impacts upon bird species resulting from the reinstatement of habitats after decommissioning is considered likely to be of negligible magnitude and medium term. These impacts are assessed to be not significant for all bird species under the terms of the EIA Regulations.

Impact 11: Suggested Mitigation
1. No mitigation is required for any species. 2. The most recent good practice guidance on habitat reinstatement will be followed.

Residual impact:

11.4.48 The good practice measures will make it more likely that habitat reinstatement measures provide benefits to bird species. Nevertheless given the small size of the areas that would require reinstatement, the residual impacts are likely to remain **not significant** for all species.

Potential cumulative impacts

11.4.49 The EIA Regulations require that the Project is assessed for cumulative impacts with other projects or plans. Guidance on assessing cumulative effects (King *et al.* 2009) 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.

11.4.50 'Target' species are those species of high and moderate NCI for which there has indication of a potential impact as a result of the Project, which may be exacerbated cumulatively. The only three target species thus identified are white-tailed eagle, red-throated diver, and herring gull. However the impact arising from the Project on red-throated diver and herring gull are so small as to be not plausible they could contribute materially to a wider cumulative effect of significance. Thus white-tailed eagle remains as the only target species for which cumulative impact assessment is needed. The Glenelg and Arnisdale Community Development Plan (GADT, 2012) identifies the following projects:

- Ardintoul Wind
- Arnisdale River Hydro,
- A'Mhaoile 900KW community-owned wind turbine.

11.4.51 In all cases these are in early conceptual stages and so it is not possible to determine the likely level of cumulative impacts.

11.4.52 As discussed in Chapter 4, EIA Methodology it is understood that a scoping report was submitted for another tidal array in Kyle Rhea but that this has not been progressed and so this is not considered to be a likely foreseeable project.

11.5 Summary

11.5.1 Twenty one species of seabirds and other water birds were regularly recorded (seen on more than three occasions) in the vantage point survey area during baseline surveys. A number of other, less common, species were recorded irregularly.

11.5.2 During the breeding season the numbers of individuals of each seabird species using the survey area for foraging are small (<1%), or very small (<0.1%), in the context of the size of their regional breeding populations. It is concluded that the survey area is of negligible importance for foraging seabirds during the breeding season.

11.5.3 Except for three species, the numbers of individuals of seabird species using the survey area for foraging in the non-breeding part of the year (e.g. autumn and winter) are also small (<1%), or very small (<0.1%), in the context of their regional population size. The numbers of cormorant and shag regularly foraging in the survey area during the non-breeding period, approach or slightly exceed 1% of the regional (mainland north-west Scotland) population. Occasionally the numbers of goosander foraging in the survey area, in the late summer, also approach or slightly exceed 1% of the regional population.

11.5.4 A high proportion of seabirds seen during survey work were simply flying through the marine survey area and not using it in any other way.

11.5.5 Several terrestrial bird species use the shorelines and adjacent land along the edge of the marine survey area. These include small numbers of oystercatcher, common sandpiper, curlew, heron and wigeon. Small numbers of oystercatcher, common sandpiper, and heron also breed at the site.

11.5.6 A wing-tagged adult white-tailed eagle, the male of the pair from a local breeding territory, regularly hunts in the survey area, especially during the summer when provisioning young. This eagle often closely approached fishing boats to take fish thrown out to it, suggesting the pair are relatively tolerant and habituated to benign human activity at Kyle Rhea.

11.5.7 Impacts during operation and decommissioning are considered in relation to disturbance installation, collision risk, and accidental release of contaminants. Overall the impacts are considered to be of negligible or low magnitude for all bird species and are of negligible or minor significance.

11.5.8 It is also concluded that the likely cumulative effects of the Project on regional populations of all bird species are negligible significance under the terms of the EIA Regulations.

11.5.9 The available information indicates, beyond reasonable scientific doubt, that the Project will not, either alone or in combination, have a significant effect on any classified or proposed SPAs.

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12 MARINE MAMMALS AND BASKING SHARK

Page

12.1 Introduction

12.1.1 This chapter of the Environmental Statement (ES) describes the existing environment within the proposed Kyle Rhea Tidal Stream Array ('the Project') and associated study area.

12.1.2 The findings of an assessment of potential impacts arising from the construction, operation and decommissioning phases of the Project are discussed in Section 12.4.

12.1.3 This chapter has links with Chapter 14, Fish and Shellfish and Chapter 17, Shipping and Navigation through potential interaction and indirect impacts with marine mammals (including cetaceans (porpoise, dolphins and whales) and pinnipeds (seals)) and basking sharks *Cetorhinus maximus*.

Study area

12.1.4 The survey area for site specific vantage point surveys (shown in **Appendix 12.2)** encompasses the majority of Kyle Rhea, including the proposed array location.

12.1.5 The study area for the marine mammal and basking shark impact assessment includes Kyle Rhea and surrounding waters, including the Sound of Sleat, Loch Alsh, the Inner Sound, and the Little Minch.

12.1.6 For assessing impacts at a population level the wider geographical context is also considered. Section 12.3, Existing environment, discusses appropriate reference populations for each species as well as potential connectivity with Special Areas of Conservation (SAC).

Overview of potential impacts

12.1.7 A number of potential impacts of the Project on marine mammals and basking sharks have been identified, including:

12.1.8 **Collision** between marine mammals and the device rotors or with vessels associated with the installation and maintenance of the Project.

12.1.9 **Underwater noise** associated with installation, operation, maintenance and decommissioning of the array could influence the normal activities of marine mammals. Many species of marine mammal use sound for detection of prey, communication and navigation. Auditory injury, physical injury or fatalities are unlikely to be caused by the level of noise associated with the Project. Key noise sources include vessels, drilling during installation and mechanical noise during operation. (**Appendix 12.6**)

12.1.10 **Barrier effects** caused by the presence of the devices are considered, however the layout of the array (shown in Figure 5.1) does not present a complete physical barrier across the strait.

12.1.11 **Disturbance** caused by increased human activity in the area, could displace seals from the haul out sites within Kyle Rhea.

12.1.12 **Electromagnetic fields** have the potential to interfere with marine mammal behaviour**.** The use of directional drilling of the export cable reduces the potential for this impact to occur. However, the small amount of inter-array cabling has some potential to affect marine mammals and basking shark.

12.1.13 **Changes to water quality** through accidental release of contaminants such as fuel from vessels associated with the Project, as well as increased suspended sediments associated with installation. Chapter 8, Marine Water Quality describes the low likelihood of contaminants entering the environment and the high dispersal that would occur following an incident due to the strong currents. As a result it is not predicted that such negligible changes to water quality would have a detectable impact on marine mammals. This potential impact is not considered further.

12.1.14 **Indirect impacts from changes to prey resource**. Impacts such as noise, habitat loss and electromagnetic fields (EMF) on fish and shellfish have the potential to alter the availability of prey available to marine mammals in the study area. Potential impacts on fish are discussed in Chapter 14, Fish and Shellfish. The importance of Kyle Rhea as a foraging ground for marine mammals is discussed in Section 12.3, Existing environment.

Policy, legislation and guidance in relation to marine mammals

12.1.15 This section identifies the key legislation, policies and guidance relevant to marine mammals and basking shark.

12.1.16 All cetaceans are European Protected Species (EPS) under Annex IV of the Habitats Directive (European Union (EU) Directive 92/43/EEC) because they are classified as being endangered, vulnerable or rare. Interim guidance for local authorities is provided in Scottish Government (2001) and provides transparency in the requirements of an EPS license.

12.1.17 Harbour porpoise *Phocoena phocoena* and bottlenose dolphin *Tursiops truncatus* along with grey seal *Halichoerus grypus* and harbour seal *Phoca vitulina* are listed as Annex II of the directive as species for which a network of Special Areas of Conservation are to be designated.

12.1.18 The Habitats Regulations 1994 (as amended in Scotland in 2004, 2007, 2008(a) and 2008(b)) implement the species protection requirements of the Habitats Directive in Scotland on land and inshore waters (0-12 nautical miles). Part II of the Habitats Regulations outlines protection for Special Areas of Conservation, designated for habitats listed under Annex I of the Habitats Directive or species listed under Annex II of the Habitats Directive. Part II of the Habitats Regulations details the protection given to EPS.

12.1.19 A license is required if the risk of injury or disturbance to EPS is assessed as ‘likely’ under regulations 41(1)(a) and (b) in The Conservation of Habitats and Species Regulations and 39(1)(a) and (b) in The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (amended in 2009 and 2010).

12.1.20 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). The Nature Conservation (Scotland) Act 2004 amends and improves the species protection provided by the Wildlife and Countryside Act 1981 to provide extension to existing protections for cetaceans from intentional disturbance to encompass protection from reckless disturbance as an offence. Basking sharks have full protection from intentional or reckless disturbance in Scottish waters (up to 12 miles offshore) under Section 6.

12.1.21 Under the Marine (Scotland) Act 2010 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 is an offence to harass seals at haulout sites which have been identified for protection under Section 117 of the Marine (Scotland) Act 2010. **Appendix 12.1**, Section 2.4 provides further detail on the management of seals in Scotland both in terms of licensing shooting, conservation areas and protected haul out sites.

12.1.22 Grey seal and harbour seal are also listed on Annex V of the Habitats Directive, which requires their exploitation or removal from the wild to be subject to management measures.

12.1.23 The site characterisation surveys undertaken to inform this EIA for the Project followed the SNH guidance on survey design and methodologies in relation to marine renewables (MacLeod *et al.,* 2011 and Sparling *et al*., 2011).

12.1.24 The impact assessment follows the latest, appropriate, guidance on Environmental Impact Assessment (EIA) (EMEC and Xodus group in press; Cefas, 2004 and IEMA 2006) and draws experience from recent examples of similar renewable energy projects in the UK and Europe.

12.2 Methodology

12.2.1 The existing environment outlined in Section 12.4 provides the baseline for impact assessment.

12.2.2 The impact assessment uses a “Rochdale envelope approach” to project description (see Chapter 5, Project Description and Chapter 4, EIA Methodology) and in line with best practice ensures that the realistic worst case scenario (WCS) is considered for each potential impact on marine mammals and basking shark.

Consultation in relation to marine mammals

12.2.3 A Scoping Opinion (**Appendix 4.1**) was sought in April 2010 and a short summary of the key issues raised in relation to marine mammals is provided in Table 12.1.

Table 12.1: Summary of consultation relating to marine mammals

Key issues raised	Response
The presence of protected species such as European Protected Species must be included and considered as part of the application process, not as an issue which can be considered at a later stage. (Scottish Ministers, Scoping opinion)	Section 12.1 discusses relevant EPS, Section 12,3, Existing Environment outlines the key species for consideration in the impact assessment. An EPS licence application will be made.
Cumulative impacts on protected sites and EPS. (SNH, Scoping opinion)	Section 12.4 considers cumulative impacts.

Key issues raised	Response
We (SNH) advise that 2 years' data collection is likely to be required in this case because the proposal is an array of 4 devices (each with two rotors), and because they are proposed within the Kyle Rhea narrows which is known to be used by cetaceans, where options for avoidance are restricted, and where cetacean usage is likely to vary considerably between years. However, we consider that reviews are an important part of the data collection process and advise that the developer should carry out a review of the techniques at 3 months and data at 12 months. (SNH, Scoping opinion)	Interim reporting has been provided to SNH and Marine Scotland after 6 months and 1 year of data collection. Data collection is currently on-going in to year 2. Additional data sources are presented to provide context to the year 1 data and inform the impact assessment prior to completion of year 2. Section 12.4 discusses the low predicted impact on marine mammals.
We (SNH) agree that vantage point watches are likely to be a key component, but the number and location should be determined by the visibility of the study area. Use of C or T pods should also be considered, particularly to address potential data gaps when the sea state is unsuitable for VP watches. (SNH, Scoping opinion)	The methodology has been discussed with Marine Scotland and SNH and it is agreed that the vantage point survey methodology is appropriate for characterisation of the site use by marine mammals as the baseline for impact assessment. Given the wave sheltered nature of the site the sea state did not become unsuitable for observations. The HWDT were commissioned to collate survey data for Kyle Rhea and surrounding waters which includes boat based acoustic surveys for harbour porpoise. A monitoring strategy will be developed by working with SNH and Marine Scotland which will consider the use of acoustic devices
As well as cetaceans the applicant should also record birds, seals and basking sharks. We (SNH) look forward to further dialogue with the applicant and Marine Scotland regarding the methodology. In addition to disturbance, noise and collision aspects listed in section 4.5.2 the assessment should also consider pollution. Cumulative aspects will also be important. (SNH, Scoping opinion)	The vantage point surveys collected data on all marine mammal species, basking sharks and birds (Chapter 11, Ornithology). A series of meetings and written correspondence has been held with SNH/ Marine Scotland to discuss the approach to EIA, in particular marine mammals. In relation to the marine water quality impact assessment (Chapter 9), the potential impact of contaminants is considered in Section 12.1 and deemed unlikely to have a discernible impact.

Key issues raised	Response
When considering the potential impacts of noise on cetaceans and other marine mammals we recommend the applicant refer to the following references: • Marine Mammals and Noise, Richardson *et al* 1995 AcademicPress; • Marine Mammal Noise Exposure Criteria: Initial Scientific recommendations, Southall *et al* 2007, Aquatic Mammals Vol 33, Issue 4. (SNH, Scoping opinion	Appendix 12.6 provides a technical report on noise modelling for construction and operation of the array and prediction of the marine mammal perception of noise from the Project. Appendix 12.6 references Southall *et al.* 2007 and Richardson *et al.,* 1995.
We (SNH) advise that the applicant establishes the distribution and usage throughout the year of the proposed deployment area by harbour and grey seals as part of the marine mammal surveys. In particular, consideration of whether this area is important as a feeding area for either species. This data should be used to make an assessment of any potential adverse impacts. It would be helpful to interpret the significance of those impacts in the context of the recently published Special Committee On Seals advice on the management of seal populations: http://www.smru.st-and.ac.uk/documents/341.pdf We do not consider aerial surveys and tagging of seals (as proposed in section 4.5.3) to be necessary in this case. (SNH, Scoping opinion)	Section 12.3, Existing environment pulls together information from the year 1 data collection (Appendix 12.2) and a literature review of available information, including SCOS (Appendix 12.1). All information is used to determine the importance of the site for feeding and breeding.
Basking sharks are known to use the area and are protected against reckless disturbance under Schedule 5 of the Wildlife and Countryside Act (1981) (as amended) and the Nature Conservation (Scotland) Act 2004. They are also listed under CITES Appendix III in UK waters. We recommend that distribution and use of the area by basking sharks should be incorporated within the marine mammal surveys, and an assessment made of any potential adverse impacts. (SNH, Scoping opinion)	Section 12.3 Existing environment discusses basking shark records for the site and considers the potential for the species to be significantly impacted by the project.
A series of letters discussing the vantage point survey methodology have been exchanged between SNH and Royal Haskoning	Approach agreed.

Key issues raised	Response
Two meetings with SNH and Marine Scotland discussed the approach to application and surveys. Agreed that interim reporting would help decision as to whether 2 years of survey data is necessary.	Interim report provided in March 2012 and Year 1 report provided in Oct 2012.

Data collection

12.2.4 The existing environment characterisation is informed by vantage point surveys carried out for the Project from July 2011 to July 2012 (**Appendix 12.2**) and DMP Statistical Solutions was commissioned to analyse the year 1 data (**Appendix 12.3**). To provide spatial and temporal context to the site specific surveys the Hebridean Whale and Dolphin Trust (HWDT) was commissioned to review their dataset for the area (Appendix 12.4). Baseline information of harbour and grey seal is provided in as a literature review to provide additional context to the site characterisation (Appendix 12.1).

12.2.5 Subacoustech was commissioned to carry out site specific noise investigation of baseline conditions (Appendix 12.5) and modelling of noise associated with the Project (Appendix 12.6.

12.2.6 The key data sources used are provided in Table 12.2.

Table 12.2: Data sources used to inform the existing environment

Data Source	Spatial coverage	Author	Years of data coverage
Appendix 12.1 Baseline seal Various	West Scotland Seal Management Area	RHDHV	1991-2010
Appendix 12.2 Year 1 vantage point survey	Kyle Rhea	Royal Haskoning – data source NRP	2011-2012
Appendix 12.3 Statistical analysis of the year 1 survey data	Kyle Rhea	DMP Statistical Solutions	2011-2012
Appendix 12.4 HWDT data analysis	Waters around south east Skye	HWDT	2003-2011
Appendix 12.5 Baseline noise	Kyle Rhea	Subacoustech	2012
Appendix 12.5 Noise Modelling	Kyle Rhea	Subacoustech	2012
JCP Phase II Report	Celtic Sea, Irish Sea, west coast of Scotland	Paxton *et al*., 2011 Report to JNCC.	1985-2010
Scientific Advice on Matters Related to the Management of Seal Populations	UK	SCOS	2003-2011
Small cetaceans in the	UK	SCANS II	2005

Data Source	Spatial coverage	Author	Years of data coverage
European Atlantic and North Sea			
University of St Andrews PhD Thesis	Kyle Rhea, waters around Skye	Cunningham	2004-2005
Scotland's Marine Atlas	Scotland	The Scottish Government	2011
Scottish Marine Renewables Strategic Environmental Assessment (SEA).	Scotland wide	Faber Maunsell	2007

Impact assessment

12.2.7 The significance of the impact is a combination of the sensitivity of the receptor and the magnitude of the impact. The impact assessments are made following IEEM guidelines for assessment (see Chapter 4, EIA Methodology), using the expert judgement of suitably qualified and experienced marine mammal specialists.

12.2.8 The sensitivity of the receptor is characterised as one of four levels high, medium, low or negligible. The definition of each level is given below in Table 12.3.

Table 12.3: Definition of terms relating to the sensitivity to an impact

Value / Sensitivity	Definition
High	Individual receptor has no capacity to avoid, adapt to, accommodate or recover from the anticipated impact
Medium	Individual receptor has very limited capacity to avoid, adapt to, accommodate or recover from the anticipated impact.
Low	Individual receptor has limited capacity to avoid, adapt to, accommodate or recover from the anticipated impact
Negligible	Individual receptor is generally tolerant to and can accommodate or recover from the anticipated impact.

12.2.9 The magnitude of the impact from the Project is based on the intensity or degree of disturbance to baseline conditions and is categorised into four levels of magnitude, high, medium, low and negligible. The definitions of each of these are given in Table 12.4 (based on Faber Maunsell, 2007).

Table 12.4: Definition of magnitude of an effect upon receptors

Magnitude	Definition
High	Permanent irreversible change to exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that >1% of the reference population are anticipated to be exposed to the impact. OR Temporary impact (limited to phase of development or Project timeframe) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that >=10% of the reference population are anticipated to be exposed to the impact.
Medium	Permanent irreversible change to exposed receptors or feature(s) of the habitat of particular importance to the receptor. Assessment indicates that >=0.5% or <1% of the reference population anticipated to be exposed to impact. OR Temporary impact (limited to phase of development or Project timeframe) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that >=5% or <10% of the reference population anticipated to be exposed to impact.
Low	Permanent irreversible change to exposed receptors or feature(s) of the habitat of particular importance to the receptor. Assessment indicates that <0.5% of the reference population anticipated to be exposed to impact. OR Intermittent and temporary impact (limited to phase of development or Project timeframe) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that >=1% or <5% of the reference population anticipated to be exposed to impact.
Negligible	Intermittent and temporary impact (limited to phase of development or Project timeframe) to the exposed receptors or feature(s) of the habitat which are of particular importance to the receptor. Assessment indicates that <1% of the reference population anticipated to be exposed to impact.

12.2.10 Table 12.5 combines the definitions of magnitude with the level of sensitivity of receptor to provide a prediction of overall significance of the impact. Red and orange cells indicate impacts which are considered to be significant within an EIA.

Table 12.5: The level of significance of an impact resulting from each combination of sensitivity and magnitude

Sensitivity	Magnitude			
	High	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

12.3 Existing environment

12.3.1 This section provides the key information relevant to the impact assessment for marine mammals and basking shark. **Appendix 12.1** provides a detailed literature review in relation to seals in waters surrounding Skye and wider in the UK. **Appendix 12.2** provides the results from site specific surveys for the project and shows harbour seal was the most commonly recorded species during the year 1 vantage point surveys (**Appendix 12.2**, Plot 3). Grey seal was the second most abundant species and a small number of harbour porpoise were also recorded. Three basking sharks were recorded in the summer of 2012. These are the key species considered for the impact assessment. Appendix 12.4 provides contextual data held by the HWDT and shows that the region holds important habitat for harbour porpoises and seals.

12.3.2 **Appendix 12.4**, Figures 5 and 6 show sightings throughout the waters off western Scotland for minke whale *Balaenoptera acutorostrata*, common dolphin *Delphinus delphis*, Risso's dolphin *Grampus griseus*, and white-beaked dolphin *Lagenorhynchus albirostris*. There are no sightings in Kyle Rhea however these species have potential to pass through Kyle Rhea. Few incidental dolphin sightings (common and bottlenose *Tursiops truncatus*) and a minke whale were recorded between July 2011 and July 2012 (Appendix 12.2).

Seals

12.3.3 There are two species of seal indigenous to the UK; grey seal and harbour (common) seal.

12.3.4 Seals spend a large portion of their time on land in order to rest, moult and breed. During this time surveys of the number of seals hauled out can are routinely conducted. In the UK seals are regularly monitored by the Sea Mammal Research Unit (SMRU). Grey seals are monitored by surveying the number of pups born during their annual breeding season (September to December). Harbour seals are monitored during their annual moult (August). Occasional pupping season (June/July) surveys are also conducted. During harbour seal surveys the number of grey seals hauled-out is also counted. Regional and population estimates are then extrapolated based on this survey data. Further information on methods for surveys both species of seal can be found in **Appendix 12.1**.

12.3.5 Additional information on sightings of seals is provided in Appendix 12.4. HWDT seal sightings collected on surveys between 2003 and 2011 around the west coast of Scotland show both harbour and grey seal are sighted across the region, and in close proximity to Kyle Rhea (Appendix 12.4). The data are analysed as sightings per unit effort per 0.05 degree^2 grid cells. For survey years 2005 to 2011 for both species of seal combined are presented in Appendix 12.4 Figure 18.1.1 to 18.1.8. During 2005, 2008, 2009, 2010 and 2011 seals were sighted in the grid cell encompassing Kyle Rhea (and Glenelg Bay) at relatively high rates.

12.3.6 There was a high degree of spatial and temporal variation in seal sightings across the region during the HWDT surveys. When totalled across all years, Kyle Rhea had one of the highest sighting rates (at 0.34 to 2.78 seals per nautical mile, **Appendix 12.4**, Figure 18). Sightings rates were highest in April, May, July, August and September (**Appendix 12.4**, Figures 18.2.1 to 18.2.7.

12.3.7 Kyle Rhea falls within the Central portion of the West Scotland Management Area (WSMA) for both harbour and grey seal (Appendix 12.1, Section 1.2.3). The Central region extends from Ardnamurchan point in the south to Rubha Rèidh (between Gairloch and Loch Ewe) in the north.

Harbour seal

12.3.8 Harbour seal has a circumpolar distribution and is widespread throughout the Northern Hemisphere. Around 4% of the world's harbour seals are found in the UK, with approximately 80% of the UK's harbour seal population located in Scotland (Defra, 2010).

12.3.9 Harbour seal use haul out sites throughout the year, but greatest concentrations onshore are seen during the summer months when breeding (June and July) and moulting (August).

Population status

12.3.10 Appendix 12.1 outlines the Management Areas used to manage seal populations around Scotland. The most recent complete survey of harbour seals around the coast of Scotland was completed between 2007 and 2009. In recent years the number of harbour seals counted during these moult surveys has declined in many of the Management Areas, including Orkney and the North coast, Shetland, the East coast, the Outer Hebrides, and West Scotland South (Strathclyde) (Figure 4, Lonergan *et al.,* 2007). Numbers counted in the wider Moray Firth and West Scotland North and Central (Highland) have shown a more stable trajectory or population growth (Appendix x, Figure 4).

12.3.11 The most recent minimum estimate of population size for the WSMA includes the current estimates from two survey regions: west Scotland Highland (Cape Wrath to Ardnamurchan Point) of 4,696 (from 2007 and 2008) and west Scotland Strathclyde (Ardnamurchan Point to Mull of Kintyre) of 5,834 (from 2007 and 2009; Duck *et al.,* 2011). This gives a total minimum estimate for the WSMA for harbour seal of 10,530.

12.3.12 The potential biological removal (PBR) in 2012 for harbour seals in the WSMA is 442. PBR provides the maximum number of animals which can be removed from a population by anthropogenic causes and allow the population to be sustainable. 184 licences have been granted for the shooting of harbour seals in 2012. (Scottish Government, 2012)

12.3.13 Within central WCMA region the closest important haul out sites include six haul out sites which are proposed as protected haul out area (**Appendix 12.1**, Table 1). Five of the sites are within 60km of Kyle Rhea, and the closest is Pabay at 14km to the north west of Kyle Rhea, in the Inner Sound (**Appendix 12.1**, Figure 2).

12.3.14 Within the WCMA there are three SAC for harbour seal; Ascrib, Isay and Dunvegan, Eileanan agus Sgeiran Lios mór (Lismore) and South-East Islay Skerries, These are approximately 91km, 118km, and 195km from Kyle Rhea respectively.

Foraging distribution and diet

12.3.15 In the UK, adult harbour seal generally forage within approximately 60km of their haul out sites (e.g. Thompson *et al* ., 1996). Data presented in Sharples *et al*., (2012) suggest an average foraging range of <40km in the Outer Hebrides; the closest regional tagging deployment to Kyle Rhea. Foraging ranges reached a maximum of 150km in this region. The

SACs mentioned previously are therefore likely to be at or beyond the average foraging range for this species in this region.

12.3.16 Between September 2003 and March 2005 SMRU deployed 24 satellite tags known as satellite relay data loggers (SRDLs) on harbour seals on the west coast of Scotland. These deployments were centred on the South-East Islay Skerries SAC (eight seals in 2003/2004 at Ardbeg Bay ad Plod Sgeirean), Jura (two seals at Lowlandmans Bay) and Ascrib, Isay and Dunvegan SAC. At the latter site a total of 14 seals were tagged in 2004/2005 at Eilean Dubh, Sgeir Nam Biast and Mingay. Individual tracks of seals tagged during these studies are shown in **Appendix 12.1**, Figure 6. None of the seals during these deployments deployments hauled out or had at sea locations in or around Kyle Rhea, either to the south in the Sound of Sleat or to the north in the Inner Sound or Loch Alsh.

12.3.17 Further tagging of harbour seals in the Outer Hebrides was conducted in 2006 as part of the Strategic Environmental Assessment (SEA) process (Sharples *et al*., 2008). Twenty one harbour seal were tagged in the Outer Hebrides, captured in the Sound of Harris (10) and the Sound of Barra (11). **Appendix 12.1**, Figure 7 shows the individual tracks from this deployment. None of the tagged animals in this study are shown to move between SACs and Kyle Rhea. Analysis is currently underway of a more recent tagging deployment in the vicinity of Kyle Rhea and the Sound of Jura, funded by the Scottish Government. Data from this study were not available to inform the present impact assessment but it is anticipated that this information will be available to SNH and Marine Scotland during their review of the application for the Project.

12.3.18 There have been limited studies on the diet of harbour seal on the west coast of Scotland. **Appendix 12.1**, Section 4.3 provides an overview of studies to date, indicating that harbour seal are opportunistic and feed on a range of prey species.

12.3.19 Common prey species include scad, herring, whiting, cod, haddock, ling, mackerel and sandeel as well as squid and octopus.

Site specific surveys

12.3.20 Between May and September in 2004 and 2005, land based counts were made at low tide haul out sites in Kyle Rhea as part of an investigation into the effects of temporal, tidal and environmental covariates on the number of seals hauled out (Cunningham, 2007). Data were collected over 45 days in 2004 and 36 days in 2005. The maximum number of seals (excluding pups) counted was 85 in June.

12.3.21 Five haul out sites in Kyle Rhea (**Appendix 11.1,** Figure 2,) were surveyed during the site specific surveys for the Project, four to the north of the Project and one to the south. Harbour seal haul out records were predominantly associated with the four northern haul out sites (**Appendix 12.2**, Figure 2b). The haul out site to the south close the Kyle Rhea village is used sporadically and may be subject to more disturbance due to being close to the village compared with the other haul out sites. **Appendix 12.2** shows a small number of juvenile harbour seals were recorded occasionally at haul out sites.

12.3.22 In addition to specific counts at haul out sites, the vantage point surveys for the Project included counts of harbour (and grey) seal in the water. The survey protocol has been agreed with SNH during consultation (Table 12.1). A summary of the sightings rates in Year 1 both at sea and hauled out (July 2001 to July 2012) is provided in **Appendix 12.2**.

12.3.23 Harbour seal were the most commonly sighted species during the marine mammal surveys, with a total of 2008 animals recorded during 1067 sightings over 144.25 hours of survey effort. A number of seals, which could not be identified to species, were also sighted (35 individuals from 12 sightings). The behaviour at the first sighting of each animal was also recorded, with the most common behaviour for harbour seals being swimming. The other key recorded behaviour was animals hauled out. (**Appendix 12.2**, Plot 4).

12.3.24 There appears to be a clear season pattern in the sighting of harbour seal, with the majority of sightings between April and August (**Appendix 12.2**, Plot 7). This reflects the normal seasonal occurrence of harbour seal around haul out sites, with low numbers in the winter months, slowly increasing towards the breeding (June and July) and moult (August) season (e.g. Thompson & Harwood, 1990)

12.3.25 The majority (1833 individuals) of harbour seals sighted during marine mammal watches were adults (**Appendix 12.2**, Plot 12), but 86 juvenile (young of the year) were also sighted. In 2011 harbour seal juveniles were observed at haul out sites in Kyle Rhea in July and August, but no pups were seen in 2012 (**Appendix 12.2**). Despite the peak in adult numbers in summer months the low number of juveniles may suggest that the haul out sites in proximity to the development are not key breeding sites.

12.3.26 DMP Statistical Solutions Ltd carried out statistical analysis of the non-hauled out sightings data, to estimate relative densities of marine mammals at sea within the study area (**Appendix 12.3**). Harbour seal (adults and juveniles) were sighted across the study area, but the majority of sightings were on the western shore (Skye side) of Kyle Rhea, north of the Project, in close proximity to a number of haul out sites (**Appendix 12.3**, Figures 3a and 3b). As discussed in **Appendix 12.2** no significant distance bias is expected within the study area given the narrow width of Kyle Rhea. **Appendix 12.2**, Figures 1 to 5 show the visible survey area.

12.3.27 Average density of harbour seal for the study area (pooled over space and time) was 0.0244 (95% CI 0.0219 to 0.0273) per 100m x 100m grid cell (**Appendix 12.3**). To provide a more realistic estimate of density for the impact assessment, density of 0.09 per 100m^2 for harbour seal is used (based on the assumption that they spend an average of 73% of their time submerged (Lesage *et al.,* 1999)).

12.3.28 The densities varied over time; averaging at less than 0.01 from September to the end of March, and peaking in May just above 0.08 (**Appendix 12.3**, Figure 10). Densities peak in proximity to the haul out sites to the north west of the Project site. (Appendix 12.3, Figure 11). Over the 13 month survey approximately 14 harbour seals and 4 grey seals were recorded per hour of effort (Appendix 12.2).

<u>Grey seal</u>

12.3.29 The geographical range of the grey seal is restricted to the Northern hemisphere. In the North East Atlantic distribution is centred on breeding colonies in the UK (predominantly Scotland), Iceland, Norway, Ireland, and The Baltic Sea. Around 36% of the world's grey seal are found in the UK, with 90% of the UK's grey seal located in Scotland (Defra, 2010).

12.3.30 Grey seal breeding and pupping occurs during October to December along the east coast of the UK. During these months, the number of seals at sea might be expected to be low, as a large proportion of the population will be hauled out to breed.

Population status

12.3.31 The 2010 breeding season survey provides the most recent estimate of UK wide pup production at the annual monitored colonies of 44,874, which is an increase of 6.1% on 2009 (Duck & Morris, 2011). A further 5,299 pups were estimated to be born at the less regularly monitored colonies. The increase in pup production between 2009 and 2010 is largely driven by increases at North Sea colonies and Orkney, whereas production in both the Inner and Outer Hebrides has remained fairly constant (**Appendix 12.1**, Table 6)

12.3.32 In the WSMA the regularly monitored grey seal breeding locations in the Inner Hebrides includes ten colonies. None of these regularly monitored colonies are within the Central region of the WSMA:

- Treshnish Isles includes four of these colonies and is also the closest grey seal SAC to Kyle Rhea:
  - Lunga;
  - Fladda;
  - Sgeir a'Chaisteil & Eirionnach; and
  - the Northern Treshnish Isles.
- Three colonies to the south of Colonsay;
  - Oronsay;
  - Eilean nan Ron; and
  - Eilean nan Eoin.
- Gunna (between Coll and Tiree);
- Soa (west of Mull); and
- Nave Island (off the North west coast of Islay).

12.3.33 These regularly monitored colonies represent those with the greatest (historical) levels of pup production, and since monitoring in the early 1980's pup production generally increased at most of the Inner Hebrides breeding colonies. In more recent years, since 2000, the increase in pup production at many of the sites has levelled off, with numbers become more stable overall (**Appendix 12.1**, Figure 2).

12.3.34 Historical telemetry data have been used to scale up counts to account for the proportion of seals that are at sea during the survey to estimate population size (Lonergan *et al*. (2011). The total estimate of grey seals in Scotland between 2007 and 2009 was 88,300 (95% confidence interval 75,400 – 105,700). The estimated population of the Inner Hebrides (including WSMA and South-West Scotland Management Area) was 9,390 (95% CI 7,100 – 12,750), approximately 10% of the Scottish population.

12.3.35 Within the WSMA the main concentrations of grey seal distribution are around the north coast of Islay the Isles of Colonsay and Oronsay, and Tiree in the south region of the WSMA, The Small Isles including Canna, Sanday and Eigg, and north west Skye. Some of these haul out sites are proposed as conservation areas (**Appendix 12.1**, Figure 2); all are within 100km of Kyle Rhea, the closest is Eigg at approximately 50km.

12.3.36 Within the WCMA there is one SAC for grey seal; The Treshnish Isles, however, other grey seal SACS within off the west coast of Scotland include The Monach Islands and North Rona. These are approximately 90km, 147km, and 215km from Kyle Rhea respectively.

12.3.37 The PBR in 2012 for grey seals in the WSMA is 297, with a total of 126 licenses granted in 2012 in this area to shoot individual seals. There is no available information on the number of licenses granted, which have also been used.

Foraging distribution and diet

12.3.38 Grey seal are known to forage up to 145km from their haul out sites (Thompson *et al.,* 1996), over wide estimated home ranges of 1,088 to 6,400 km² (Dietz *et al.,* 2003).

12.3.39 It is therefore possible that seals that haul out at one of the SACs in the west coast of Scotland use Kyle Rhea to transit between foraging and haul out areas. However, the spatial segregation between these breeding colonies and Kyle Rhea would limit the potential for interaction during the breeding season.

12.3.40 Matthiopoulos *et al.* (2004) used telemetry data and count data to model seal behaviour in association with specific haul out sites and to generate usage maps for grey seals. Telemetry data collected by SMRU from 1991 to 2008 were collated following methods outlined in Matthiopoulos *et al.* (2004) to update usage maps as part of the SEA process (Murphy *et al.,* 2009). At sea locations for all seals included in this analysis are shown in **Appendix 12.1** (Figure 9 and 10). These figures show the data from a large scale tagging deployment of grey seals in the Inner Hebrides in 2003 and 2004 (McConnell, 2006), at sea locations from at least one seal are shown in close proximity to Kyle Rhea.

12.3.41 Studies of the diet of grey seal on the west coast of Scotland are limited. The most recent widespread study of grey seal diet is based on scat collected in 2002 (Hammond *et al*., 2006). A number of haul out sites across the whole of Scotland were surveyed either monthly or quarterly for scat. Fish otoliths and cephalopod beaks were recovered, identified and measured. Sandeel, gadoids and herring were the main prey across the sites sampled with benthic species important in the Inner Hebrides, as well as flatfish in the summer months. In the northern Inner Hebrides, dragonet, sandeel, cod and haddock were the main species in the diet. In the southern Inner Hebrides, sandeel and cod were the main prey.

Site specific surveys

12.3.42 As with harbour seals, grey seals were recorded at the four haul out sites to the north west of the Project during the vantage point surveys (Appendix 12.2, Figures 3a and 3b). Only 1 juvenile (< 1 year) grey seal was recorded at a haul out site within Kyle Rhea (**Appendix 12.2**).

12.3.43 Grey seal was the second most common marine mammal species sighted during the vantage point surveys with 562 individuals sighted during 402 sightings. Over 99% of grey seals recorded were adults, with only 2 juveniles recorded (**Appendix 12.2**, Plot 11).

12.3.44 As with harbour seals, the greatest density of grey seal at-sea sightings are close to the four northern haul out sites, although there are sightings throughout the survey area, including at the array site (**Appendix 12.3**, Figure 6). The majority of the recorded behaviours for grey seals (229 individuals) when first seen was bottling, while hauled out (167 seals) and swimming (165 seals) were the remaining recorded behaviours. A high number (28.6 per hour effort) of grey seals was recorded in July 2011 compared with other summer months, including August 2011 and May to July 2012, which all had less than 10 animals per hour effort. September to November 2011 and March to April 2012 had very few sightings (less than four per hour effort) and December to February had no grey seal sightings (**Appendix 12.2** Plot 8). The low sightings during the breeding season further supports the view that grey seal are not likely to be breeding in the area.

12.3.45 Statistical analysis of grey seal vantage point data (excluding hauled out animals), provides an average density of grey seal for the study area (pooled over space and time) of 0.006 (95% CI 0.0053 to 0.0069) per 100m x 100m grid cell. As with harbour seals, densities peak in proximity to the haul out sites to the north west of the Project site (**Appendix 12.3**, Figure 19). To provide a more realistic estimate of density for the impact assessment, densities of 0.04 per 100m^2 have been estimated for grey seal (based on the assumption that they spend an average of 86% of their time submerged (Thompson *et al.,* 1991)).

Cetaceans

12.3.46 In the wider study area as defined in **Appendix 12.4** (Figure 1) species of cetacean that have been observed (either visually or acoustically) during HWDT surveys include harbour porpoise, bottlenose dolphin, short-beaked common dolphin, Risso's dolphin, white-beaked dolphin and minke whale. Only harbour porpoise and minke whale were observed in the grid cell which encompasses Kyle Rhea during surveys between 2003 and 2011 (**Appendix 12.4**).

12.3.47 Analysis of the HWDT and additional data over the Cetlic Sea, Irish Sea and West Coast of Scotland, has been undertaken as part of the data analysis for the Joint Cetacean Protocol (JCP) Data Resource (Paxton *et al.,* 2011). This analysis provides contextual information with local area estimates for renewable energy development sites, including the Kyle Rhea and Loch Alsh area, for a number of species.

12.3.48 The Joint Cetacean Protocol (JCP) provides abundance estimates for harbour porpoise, minke whale, bottlenose dolphin, short-beaked common dolphin, Risso's dolphin, and white sided dolphin in the waters off the west of Great Britain. Estimates are produced by using existing data to develop a model and extrapolate for areas not surveyed.

<u>Harbour porpoise</u>

12.3.49 Harbour porpoise were the most commonly occurring species during HWDT surveys. They were also the only cetacean observed during the Project marine mammal watches although incidental sightings of other cetaceans were recorded (**Appendix 12.2**).

12.3.50 The Sea Watch Foundation (undated) 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 were mostly recorded within 15km of the shore and between 50 and 150m depth. Porpoises are sighted in small groups or singly, frequently occurring in narrow sounds or bays. There is an apparent relationship between tidal currents and porpoise distribution (Marubini *et al*., 2009). Harbour porpoise are characteristically shy of boats and other anthropogenic activities; and harbour porpoises are thought to be easily disturbed.

12.3.51 The main mating season is summer, and birth takes place 10-11 months later (usually between May and August with a peak in June). Calves are suckled for between four and eight months, and the mother usually reproduces every 1-2 years. Porpoises take three to four years to reach sexual maturity and have a relatively short life span usually of no more than 15 years, although animals have been recorded up to 24 years of age. (SeaWatch Foundation, undated)

Population status

12.3.52 Since 1985, the abundance of harbour porpoise in the Celtic Sea, Irish Sea and West Coast of Scotland (the study region included in the Joint Cetacean Protocol (JCP) analysis) showed an increasing trend, until peaking in 2005-2006. Since then estimated of abundance have been in decline, this trend is mirrored by local estimates at Kyle Rhea (Paxton *et al.,* 2011).

12.3.53 Abundance in 2010 for the JCP study region peaked in August, at around 60,000 porpoise (Paxton *et al.,* 2011). Among the local area estimates generated, the lowest estimates of harbour porpoise abundance were for the Kyle Rhea and Loch Alsh area (333km^2); estimates of abundance here also peaked in August, at approximately 150 (100-250, 95%CI) porpoise.

12.3.54 Estimates of density for harbour porpoise across the region are shown in Figure 12.1. Density in the Kyle Rhea area is estimated at between 0.1 and 1 animals per km^2.

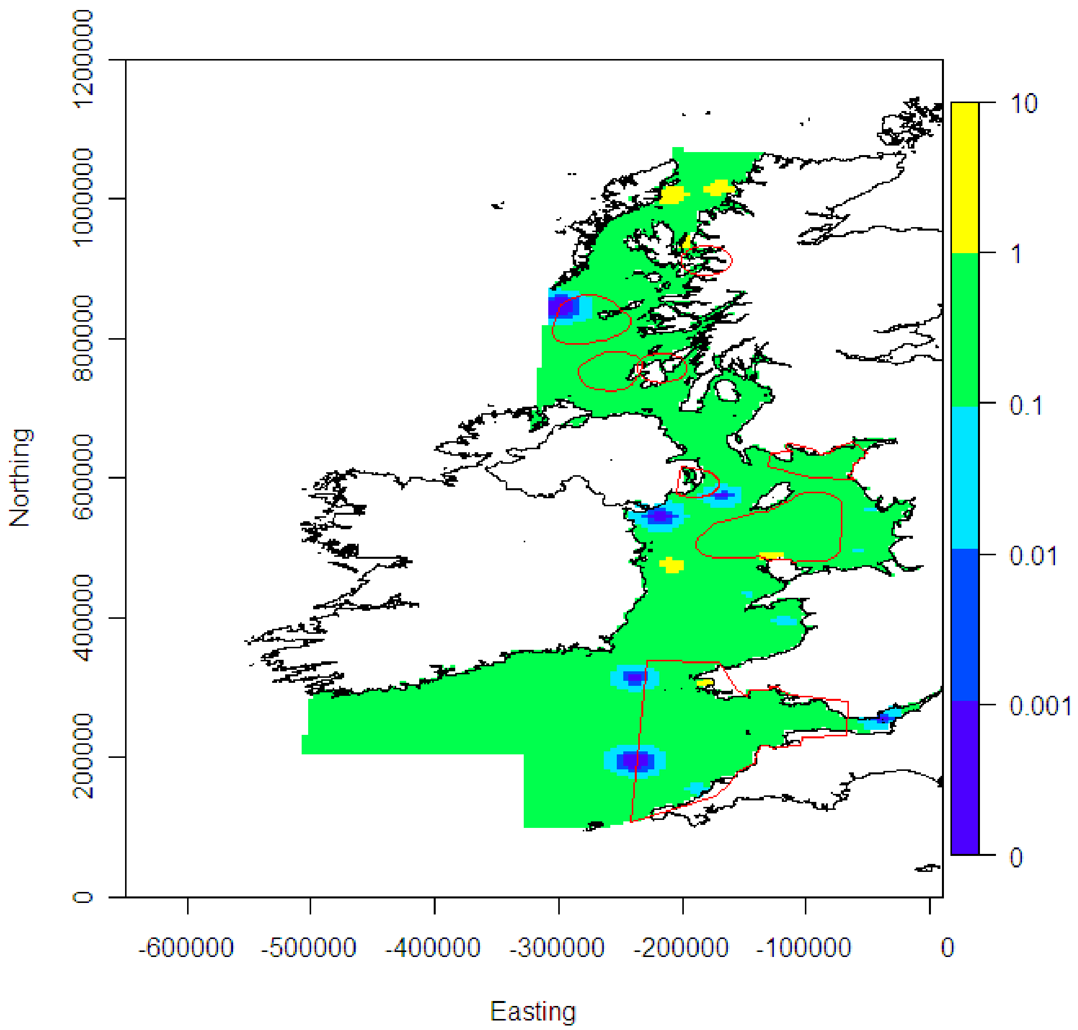

Figure 12.1: Predictions for harbour porpoise density for August 2010. Colours indicate densities (animals/km^2) Paxton *et al.,* 2011.

12.3.55 HWDT harbour porpoise visual and acoustic detections were spatially widespread throughout the waters around the south of Skye and both visual and acoustic detections occurred in every year (2005 to 2011) and month (surveys April to October); however sightings within Kyle Rhea were more variable (**Appendix 12.4**).

12.3.56 Sightings were too infrequent to determine any seasonal trends from the site specific survey and the HWDT surveys focus only on summer months. The highest concentrations of harbour porpoise within the waters around the south of Skye were found in the Sound of Sleat. The Sound of Sleat has been identified as an area of high importance to harbour porpoise (Embling *et al.* (2010) and by Booth (2010), cited in **Appendix 12.4**). Harbour porpoise are highly mobile and are thought to move widely across the Hebrides using corridors to travel between foraging locations and high-use areas. The narrow passage at Kyle Rhea is likely to be an important corridor between core habitats in the Sound of Sleat and the Inner Sound.

Foraging distribution and diet

12.3.57 The diet of harbour porpoise in Scottish waters is uncertain but available information indicates prey species are dominated by small demersal and pelagic shoaling fish, such as sandeel and whiting (Santos *et al.*, 2004). The distribution of these prey species is discussed further in Chapter 14, Fish and Shellfish.

Site specific surveys

12.3.58 Thirty eight harbour porpoise were recorded during nine sightings events. Pod sizes ranged from two to five animals (**Appendix 12.2**). Harbour porpoise were recorded towards the centre of Kyle Rhea along the full length of the strait (**Appendix 12.2** Figure 5).

12.3.59 Over 75% of harbour porpoise recorded were adults, however, it can be difficult to determine accurate ages in a pod, therefore some were recorded as a mix of adults and juveniles or as unknown age groups (**Appendix 12.2**, Plot 12).

12.3.60 Insufficient harbour porpoise sightings were made to generate estimates of density within the study area.

Risso's dolphin

12.3.61 Risso's dolphin is distributed across north-east European waters. The shelf waters off north-west Scotland, and particularly around the Inner and Outer Hebrides (Faber Maunsell, 2007). No population assessment exists for Risso's dolphins in north-east Atlantic waters. The SCANS II survey found no Risso's dolphins (SCANS II, 2006). This means that the present status of Risso's dolphins occurring in UK waters is not known sufficiently to estimate population and trends (WDCS, undated).

12.3.62 The ecology of Risso's dolphin is not well known. In the UK, Risso's dolphin seems to be equally common throughout the year in some areas, and show no evidence of seasonal migration (Evans *et al.,* 2003). The key prey species of Risso's is believed to be squid and occasionally small fish (Seawatch Foundation, undated a). The JCP (Paxton *et al.,* 2011) predicted the number of Risso's dolphin around Kyle Rhea was 8 (CI: 1 to 8) in 2010. No sightings of Risso's dolphin were recorded during the Project specific surveys.

Short beaked common dolphin

12.3.63 Short beaked common dolphin is distributed in the North Atlantic and is abundant in continental shelf waters off the west of the UK, particularly the Celtic Sea, and off the south east of England and south east of Ireland. SCANS II (2006) provides an abundance estimate of 63,366 (95% CI=26,973-148,865) for the SCANS survey area (the west of the UK) based on 2005 aerial and boat based surveys.

12.3.64 Short beaked common dolphin is also abundant in the offshore waters of the Scottish west coast. Density maps provided in SCANS II (2006) show an area of high density to the south of the Western Isles.

12.3.65 Common dolphin migrates northwards in summer and is frequently seen in the Sea of the Hebrides (south and west of Skye) in the warmer months (Faber Maunsell, 2007). Common dolphin prey is generally small schooling fish (Faber Maunsel, 2007).

12.3.66 The JCP (Paxton *et al.,* 2011) estimates that abundance in Kyle Rhea in 2010 was approximately 2 animals. There were no sightings of common dolphin made from the vantage points during the Project specific surveys however an incidental sighting of a pod of at least 4 animals was recorded in June 2012 (Appendix 12.2).

White beaked dolphin

12.3.67 White beaked dolphin appear to have Scottish coastal waters at the centre of their distribution in the north east Atlantic and are predicted to be the second most abundant cetacean below harbour porpoise (Northridge *et al.* 1995 cited in Faber Maunsell, 2007). The JCP (Paxton *et al.,* 2011) estimates that abundance around the Kyle Rhea area in 2010 was inconsistent throughout the year, fluctuating between 25 and 0 throughout the year, with a peak of around 50 in December 2010. No white-beaked dolphins were recorded during the vantage point surveys.

12.3.68 SCANS II (2006) provides an abundance estimate of 22,664 (95% CI=10,341-49,670) based on 2005 aerial and boat based surveys.

12.3.69 White-beaked dolphins are believed to eat a variety of prey, such as cod, whiting, hake, haddock, mackerel, and herring, various species of sandeels, gobies, flatfishes, and scaldfishes (Seawatch Foundation, undated b).

Bottlenose dolphin

12.3.70 Bottlenose dolphins are found throughout tropical and temperate seas worldwide in a wide range of habitats, from shallow coastal locations, offshore continental shelf and beyond (Reid *et al.,* 2003). They are found throughout Scottish waters, with a key population in the north east at the Moray Firth for which they are a primary feature of the Special Area of Conservation (SAC). The JCP (Paxton *et al* ., 2011) estimates abundance of bottlenose dolphin at Kyle Rhea to be very low, at one or two individuals in 2010. An incidental sighting of a pod of around 6 bottlenose dolphin was recorded in May 2012, associated with the site specific surveys.

12.3.71 Bottlenose dolphin breed throughout the year, however, Anderwald & Evans (2010) report peaks between May and October.

12.3.72 Bottlenose dolphin feed on demersal or benthic fish (e.g. eels, flounder, dab, sole, turbot, haddock, hake, mullet, and cod), mid-water fish (e.g. salmon, trout, bass, horse mackerel, herring, blue whiting), and marine invertebrates (cephalopods and shellfish; Anderwald & Evans, 2010).

Minke whale

12.3.73 Minke whale occurs throughout the year on the north west European continental shelf, however, most sightings off Scotland occur between May and September (Faber Maunsell, 2007). Reid *et al.* (2003) shows a high number of sightings off the west coast of Scotland. The JCP (Paxton *et al.,* 2011) provides abundance estimates, with a peak of six minke whales in February 2010 around Kyle Rhea. This area is not shown to be a hotspot for minke whales. The low number of sightings limits the ability to calculate reliable density estimates. No minke whale were recorded during the vantage point surveys however an incidental sighting was recorded in the area (**Appendix 12.2**).

12.3.74 SCANS II (2006) provides an abundance estimate of 18,614 (95% CI=10,445-33,171) for the SCANS II survey area based on 2005 aerial and boat based surveys. Evans *et al.* (2003) reports that sighting rates of minke whales increased in west, north and east Scotland since the early 1990s until 2002 (the latest available data at the time of reporting).

12.3.75 Minke whale feed on schooling prey, typically fish or crustaceans (Faber Maunsell, 2007). The two confirmed sightings during the vantage point survey showed no evidence of feeding as far as could be ascertained from the vantage point; the whales appeared to be transiting through the site.

Basking sharks

12.3.76 The basking shark is a widely distributed pelagic species. It is the largest fish in British waters (second largest in the world) growing up to approximately 10m in length and is predominantly recorded off the west coast.

12.3.77 Basking sharks generally live in open water, but migrate towards the shore in summer, when they can be seen 'basking', or swimming slowly, at the surface with their mouth wide open. They are known to migrate over large distances in both offshore and coastal waters at depths from the surface to over 750m. They are particularly associated with tidal fronts on the continental shelf and shelf edge where they feed on plankton (Scottish Government, 2011).

Tagging work has shown that they make extensive horizontal and vertical migrations to locate feeding hotspots, often associated with frontal systems (Faber Maunsell, 2007).

12.3.78 Two areas where significant numbers of sharks can be seen at the surface, on a regular basis include the islands of Hyskeir and Canna in the Sea of the Hebrides, and the island of Coll in the Inner Hebrides (Speedie *et al.* 2009, cited in **Appendix 12.4**). Other areas of high sighting rates include the waters off the west coast of Mull, around the Treshnish Isles and the south east coast of the Outer Hebrides (**Appendix 12.4**, Figure 7). During HWDT surveys between 2003 and 2011 basking shark were sighted in the wider study area. No sightings were made in the grid cell encompassing Kyle Rhea (and Glenelg Bay) all sightings were to the southern tip of Skye, at Aird of Sleat (**Appendix 12.4**, Figure 17 to 19).

12.3.79 In west Scottish waters, basking sharks are frequently encountered between May and October (**Appendix 12.4**). Single basking sharks were recorded in May, June and July 2012 (4 sightings in total). These were incidental sightings recorded by the surveyor for the site specific vantage point surveys (**Appendix 12.2**).

12.3.80 UK-wide basking shark sightings data are collated by the Marine Conservation Society (MCS), producing annual sightings reports. The latest available annual report is for 2009 which provides sightings distribution maps. In 2009 the number of sightings in the Inner Hebrides declined, however, across the whole of the UK 2009 saw a slight increase in the number of sightings (1150) from 2008 numbers (891). In 2006 to 2008 sightings decreased and so 2009 is approximately half the number of the record high in 2006 (2,273, Figure 12.2). The total number of sharks sighted in 2009 was 2806.

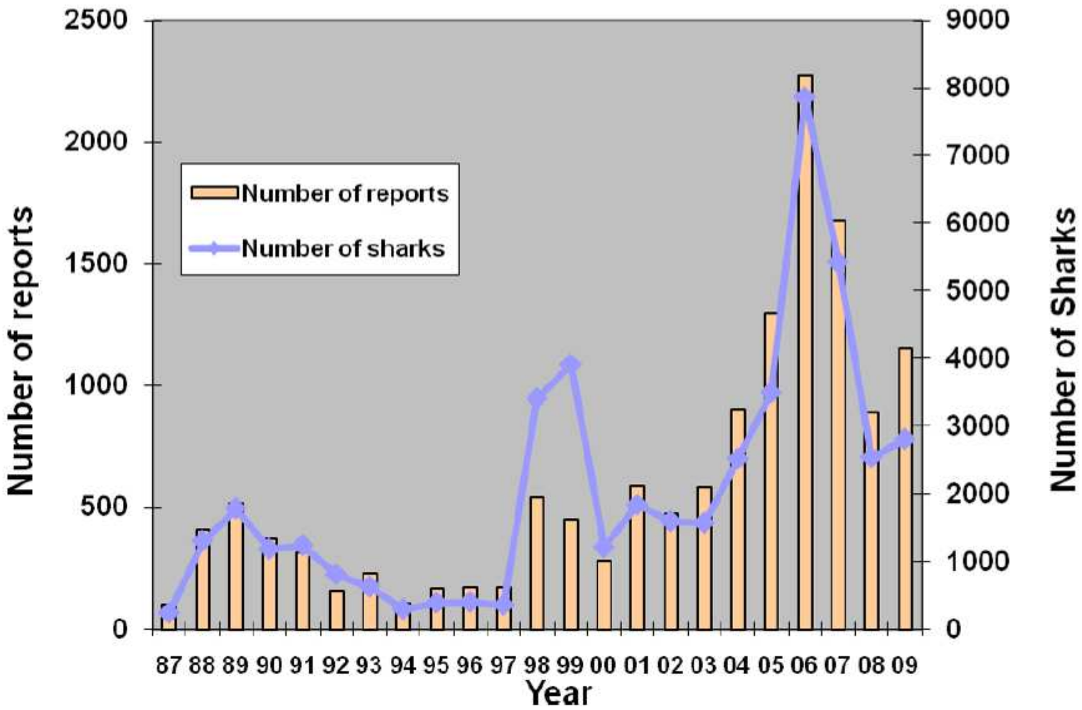

Figure 12.2: Number of reports and total number of sharks, per year 1987-2009 (Source: MCS (2009)

12.3.81 OSPAR (2009) report 50-90% population wide declines in recent years although there are limited data to validate these trends. As a result of the declining numbers recorded, the basking shark is listed as threatened and/or declining under the OSPAR convention (OSPAR, 2009).

Underwater noise

12.3.82 Appendix 12.5 provides the baseline noise conditions in Kyle Rhea from a site specific survey carried out in July 2012. High levels of high frequency broadband noise (between 20 kHz and 150 kHz) were recorded. This high frequency noise was significantly greater when the tide was flowing and peaked approximately 100 to 200m north of the Project.

12.3.83 The unweighted Root Mean Square (RMS)[25] noise levels recorded during the baseline noise survey across the study area are presented in Appendix 12.5, Tables 4-1 to 4-4. The RMS levels ranged from 95.9 to 135 dB re 1µP.

12.3.84 The baseline noise has been assessed against the likely perception for relevant species, measured in dBht. The following dBht categories are discussed further in **Appendix 12.5**.

- 0 – 50 dBht, low likelihood of avoidance;
- 75> dBht, mild avoidance with potential for habituation; and
- 90> dBht strong avoidance expected.

12.3.85 The baseline noise conditions for harbour seals ranged from 18 to 59.9 dBht perception levels. It is therefore unlikely that the existing baseline noise conditions in Kyle Rhea cause disturbance to seals. For harbour porpoise the high levels of high frequency noise results in perceived noise of 47.2 to 95.5 dBht, falling within the mild to strong avoidance category. As harbour porpoise were recorded within the Kyle it is likely that some habituation already exists to this level of noise.

12.4 Impact assessment

Do nothing scenario

12.4.1 During a 'do nothing scenario' grey seals and harbour seals will continue to have stable populations in the WSMA and will continue to use haul out sites within Kyle Rhea. Kyle Rhea will continue to be used for hauling out but not as an important feeing or breeding area. Harbour porpoise will continue to transit through the site infrequently.

Potential impacts during construction

Impact 1: Collision risk

12.4.2 The increase in vessels in the study area presents a potential risk of marine mammals being struck by the hulls of the installation vessels. If dynamic positioning (DP) vessels with ducted propellers are used (see Chapter 5, Project Description) there may be an additional potential collision risk in line with the seal spiral injuries described in **Appendix 12.1** may also occur.

12.4.3 Foundation drilling and installation for the Project will involve a DP vessel, moored or jack up barge for. Installation of the SeaGen devices on to the foundations will involve either a jack up barge, moored anchor barge, or DP vessel (see Chapter 5, Project description). The use of barges will require up to two support tug vessels and a multicat vessel may also be required if an anchor barge is used. A small crew transfer vessel will be required throughout installation. Equipment and materials will be brought to the site by sea using a large flat top barge.

12.4.4 Chapter 17, Shipping and Navigation outlines the existing level of shipping in the area.

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[25] an "average" value when calculating the level of continuous sound and vibration

During winter months approximately 5 vessels per day were recorded and in summer months an average of 23 vessels per day were recorded. The increase is mainly a result of increased recreational vessels (e.g. yachts) in summer months. Other vessels recorded include fishing vessels and fish farm support vessels (approximately 3 to 4 per day year round), cargo vessel (approximately 1 per day), and occasional (less than 1 per day) military vessels, tankers, tugs, and a passenger ferry. As a result marine mammals in this area are already accustomed to the presence of vessels travelling through Kyle Rhea. Installation vessels will be manoeuvring at very slow speeds within the Kyle.

Hull impacts

12.4.5 During installation period, increased vessel traffic within Kyle Rhea and between Kyle Rhea and the local port (likely to be Kyle of Lochalsh) has the potential to increase the risk of collision with marine mammals.

12.4.6 Worldwide, shipping collision is a recognised cause of marine mammal (particularly cetacean) mortality (Faber Maunsell, 2007). Due to the number of vessels already using Kyle Rhea and the relatively limited duration over which vessel activity will increase as a result of installation it is considered that the likelihood of collision is low. There is no current evidence of on-going collisions with marine mammals in the area.

12.4.7 Studies, such as the Dolphin Space Programme (DSP) (2009) suggest that maintaining a steady speed allows dolphins to move away from vessels. A protocol will therefore be established to ensure installation vessels travelling in to the area maintain a suitably safe speed, moving at a steady speed in a predictable and planned manner throughout the installation period.

12.4.8 Based on high existing levels of vessel activity in the Kyle, 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 low magnitude is predicted.

12.4.9 Grey seal and harbour seal are the most likely species to be affected by collision risk having the greatest density in the study area, however both populations have some tolerance to accommodate change, at a population level based on the PBRs discussed in Section 12.3, Existing environment which provides a low sensitivity based on the definitions provided in Table 12.3. Collision risk is therefore predicted to be of **minor** significant effect.

Ducted propellers

12.4.10 In the UK since 2008 large numbers of harbour and juvenile grey seal carcasses have been found with spiral injuries. The distinctive spiral injuries are consistent with animals having encountered a single, rotating right-angled blade, which are thought to be caused by the seals being drawn through ducted propellers (Thompson *et al.,* 2010). The limited existing data tends to support the view that ducted propellers may be the cause of these injuries, and the total number of seals that may have been injured or killed is unquantifiable.

12.4.11 Vessels with ducted propellers may be used during the installation phase of the Project. Guidance in assessing the potential risk of spiral injuries has been provided by the Statutory Nature Conservation Agencies (SNCAs, April 2012). The risks are considered in relation to harbour and grey seal, with higher potential risk for harbour seal due to the widely declining populations of harbour seal around the UK. Given the distance between the Project site and the closest harbour seal (>30 nm nautical miles) and grey seal (>4nm) SACs the risk in relation to the Project is considered low based on the guidance provided by SNCA (April 2012).

12.4.12 The majority of carcasses found to date have been of adult harbour seals and so the sensitivity of individual harbour seals is classified as high. Although carcasses of juvenile grey seal have also been recorded with spiral injuries, given the low number of juvenile grey seal recorded at the site and the relatively large distance from any breeding site, grey seal sensitivity is assessed as medium based on the definitions provided in Table 12.3.

12.4.13 In the context of the stable populations of both harbour and grey seal in the study area and the resultant high PBR levels, as well as the guidance provided by SNCA (April 2012) that the risk is low due to the distance from SACs, the magnitude of the impact to the harbour and grey seal populations is negligible.

12.4.14 Assuming vessels with ducted propellers are used in the installation, the resulting impact significance will be **minor** for both seal species. Available information and understanding of the factors involved in seal spiral injuries is limited at the time of writing and this assessment may alter in light of new information or guidance.

Impact 1: Suggested Mitigation
Work is on-going to understand the mechanism behind these fatalities and to investigate potential mitigation measures. SeaGeneration (Kyle Rhea) Ltd will seek to engage fully and comply with recommendations and good practise as they develop. No mitigation is currently suggested, or recommended, following JNCC guidelines.

Residual impact:

12.4.15 In the absence of any proven or agreed mitigation measures to date, the residual impact for collision with hulls and ducted propellers remains as **minor**.

Impact 2: Noise and vibration

<u>Percussive drilling</u>

12.4.16 **Appendix 12.6** provides detailed information on a modelling study of installation noise (percussive drilling of device foundations and vessel noise) carried out by Subacoutech.

12.4.17 The noise levels for modelling percussive drilling are taken from measurements gathered at the EMEC Falls of Warness tidal test facility. This is more comparable to the potential noise for the Project than the previous SeaGen installation methodology at Strangford Lough (see Appendix 12.6, Section 4.2).

12.4.18 The source level for percussive drilling is predicted to be 183dB re. 1µPa @1m under maximum operating power and 179 dB re. 1µPa @1m under normal operating power. It is not expected that this level of noise will result in fatalities, physical injury or auditory injury to marine mammals or basking shark.

12.4.19 Distances at which seals could be expected to exhibit mild avoidance (75dBht) are 58m at normal operating power and 93m at maximum operating power. Strong avoidance (90dBht) is expected at 19m for seals during maximum power and at 12m for normal operating power.

12.4.20 Mild avoidance (75dBht) for harbour porpoise is expected at a distance of 770m for normal operating power and 1.3km for maximum operating power, however it should be noted that background noise conditions at Kyle Rhea ranged from 46 to 95.5 dBht for harbour porpoise. Strong avoidance (90dBht) is expected at 210m for harbour porpoise at maximum power and 130m at normal power). As discussed in Section 12.3, Existing environment, harbour porpoise are recorded in Kyle Rhea despite background noise levels reaching greater than 90dBht and therefore some habituation can be expected.

12.4.21 With approximately 400m to the east of the array and 100m to the west (see proposed array layout in Figure 5.1), the potential noise footprint using 90dBht for maximum power (210m range for harbour porpoise and 19m for seals) is therefore unlikely to present a potential barrier as there will be a section of the Kyle which is not insonified by noise levels likely to evoke strong avoidance. Any small scale displacement from this noise footprint is unlikely to cause a significant impact e.g. on feeding success during the temporary drilling works.

12.4.22 The sensitivity of both species of seals, as well as harbour porpoise is predicted to be low based on the definitions provide in Table 12.3. There is limited understanding of the impact of underwater noise on basking shark, however as with other fish species, they are predicted to have much less sensitivity than marine mammals and so **negligible** sensitivity is predicted.

12.4.23 Installation of the device foundations will take up to 72 days in total[26] (18 days per device) with continuous drilling for up to 30 hours per pile (worst case). This will be interspersed with periods of approximately 78 hours in between drilling of each pile while non-drilling activities such as grouting the piles in place (Chapter 5, Project Description) .

12.4.24 The relatively short timescale of installation works, the low proportion of drilling works (<30% of the 72 days for foundation installation), and the findings of the noise modelling, all show that marine mammals are not expected to be excluded from Kyle Rhea due to drilling noise. Magnitude is predicted to be **negligible,** giving **negligible** impact significance.

<u>Vessel noise</u>

12.4.25 Increased vessel traffic can provide a significant source of noise during installation. However, due to the number of vessels already using Kyle Rhea, 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.

12.4.26 **Appendix 12.6** provides predicted perception of vessel noise (based on a jack up barge) at a distance of approximately 90-140m. Average dBht for harbour porpoise is 75 and for seals is 57 and so this is lower than some measurements made for background noise.

12.4.27 The magnitude of vessel noise is therefore negligible and sensitivity of marine mammals low, giving and impact of **negligible** significance.

Impact 2: Suggested Mitigation
No mitigation suggested

Residual impact:

In the absence of mitigation the impact of noise on marine mammals will remain **negligible.**

Impact 3: Disturbance

12.4.28 Noise disturbance and visual presence of vessels equipment and personnel during the installation works could potentially displace seals from haul out sites within Kyle Rhea. However aerial surveys pre- and post-installation of the SeaGen device in Strangford Lough showed no evidence of significant between year changes in the seal use of haul out sites in the vicinity of that device. Any short term displacement which may have occurred during installation was therefore unlikely to have had a significant effect on the population and a similar level of effect is anticipated for Kyle Rhea. The use of directional drilling for the

[26] Excluding potential weather delays

routing of the export cable (as was done at Strangford Lough) avoids direct disturbance to the intertidal area and further minimises the potential impact.

12.4.29 This potential disturbance will be temporary, occurring throughout the installation phase, during summer months only, for up to two years. The magnitude of this impact is low under the definitions provided in Table 12.3.

12.4.30 Section 12.3, Existing environment, describes the use of seal haul out sites at Kyle Rhea. It is not expected that these sites are significant breeding areas, based on evidence collected during the first year of site specific survey. In addition, there are also no proposed designated haul out sites at Kyle Rhea, therefore sensitivity is deemed to be low. This results in an impact of **minor** significance.

Impact 3: Suggested Mitigation
No mitigation suggested

Residual impact:

In the absence of mitigation the impact of disturbance on seal haul out sites will remain **minor.**

Potential impacts during operation

Impact 4: Collision risk

12.4.31 The moving rotors of the devices pose a potential collision risk for marine mammals and basking shark. Quantifying the likelihood and consequences of such an interaction is difficult, due to a lack of understanding and empirical data relating interactions between seals and cetaceans with tidal devices.

12.4.32 Data from the detailed Environmental Monitoring Programme (EMP) collected during the first 3 years of operation of the SeaGen project at Strangford Lough suggest that harbour seal have changed their behaviour in response to the operation of the device. Seals tagged during the operational phase have exhibited small scale differences in transit routes and transit rates, when compared to pre-installation, possibly indicating device avoidance (Royal Haskoning, 2012). In summary, those data indicate an awareness of the device by seals in Strangford Lough, as would be expected, with animals showing slight changes in their behaviour to go around the device. To date no evidence of a direct interaction between the operating device at Strangford Lough has been observed, with SeaGen currently shut down by remote active sonar operators when a "marine mammal target[27]" is detected within 30m of the operational device.

12.4.33 This impact assessment has used the encounter rate model developed by Marine Scotland Science (MSS) (Davies & Thompson, 2011) for the key species in Kyle Rhea (i.e. harbour seal, grey seal and harbour porpoise), in order to present modelling results in this impact assessment which are in turn compatible with those the Regulators will use to inform a consenting decision. For other species including basking shark, minke whale and dolphin species the very limited numbers in Kyle Rhea result in a predicted **negligible** impact magnitude. These species are all predicted to have a **high** sensitivity based on the definitions provided in Table 12.3, resulting in **low** significance.

[27] Given the resolution of the active sonar technology a number of false targets (e.g. drift wood and clumps of seaweed) trigger a shutdown.

12.4.34 The MSS model framework is based on the approach pioneered by Band (2000, 2007), and covers; the behaviour (including diving and avoidance behaviour) of the vulnerable species, the physics of collision with the rotors, and the consequences for the populations concerned. The MSS model is used in this assessment to estimate the numbers of potential collisions between seals, harbour porpoise, and the rotors. Further detail on the assumptions and figures used in the model are provided in **Appendix 12.7**.

12.4.35 Limited diving behaviour was observed for harbour and grey seal during the vantage point surveys (**Appendix 12.2**), however a precautionary approach, using dive rates provided by SMRU (shown in Table 12.7), has been used in the assessment. If seals are spending a large amount of time at the surface while in the study area, as indicated by the vantage point surveys, then the potential for interactions between seals and the device will be significantly reduced.

12.4.1 Seal density estimates described in Section 12.3, Existing environment are used in the collision model. The density estimate of 0.45 per km^2 provided in Paxton *et al.* (2011) is used in the assessment, however, a study of the use of Kyle Rhea by harbour porpoise (Wilson *et al*., 2012), shows that they generally occur in very low densities in areas of high tidal flow. This suggests that this density estimate used for the model may be an overestimate at the fine scale around the high tidal currents of Kyle Rhea. During the vantage point surveys an average sightings rate of 0.06 harbour porpoise per hour was recorded (**Appendix 12.2**). Operational noise levels may also cause avoidance behaviour, which would reduce the density of animals in close proximity to the device. However, this factor is captured in the use of estimated avoidance rates, discussed below.

12.4.2 To date, there are limited data which can inform avoidance rates for seal and porpoise. Data from telemetry studies at Strangford suggest that seals may be exhibiting a degree of avoidance, with peaks in transit approximately 250m either side of the device (Lonergan *et al.,* 2010). Noise studies, detailed in **Appendix 12.6** also show that mild avoidance (75dBht) could be expected at 100m and strong avoidance (90dBht) at 8m for seal and 90m for harbour porpoise. This suggests that seals will have the ability to detect the rotors and take evasive action. The model uses an estimate of avoidance rates, which reflects the degree to which the behaviour of the animal in the absence of the devices acts to reduce the risk of collision (for example, taking account of reduced rate of foraging at the times of highest tidal velocity), and behavioural changes that may be introduced by awareness of the presence of the devices. The MSS model suggests a range of avoidance rates between 95% and 99.8%, following the rates typically used in the assessment of collision risk in birds.

12.4.3 There are a number of significant limitations with the use of the MSS model, related firstly to the difference in the characteristics of tidal turbines, compared to wind turbines, and secondly to the extrapolation of marine mammal avoidance behaviour from the behaviour of birds encountering wind turbines.(on which the Band model is based). The additional uncertainty in the effects of the complex flow patterns of water around tidal devices adds to the levels of uncertainty within the model, however, it is not expected that marine mammals (or any objects) could be drawn into the rotors. The MSS model is highly likely to present high probabilities for collision for large animals such as seals, and can be considered highly precautionary despite its other limitations.

12.4.4 Results of the encounter model are summarised in Table 12.7 for harbour and grey seal, as well as harbour porpoise. The avoidance rates presented include a range of values in order to reflect the uncertainty in the true rates. Likely avoidance rates have not been subject to rigorous scientific study and remain difficult to quantify as it is not possible to determine how seals may respond to the presence of a device or how the interaction of devices within the array could change the avoidance rates due to acoustic cues or displacement. As previously discussed, Marine Scotland routinely use 95% to 99.8% avoidance rate as a default standard. It should also be noted that avoidance rates could be 100% given the ability of marine mammals to manoeuvre efficiently in the marine environment and detect existing natural and anthropogenic features without collision.

Table 12.7: Result of the collision risk modelling.

	Harbour seal	Grey seal	Harbour porpoise	
dives per hour	12	6	60	120
Avoidance rate (%)	**No. of potential collisions per year**			
95	128	36	40	79
98	51	14	16	32
99	26	4	8	16
99.5	13	7	4	8
99.8	5	1	2	3

12.4.5 Individual harbour seal and grey seal are considered to have **high** sensitivity to this impact based on the definitions provided in Table 12.3. Potential collision rates from the modelling exercise indicate that at 95% avoidance rate approximately 1.2% of the harbour seal population could be impacted, and approximately 0.7% of the grey seal population could be impacted. The impacts for harbour porpoise at this avoidance rate are <0.2% of the regional population. Given the precautionary nature of the MMS model these levels of impact provide a precautionary impact assessment. It should be noted that given the slow tip speed of 12m/s (27mph) at full power and less for a large proportion of the time, as well as the rounded leading edge of the rotors, a collision may not result in a fatality.

12.4.6 The results of the collision risk modelling for seals can also be compared to the PBR for the WSMA, of 442 for harbour seal and 297 for grey seal. Based on the existing number of issued licences (184 for harbour seal and 126 for grey seal), the population has the capacity to accommodate the potential impact, using avoidance rates of 95% or greater. The impact magnitude is considered to be **low** for harbour seal, and **negligible** grey seal and for harbour porpoise. The significance is therefore **moderate** in harbour seal, and **minor** in harbour porpoise and grey seal.

Impact 4: Suggested Mitigation
1. No mitigation is suggested at this stage - but an adaptive management approach to this potential impact will be agreed post consent, informed by anticipated near field behaviour data for seals from Strangfrod Lough, where imminent removal of shutdown protocols is expected. 2. SeaGeneration (Kyle Rhea) Ltd is committed to working with Marine Scotland and SNH to develop an appropriate Environmental Monitoring Plan to monitor for collisions and will reassess the need for a mitigation strategy if collisions are identified.

Residual impact:

In the absence of specific mitigation the residual significance remains **minor** for grey seal and harbour porpoise and **moderate** in harbour seal.

Impact 5: Noise and vibration

12.4.7 Measurements of operational noise from previous devices (SeaFlow and SeaGen) were used to model the operational noise at Kyle Rhea and scale up for an array of four 2MW devices (see **Appendix 12.6**).

12.4.8 As previously discussed, strong avoidance (90dBht) is predicted at 8m for seals and 90m for harbour porpoise. Mild avoidance (75dBht) is predicted at 100m for seals and 1.1km for harbour porpoise although, as previously discussed Kyle Rhea existing background noise levels reach up to 95.5dBht (strong avoidance) for harbour porpoise and yet they are still observed occasionally. These predicted avoidance responses will minimise any potential risk of long term cumulative exposure impacts for seals spending a long amount of time in close proximity to the devices. The sensitivity of individual marine mammals to this level of noise is predicted to be low. As previously discussed this level of operational noise may allow marine mammals to detect and avoid the array.

12.4.9 Given 400m to the east of the array and 100m to the west (see proposed array layout in Chapter 5, Figure 5.2) in which marine mammals could pass the array, the predicted levels of strong avoidance are unlikely to exclude animals from using Kyle Rhea or transiting through. Any small scale displacement is predicted to cause an impact of low magnitude. The impact significance is therefore deemed to be **minor**.

Impact 5: Suggested Mitigation
1. No mitigation suggested 2. An EMP will be established to monitor potential impacts

Residual impact:

In the absence of specific mitigation the residual significance remains **minor.**

Impact 6: Barrier effects

12.4.10 The physical presence of the array could potentially displace marine mammals from preferred migratory and transit routes within Kyle Rhea.

12.4.11 During ongoing operation of the SeaGen device in Strangford Lough no significant barrier effect has been observed. Passive acoustic monitoring (using TPODS) for 3 years during operation indicates that harbour porpoise are able to pass through the narrows where the device is located. Visual and tagging surveys of seals show continued use of the area with no significant barrier effect or long term change to seal haul out usage (SMRU data presented in Royal Haskoning, 2012).

12.4.12 Section 12.3, Existing environment shows that harbour porpoise appear to mainly be using Kyle Rhea for transit from north to south (or vice versa). Seals appear to mainly be using haul out sites to the north west of the Project site but may come in from the south and therefore need to transit past the array. The sensitivity is predicted to be medium based on the definitions provided in Table 12.4. Basking sharks, minke whale and dolphin species may use Kyle Rhea for transit although the numbers recorded within the Kyle are very low. Therefore the sensitivity for these species is predicted to be low. An array of devices could have more potential to act as a barrier than the single SeaGen device in Strangford Lough; however the array takes up approximately 140m of Kyle Rhea with 100m of clearance to the west and 400m to the east and so no physical barrier effect is expected for any marine mammal species. The magnitude of this impact is therefore predicted to be negligible.

12.4.13 The receptor sensitivity is predicted to be low and therefore the impact is predicted to be of

minor significance.

Impact 6: Suggested Mitigation
No mitigation suggested

Residual impact:

In the absence of mitigation the residual impact remains of **minor** significance.

Impact 7: EMF

12.4.14 There may be potential for marine mammals and basking shark to exhibit behavioural changes including displacement due to the presence of electromagnetic fields (EMF) around inter-array cables (Gill *et al.* 2005). There is currently limited information on this effect but it is widely believed that marine mammals use the geomagnetic field to navigate long distance migrations (Kirschvink *et al.* 1986; Klinowska, 1985).

12.4.15 Although it is assumed that harbour porpoise are capable of detecting small differences in relative magnetic field strength, this is unproven and is based on circumstantial information (Marine Scotland, 2011). There is also, at present, no evidence to suggest that existing cables have influenced cetacean movements. Harbour porpoise move in and out of the Baltic Sea with several crossings over operating subsea high voltage direct current cables in the Skagerrak and western Baltic Sea without any apparent effect on their migration pattern (Faber Maunsell, 2007). There is no evidence that pinnipeds respond to electromagnetic fields EMF and therefore marine mammal sensitivity is deemed to be negligible.

12.4.16 Gill *et al.* (2009) provides evidence that benthic elasmobranch species showed some response to the presence of EMF emitted by a subsea cable, however the basking shark is a pelagic species and therefore less likely to be affected.

12.4.17 The estimated length of inter-array cabling is 595m of 33kV (surface laid). This is a very small amount of low voltage cabling compared with large offshore wind projects, for example. It is therefore predicted that the impacts of EMF will be of negligible magnitude. As a result the significance is predicted to be **negligible.**

Impact 7: Suggested Mitigation
1. No mitigation suggested

Residual impact:

In the absence of mitigation the residual impact remains of **negligible** significance.

Impact 8: Indirect impacts from changes to prey resource

12.4.18 The presence of a tidal array has the potential to alter the fish numbers and distribution in the vicinity and therefore have indirect impacts on marine mammals by changing the available prey resource. Chapter 14, Fish and Shellfish predicts impacts of minor to negligible significance and therefore the magnitude of this impact on marine mammals is predicted to be negligible.

12.4.19 As discussed in Section 12.3, Existing Environment, Kyle Rhea does not appear to be a significant feeding area for marine mammals, based on 1 year of site specific survey data (**Appendix 12.2**). The sensitivity of marine mammals is therefore predicted to be negligible, resulting in an impact of **negligible** significance.

Impact 8: Suggested Mitigation
No mitigation suggested

Residual impact:

In the absence of mitigation the residual impact remains of **negligible** significance.

Potential impacts during the decommissioning phase

12.4.20 The potential impacts arising from decommissioning activities are expected to be of similar nature and magnitude as those predicted for the installation phase, with the exception of drilling which will not occur during decommissioning. Therefore the impacts to marine mammals will at worst have the same significance as those assessed during installation and therefore be of negligible to minor significance.

Potential cumulative impacts

12.4.21 At the time of writing there are no foreseeable projects which could contribute to cumulative impacts on marine mammals in Kyle Rhea or the wider area around Skye, in the inner Sound, Sound of Sleat, or the Little Minch. Given the low level of impacts predicted for the Project cumulative impacts from any projects further afield are unlikely.

12.5 Summary

12.5.1 A variety of sources were used to characterise the existing environment in relation to marine mammals and available data from the detailed EMP in Strangford Lough as well as other project examples as appropriate were used to carry out the impact assessment.

12.5.2 The key species in Kyle Rhea is harbour seal with high numbers recorded during the Project specific surveys. The region (the central West Scotland Management Area) supports a stable harbour seal population which is in contrast to declining numbers at a number of sites around the UK. There were also a high number of grey seals recorded at the site, with this population also stable as it is across the UK. Occasional harbour porpoise sightings and incidental common dolphin, bottlenose dolphin, minke whale and basking sharks were recorded within Kyle Rhea. The findings of the Project specific survey report were broadly consistent with available literature for the site and wider study region.

12.5.3 The greatest potential impacts include collision risk during installation, in particular seal collision risk/interaction f with DP vessels, and during operation, with moving rotors. However harbour and grey seal populations are stable in the study area and so are relatively robust to potential changes. This impact was assessed as moderate significance for harbour seals and minor for other marine mammals. SeaGeneration (Kyle Rhea) Ltd is committed to working with Marine Scotland and SNH to develop an appropriate monitoring and mitigation strategy. t All other impacts were assessed as minor or negligible.

12.5.4 Given the high levels of background noise measured at the site (**Appendix 12.5**) the magnitude of installation and operational noise (**Appendix 12.6**) is relatively low and is not expected to cause any significant displacement or barrier effects.

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13 BENTHIC ECOLOGY

Page

13.1 Introduction

13.1.1 This chapter of the Environmental Statement (ES) describes the character and sensitivity of seabed communities within the vicinity of the proposed Kyle Rhea Tidal Stream Array ('the Project') and associated study area.

13.1.2 It presents the findings of an assessment of potential impacts arising from the construction, operation and decommissioning of the Project.

13.1.3 This chapter has links with Chapter 7, Marine Physical Environment and Coastal Processes, Chapter 14, Fish and Shellfish and Chapter 15, Commercial fisheries. Potential impacts to the intertidal environment are considered in Chapter 10, Terrestrial and Intertidal Ecology.

Study area

13.1.4 The benthic ecology study area is displayed in Figure 13.1 and is determined by the boundaries of Kyle Rhea. A drop down video survey was undertaken to characterise the existing environment within this study area, however due to the fact that the survey team completed the survey of the initial study area with time to spare an extended study area was also included (shown in Figure 13.1).

Overview of potential impacts

13.1.5 A guidance document produced for Marine Scotland providing advice on the Environmental Impact Assessment (EIA) for Wave and Tidal developments (EMEC and Xodus, 2010) lists the potential impacts on benthic ecology as:

- Substratum / habitat loss / damage.
- Smothering.
- Scour around devices and other subsea infrastructure (including mooring cables as result of movement with wave and tides).
- Increased suspended sediment and turbidity from installation of devices and other subsea infrastructure.
- Disturbance of contaminated sediments.
- Decrease in water flow and/or wave exposure.
- Pollution from routine and accidental discharges.
- Colonisation of subsea infrastructure.

Policy, legislation and guidance in relation to benthic ecology

13.1.6 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' protected areas including Special Areas of Conservation (SAC). Where a project has potential to significantly affect a Natura 2000 site the competent authority (in this case Marine Scotland, advised by Scottish Natural Heritage) will undertake a Habitats Regulations Appraisal (HRA). The Conservation (Natural Habitats, & c.) Regulations, 1994 (as amended in Scotland) transpose the Habitats Directive into national law and outline the designation and protection required for 'European Sites' and European Protected Species' (EPS).

13.1.7 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).

13.1.8 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.

13.1.9 The application for the offshore elements of the development plus substation (there will be no works in the intertidal) will be made under Section 36 of the Electricity Act 1989, currently managed by Marine Scotland Licencing Operating Teams (MS-LOT). A Marine Licence under the Marine (Scotland) Act, 2010, will also be required for the placement of materials on the seabed, including the device foundations and any mooring blocks / anchors required during installation. Further details regarding the legislative context for this application are provided in Chapter 2, Policy and Legislation.

13.1.10 Site specific baseline benthic characterisation surveys were informed by recent draft guidance on survey and monitoring for marine renewables developments in Scotland, commissioned by Scottish Natural Heritage (SNH) and MS-LOT (Saunders *et al* ., 2011). Although no works are planned in the intertidal zone, intertidal surveys were also completed and are discussed in Chapter 13, Terrestrial and Intertidal ecology.

13.1.11 A number of guidance documents have been produced with regard to the assessment of the impacts of renewable energy projects, which can be applied to tidal developments. Guidance for offshore wind farm EIA produced by CEFAS (2004), highlights the need for potential impacts to be identified prior to commencement of benthic survey in order to inform survey design. That 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. The assessment of the magnitude and significance of changes to hydrodynamics at a site are also suggested.

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

13.1.13 A series of documents commissioned by Marine Scotland also advise on the application requirements for a Marine Licence. Part four of that advice (Wave and tidal annex) provides specific guidance on the assessment of benthic ecology (Emec and Xodus, 2010). Relevant aspects of this guidance are also considered throughout this chapter.

13.1.14 SNH has recently been undertaking a review of marine habitats and species to identify those considered to be of greatest marine nature conservation importance in Scottish Territorial waters – referred to as 'Priority Marine Features'. This has resulted in the production of a recommended list of Priority Marine Features (SNH & JNCC, 2012). This list will be used to support the advice that SNH gives on marine biodiversity, playing a role in the delivery of new marine planning and licensing systems set out in the Marine (Scotland) Act (2010), and is a relevant document for assessing habitats and species of conservation importance within the study site.

13.1.15 The Institute of Ecology and Environmental Management (IEEM) released their guidelines on ecological impact assessment in Britain and Ireland for the Marine and Coastal environment (IEEM, 2010). These guidelines provide a detailed methodology on ecological impact assessment, and much of the advice from this document is incorporated into this chapter. However, the suggested method for assessment has been adapted slightly to take into account other guidance as well as past experience.

13.1.16 The Scottish Environment Protection Agency (SEPA) recommends that applicants consider the risks of introducing non-native species as part of the EIA process, including best-practice steps by which they can manage those risks.

13.1.17 The International Maritime Organisation (IMO) has produced guidelines which provide useful recommendations on general measures to minimise the risks associated with biofouling (including introduction of non-native species) for all types of ships. Guidance for the prevention and management of invasive species in the oil and gas industry has also been recently produced (2010) by IPIECA (www.ipieca.org/publication/alien-invasive-species-and-oil-and-gas-industry).

13.2 Methodology

Consultation in relation to benthic ecology

13.2.1 Consultation with statutory bodies and key stakeholders was undertaken through a formal EIA scoping process. The scoping response is provided in **Appendix 4.1** and the key items of relevant to benthic ecology are outlined in Table 13.1, below.

13.2.2 The drop down video survey plan was provided to SNH and Marine Scotland and was further discussed and agreed at a meeting on 20th June 2012.

13.2.3 The survey results were also provided to SNH, Marine Scotland and the Highland Council. Feedback has been received outlining that the data collected is satisfactory to inform the EIA and HRA.

Table 13.1 Summary of consultation relating to benthic ecology

Key issues raised	Response
The ES needs to show that the applicants have taken account of the relevant wildlife legislation and guidance namely, Coast Protection Act 1949 section 34, Council Directives on The Conservation of Natural Habitats and of Wild Flora and Fauna, Scottish Executive Interim Guidance on European Protected Species, Development Sites and the Planning System and the Scottish Biodiversity Strategy and associated Implementation Plans. (Scottish Ministers)	Section 13.1, Introduction (including policy, legislation and guidance) and Section 13.4 Impact Assessment

Key issues raised	Response
The presence of species on Schedules 5 (animals) and 8 (plants) of the Wildlife & Countryside Act 1981 should be considered where there is a potential need for a licence under Section 16 of that Act. (Scottish Ministers)	Such species are considered within this chapter and in Chapter 10, Terrestrial and intertidal ecology.
Where a proposal involves shipping or port developments, it may be necessary to submit a detailed description of the actions to be taken to prevent the introduction of non-native marine species from ballast water transfers or hull-fouling which can result in a deterioration of a water body under The Water Framework Directive. (SEPA)	The potential to introduce non-native marine species and approach to mitigation of this risk are discussed and assessed in Chapter, 9 Water Quality.
A baseline assessment of existing intertidal and subtidal habitats and species should include any UK Biodiversity Action Plan habitats and species e.g. maerl, sea pens, eel grass, horse mussels. Developers will then be able to ascertain if they are required to supplement or quantify the available data with in-field surveys. (SEPA)	The baseline assessment evaluates existing knowledge of UK BAP habitats and species within the study area. This was supplemented with both intertidal and subtidal surveys to establish presence and extent.
The key issues that we expect the developers to give the most thorough attention are: • Lochs Duich, Long and Alsh Reefs Special Area of Conservation (SAC), • Kinloch and Kyleakin Hills SAC and Site of Special Scientific Interest (SSSI), • European Protected Species (EPS), particularly cetaceans and otters. • Cumulative impacts on protected sites and EPS. (SNH)	Impacts to the Lochs Duich and Alsh SAC are considered within this chapter and impacts to the Kinloch and Kyleakin and otters are considered in Chapter 10, Terrestrial & Intertidal Ecology. Potential impacts on cetaceans are considered in Chapter 12, Marine mammals & basking shark (& UW noise).
The ES should provide sufficient detail to inform any future appropriate assessment which would be carried out by Marine Scotland as competent authority. (SNH)	Information to support HRA and the appropriate assessment will be contained within a separate document that will be submitted as part of the application (Royal HaskoningDHV, 2012).
A baseline survey is available for the [Loch Lochs Duich, Long and Alsh Reefs] SAC (Entec 2000). This includes shore type maps and predictive mapping of benthic life forms. It provides useful broad scale information but the underlying data is not sufficiently detailed to allow accurate biotope mapping. (SNH)	This document was requested from SNH. Broadscale survey carried out by Entec in 1996 has been considered. However the site specific habitat mapping carried out for the Project provides more detailed and up to date information.

Key issues raised	Response
The applicant has suggested using drop down video and/or diver surveys to provide detailed data; we recommend that ROV video transects and still photography using a weighted drop frame also be considered. We look forward to discussing the detail of the survey techniques with the applicant and Marine Scotland. It would also be useful to schedule in a review after early analysis in case further work is required. (SNH)	ROV and stills were considered, however due to the strong tidal currents these methods would not have been appropriate. In addition, the purpose of the survey was seabed mapping and characterisation. The methods used for benthic survey were agreed with SNH and Marine Scotland.
It is worth highlighting that the reef feature includes rocky, stony and biogenic reef. The Joint Nature Conservation Committee JNCC have recently clarified what constitutes stony reef: Irving, R, (2009), The identification of the main characteristics of stony reef habitats under the Habitats Directive, JNCC Report 432, and ISSN 0963 8091 available via the JNCC website at: http://www.jncc.gov.uk/page-5023 (SNH)	This information has been taken into account throughout this chapter.
Particular attention should be given to the site's conservation objectives and the following aspects should also be considered: Damage/disturbance caused by boat moorings, cables and other ancillary aspects; Consideration of hydrodynamic changes; Accidental release of hydraulic fluids and potential pollutants including the use of anti-foulants and sacrificial anodes. (SNH)	These potential impacts have been considered in Section 13.4 of this Chapter.
In principle, we support proposals for directional drilling for cables because this offers an opportunity to minimise the benthic impacts of cable laying. Providing best practice is followed and a pollution prevention package is drawn up, the effects from potential pollutants may be minimised. We advise that environmental practices and management for hydraulic fluids and potential pollutants are detailed within the ES. (SNH)	Pollution prevention is discussed in Chapter 9, Water Quality.
The evidence presented, either new or existing, should ensure that the surveys conducted satisfactorily establish the location of any reef habitats, including biogenic reefs such as *Modiolus modiolus*, and any listed species in respect to the proposed positions of the 4 devices. (Marine Scotland)	The site specific survey covers the whole Kyle Rhea site, but specifically focuses on the proposed positions of the devices themselves.
It would be extremely useful to know if the quality of the reef structures associated with Kyle Rhea represents the very best of the habitats within the SAC. If they are, it should be considered how this would change the assessment, if at all, in terms of site suitability, additional data collection, array design, installation methodology, etc. This information will also guide the methodologies for site preparation and the installation of the devices and associated cabling. Alterations to the current methodologies will be required as a result of newly acquired information. (Marine Scotland)	It was not practical to sample the entire SAC. The reefs found within Kyle Rhea are good examples of rocky reef and therefore the impacts to these features are assessed using appropriate sensitivity in section 13.4.
The installation, replacement and maintenance of undersea cables have the potential to cause direct loss of reef habitat as well as local deterioration of reef habitats and communities. (Marine Scotland)	This impact is considered with Section 13.4 of this Chapter.

Key issues raised	Response
The developer should provide evidence of the presence or absence of qualifying habitats or species in the vicinity of the marine devices and cable routes especially *Modiolus modiolus* beds. Existing surveys or data may be acceptable if they can provide sufficient detail of the species and habitats present. Considerable disturbance to benthic habitats will occur from laying the inter-device cables by trench. Other less disturbing methods should be considered in the ES. (Marine Scotland)	A site specific survey was undertaken which showed no evidence of *Modiolus modiolus* beds within the study area. Details of the survey data collected, including seabed habitat maps are provided in this chapter and associated appendices. Methods for cable laying and other installation works are detailed in Chapter 5, Project Description. However, it is noted that and cables would be laid directly onto the seabed, with no trenching, the method with least potential to disturb benthic habitats.

Data collection

13.2.4 A large number of resources have been used to acquire data to inform the existing environment within Kyle Rhea and the wider study area. Additional data sources have been used within the impact assessment (Section 13.4). Table 13.2 contains a list of main data sources that have been used within this chapter.

Table 13.2 Data sources to inform the benthic ecology existing environment and assessment

Data Source	Spatial coverage	Author	Year
Site condition monitoring of the SAC	Lochs Duich, Long and Alsh Reefs SACs	Emu Ltd.	2006
Underwater video surveys report	Wave and tidal energy sites in Scottish waters	More and Robertson	2011
Marine Scotland Interactive.	Wave and tidal energy sites in Scottish waters	Marine Scotland	2011
Scottish Marine SEA	North and West Scotland	Faber Maunsell	2007
Appendix 13.1 Benthic survey	The benthic environment of the study area.	Envision mapping	2012
Marine Life Information Network (Marlin)	UK wide	Various	2012

Desk based study

13.2.5 To inform both the scope of the benthic survey and the impact assessment within this chapter, a desk based study was conducted. The study used a variety of resources including the site conditioning monitoring of the area (Emu, 2006), overview reports of the wider area (Wilding *et al.,* 2005) and the results of benthic surveys designed to identify species and habitats within potential sites for wave and tidal energy production (Moore and Robertson 2011).

Geophysical study 2010

13.2.6 In 2010 a geophysical survey of the Kyle Rhea strait was commissioned by Sea Generation (Kyle Rhea) Ltd. The study included multibeam swath bathymetry, side scan sonar and magnetometer surveys of Kyle Rhea. More detail is provided in (Chapter 7, Marine Physical Environment and Coastal Processes).

Benthic study - 2012

13.2.7 Further to the desk based study, and building upon geophysical data collected in 2010, a drop down video benthic survey was commissioned by Sea Generation (Kyle Rhea) Ltd. The survey was designed by Royal Haskoning and Envision Mapping Ltd, and was carried out by Envision Mapping Ltd in June 2012. As previously discussed the approach and results for this survey have been discussed and agreed with Marine Scotland and Scottish Natural Heritage (SNH). The results of this survey are used to define the existing environment and inform the impact assessment in Section 13.4.

13.2.8 The objectives of the benthic survey were to characterise the seabed within the study area (Figure 1.1) in terms of:

- Distribution and abundance of marine habitats and communities;
- Identify habitats or species of conservation importance; and
- Determine the substrate type at all locations sampled.

13.2.9 Prior to the drop down video survey, the data from the geophysical survey in 2010 and other available habitat data were used to provisionally map the study area into habitat types, following methods described in guidelines by Mapping European Seabed Habitats (MESH, 2008). This provided a framework within which the sample locations were selected to ground-truth each habitat class a minimum number of times with the locations spread throughout the survey area.

13.2.10 The analysis suggested that Maerl (currently listed under Annex V of the EU Habitats Directive) might also be present. In addition, the eelgrass *Zostera marina* could potentially have been found in the shallow sediment. Eelgrass is a Habitat Action Plan species and a component of a number of priority habitats in the EC Habitats Directive. It was recognised that neither Maerl nor Eelgrass had been recorded in Kyle Rhea, but it was felt that the sampling should be vigilant for these habitats.

13.2.11 In their scoping opinion (**Appendix 4.1**) Marine Scotland expressed the need to combine video sampling with grab sampling as part of the benthic survey. However due to the predominantly hard nature of the seabed (Chapter 7, Marine Physical Environment and Coastal Processes) it was subsequently agreed (with Marine Scotland and SNH, during meeting 20th June 2012) that grab sampling would be inappropriate for the site and that video sampling would be the primary method used to ‘ground truth’ acoustic data.

13.2.12 The benthic survey report is presented in Appendix 13.1. Fifty video samples were proposed and 54 were eventually collected from within the study area. An additional 16 samples were collected from an extended study area (Figure 13.1) to the south of the Kyle as time allowed for additional stations. The focus of the sampling was designed to target the area where the devices are to be installed with additional samples to be taken north and south (in line with the tidal flow) of the proposed installation sites. Note also that some samples were located south of the Kyle for completeness especially considering the nearness of the devices to the southern entrance to Kyle Rhea (Figure 13.3).

13.2.13 The data from analysis of drop video was combined with the geophysical data to create a habitat map. This was done by creating a small buffer zone around each sample point from which geophysical data were extracted. These data were associated with habitat and biotope classes and used to create statistical signatures (separately) for habitats and biotopes. These two statistical signature sets were then used to interpret the complete coverage to estimate the distribution of habitats and biotopes.

Impact assessment

13.2.14 The significance of the impact imposed by the Project 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 13.3.

Table 13.3 Definition of magnitude of an impact upon receptors

Magnitude	Definition
High	Very significant, permanent / irreversible changes, over the whole feature / asset, and / or significant alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. And / Or Impact certain or highly likely to occur.
Medium	Significant, permanent / irreversible changes, over the majority of the feature / asset, and / or noticeable alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. And / Or Impact likely to occur.
Low	Noticeable, temporary (during the Project duration) change, over a minority of the feature / asset, and / or limited but noticeable alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. And / Or Impact may possibly occur.
Negligible	Noticeable, temporary (for part of the Project duration) change, or barely discernible change for any length of time, over a small area of the feature or asset, and/or slight alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. And / Or Impact unlikely to occur or will occur only rarely.

13.2.15 The sensitivity/value/importance of the receptor for each impact is characterised as one of four levels, high, medium, low or negligible. The definition of each level is given below in Table 13.4.

Table 13.4 Definition of terms relating to the sensitivity to a receptor to an impact

Value / Sensitivity	Definition
High	No capacity to accommodate the proposed form of change.
Medium	Very low capacity to accommodate the proposed form of change.
Low	Low capacity to accommodate the proposed form of change.
Negligible	Receptor has some tolerance to accommodate the proposed change.

13.2.16 Table 13.5 combines the definitions of magnitude with the level of sensitivity/value/importance of receptor to provide a prediction of overall significance of the impact. The boxes shaded in red and orange represent an impact which is likely to be considered significant within an EIA.

Table 13.5 The level of significance of an impact resulting from each combination of sensitivity and magnitude

Sensitivity	Magnitude			
	High	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

The significance of the impact is a combination of the sensitivity of the receptor and the magnitude of the impact. The impact assessments are made following IEEM guidelines for assessment (see Chapter 4, EIA Methodology), using the expert judgement of suitably qualified and experienced specialists.

13.3 Existing environment

The wider region

13.3.1 Kyle Rhea is part of a network of sea lochs and tidal narrows comprising three interlocking loch systems of Loch Duich, Loch Long and Loch Alsh, that support a wide range of habitats and species. Many of these hold high conservation value and as such the area has been designated as the Loch Duichs, Long and Alsh Reefs SAC (further detail is provided below). Key habitats within this system include the following:

- Very sheltered, rocky reefs subject to variable salinity in Loch Long;
- Deep sublittoral bedrock cliffs supporting communities characterised by brachiopods and anemones in Loch Duich;
- Dense beds of the normally cryptic brittlestar *Ophiopholis aculeata* within the centre of the loch system; and

- Tide-swept bedrock communities in Kyle Rhea (Emu, 2006).

13.3.2 The diversity of habitat type within the wider area is a function of the variety in oceanographic conditions experienced and the habitats available. The convoluted nature of the coastline creates a range of conditions, from sheltered enclosed lochs with little tidal current, to exposed shores and tidal narrows with some of the fastest tidal flows in the UK.

The study area

Marine Scotland surveys

13.3.3 Marine Scotland commissioned a number of surveys that were designed to investigate the benthic ecology of potential sites for wave and tidal energy developments (Moore and Robertson, 2011). The positions of the video samples collected from the site are displayed in Figure 13.2. During those surveys a number of important benthic habitats and species were identified in the vicinity of Kyle Rhea:

13.3.4 The tall seapen *Funiculina quadrangularis,* which is a PMF species (see paragraph 13.1.14), was found to be abundant at the southern entrance to Kyle Rhea, at sample station KR1/10. Also in the same area, a tide-swept *Laminaria hyperborea* (kelp) park on mixed substrata (IR.MIR.KR.LhypTX.Pk) was recorded at sample locations KR2/10 and KR3/10 (Moore and Robertson 2011).

13.3.5 Neither of the features discussed above was located within the study area, although they were both present within the extended study area (Figure 13.2). It is unlikely that the tall seapen is present within the study area as the mud habitat it requires is not present there (Appendix 13.1). No evidence of the tall sea pen was found during the site specific surveys (see below).

Benthic survey - 2012

13.3.6 As outlined earlier in this chapter, a site specific benthic mapping survey was commissioned by Sea Generation (Kyle Rhea) Ltd., building upon data from an earlier acoustic survey. Details of the survey methodology are presented in Section 13.2 of this chapter and the survey report is provided in **Appendix 13.1**.

13.3.7 During this survey 82 taxa were recorded during analysis of the video collected. The dominant species in the circalittoral areas in the centre of the main channel were the oaten pipes hydroid *Tubularia indivisa*, dead man's fingers *Alcyonium digitata*, and the anemones *Sagartia elegans*, *Corynactis viridis* (jewel anemone) and *Metridium senile* (plumose anemone). These species formed almost 100% coverage of the substrate at several stations surveyed. These species are characteristic of accelerated tidal stream environments and might be expected in the tidal current regime and in the depths that occur at Kyle Rhea.

13.3.8 In shallow water towards the edges of the Kyle, where the tidal flow is reduced compared to that experienced in the centre, the dominant species were the kelp *Laminaria hyperborea*, hydroids such as *Nemertesia* spp. and *Sertularia* sp., and foliose red algae. This composition of habitats is similar to those found in Strangford Lough prior to and after installation of the SeaGen device (Royal Haskoning, 2011).

13.3.9 Other obvious and widespread species, such as the sea urchin *Echinus esculentus*, starfish *Asterias rubens* and velvet swimming crab *Necora puber*, were present throughout the depth range surveyed. The sponge *Pachymatisma johnstoni*, also a species characteristic of areas of high tidal current, was frequently observed in the circalittoral zone of Kyle Rhea.

Seabed substrate mapping

13.3.10 Twelve different categories of seabed substrate were recorded across the study area and extended study area (Figure 13.4). The deeper areas, in the central channel, were comprised mainly of bedrock. Surrounding these was a mix of sediment categories, from boulders through to coarse sand. The rugged bedrock and boulder area ‘reef’ is included in the Habitats Directive Annex 1 list of habitat types (JNCC, undated [a]). Further detail on the rocky reef habitat is provided under the title “Lochs Duich, Long and Alsh Reefs marine SAC” below.

13.3.11 Much of the eastern side of Kyle Rhea is categorised as “boulders and gravel” with small amounts of “bedrock, boulders and gravel” and “bedrock and coarse sand” present at the northern end of the study area. The western side of the Kyle is a complex mix of many different substrates but is mainly dominated by the “bedrock, boulders and gravel” category and the “boulders and gravel” category (Figure 13.4).

13.3.12 The substrate in the ‘extended study area’ at the southern end of Kyle Rhea was characterised using only video samples, as geophysical data for this area were not available. The rugged bedrock which characterises the lower central section of the Kyle appears to continue for some distance into the extended study area (Figure 13.4), however the main substrate type has been identified as “bedrock and boulders”. At the extreme south eastern edge of the extended study area gravel was identified. This is likely to be present as a result of the lower velocity tidal currents that are present within this area, allowing the settlement of sediment.

Biotope mapping

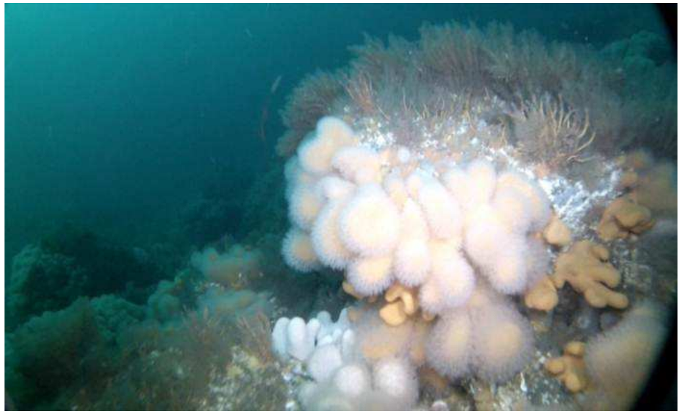
13.3.13 Thirteen different biotope categories were allocated during the mapping process (**Appendix 13.1**). The distribution of the biotopes appears to reflect the pattern of the natural contours of the site. Those based on the presence of kelp occur towards the edges of the channel in the shallower water; those with large densities of foliose red algae occupy the next lower ‘shelf’; below this, in deeper water, encrusted (with Corallinaceae and *Pomatoceros*) cobble and gravel is found, and, finally, the *Alcyonium/Tubularia* biotopes tend to occur on bedrock forming the deeper ‘basin’ of the channel.

13.3.14 The dominant biotope was ‘*Alcyonium digitatum* with dense *Tubularia indivisa* and anemones on strongly tideswept circalittoral rock’, occurring in 25 of the 70 samples.

13.3.15 All biotopes found within the Study Area and Extended Study Area are presented in Table 13.6, with accompanying descriptions based on Conner *et al* 2004. Figure 13.5 presents the location and extent of each of the habitats detailed in Table 13.6.

Table13.6 Biotopes within the study area and extended study area

Biotope code	Description	Study area images
CR.HCR High energy circalittoral rock	This habitat complex occurs on extremely wave-exposed circalittoral bedrock and boulders subject to tidal streams ranging from strong to very strong. Typically found in tidal straits and narrows. The high energy levels found within this habitat complex are reflected in the fauna recorded. Sponges such as *Pachymatisma johnstonia*, *Halichondria panicea*, *Esperiopsis fucorum* and *Myxilla incrustans* may all be recorded. Characteristic of this habitat complex is the dense 'carpet' of the hydroid *Tubularia indivisa*. The barnacle *Balanus crenatus* is abundant on the rocky substrata and *Alcyonium digitatum is* often present on rocky outcrops.	
CR.HCR.FaT.CTub Tubularia indivisa on tideswept circalittoral rock	This biotope is typically found on the vertical and upper faces of strongly tide-swept, wave-exposed circalittoral bedrock and boulders. It is characterised by a dense carpet of *Tubularia indivisa*. The barnacle Balanus crenatus, where present, is recorded as common. The accompanying species in the community are determined by tidal stream strength. On the more sheltered sides of headlands, where tidal streams are accelerated, sponges such as *Pachymatisma johnstonia, Esperiopsis fucorum, Myxilla incrustans* and *Halichondria panicea* proliferate forming the CTub.CuSp sub-biotope. There may also be a scattered bryozoan turf, formed by criisid bryozoans. Other species recorded in this biotope include the anemones *Sagartia elegans, Actinothoe sphyrodeta, Corynactis virdis* and *Urticina felina*. There may be scattered clumps of hydroids such as *Sertularia argentea* and *Nemertesia antennina*. Where `relative shelter' is afforded by the topography of the seabed, the bryozoans *Flustra foliacea*, *Alcyonidium diaphanum* and the crab *Cancer pagurus* may be found, *Asterias rubens* and *Calliostoma zizyphinum* may also be present.	

Biotope code	Description	Study area images
CR.HCR.FaT.CTub.Adig *Alcyonium digitatum* with dense *Tubularia indivisa* and anemones on strongly tide-swept circalittoral rock	This biotope is typically found on exposed circalittoral bedrock and boulders in sounds, narrows and around tide-swept promontories in accelerated tidal streams. It is dominated by aggregations of dead man's fingers *Alcyonium digitatum*, and dense clumps or continuous cover of *Tubularia indivisa*, particularly on prominent ledges and ridges. Anemones such as *Sagartia elegans*, *Urticina felina*, *Metridium senile*, *Actinothoe sphyrodeta* and *Corynactis virdis* form a prominent component of the community. Occasionally, massive sponges such as *Pachymatisma johnstonia* and *Esperiopsis fucorum* may be present. Encrusting species such as the polychaete *Pomatoceros triqueter* and the barnacle *Balanus crenatus* may be dotted around the rocks, and the top shell *Calliostoma zizyphinum* may also be observed. Clumps of the bryozoan *Flustra foliacea* are occasionally seen. The starfish *Asterias rubens* may be seen amongst a patchy turf of *Crisia denticulata* and the bryozoan *Alcyonidium diaphanum*. This biotope may also be found on tideswept wrecks and other artificial sustratum.	
CR.MCR.EcCr.FaAlCr.Pom Faunal and algal crusts with *Pomatoceros triqueter* and sparse *Alcyonium digitatum* on exposed to moderately wave-exposed circalittoral rock	This biotope is typically found on the upper faces of exposed and moderately exposed circalittoral bedrock or boulders subjected to moderately strong to weak tidal streams. The rocky substratum is generally covered with encrusting red algae and the white, calcareous tubes of the polychaete *Pomatoceros triqueter*, dotted with the abundant urchin *Echinus esculentus*. *Alcyonium digitatum* is usually seen attached to the rocky surface underneath rock overhangs and large boulders. The relative biomass of *Alcyonium digitatum* is generally lower than in other biotopes as they are small. Sparse clumps of the hydroid *Abietinaria abietina* are frequently observed, and bryozoan crusts such as *Parasmittina trispinosa* are occasionally seen. Echinoderms such as the brittlestars *Ophiothrix fragilis* and *Ophiocomina nigra*, and the crab *Cancer pagurus* may be seen within crevices in the boulders/rock whilst the starfish *Asterias rubens* may be seen on the rock surface. Muddy-gravel patches between boulders (especially within Scottish sealochs) provide a suitable habitat for the anemone *Urticina felina*. Within this biotope, there is some regional variation and the hydroid *A. abietina* is typically found in higher abundances in northern (Scottish) regions.	

Biotope code	Description	Study area images
IR.HIR.KFaR.FoR Foliose red seaweeds on exposed lower infralittoral rock	Dense turf of foliose red seaweeds on exposed or moderately exposed lower infralittoral rock, generally, at or below the lower limit of the kelp. Most of the red seaweeds are common to the kelp zone above. Foliose species commonly present include *Dilsea carnosa, Hypoglossum hypoglossoides, Schottera nicaeensis, Cryptopleura ramosa* and *Delesseria sanguinea*. The red seaweed species composition varies considerably. As well as a varied red seaweed component, this biotope may also contain kelp plants and brown foliose seaweed *Dictyota dichotoma*. Coralline crusts cover the bedrock beneath the seaweeds. The fauna comprises low-encrusting forms such as the tubeworms *Pomatoceros* spp., *Alcyonium digitatum, Urticina felina* and *Caryophyllia smithii* and sponge crusts such as *Cliona celata, Esperiopsis fucorum, Scypha ciliata* and *Dysidea fragilis*. Other fauna potentially present includes includes *Calliostoma zizyphinum, Echinus esculentus Asterias rubens, Marthasterias glacialis* and *Cancer pagurus*. Bryozoan crusts such as *Electra pilosa* can be found fronds on red seaweeds and *Nemertesia antennina* may be present on underlying rock.	
IR.MIR.KR.LhypT.Ft *Laminaria hyperborea* forest, foliose red seaweeds and a diverse fauna on tide-swept upper infralittoral rock	Exposed to moderately exposed, tide-swept bedrock and boulders, with dense *Laminaria hyperborea* forest, characterised by a rich under-storey and stipe flora of foliose seaweeds. The kelp stipes support epiphytes such as *Callophyllis laciniata, Corallina officinalis, Cryptopleura ramosa, Membranoptera alata*, and *Phycodrys rubens*. Kelp stipes may also be encrusted by the ascidians such as *Botryllus schlosseri*. Epilithic seaweeds *Dilsea carnosa, Hypoglossum hypoglossoides, Delesseria sanguinea, Plocamium cartilagineum, Brongniartella byssoides*, and *Dictyota dichotoma* and crustose seaweeds occur beneath the kelp. The kelp fronds are often covered with growth of *Obelia geniculata* or the bryozoan *Membranipora membranacea*. On the rock surface, a rich fauna comprising of the sponges *Pachymatisma johnstonia, Halichondria panicea, Esperiopsis fucorum, Dysidea fragilis,* the anthozoans *Urticina felina, Alcyonium digitatum* and *Caryophilia smithii,*. Other fauna include *the barnacle Balanus crenatus, seasquirt Clavelina lepadiformis, molluscs such as Calliostoma zizyphinum*, and *Gibbula cineraria, as well as the starfish Asterias rubens* and brown crab *Cancer pagurus*.	

Biotope code	Description	Study area images
IR.MIR.KR.LhypT.Pk Laminaria hyperborea park with hydroids, bryozoans and sponges on tide-swept lower infralittoral rock	Exposed to moderately wave-exposed, strongly tide-swept, rock with *Laminaria hyperborea* park characterised by a rich under-storey and stipe flora of foliose seaweeds such as Phycodrys rubens, *Plocamium cartilagineum*, *Hypoglossum hypoglossoides, Kallymenia reniformis, Cryptopleura ramosa* and *Delesseria sanguinea*. The red seaweed *Heterosiphonia plumosa* can be present, as can the foliose brown seaweed *Dictyota dichotoma* and coralline crusts. Amongst the red seaweeds is a rich fauna comprising sponges including *Pachymatisma johnstonia, Stelligera rigida, Esperiopsis fucorum* and *Dysidea fragilis*, anthozoans *Alcyonium digitatum* and *Caryophyllia smithii*,, hydroids *Aglaophenia pluma* and *Nemertesia antennina*, colonial ascidians *Clavelina lepadiformis* and *Morchellium argus* and bryozoans such as *Electra pilosa*. The flora and fauna of this biotope are similar to the wave exposed kelp park (LhypR.Pk), but LhypT.Pk has a greater faunal component including the barnacle *Balanus crenatus*, the echinoderm *Asterias rubens* and the crab *Necora puber*.	
IR.MIR.KR.LhypTX.Ft *Laminaria hyperborea* forest and foliose red seaweeds on tide-swept, upper infralittoral mixed substrata	Moderately wave-exposed to wave sheltered, tide-swept mixed substrata, with *dense Laminaria hyperborea* forest and sparser *Laminaria saccharina*, characterised by an under-storey and stipe flora of foliose seaweeds. The kelp stipes support epiphytes such as *Palmaria palmata Callophyllis laciniata, Cryptopleura ramosa, Membranoptera alata*, and *Phycodrys rubens*. At some sites, instead of being covered by red seaweeds, the kelp stipes are heavily encrusted by ascidians such as *Botryllus schlosseri*. Epilithic seaweeds such as *Delesseria sanguinea, Plocamium cartilagineum, Odonthalia dentata, Dictyota dichotoma* and *Desmarestia aculeata* as well as crustose seaweeds, commonly occur beneath the kelp. Kelp fronds are often covered with growth of the hydroid *Obelia geniculata* or the bryozoan *Membranipora membranacea* and although these species are also found in most kelp forests, in this biotope they are particularly dense. On the rock surface, a rich fauna comprising anthozoans such as *Urticina felina*, the barnacle *Balanus crenatus*, the calcareous tubeworm *Pomatoceros triqueter,* colonial ascidians such as *Clavelina lepadiformis*,gastropods *Calliostoma zizyphinum* and *Gibbula cineraria*, and the bryozoans *Electra pilosa* and *Alcyonidium diaphanum* occur. Also found on the rock are the echinoderms *Echinus esculentus, Asterias rubens* and *Ophiothrix fragilis*, and the crabs *Cancer pagurus, Pagurus bernhardus* and *Necora puber*.	

Biotope code	Description	Study area images
IR.MIR.KT.XKTX Mixed kelp and red seaweeds on infralittoral boulders, cobbles and gravel in tidal rapids	Mixed substrata of boulders, cobbles, pebbles and gravel, typically found in tidal rapids with kelp *Laminaria saccharina* and *Laminaria hyperborea* and red seaweeds. *L. saccharina* usually dominates this habitat although *L. hyperborea* may occur in equal abundance at some sites. The kelp in these tidal rapids does not form the same dense canopies associated with stable tide-swept bedrock, but generally occurs at lower abundance (Frequent). Other brown seaweeds occur in significant amounts in these tidal rapids including *Dictyota dichotoma, Halidrys siliquosa* and *Chorda filum*. These mixed substrata support a greater diversity of species than scoured bedrock narrows (XKT). In particular, there is an increase in red algal species such as *Corallina officinalis, Bonnemaisonia hamifera* and *Ceramium nodulosum*, although none occur in any great abundance. Red seaweeds common to both XKT and this biotope include *Chondrus crispus*, *Delesseria sanguinea*, *Plocamium cartilagineum* and *Phycodrys rubens*. Good examples of this biotope also often have maerl gravel (Lithothamnion sp.) or rhodoliths between cobbles and boulders. Where maerl dominates, the biotope should be recorded as a maerl bed (SS.SMP.Mrl). The sponges associated with more stable, tide-swept conditions are generally absent, but the anthozoan *Anemonia viridis* might be present. Cobbles and pebbles are encrusted by the ubiquitous polychaete *Pomatoceros triqueter* and provide shelter for scavenging crabs such as *Carcinus maenas*, the hermit crab *Pagurus bernhardus*, gastropods such as *Gibbula cineraria* and echinoderms such as *Echinus esculentus, Asterias rubens, Ophiocomina nigra* and *Ophiothrix fragilis* which favour these sites of increased water movement.	
SS.SCS Sublittoral coarse sediment (unstable cobbles and pebbles, gravels and coarse sands)	Coarse sediments including coarse sand, gravel, pebbles, shingle and cobbles which are often unstable due to tidal currents and/or wave action. These habitats are generally found on the open coast or in tide-swept channels of marine inlets. They typically have a low silt content and a lack of a significant seaweed component. They are characterised by a robust fauna including venerid bivalves	

Biotope code	Description	Study area images
SS.SCS.CCS Circalittoral coarse sediment	Tide-swept circalittoral coarse sands, gravel and shingle generally in depths of over 15-20m. This habitat may be found in tidal channels of marine inlets, along exposed coasts and offshore. This habitat, as with shallower coarse sediments, may be characterised by robust infaunal polychaetes, mobile crustacea and bivalves. Species of holothurian such as *Neopentadactyla mixta* may also be prevalent in these areas along with the lancelet *Branchiostoma lanceolatum*.	
SS.SMp.Mrl Maerl beds	Beds of maerl in coarse clean sediments of gravels and clean sands, which occur either on the open coast or in tide-swept channels of marine inlets (the latter often stony). In fully marine conditions the dominant maerl is typically *Phymatolithon calcareum* (SMP.Pcal), whilst under variable salinity conditions in some sealochs beds of *Lithothamnion glaciale* (SMP.Lgla) may develop.	

Biotope code	Description	Study area images
SS.SMx.CMx Circalittoral mixed sediment	Mixed (heterogeneous) sediment habitats in the circalittoral zone (generally below 15-20m) including well mixed muddy gravelly sands or very poorly sorted mosaics of shell, cobbles and pebbles embedded in or lying upon mud, sand or gravel. Due to the variable nature of the seabed a variety of communities can develop which are often very diverse. A wide range of infaunal polychaetes, bivalves, echinoderms and burrowing anemones such as *Cerianthus lloydii* are often present in such habitat and the presence of hard substrata (shells and stones) on the surface enables epifaunal species to become established, particularly hydroids such as *Nemertesia* spp and *Hydrallmania falcata*. The combination of epifauna and infauna can lead to species rich communities. Coarser mixed sediment communities may show a strong resemblance, in terms of infauna, to biotopes within the SCS complex. However, infaunal data for this biotope complex is limited to that described under the biotope MysThyMx, and so are not representative of the infaunal component of this biotope complex.	

Species of conservation importance

13.3.16 Some of the individual species recorded in the video survey are of particular note, having conservation importance. These are discussed below:

Maerl

13.3.17 Maerl was recorded at Stations 52, 53 and 55 (Figure 13.3 and Figure 13.5). There are two common species of maerl in Scotland: *Phymatolithon calcareum* is widespread, and *Lithothamnion glaciale* is more northern in its range. It is not easy to tell them apart. Both species form beds, which UK BAP Priority habitats (JNCC, 2012). Maerl is an important habitat for a wide variety of marine animals and plants, and further detail on the importance of maerl as a habitat is provided below in the "Habitats of conservation importance" section.

13.3.18 The sample stations at which maerl was identified are to the south of the Study Area and are all in excess of 770km from the nearest device location.

Sand eels

13.3.19 Sandeel *Ammodytes* sp. was identified at station 62 (Figure 13.1). The two *Ammodytes* species present in UK waters are difficult to distinguish underwater and so it is not clear which species was recorded in Kyle Rhea. Both *A. marinus* and *A. tobianus* are included in the 'Recommended list of Priority Marine Features in Scottish Territorial Waters' (SNH and JNCC, 2012). In addition, *Ammodytes marinus* is also a Priority Species in the UK Biodiversity Action Plan for Scotland (JNCC, 2012). This species is also considered within Chapter 14, Fish and Shellfish.

Other species

13.3.20 Spurdog (or Spiny dogfish) *Squalus acanthias* and harbour seal *Phoca vitulina* were also observed during the benthic survey at stations 52 and 63 respectively (Figure 13.3). These species are considered in Chapter 14, Fish and Shellfish and Chapter 12, Marine mammals & basking shark, respectively.

13.3.21 No evidence was found during the benthic surveys of the presence of any species listed in Schedule 5 of the Wildlife and Countryside Act 1981 (as amended in Scotland through the Nature Conservation (Scotland) Act 2004).

Habitats of conservation importance

13.3.22 Two habitats of conservation importance were identified in the study area.

Maerl

13.3.23 As previously discussed maerl was recorded during the drop down video survey. This forms the maerl bed habitat (biotope SS.SMp.Mrl) and was found at station 55 which is approximately 1000m south of the device locations and is within the extended survey area (Figure 13.1 and Figure 13.5). This habitat is included within the 'Recommended list of Priority Marine Features in Scottish Territorial Waters' (SNH and JNCC 2012). Maerl beds are also a UK BAP Priority habitat (JNCC, 2012).

13.3.24 Maerl beds typically develop in tidal environments, such as in the narrows and rapids of sea lochs, or the straits and sounds between islands. They are an important habitat for a wide variety of marine animals and plants which live amongst or are attached to ‘branches’ of maerl, or burrow in the coarse gravel of dead maerl beneath the top living layer.

13.3.25 Potential threats to maerl beds include obstruction to water flow, building of barrages, causeways and bridges are potential blockages to water flow, particularly in sea lochs and between islands, causing fine sediment particles to accumulate between the maerl fragments and smother the bed.

Laminaria hyperborea on tide-swept infralittoral mixed substrata

13.3.26 *Laminaria hyperborea* on tide-swept infralittoral mixed substrata (biotope IR.MIR.KR.LhypTX) was identified at stations 18, 21, 31, 38, 41, 54 and 68. These sample stations are all located around the edges of the narrows and the closest to proposed position of the devices are 21 and 31 which are located 99m and 154m from the nearest devices respectively. This biotope is included in the ‘Recommended list of Priority Marine Features in Scottish Territorial Waters’ (SNH and JNCC 2012).

Tide-swept channels

13.3.27 Tide-swept channels are also listed under UK BAP Priority habitats (JNCC, 2012), where the habitat action plan uses the term 'tidal rapids' to cover a broad range of high energy environments including deep tidal streams and tide-swept habitats. The following biotopes, recorded within the survey area, are associated with tideswept conditions:

- CR.HCR.FaT.CTub
- IR.MIR.KR.LhypTX.Ft
- CR.HCR.FaT.CTub.Adig
- IR.MIR.KR.LhypT.Pk
- IR.MIR.KT.XKTX
- IR.MIR.KR.LhypT.Ft
- SS.SMp.Mrl

13.3.28 Current and potential threats to tide-swept channels listed on the UK BAP documentation (JNCC, 2012) include:

- Obstruction to the water flow
- Tidal power generation

Designated sites

13.3.29 The entirety of the study area and approximately half of the extended study area is within the Lochs Duich, Long and Alsh Reefs marine SAC.

13.3.30 The SAC is designated for its reef interest an Annex 1 habitat. The advice produced by SNH under Regulation 33 of the Habitats Regulations is considered within the document “Information to inform habitat regulations appraisal” (Royal Haskoning, 2012), which accompanies this assessment in support of the application. A summary of this information is provided below.

13.3.31 The description of the SAC reef features in Annex B to the Regulation 33 advice, is:

“The reefs of Lochs Duich, Long and Alsh and the tide-swept sound of Kyle Rhea are part of an integral fjordic system of high habitat diversity and one of the very best examples of the 40 such systems in Scotland. The site includes extensive representative examples of reef communities that are characteristic of Scottish fjordic lochs, in addition to several which are

rare elsewhere in Scotland. The reefs are also some of the finest examples of their kind in the EU and as such they are of international importance."

13.3.32 The tidal energy within Kyle Rhea is also noted as follows:

"Exceptionally strong tidal streams flow through Kyle Rhea….

13.3.33 Aspects of the reef interest within Kyle Rhea are also referenced as:

"Bedrock in Kyle Rhea supports rich communities characteristic of such localised areas of very strong water flow and is typically dominated by the hydroids Tubularia indivisa and Sertularia argentea, the barnacle Balanus crenatus, anemones, sponges and ascidians Ascidia virginea, Boltenia echinata and Pyura squamulosa."

13.3.34 A wide range of topographical reef forms meet the EU definition of this habitat type. Rocky reefs are extremely variable, both in structure and in the communities they support. (Irving, 2009 and the JNCC website (JNCC, undated[b]). These range from vertical rock walls to horizontal ledges, sloping or flat bed rock, broken rock, boulder fields, and aggregations of cobbles. Reefs are characterised by particular communities which vary according to local conditions. In strong tidal streams there are communities of barnacles, the soft coral *Alcyonium digitatum*, massive sponges and hydroids. It is on the basis of these descriptions that parts of the seabed in Kyle Rhea are thought likely to be classified as 'reef'.

13.4 Impact assessment

Do nothing scenario

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

13.4.2 Work undertaken for the SeaGen device in Strangford Lough, Northern Ireland to monitor benthic ecology of a similar SAC designated reef feature uses a control site out with the area of potential impact from the device and supports the suggestion that natural changes to benthic ecology will be significant in a tidal narrow such as Kyle Rhea (Kennedy *et al*, in submission).

13.4.3 During a 'do nothing scenario' the benthic communities in the area are not be expected to show any detectable non-natural change. However, in a dynamic environment such as Kyle Rhea large natural changes in benthic communities are expected.

Potential impacts during construction

13.4.4 This section considers potential impacts to benthic ecology that may occur during construction of the Project.

Impact 1: Habitat loss

13.4.5 Installation of the Project will have a direct impact of removing benthic habitat. This impact will occur in the construction phase of the Project and will continue through the operation phase, it is however only considered here (in the potential impacts during construction section) to avoid repetition. The primary operations that will result in the direct loss of habitat will include installation of the four devices and laying of the inter-array cables. Each device will have a worst case footprint of 15.2m^2 (assuming a quadropod foundation structure) and a maximum length of 595m of inter-array cable with a diameter of 0.108m will be surface laid (Chapter 5, Project Description). This provides a total potential permanent footprint of approximately 125m^2.

13.4.6 The indicative locations of the devices as well as the array area are displayed along with the benthic habitats in Figure 13.5. Although the devices are likely to be situated at the indicative locations, there is potential for the devices to be located anywhere within the array area. Therefore the biotopes which may be affected by permanent habitat loss include: CR.HCR.FaT.CTub, CR.HCR.FaT.CTub.Adig, SS.SMX.CMX, IR.MIR.KR.LhypT.Pk and CR.HCR.

13.4.7 The maximum possible impact would occur if the entire 125m^2 of the Project were to be placed within one of these biotopes. If this unlikely scenario were to arise, the maximum percentage loss of known (through benthic mapping) habitat would occur within the biotope CR.HCR, which would represent less than 0.6% of the known extent of this biotope mapped extent (Table 13.7). In addition, the actual extent of the habitats mapped may extend beyond the surveyed area, potentially reducing further the percentage of habitat affected.

Table13.7 Biotopes within the study area and the percentage of each that may be taken in the worst case scenario.

JNCC biotope code	Footprint as a % of habitat
IR.MIR.KR.LhypT.Pk	0.27
SS.SMx.CMx	0.11
CR.HCR.FaT.CTub	0.21
CR.HCR.FaT.CTub.Adig	0.19
CR.HCR	0.55

13.4.8 Therefore the magnitude of this impact is considered to be **negligible**, relative to the known or mapped area. Following the temporary installation impacts and during operation of the Project the foundations of the devices and the cables are likely to be colonised by new species and habitats, this point is discussed further in impact 10 below.

13.4.9 Given the conservational importance of these biotopes all of which apart from SS.SMx.CMx can be considered to be reef biotopes, (which is one of the primary features of the SAC designation) the sensitivity of the receptor is considered to be **high**.

13.4.10 A negligible magnitude of impact combined with a high sensitivity leads to an impact of **minor adverse** significance.

Impact 1: Suggested mitigation
22. Localised habitat loss during the installation of the Project is an unavoidable consequence of the Project. Best practice guidance will be followed to ensure that potential habitat loss is minimised throughout the proposed works. 23. Sea Generation (Kyle Rhea) Ltd will work with Marine Scotland and SNH to develop an appropriate Environmental Monitoring Programme.

Residual impact:

13.4.11 Implementation of the above mitigation is likely to reduce the magnitude of the impact, however, the sensitivity of the receptor will remain the same and therefore the impact, although reduced, is likely to remain of **minor adverse** impact.

Impact 2: Habitat disturbance

13.4.12 There will be an area of seabed that will be temporarily directly disturbed by the installation of the Project. Activities that will directly disturb benthic species and habitats will be primarily associated with the methods used to hold construction vessels in place during installation. Of the methods currently under consideration (Chapter 5, Project description), the scenario which will cause the largest area of disturbance (and is therefore the worst case scenario) is using an anchored barge. The use of a jack up barge will create a smaller area of disturbance and the use of a Dynamic Positioning (DP) vessel would greatly reduce the size of this impact on the seabed. It is important to note, however, that on more detailed investigation, it may not be possible to use DP vessels or jack up barges in the Kyle Rhea site.

13.4.13 An anchored barge will maintain its position using between four and eight anchors and an eight point anchor spread is therefore considered to provide the worst case for habitat disturbance. Repositioning of two of the anchors is also likely to be required in order to access the four device locations, therefore 10 anchor footprints are considered. Anchor options include gravity anchors, each of approximately 5x5m (25m^2) or drag anchors of 3x5m (15m^2). A 5m buffer has also been assumed to allow for potential movement of the anchor during manoeuvring. The seabed footprint of each anchor with the conservative buffer is a maximum of approximately 177m^2. There is some potential for catenary of the anchor chain as the barge manoeuvres, with some of the resulting ‘slack’ chain resting on the seabed. This is estimated to result in a worst case scenario for seabed abrasion of up to 80m of seabed along the line of each of the chains, with a corridor 1m wide. It should be noted that the footprint of a proportion of the anchor chain catenary will also overlap from some of the worst case anchor footprint (Figure 13.6). The maximum estimated footprint of seabed impact for all anchors and chain catenary, for a large anchor barge installing all four devices is approximately 4171m^2, with a conservative 5m buffer around the anchors and 1m buffer around the chains.

13.4.14 In addition to the disturbance caused by moorings, it is possible that once the inter-array cables have been installed they may exhibit some limited movement on the seabed. Over time they will become stationary within the reef as they become encrusted with benthic species, which will reduce the chance of any further movement. For the purpose of this assessment it is has been assumed that the cables will move on average up to 5cm in either direction along their entire length, resulting in a temporary disturbed area of 59.5m^2

13.4.15 Indicative device, inter-array cable and anchor positions are displayed in Figure 13.6. These are subject to change depending on detailed geotechnical studies which will be carried out prior to the installation and the eventual positions of the devices may be anywhere within the ‘array area’ (the red box in Figure 13.6). The positioning of the devices will determine the final anchor spread and anchor locations. In order to quantify the approximate levels of disturbance to the different habitats a simple model has been created using Arc GIS V10.

13.4.16 Figure 13.6 illustrates the anchor spread and catenary locations assuming the devices are positioned in the indicative locations. The GIS model assumes that the anchor and catenary layout is relatively fixed in relation to the devices. The model also assumes that the layout of the devices is fixed in relation to each other. The model places the devices in a number of different locations and then calculates the area of each biotope which would be impacted upon in each different position. The model calculated the impact through 16 different device locations and the largest possible area of impact to each biotope was recorded. The 16 different scenarios used in the model are displayed in Appendix. 13.2.

13.4.17 The model used cannot reveal the actual final impact but does allow the calculation of a theoretical worst case scenario for each biotope. Importantly, the eventual impact is likely to be far smaller in magnitude than the results of the model.

13.4.18 Table 13.8 below presents the maximum / worst case area of impact (as calculated using the model) for each biotope and provides the area of potential disturbance as a percentage of each biotope.

Table 13.8 Biotopes within the study area and extended study area and the percentage of each habitat that may be disturbed in the worst case scenario

JNCC biotope code	Total within Footprint Area (m²)	Worst case % of disturbance
IR.MIR.KT.XKTX	149.1	0.39
IR.MIR.KR.LhypTX.Ft	582.4	0.80
IR.HIR.KFaR.FoR	632.6	0.23
IR.MIR.KR.LhypT.Pk	786.3	1.70
SS.SMx.CMx	1704.9	1.54
CR.HCR.FaT.CTub	1328.5	2.19
CR.HCR.FaT.CTub.Adig	977.0	1.50
CR.HCR	488.8	2.15
CR.MCR.EcCr.FaAlCr.Pom	788.1	1.29
IR.MIR.KR.LhypT.Ft	167.9	0.65

13.4.19 As shown in Table 13.8 the maximum percentage area of impact of any biotope found using the model is just over 2% and occurs in the biotope CR.HCR therefore the magnitude of the impact is considered to be **negligible**. The impacts will be temporary and it is expected the impacted habitat would rapidly recover from the disturbance. Based on sensitivity information provided by the Marine Life Information Network website[28] for these biotopes, similar biotopes and the key species for each biotope (MarLIN has only directly assessed one (CR.MCR.EcCr.FaAlCr.Pom) of the biotopes that may be impacted) the sensitivity to abrasion and physical disturbance is generally low with high recoverability However, given the conservation value of the benthic ecology within Kyle Rhea, as described in Section 13.3, the sensitivity of the receptor is considered to be **high**.

13.4.20 Following the assessment matrix (Table 13.5) and using expert judgement the impact is considered to be of **minor adverse** significance.

Impact 2: Suggested Mitigation
1. Localised habitat disturbance during the installation is an unavoidable consequence of the Project. Best practice guidance will be followed by minimising the area of habitat disturbance as far as is practicable throughout the proposed works. 2. Where it is practicable and safe to do so attempts will be made to avoid siting anchors within the reef biotopes. This however may not be possible as the majority of the site could be considered to be reef biotope. 3. Sea Generation (Kyle Rhea) Ltd will work with Marine Scotland and SNH to develop an appropriate Environmental Monitoring Programme. This will further

[28] http://www.marlin.ac.uk/

Impact 2: Suggested Mitigation
reduce the impacts where possible.

Residual impact:

13.4.21 Implementation of the above mitigation is likely to reduce the magnitude of the impact, however the sensitivity of the receptor will remain the same and therefore the impact is likely to remain as a **minor adverse** impact.

Impact 3: Increased suspended sediments/ smothering

13.4.22 The following installation activities may increase the turbidity of the surrounding water:

- Drilling the holes for the pin-piles which will hold the base in place;
- Placing the quadropod onto the pins;
- Laying of the inter-array cables (See Chapter 5, Project description for explanation of the inter-array cable options);
- Horizontal Directional Drilling (HDD) of the boreholes for the export cable(s) at the breakout point;
- Placement of anchors to hold the installation barge in place.

13.4.23 An increase in suspended sediment has the potential to impact upon benthic species through smothering (sediment being deposited on the organism thereby burying it) or has the potential to interfere with the filter feeding mechanisms impairing the organisms ability to feed (Lohrer *et al*., 2006).

13.4.24 Chapter 7, Marine Physical Environment and Coastal Processes, considers potential for proposed drilling, cable laying and anchor positioning work to lead to increased sediment dispersion and siltation. Chapter 7 considers that the low volumes of sediment expected to be mobilised during these activities mean that there will only be low levels of material displaced around the foundations inter-array cables and anchors. The coarse material will settle within a close proximity to the activities following disturbance. Finer material will generally remain in suspension longer and given the high tide velocities these will disperse rapidly. The magnitude of potential impact was considered to be negligible.

13.4.25 As indicated in (Chapter 7, Marine Physical Environment and Coastal Processes) increases to suspended sediment will be small scale and localised. Therefore installation of the devices and inter-array cables will have potential to increase the suspended sediment within biotopes: CR.HCR.FaT.CTub, CR.HCR.FaT.CTub.Adig, SS.SMX.CMX, IR.MIR.KR.LhypT.Pk and CR.HCR which are located within the 'Array Area'

13.4.26 MarLIN has not made a direct assessment of the sensitivity of the any of these biotopes within the array area or for the key species *Tubularia indivisa*. *Alcyonium digitatum* which was commonly identified within the study area has intermediate intolerance to a decrease in flow rate and smothering, and low intolerance to an increase in suspended sediment. Recoverability is considered to be high to very high (Budd 2008). Given the conservational importance of these biotopes (all could be considered to be reef habitats, the primary features of the SAC designation, the sensitivity of the receptor is considered to be **high**.

13.4.27 Following the assessment matrix (Table 13.5), a combination of negligible magnitude and high sensitivity suggests an impact with potential for **minor adverse** significance.

Impact 3: Suggested Mitigation
1. Allow sufficient time for any increases in turbidity to clear between drilling operations 2. Allow sufficient time for any increases in turbidity to clear between positioning of

Impact 3: Suggested Mitigation
anchors for securing of installation barge if used.

Residual impact:

13.4.28 If the proposed mitigation is implemented the magnitude of the impact may be reduced, however, the sensitivity of the receptor will remain the same therefore the impact is likely to remain of **minor adverse** significance.

Impact 4: Release of contaminated sediment

13.4.29 Installation activities that may result in the release of sediment bound contaminants include the placing of the devices and anchors on the seabed and the laying of the inter-array cables (See Chapter 5, Project description). If sediment borne contaminants are released into the water column they may have detrimental impacts on benthic species.

13.4.30 The water and sediment quality within Kyle Rhea is reported as being good (Chapter 9, Marine Water Quality). The area was designated as a Shellfish Water in 2002 which triggered a monitoring program that was implemented between 2003 and 2007. Contaminants were found in the tissue of the sampled mussels in 2003. The contamination source was believed to be a small number of septic tank point source discharges into Kyle Rhea as well as a discharge from the Glenelg public septic tank (Chapter 9, Marine Water quality). Since 2004 the results for all parameters set out in the Water Framework Directive have been good, demonstrating that the overall water and sediment quality within Kyle Rhea is high.

13.4.31 The majority of the array area in which the four tidal devices will be located contains substrate described as either "rugged bedrock and boulders" or rugged bedrock (Figure 13.4). Small sections in the south and north of the array area contain "coarse sand". As these areas are very small it is unlikely that there will be large quantities of sediment disturbed by placing the devices or inter-array cables on the seabed. There is however potential for the anchors associated with the positioning of the installation barge to be located within areas of sediment. The level of disturbance is anticipated to be small (Chapter 7, Marine Physical Environment and Coastal Processes) and as only one anchor will be positioned at a time and any contaminated suspended sediment will be rapidly dispersed the impacts will be temporary. This coupled with the generally high water quality indicates that the magnitude of this impact will be negligible.

13.4.32 Due to the conservational value of the habitats that may be affected the sensitivity of the receptor is considered to be **high**. Following Table 13.5 results in an impact of **minor adverse** significance for a high sensitivity and low magnitude of impact.

Impact 4: Suggested Mitigation
1. Allow sufficient time for any increases in turbidity to clear between drilling operations 2. Allow sufficient time for any disturbed contaminated sediment to clear between positioning anchors for the construction barge if used.

Residual impact:

13.4.33 If the suggested mitigation measures are implemented the sensitivity of the impact will be reduced as the receptor will have greater capacity to accommodate this particular impact (Table 13.3) and the residual impact is likely to be reduced to **negligible** significance.

Impact 5: Pollution from routine and accidental discharges.

13.4.34 The installation process will involve the use of a number of fluid substances (see Chapter 5, Project Description), some of which may have the potential to have detrimental impacts on benthic species if contact is made. The majority of such substances would only enter the marine environment accidentally. However the release of some substances to the marine environment will be unavoidable, this will include: drilling fluids released at the point of HDD breakout as the drilled hole is cleared and filled with the cable and its housing, and grout released as the pin piles are secured.

13.4.35 The drilling fluids used in the HDD process will be non-toxic and will be rapidly dispersed in the energetic tidal environment, and will therefore have very little potential for impact on benthic organisms after discharge. The drilling of the pin-pile sockets will use seawater to lubricate the drill bit thus removing any harmful substances from that operation.

13.4.36 During the grouting process (see Chapter 5, Project Description) some grout will also be lost to the marine environment; however, the type of grout used will also be cementitious nontoxic and will again be rapidly dispersed by tidal currents. The magnitude of pollution caused by routine discharges is therefore assessed as **negligible**.

13.4.37 The installation of the devices will involve a number of vessels, which could include: a barge or dynamic position (DP) vessel, an installation vessel and a number of tugs, all of which carry fuel, oils, and lubricants, and are coated in antifouling paint (Chapter 5, Project Description). The risk of these substances being released to marine environment as accidental discharges is small (as risks are managed at a minimum by shipboard Environmental Management Systems (EMS)) and all discharges would be rapidly dispersed by the strong tidal currents that are a feature of the site. A Navigational Risk Assessment (**Appendix 17.1**) outlines mitigation measures to avoid vessel collisions.

13.4.38 A large DP vessel could carry up to 3,000,000 litres of marine diesel stored in a number of separate tanks (Technip web site). The worst case scenario from a single tank rupture is likely to result in approximately 600,000 litres of marine diesel released into the marine environment over a short period of time. Hydrocarbon based spills can have a number of environmental impacts. Actual impacts will vary depending on a wide range of factors including; the volume, type of liquid spill, the sea state and weather conditions at the time of the spill. Any spill would be rapidly dispersed and the risk of such a spill occurring is considered to be very low, therefore the magnitude of this potential impact is considered to be **negligible**.

13.4.39 The conservation value of the habitats potentially affected by release of contaminants means that the sensitivity of the receptor is considered to be **high**. This results in an impact of **minor adverse** significance.

Impact 5: Suggested Mitigation
1. All vessels associated with Project operations will comply with IMO/MCA codes for prevention of oil pollution and any vessels over 400 GT will have onboard Ship Oil Prevention Emergency Plans (SOPEPs). 2. All vessels associated with Project operations will carry on-board oil and chemical spill mop up kits. 3. Where possible vessels with a proven track record for operating in tidal races will be used. 4. Vessel activities associated with installation, operation, routine maintenance and decommissioning will occur in suitable conditions to reduce the chance of an oil

Impact 5: Suggested Mitigation
spill resulting from the influence of unfavourable weather conditions.

Residual impact:

13.4.40 If the above mitigation is implemented the magnitude of the impact will be reduced, as the potential for an accidental spill to occur will decrease however the impact will remain of **minor adverse** significance.

Impact 6: Noise and vibration

13.4.41 The installation phase will create underwater noise and vibration with the potential to physically damage benthic species or affect their behavioural patterns. The main sources of noise associated with installation will be from drilling activities and installation vessels. The noise emitted from vessels can be generated by propeller blade rotation, engine noise and flow through the water. (appendix 12.6)

13.4.42 In support of this EIA, Sea Generation (Kyle Rhea) Ltd. commissioned a survey of the baseline underwater noise conditions at Kyle Rhea (**Appendix 12.5**). This report concluded that due to the high velocity tidal currents and turbulent nature of the area, high background noise levels are present particularly during the middle of the tidal cycle when the currents were running at the greatest speeds.

13.4.43 The majority of sessile benthic species such as tube worms, barnacles, hydroids, cnidarians and bryozoans are believed to be far less sensitive to noise or vibrations than the less noise sensitive fish species. As the vast majority of organisms recorded during the benthic surveys (Appendix 13.1) 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 impact is considered to be of **negligible** magnitude.

13.4.44 As discussed previously it is unlikely that benthic species will be capable of detecting the noise produced by installation activities against the high levels of background noise, unless they are in very close proximity to drilling operations. Sensitivity of the receptor is therefore considered to be **low**. A negligible magnitude and a low sensitivity lead to and impact significance that is **negligible**.

Impact 6: Suggested Mitigation
1. No mitigation measures are suggested

Residual impact:

13.4.45 As no mitigation measures are suggested the impact will remain of **negligible** significance.

Impact 7: Introduction of non-native marine species

13.4.46 Chapter 9, Marine Water Quality discusses the potential for non-native marine species to be introduced to Kyle Rhea and the surrounding environment by vessels and equipment that have been used in other parts of the UK and around the world; contaminated ballast water is a particular risk.

13.4.47 Invasive marine non-native species pose a potential threat to biodiversity as they may have negative impacts upon native species and consequently threaten regional ecosystems (SNH, 2011). Concerns were also raised about the possible introduction of non-native species by the Scottish Environment Protection Agency (SEPA) during the scoping process (See Table 13.1).

13.4.48 As discussed in Chapter 9 it is unlikely that non-native species could become established in the extreme tide-swept conditions at Kyle Rhea and outcompete the specialist species present in this environment. In addition, modern antifouling techniques make it is less likely that non-native species would be able to travel to the area attached to the hull of the vessel. Vessels used during installation will also be sourced from the, UK or from northern European as much as is practicable, reducing the potential for movement of invasive species. Therefore the magnitude of the impact is considered to be **negligible**.

13.4.49 It is difficult to determine the receptors sensitivity to the introduction of marine non-native species, however, given the conservational importance of benthic communities within Kyle Rhea, sensitivity has been assessed as **high**.

13.4.50 High sensitivity and negligible magnitude result in an impact of **minor adverse** significance.

Impact 7: Suggested Mitigation
1. Mitigation is discussed in Chapter 9, Marine Water Quality and follows appropriate guidance. A risk assessment will be completed with the aim of compliance with the Water Framework Directive and Marine Strategy Framework Directive objectives.

Residual impact:

13.4.51 If the suggested mitigation is implemented the chance of marine non-native species becoming established within the Kyle Rhea area is reduced and therefore the impact is likely to be of **negligible** significance.

Potential impacts during the operation and maintenance phase

Impact 8: Pollution from routine and accidental discharges.

13.4.52 When the array is operational there are two main ways in which pollutants may enter the marine environment and therefore impact upon the benthic ecology. The first is through accidental spills from maintenance vessels, and the second is through antifouling which has been applied to the devices and infrastructure.

13.4.53 The vessels to be used during operations and maintenance will be the same size or smaller than those during installation and will therefore have similar inventories of potential pollutants. The lower number of required vessels during operation compared with installation reduces the likelihood of spillage, mitigation measures and residual impacts are considered separately and in greater detail in Chapter 9, Marine Water Quality and Chapter 17, Shipping and Navigation. Vessel spillage during installation is discussed earlier in this chapter (Impact 5), and the same **minor adverse** impact significance predicted for accidental discharges is applied here.

13.4.54 Antifoulants will be applied to the rotor blades and a 3m strip of the sub-sea tower (Chapter 5, Project Description). Sea Generation (Kyle Rhea) Ltd is committed to choosing the Best Practicable Environmental Option (BPEO) for the use of antifoulants, and will decide which methods will be used nearer to the construction date. It is however likely that a teflon based antifoulant, which is non-leaching and works through physical properties as opposed to the presence of biocides, will be used. Any active components associated this product or any other antifoulant used will on entering the water column be rapidly dispersed in the strong tidal currents that are a feature of the area. The exposure, if any, of benthic species to active components will therefore be limited. Due to the small area likely to be treated with antifoulants, Sea Generation (Kyle Rhea) Ltd's commitment to use the BPEO, and the dispersive nature of the site, the magnitude of this impact is considered to be **negligible**.

13.4.55 Based on the importance of the potential reef habitats receptor, a precautionary, **high** sensitivity has been assumed. A low magnitude and a high sensitivity indicates a **minor adverse** impact significance

Impact 8: Suggested Mitigation
1. See mitigation measures, Impact 5 for pollution through accidental discharges. 2. When a decision is made prior to construction, on the BPEO for antifouling for the devices, the sensitivity of the benthic species in the area should be taken into account.

Residual impact:

13.4.56 Following the implementation of the suggested mitigation, it is likely that the potential impacts associated with routine and accidental discharge can be reduced to **negligible** impact significance.

Impact 9: Electromagnetic Fields (EMF)

13.4.57 The electric current that is carried in the inter-array cables will generate magnetic fields that have the potential to interact with benthic species and to affect their behaviour.

13.4.58 In addition to visual cues, some species use the magnetic field of the earth to orient (Fisher & Slater, 2010). The magnetic component of EMF in close proximity to large export or transmission cables may be of similar strength to that of the Earth's magnetic field and so may have the potential to affect magneto-sensitive species (Inger *et al*., 2009). It should be noted that the power transmission potential from the export cables for the Project is far lower than offshore wind farms or major power transmission links between some Scottish islands and mainland grid, and as a result, the potential for impacts of this nature caused by the Project will be far less than existing installed cables.

13.4.59 EMF may have the potential to affect some benthic species, for example the larvae of barnacles and the embryonic stages of sea urchins (Fisher & Slater, 2010). However, the scale of any impact, would be limited to a small area in the 'near field' around the cables, and given the rapid dispersion of any larvae away from their point of origin and potential EMF exposure, the potential for impact will be limited. Chapter 14, Fish and Shellfish describes the possible impacts of EMF in greater detail.

13.4.60 At a worst case the cabling for the array could include 595m of surface laid subsea inter-array cabling between the devices. This would cover a maximum area of approximately $59m^2$ which is less than 0.01% of the benthic study area. The potential magnitude of impacts on benthic ecology due to EMF exposure is therefore considered to be **negligible**.

13.4.61 It is very unlikely that benthic species will be affected by EMF and the sensitivity of benthic ecology to EMF is considered to be **low**. Following the impact assessment matrix detailed in Table 13.5 a negligible magnitude and a low sensitivity indicates a potential impact of **negligible** significance.

Impact 9: Suggested Mitigation
1. No mitigation suggested

Residual impact:

13.4.62 No mitigation measures have been suggested and the impact significance will remain **negligible**.

Impact 10: Introduction of new habitat

13.4.63 The physical presence of the devices and associated infrastructure will introduce additional hard substrate to the study area. Benthic organisms will be able to colonise this new substrate which may increase local populations of certain species.

13.4.64 The devices will be located on existing substrate that has been categorised as "rugged bedrock and boulders" or rugged bedrock (Figure 13.4) and therefore the introduced substrate will be broadly similar to the surrounding area.

13.4.65 There is growing evidence that renewable energy developments in the marine environment are rapidly colonised (Wilhelmsson, 2009). Monitoring at the Horns Rev offshore wind farm indicated that within two years of completion, the monopiles and scour protection were colonised by 11 species of algae and 65 invertebrate taxa. In addition the mobile invertebrates (decapods and molluscs) were found on the scour protection with the sessile species settling on the monopiles (Bio/Consult, 2004). At the Egmond aan Zee wind farm in The Netherlands (Daan *et. al.,* 2009), 33 species were found to have colonised the monopiles with 17 species on the scour protection after two years of monitoring.

13.4.66 Information from the SeaGen tidal device in Strangford Lough shows that some, but not all, of the hard structures below the surface had experienced marine growth after 3 years of installation. Studies commissioned by Marine Current Turbines Ltd. and reported by Royal Haskoning (2011), show that those parts of the SeaGen device which were closest to the attachment point with the seabed, became colonised by the main species associated with the underlying natural biotope CR.HCR.FaT.BalTub (*B. crenatus* and *T. indivisa* on extremely tide-swept circalittoral rock). This was the dominant biotope at that location prior to installation of SeaGen. This indicates that the device (or at the least some major structural parts of the device) provides additional habitat which has some similar characteristics to that which existed pre-installation. At the Kyle Rhea site the same CR.HCR.FaT.BalTub biotope is found within the array area and the indicative device locations are either within it or in close proximity to this biotope (Figure 13.5).

13.4.67 The major immobile elements of the device structures (pin-piles, quadropod structure and lower tower) of the Strangford SeaGen were colonised by the blue mussel biotope CR.MCR.CMus.CMyt (*Mytilus edulis* beds with hydroids and ascidians on tide-swept exposed to moderately wave-exposed circalittoral rock) (Royal Haskoning, 2011). This biotope was not recorded in Strangford Narrows during previous marine biological surveys although it may have been present in tide swept shallow areas which were not surveyed. Royal Haskoning (2011) reported that this biotope provides a food source for some fish species, echinoderms and crustaceans, Given the similarity with the structures proposed at the Kyle Rhea site and the previous records of *Mytilus* in the Kyle it may be assumed that mussels could colonise the devices in Kyle Rhea in the same way, so the intention would be to limit colonisation of new biotopes by applying non toxic antifouling coatings on the upper areas of the devices (see Chapter 5, Project description for details) and with supplementary clearance of any significant growth identified, to prevent colonisation.

13.4.68 The colonisation of new hard structures is likely to be limited to the devices, acting as an artificial reef, but could extend to the surrounding seabed area. New substrate will promote local increases in abundance of some species with colonising species likely to be the same species already present in Kyle Rhea and nearby areas. Additionally, as some parts of the structures deployed for this project will be treated with antifouling to limit colonisation, the magnitude of potential impact is considered to be **negligible**.

13.4.69 The sensitivity of the receptor to increased habitat availability is difficult to qualify, however it is thought that the receptor will tolerate this impact, and may benefit positively from the habitat addition and therefore the sensitivity to this impact is considered to be **low** (Table 13.3). A negligible magnitude and a low sensitivity result in an impact of **negligible** significance.

Impact 10: Suggested Mitigation
1. No mitigation measures are suggested

Residual impact:

As no mitigation measures are suggested it is likely that the impact of the introduction of new habitat will remain of **negligible** significance.

Impact 11: Hydrodynamic change and changes in sediment

13.4.70 Changes in current regime and coastal processes have the potential to alter the parameters within which benthic habitats exist, therefore potentially altering the communities that can survive in the area.

13.4.71 Chapter 7, Marine Physical Environment and Coastal Processes, describes the predicted changes to hydrodynamic regime and sediment distribution. The presence and operation of the devices is predicted to cause limited, near-field effects of low magnitude. The proportion of habitats affected will therefore be **negligible**.

13.4.72 The benthic community is deemed to be of **high** sensitivity given the SAC site designation resulting in an impact of **minor adverse** significance.

Impact 11: Suggested Mitigation
Mitigation for this impact is associated with reducing changes to the coastal processes and is discussed in Chapter 7, Marine Physical Environment and Coastal Processes

Residual impact:

The impact will remain of **minor adverse** significance.

Potential impacts during the decommissioning phase

13.4.73 The impacts produced during decommissioning are expected to be of similar nature and magnitude as those predicted for the construction phase with the exception of drilling which will not occur during decommissioning. Therefore the impacts to benthic ecology will at worst have the same significance as those assessed during installation. A detailed decommissioning plan will be produced prior to the decommissioning date, which will seek to minimise the impacts. This will include consultation with the regulator and depending on how the foundations of the devices have been colonised it may be decided that it is environmentally advantageous to leave the foundations of the devices in place.

13.5 Summary

13.5.1 Site specific studies were used to supplement the existing knowledge of the benthic species and habitats that exist within Kyle Rhea. These studies provide a high level of detail increasing confidence in the accuracy of the impact assessment.

13.5.2 Impacts were predicted to be of highest significance during construction through drilling and anchoring of vessels.

13.5.3 Less significant potential impacts are predicted during operation and maintenance, with those that do occur, predicted to be less severe than those associated with installation. The potential impact of routine and accidental discharges would be of a lower magnitude than predicted for installation but remains within the same significance category during operation and maintenance as during installation.

13.5.4 Although a number of impacts are predicted to affect benthic ecology, these effects are limited. Colonisation of the device may have a beneficial impact on benthic ecology.

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14 FISH AND SHELLFISH

Page

14.1 Introduction

14.1.1 This chapter of the Environmental Statement (ES) describes the existing environment with regards to fish and shellfish within the study area (as defined below).

14.1.2 The chapter reviews the distribution and seasonal abundance of fish and shellfish species, which have been recorded within the study area and across the wider region. This description draws upon data collected through site specific and / or regional surveys, in the published and grey literature, as well as original data collection.

14.1.3 Subsequently, it presents the findings of an assessment of potential impacts arising from the construction, operation and decommissioning phases of the Project.

14.1.4 This chapter has links to and therefore should be read in conjunction with Chapter 11, Ornithology, Chapter 12, Marine Mammals & Basking Shark, Chapter 13, Benthic Ecology and Chapter 15, Commercial Fisheries in order to gain a full overview of baseline conditions and potential impacts.

Study area

14.1.5 Two scales of study area have been identified, within which the majority of potential impacts on fish and shellfish will be considered. These are displayed in Figure 14.1 and are:

- The Local Study Area (LSA) which encompasses Kyle Rhea and contains the proposed array site (see Figure 14.1); and
- The Wider Study Area (WSA) which is defined by International Council for Exploration of the Sea (ICES) rectangle 43E4 (see Figure 14.1).

14.1.6 Due to the importance of Scotland in terms it's Atlantic salmon (and to a lesser extent sea trout) population and concerns raised during consultation relating specifically to this species, a Regional Study Area (RSA) which incorporates the west and north coast of Scotland is also considered when assessing impacts to that species.

Overview of potential impacts

14.1.7 Guidance produced to aid the consenting process for marine renewables in Scotland (EMEC and Xodus, 2010) lists the potential impacts that wave and tidal energy developments may have on fish and shellfish as:

- Barrier to movement / interruption of known migratory routes;
- Collision risk;
- Substratum loss, in particular in relation to benthic spawning fish and shellfish, loss of nursery grounds and the potential loss of or damage to

habitat supporting food supply and providing shelter;
- Disturbance/injury as a result of noise, vibration etc.
- Pollution from routine and accidental discharges;
- Changes in suspended sediment levels and turbidity;
- Electric and magnetic field effects;
- Disruption of feeding and spawning; and
- Displacement from spawning and feeding areas.

14.1.8 The guidance also highlights that any negative impacts on fish and shellfish species may have a negative impact upon commercial fisheries with potential knock on effects to the local economy. Chapter 15, Commercial fisheries assesses the potential knock on impacts to commercial fishermen from changes in fish and shellfish abundance.

14.1.9 All of the potential impacts listed above are addressed within the impact assessment section of this Chapter (Section 14.4, Impact assessment).

Policy, legislation and guidance

Legislation

14.1.10 There are a number of regulatory frameworks which will be taken into account when assessing the impacts of the development on fish and shellfish. These include:

- EC Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (the Habitats Directive).
- Marine Scotland Act 2010.
- Conservation (Natural Habitats &c) Regulations 1994 (the Habitats Regulations), as amended in Scotland.
- Wildlife and Countryside Act 1981.
- OSPAR Convention. The Convention for the Protection of the Marine Environment of the North-East Atlantic.
- Nature Conservation (Scotland) Act 2004

14.1.11 Non-statutory measures are outlined in the following:

- The UK Biodiversity Action Plan,
- The recommended List of Priority Marine Features (PMFs) (SNH 2012)
- Western Isles Biodiversity Action Plans.

EIA guidance

14.1.12 The European Marine Energy Centre (EMEC) and Xodus Group (2010) were commissioned by Marine Scotland to produce a guidance document to help developers with consenting, Environmental Impact Assessment (EIA) and Habitats Regulations Appraisal (HRA) for marine renewable energy developments in Scotland. The draft version of this document provides the following advice with regards to fish and shellfish.

14.1.13 The baseline assessment should identify the presence, distribution, seasonality and abundance of fish and shellfish both at the site and in the surrounding area and indicate the relative importance of these species. The baseline assessment should include consideration of the following:

- The nearest protected habitats;
- Species of fish/shellfish, that are of conservation importance;
- Species of fish/shellfish in the area that are of most importance to recreational and commercial fisheries;
- Species that have restricted geographical distribution and are locally abundant;

- Species of elasmobranch fish (as these considered sensitive to marine developments); and
- Identification of migratory and spawning fish that may be affected by the development.

14.1.14 In identifying the above species, the baseline assessment should include the following aspects for each:

- Spawning areas and seasons;
- Nursery grounds;
- Feeding grounds;
- Over-wintering areas for crustaceans such as lobster/crab; and
- Migration routes.

14.1.15 EMEC (2011) has also 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 impacts on fish resources may also be relevant in other locations, such as Kyle Rhea:

- 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.

14.2 Methodology

14.2.1 This assessment follows the latest, appropriate, guidance on Environmental Impact Assessment (EIA) (EMEC and Xodus, 2010; Cefas, 2004 and IEMA 2006) and draws on experience from recent examples of similar renewable energy projects in the UK and Europe.

14.2.2 A baseline for fish and shellfish within the study area (as defined below) was established through a desk based review. An impact assessment was then conducted to predict the potential significance of the impacts of the development upon that baseline.

14.2.3 The impact assessments use a Rochdale envelope approach (see Chapter 4, EIA Methodology), where any uncertainty regarding aspects of the project description leads to the use of a realistic worst case scenario for each of the potential receptors assessed.

14.2.4 No site specific dedicated fish surveys were undertaken for this project; however, a benthic survey was completed primarily to inform Chapter 13, Benthic Ecology. The survey consisted of 70 drop down video tows, located strategically, to firstly identify the benthic ecology within the vicinity of the Project and secondly to characterise the habitats within the Kyle Rhea study area. The survey also identified a number of shell fish species and those results have been incorporated within this chapter.

Consultation in relation to fish and shellfish

14.2.5 A Scoping Opinion was sought from the Scottish ministers on the 1st of April 2010 (**Appendix 4.1**). Key issues identified which were pertinent to fish and shell fish are presented in Table 14.1. Subsequent to the Scoping Opinion further consultation, primarily through the projects Fisheries Liaison Officer (FLO), regarding fish and shell fish was carried out (See Chapter 6, Consultation for further detail). Summaries of these consultations are also included within the Table 14.1.

Table 14.1 Summary of consultation relating to fish and shellfish

Key issues raised	Response
During scoping	
Marine Scotland informed the project team that the following wildlife legislation and guidance should be taken into account. Namely:, Coast Protection Act 1949 section 34, Council Directives on The Conservation of Natural Habitats and of Wild Flora and Fauna, and on Conservation of Wild Birds (commonly known as the Habitats and Birds Directives), the Wildlife & Countryside Act 1981, the Nature Conservation (Scotland) Act 2004, the 1994 Conservation Regulations, Scottish Executive Interim Guidance on European Protected Species, Development Sites and the Planning System and the Scottish Biodiversity Strategy and associated Implementation Plans.	These pieces of legislation have been taken into account in both Section 3 (Existing Environment) and Section 4 (Impact Assessment) of this chapter.
The presence of species on Schedules 5 (animals) and 8 (plants) of the Wildlife & Countryside Act 1981 should be considered where there is a potential need for a licence under Section 16 of that Act. (Marine Scotland)	As above
Marine Scotland indicated that baseline noise data is useful provided the developer repeats the surveys once the device is in situ for comparison. Potential limitations to fishing opportunity and effects on catches should be emphasised	A baseline noise study was carried out by Subacoustech and the results are incorporated within Section 14.4 of this chapter. Fishing opportunities are considered in Chapter 15, Commercial Fisheries.
Marine Scotland stated that impacts on migratory fish including salmon, sea trout, lamprey and sandeels must be considered. Potential impacts may include physical or avoidance reactions at both the individual and population level and there may also be avoidance due to electromagnetic sensitivity at both adult and juvenile stages.	Impacts to these species are considered in Section 4 of this chapter
Marine Scotland indicated that it may be necessary for the developer to implement a monitoring strategy to assess the influence on salmonid fish populations. The expected levels of noise production must be identified within the ES and by using published literature, decide what impact, if any, this will have on fish movements through the area.	Post consent the project team will work closely with Marine Scotland to develop an EMP. This will consider all receptors which Marine Scotland require post-installation monitoring following consideration of the ES.
Marine Scotland believes that offshore renewable developments have the potential to directly and indirectly impact diadromous fish of freshwater fisheries interest including Atlantic salmon, anadromous brown trout (sea trout) and European eel. These species use the coastal areas around Scotland for feeding and migration and are of high economic and / or conservation value. As such they should be considered during the EIA process.	These species are all considered within the chapter of the ES. The impacts considered are based upon the scoping opinion received and current knowledge of potential impacts.

Key issues raised	Response
Marine Scotland state that In the case of Atlantic salmon information will be required to assess whether there is likely to be any significant effect of developments on rivers which are classified as Special Areas of Conservation (SAC's) for Atlantic salmon under the Habitats Directive. Where there is the potential for significant impact then sufficient information will be required to allow Marine Scotland to carry out an Appropriate Assessment.	Impacts to Atlantic salmon are considered within the impact assessment (section 14.4) and potential threats to populations within SACs are considered within a separate document that will be submitted as part of the application (Royal HaskoningDHV, 2012).
Subsequent to the scoping consultation	
The Secretary of the Glenelg & Arnisdale fishing club contacted the project's FLO, requesting that the EIA include an assessment of the impacts of the array acting as a barrier to fish migration to and from the Glenmore river in Glenelg.	An assessment of the potential for the Project to act as a Barrier to Salmon is provided in Section 14.4 impact assessment and includes the potential for barrier effects caused by noise, EMF and collision risk.
Concerns about the Project acting as a barrier for fish species migrating through the Kyle Rhea were also raised by the Wester Ross Fisheries trust through phone correspondence.	The potential for the Project to act as a barrier to fish is considered in Section 14.4 of this chapter

Data collection

14.2.6 The principal data sources relevant to fish and shellfish are shown below in Table 14.2

Table 14.2 Data sources to inform the existing environment

Data Source	Spatial coverage	Author	Year
Spawning and Nursery Grounds	UK	Cefas (Ellis *et. al*. 2012)	2012
Spawning and Nursery Grounds	UK	Cefas (Coull *et. al*.1998)	1998
Landings data	ICES Rectangles 45E3, 45E4, 46E3 and 46E4	Marine Scotland Science	2006-2010
Benthic Survey Report	Local Study Area	Envision	2011
National Biodiversity Network (NBN) Gateway	UK	NBN	1990-present
Marine Scotland report on migratory fish	Scotland	Malcolm *et al*., 2010)	All available data up to 2010
Scottish marine renewables strategic environmental assessment (SEA)	Scottish waters	Faber Maunsell and Metoc plc	Produced in 2007 and compiles a series of relevant data sources
Rod and Line, Net and Cobble and Fixed Engine Salmon catch data	Northwest Scotland, Outer Hebrides	Marine Scotland	1952-2011
Stakeholder consultation/scoping opinions;	Kyle Rhea	NA	2012
Marine Life Information Network (MarLIN)	UK	Various	All available

Data Source	Spatial coverage	Author	Year
			data up to the present time

14.2.7 The above data were interrogated as part of a desk study to compile a list of all species that may be present within the study areas.

Impact assessment

14.2.8 The impact assessment follows the standard methodology as presented in Chapter 4, EIA Methodology in assessing impacts on the Project as presented in Chapter 5, Project Description. However for the assessment of certain receptors there is a requirement to develop specific criteria for the 'sensitivity of receptor' and 'magnitude of impact'. For fish and shellfish, the significance and magnitude criteria are displayed in Tables 14.3 and 14.4 respectively.

14.2.9 Table 14.3 defines the sensitivity and conservation value or importance fish and shellfish receptors to potential impacts, based on the degree to which the receptors are valued nationally, regionally, or locally as well as their capacity to accommodate impacts.

Table 14.3 Definition of terms relating to the sensitivity of fish and shellfish receptors

Value / Sensitivity	Scale	Definition
High	International/ National	Species which have been designated for their international or nationally importance i.e. UK BAP species /OSPAR designations/ IUCN Red list (listed as endangered and critically endangered). Sensitivity: The receptor has no or very limited capacity to accommodate the proposed form of change and the impact may cause death of permanent damage. The change affects the whole population.
Medium	Regional	Species that have been designated for their regionally important biodiversity or habitat (Local BAP species). Sensitivity: Receptor has limited capacity to accommodate the proposed form of change or it may result in behavioural changes affecting a significant proportion of the population.
Low	Local	Species that have been designated as having local importance Sensitivity: Receptor has some tolerance to accommodate the proposed change. Small proportion of the population only is affected.
Negligible		Species with little or no local importance Sensitivity: Receptor is generally tolerant and can accommodate the proposed change

14.2.10 The level of magnitude of an impact on each receptor is defined in Table 14.4 and can be described in terms of the extent, duration, frequency, severity and probability

Table 14.4 Definition of terms relating to the magnitude of impacts on fish and shellfish

Magnitude	Definition
High	Fundamental change to the baseline condition of fish and shellfish ecology, resulting in major alteration to the population density, diversity or abundance.
Medium	Detectable but non-fundamental temporary or permanent consequential changes to the baseline condition resulting in noticeable alteration of the size and/or quality 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 or no change to the baseline condition of the fish community

14.2.11 Table 14.5 combines the definitions of magnitude with the level of sensitivity/value/importance of receptor to provide a prediction of overall significance of the impact. The categories highlighted in red are considered to be significant in the context of the EIA.

Table 14.5 The level of significance of an impact resulting from each combination of sensitivity and magnitude

Sensitivity	Magnitude			
	High	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

14.2.12 The significance of the impact is a combination of the sensitivity of the receptor and the magnitude of the impact. The impact assessments are made following IEEM guidelines for assessment (see Chapter 4, EIA Methodology), using the expert judgement of suitably qualified and experienced specialists.

14.3 Existing environment

14.3.1 This section describes the existing environment of the LSA in which the Project will be located and considers the WSA as illustrated in Figure 14.1 and explained in Section 14.2 Methodology.

14.3.2 Distribution patterns of fish and shellfish are determined by a number of factors. Over broad spatial areas, the main abiotic factors that affect the distribution of fishes and fish communities are water temperature, salinity, depth, local scale habitat features and substrate type. Biotic factors include predator-prey interactions, competition and anthropogenic factors. For example, the presence of artificial structures in the marine environment and practice of fisheries activities are important factors at various temporal and spatial scales.

Species present

14.3.3 In order to compile a list of fish and shellfish species potentially present within the study areas, and therefore with potential to be impacted upon by theProject, it is necessary to interrogate a number of resources including: landings data covering the WSA (provided by Marine Scotland Science); the Scottish Renewable Energy Strategic Environmental Assessment (SEA) (Faber Maunsell, 2007); Spawning and nursery data provided by Cefas (Coull *et al*., 1998 and Ellis *et al*., 2012) and knowledge acquired through consultation with local stakeholders that use the study area for fishing (both Angling and commercially).

14.3.4 In order to identify the main species potentially present within the WSA, landings data from ICES rectangle 43E4 from 2007 to 2011 has been interrogated. A summary of the species for which more than 10 tonnes were landed (which is also the top 8 most landed species) is provided in Table 14.6. A complete list of all species landed within that area by year (including 2006) is also displayed in **Appendix 14.1**.

Table 14.6 Landings of the top eight species by quantity between 2007 and 2011 from within ICES rectangle 43E4 (the WSA).

Species	Scientific Name	Quantity (tonnes)
Nephrops (Norway Lobster)	*Nephrops norvegicus*	1788
Scallops	*Pecten Maximus*	1097
Edible Crabs	*Cancer pagurus*	392
Razor Clam	Solen *spp.*	145
Sprat	*Sprattus sprattus*	104
Velvet swimming crabs	*Necora puber*	90
Mackerel	*Scomber scombrus*	20
Lobsters	*Homarus gammarus*	10

14.3.5 It is recognised that fishing methods and species targeted are largely market driven and landings may not be completely representative of all species within the area. 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. Two other data sources are described below.

14.3.6 The Scottish Marine Renewables Strategic Environmental Assessment (SEA) (Faber Maunsell, 2007) contains a list of finfish and shellfish species. This list draws together several sources and considers much of the west coast of Scotland, including the study areas. The SEA list can be found in **Appendix 14.2**.

14.3.7 A third method for identifying which species may be impacted by the Project considers t which species are known to spawn or have nursery grounds in the area. To complete these exercises two main data sets were acquired from Cefas (Coull *et. al.,* 1998 and Ellis *et al.*, 2010). Both data sets contain information on the geographical locations of spawning and nursery grounds of many fish species around the UK. Spawning and nursery grounds are assigned a level of intensity (high, undetermined or low) depending on the level of activity thought to occur at each location. The first data set (Coull *et al*., 1998) was produced in 1998 and has largely been superseded by the second data set (Ellis *et al*., 2010). However some species which were included by the Coull *et al*., (1998) were not assessed by Ellis *et al*. (2010) and therefore both data sets have been interrogated. It should however be noted that as Ellis *et al*. (2010) data is more recent it is likely to be more reliable than the Coull *et al*. (1998) data , which is 14 years old at time of writing.

14.3.8 It should also be noted that both the Coull *et al.,* (1998) and Ellis *et al*.(2010) data are broadscale and are more indicative of areas where a species may spawn or use as a nursery ground rather than presenting a definitive distribution. Therefore they often include areas that are not of importance, within the wider areas identified.

14.3.9 Spawning and nursery grounds relevant to the study areas can be seen in Figures 14.3 to 14.6. The proximity of these spawning and nursery grounds to the LSA is presented in Table 14.7.

Table 14.7 Species with spawning and/or nursery grounds within the LSA

Common name	Scientific Name	Spawning ground distance from LSA (km)	Nursery ground distance from LSA (km)
Anglerfish	*Lophius piscatorius*	NA	0*
Blue Whiting	*Micromesistius poutassou*	NA	23*** Northwest
Cod	*Gadus morhua*	NA	0**
Common skate	*Dipturus batis*	NA	0*
European hake	*Merluccius merluccius*	NA	0*
Haddock	*Melanogrammus aeglefinus*	NA	80** North
Herring	*Clupea harengus*	57 north	0***
Ling	*Molva molva*	NA	23*** Northwest
Mackerel	*Scomber scombrus*	NA	0*
Nephrops	*Nephrops norvegicus*	0**	0**
Norway pout	Trisopterus esmarkii	NA	90 West
Plaice	*Pleuronectes platessa*		26 north
Saithe	*Pollachius virens*	NA	0**
Sandeel	*Ammodytes spp*	0*	23*** Northwest
Spotted ray	*Raja montagui*	NA	0*
Sprat	*Sprattus sprattus*	0**	6** East
Spurdog	*Squalus acanthias*	NA	0***
Thornback ray	*Raja clavata*	NA	23* Northwest
Tope	*Galeorhinus galeus*	NA	23* Northwest
Whiting	*Micromesistius poutassou*	0**	0***

***=high intensity, **=undetermined intensity *= low intensity

14.3.10 The only species which have spawning grounds which overlap with the LSA are sandeel, nephrops, sprat and whiting (Figure 14.3). The LSA represents 0.397% of that particular sandeel spawning ground; 0.63% of the nephrops spawning ground, 0.28% of the whiting and 0.0003% of the sprat spawning grounds. It is worth noting that the indicative spawning ground for sprat in Coull *et al*. (1998) covers much of UK waters, and not all locations in that area will be used for that purpose.

14.3.11 Several species of fish have nursery grounds which overlap with the LSA, however, it is only whiting, spurdog and herring that are high intensity. The majority of the west coast of Scotland and the north west coast of England has been identified as a herring nursery ground and the spurdog nursery grounds range from the Irish sea in the south, to the northern Irish coast in the west up to north Scotland and Orkney. The whiting nursery grounds vary in intensity but cover the much of UK waters (Ellis *et al*.,2012).

14.3.12 Nephrops, cod and saithe all have nursery grounds of undetermined intensity which overlap with the LSA. The nephrops nursery grounds are the same size as their spawning grounds and therefore the LSA represents 0.63% of their area. The saithe nursery grounds cover much of the coastal waters of Scotland (Coull *et. al*., 1998) and the cod grounds cover waters in the northern half of the UK as well as the Irish Sea and much of the North Sea.

14.3.13 Analysis of all of the data sources, as detailed earlier, allows compilation of a list of species that may be present within the study areas. The list is displayed in Table 14.8 and includes important species, in terms of:

- Commercial value;
- Sensitivity (those that have nursery and/ or spawning grounds in the vicinity of the development); and
- Local importance (Species that have been identified as locally important by the local fishing industry).

14.3.14 The list also includes anadromous[29] species that have been identified as present through the consultation process (both through the Scoping Opinion and further consultation with District Salmon Fisheries Boards) and through desk based research. Anadromous species include; Atlantic salmon *Salmo salar*, European eel *Anguilla anguilla*, sea trout *Salmo trutta,* river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus*, as well as other species of high conservation concern such as the thornback ray *Raja clavata*, the spotted ray Raja montagui. In addition basking sharks *Cetorhinus maximus* are included within Chapter 12, Marine Mammals & Basking shark.

[29] fish species that spend part of their life at sea, but migrate up rivers in order to breed.

Protected species

14.3.15 Many of the fish and shellfish identified in the species list (Table 14.8) are protected by international or national legislation, or through voluntary agreement such as:

- The EU Habitats Directive 92/43/EEC (as amended);
- The Oslo and Paris Conventions for the protection of the marine environment of the North-East Atlantic (OSPAR) List of Threatened and/or Declining Species and Habitats;
- The International Union for Conservation of Nature (IUCN) has compiled a list of species that are endangered;
- The CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora);
- The Western Isles Biodiversity Action Plan which makes a contribution to the wider UK Biodiversity Action Plan;
- The recommended Priority Marine Features (PMF) list which contains habitats and species which the Scottish Government believes to be of greatest conservation importance in Scottish territorial waters; and
- The Wildlife and Country side act provides the cornerstone to nature conservation in the UK. Section 9 of the act allows for the protection of specifically listed wild animals, including marine species (listed in Schedule 5 of the Act). Schedules 5, 8 and 9 are reviewed every five years and revised. The next scheduled review is 2013.

Trends in abundance

14.3.16 Interrogation of the landings data does not indicate any obvious trends in the quantity of fish landed from with the WSA over the past six years. However when the amount of fishing effort is taken into account (days at sea)[30] the amount of fish taken from the WSA per day of fishing effort declined between 2006 and 2010, but recovered slightly in 2011 (Figure 14.2). As discussed in Chapter 15, Commercial Fisheries the general long term trend in landings across the WSA has been a downward.

14.3.17 The quantity of fish taken per day of effort, within this area of sea is relatively low compared with other UK waters. This may have resulted in low amounts of fishing activity occurring within this area of sea (see Chapter 15, Commercial fisheries). No commercial fishing currently takes place within the LSA.

[30] Values for fishing effort are available from the Marine Scotland Fishing Effort and Quantity and Value web page.

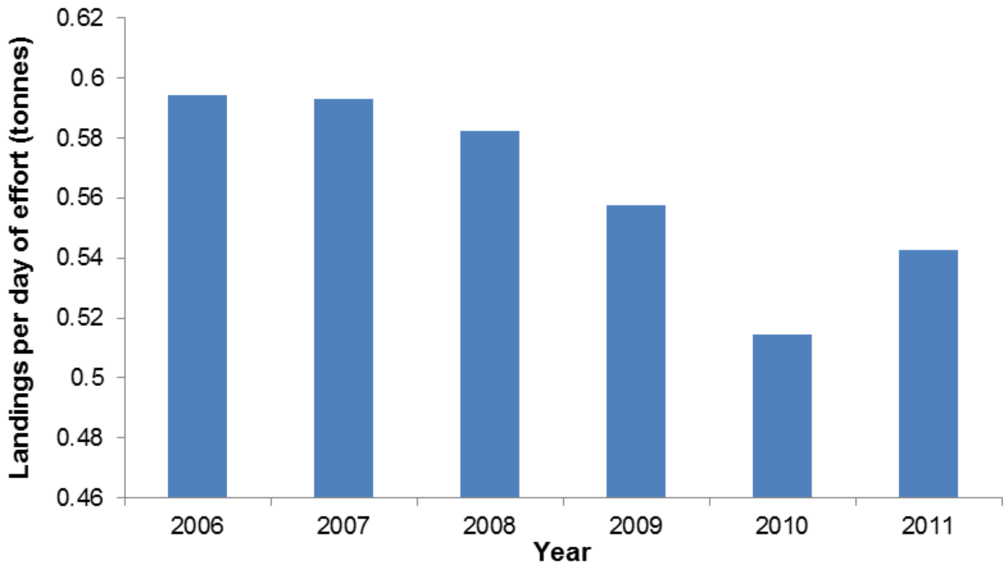

Figure 14.2 Total landings from the WSA (ICES rectangle 43E4) by year per day of effort.

Individual species

14.3.18 This section considers all species that have been identified above as potentially important to the LSA. A high level screening process, has been applied to remove the species that are unlikely to be present in significant numbers within the LSA therefore refining the species which will be included in the impact assessments. Species have been excluded due to reasons such as habitat preference and behaviour traits. Table 14.8 summarises why species are included or excluded from further investigation.

Table 14.8 Species likely to be present in within the LSA

Species	Potential to be present within the LSA	Justification
Anglerfish *Lophius piscatorius*	Low	Anglerfish are found mostly on sandy or muddy bottoms but are also present on shell, gravel and occasionally rocky areas (Reeve 2008), the latter occurring in the LSA (Chapter 13, Benthic Ecology)
All lamprey species *Petromyzontiformes*	Low	Very little is known about the migratory patterns of Lampreys in the marine environment and therefore they cannot be discounted.
Blue whiting *Micromesistius poutassou*	Unlikely	This species is usually found in water depths greater than those present within the LSA (Barnes 2008a ; DECC 2008)
Brown crab *Cancer pagurus*	High	Brown Crab has a habitat preference of rocky reef which are present within the LSA this species was potentially identified (although the surveyors could not be certain) at station 10 of benthic survey (**Appendix 13.1**)
Cod *Gadus morhua*	High	Cod has been landed from with the WSA in every year between 2006 and 2011. Additionally there are cod nursery grounds which overlap with the LSA

Species	Potential to be present within the LSA	Justification
Common skate *Dipturus batis*	Unlikely	Although skates and rays have been landed in small amounts from within WSA between 2006 and 2011, this species live on fine sand and muddy bottoms (Neall *et. al.,* 2008), habitats that are not found within the LSA (Chapter 13, Benthic Ecology)
European eel *Anguilla anguilla*	Low	Due to the sensitivity of this species and the recent widespread population decline the worst case scenario approach is adopted which assumes European Eels are migrating through the LSA.
European hake *Merluccius merluccius*	Unlikely	Adults are found in water depths between 75 and 350m (Barnes, 2008b) and although the LSA is within hake nursery grounds of low intensity (Figure 14.4) juveniles of this species show a preference for muddy sediment, where they feed on crustaceans; this habitat is not found in the LSA.
European spiny lobster *Palinurus elephas*	Low	This species has a preference for rocky habitats, and both data from MarLIN (Jackson *et al.,* 2009) and NBN indicate that this species could be present within the LSA, however this species tend to prefer open coast.
Green crab *Carcinus maenas*	High	Suitable habitat for this species is widely available within the LSA.
Haddock *Melanogrammus aeglefinus*	Unlikely	Adults occur at depths of 40m to 300m over sand and gravel; The LSA does not contain these conditions. Although there is a Haddock nursery ground of undetermined intensity approximately 80km to the north of the LSA it is recognised that haddock nursery (Faber Maunsell,2007) grounds are generally offshore and therefore juveniles are not likely to be present within the LSA.
Herring *Clupea harengus*	High	No herring were landed from within the WSA between 2006 and 2011. The LSA is within the herring nursery ground so theoretically juveniles may pass through the area, however due to the strong tidal currents and inability of the juvenile fish to sustain rapid movement against the current they are not expected to spend a significant amounts of time in Kyle Rhea.
Lemon sole Microstomus kitt	Low	Lemon sole have been landed from the WSA in very small quantities in most years between 2006 and 2011. They have a preference for on stony substrates (Barnes 2008c) which are present within the LSA (Chapter 13, Benthic Ecology), however the extreme tidal flows experienced within the LSA are likely to deter this species
Ling *Molva molva*	High	Ling were caught from within the WSA in 2006 and in 2011. The species has a preference for rock habitat in water depths as shallow as 10m such as is found within the LSA.

Species	Potential to be present within the LSA	Justification
Lobster *Homarus gammarus*	High	Has a habitat preference of rock reef which are present within the LSA.
Mackerel *Scomber scombrus*	High	Mackerel were landed from the WSA in 2011; however this species was not landed from the WSA during 2006 to 2010.
Nephrops (Norway lobster) *Nephrops norvegicus*	Unlikely	Although this species was landed consistently in relatively large quantities across all years 2006-2011, this species require fine cohesive mud which is stable enough to support their unlined burrows (Sabatini and Hill, 2008). This habitat is not present within the LSA (Chapter 13, Benthic Ecology)
Razor clam *Solen spp.*	Unlikely	Razor clams require stable fine sediment to burrow into. This habitat is not found t within the LSA (Chapter 13, Benthic Ecology)
Saithe *Pollachius virens*	High	Adults inhabit water depths of between 100 and 200m. There are no spawning grounds within the LSA however the LSA is within nursery ground of undetermined intensity (Figure 14.5). In addition anecdotal evidence from angling boat operators suggest that saithe are caught in close proximity to the LSA.
Salmon *Salmo salar*	High	Salmon are likely to be present within the LSA as there are a number of salmon rivers within its vicinity (Figure 14.8).
Sandeel *Ammodytidae*	Low	Although a single sandeel was identified within the LSA (**Appendix 13.1**) the Marine Renewables SEA (Faber Maunsell, 2007) highlights that this group of species have a habitat preference for stable sand or gravel which is not abundant within the LSA.
Scallops *Pecten maximus*	Unlikely	Not observed during the benthic survey and suitable habitat is not present at the LSA.
Sea trout *Salmo trutta*	High	NBN Gateway indicates that sea trout are present in a number of rivers that surround the LSA Figure 14.8
Spotted ray *Raja montagui*	Unlikely	The majority of the population are found from 100-500m. This species live on soft substrates, preferring sand (Ellis *et. al*., 2007) and therefore is unlikely to be regularly present within the LSA.
Sprat *Sprattus sprattus*	High	Sprat were landed from the WSA in 2011, however this species was not landed from the WSA during 2006 to 2010, the LSA is within a sprat spawning ground of high intensity and unidentified intensity nursery grounds are located to the east in lochs Duich and Long.
Spurdog *Squalus acanthias*	High	This species was landing in most years between 2006 and 2011 and the LSA is within a high intensity

Species	Potential to be present within the LSA	Justification
		nursery ground for this species.
Thornback ray *Raja clavata*	High	This species can be found on patches of sediment among rocky outcrops and boulders and as this habitat occurs within the LSA thornback ray may be present. In addition this species was landed from the WSA in 2010 and in 2011, and has nursery grounds within 30km of the LSA.
Tope *Galeorhinus galeus*	Unlikely	Tope were not caught within the WSA during 2006 to 2011, there is a tope nursery ground 23km to the northwest of the LSA however it is unlikely that juvenile tope would migrate to the LSA in significant numbers, nor that the development would interact with tope causing an impact.
Velvet swimming crab *Necora puber*	High	Has a habitat preferences of rock reef which is present within the LSA and was identified in the benthic survey.
Whiting *Micromesistius poutassou*	High	Small amounts of whiting were caught within the WSA in 2006 and in 2011. Additionally the LSA is within an area used by whiting as a spawning ground and a high intensity nursery ground.

14.3.19 It is assumed that all species identified as likely to be present within the LSA have the potential to be affected by the development. Further information regarding the ecology of these species is provided below and is used to determine the sensitivity of the species in the impact assessment.

Shellfish

14.3.20 Shellfish are very important to the WSA area and make up 96% of the live weight of species landed from the ICES rectangle.

Brown crab

14.3.21 Brown crab *Cancer pagurus* (also called edible crab) is one of the three main shellfish species targeted by fishermen in the WSA (Chapter 16, Commercial Fisheries) and were the third most landed species from 2007 and 2011 (Table 14.6).

14.3.22 Brown crab are mostly found in rocky areas such as those that characterise the LSA (Chapter 13, Benthic Ecology), but may also be found on sand, gravel and mud from the intertidal to 100m depth (Niel and Wilson, 2008). During benthic surveys (Appendix 13.1) one individual was potentially identified at station 10 (Chapter 13, Benthic Ecology) within the LSA. Mating occurs in spring and summer. Females are 'berried' (carrying eggs under the abdomen) for 6-9 months after copulation and release the larvae in late spring/early summer (Thompson *et al*., 1995). Tagging studies show that edible crabs may move a few kilometres a day, and hundreds of kilometres in the long term (The Scottish Government, 2011).

Green crab

14.3.23 The green crab or common shore crab *Carcinus maenas* is a feature of the landings from the WSA and was the 18th most landed species (**Appendix 14.1**). This species is common in the intertidal and subtidal zone around much of the UK and can be found in a variety of different habitats. Spawning in Scotland occurs during the spring and females are then berried for up to 4 months, depending on temperature, before the eggs hatch.

Velvet swimming crab

14.3.24 The velvet swimming crab *Necora puber* (also known as the devil crab), is heavily targeted within the WSA. 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 significant migrations (Fisheries Research Services, 2004) and this species was not identified during the benthic survey (Appendix 13.1).

European spiny lobster

14.3.25 The crawfish or European spiny lobster *Palinurus elephas* was landed in very small quantities from within the WSA in most years between 2006 and 2011 (**Appendix 14.1**). This species may well be present within the LSA as their preferred habitat is rocky, exposed coasts (Jackson *et al.,* 2009). This species is a UK BAP species and has also been identified as a PMF by Scottish Natural Heritage on the recommended list (SNH, 2012). The main UK populations of this species are confined to the west coast of Scotland with a small population occurring in Cornish waters.

Common lobster

14.3.26 The common lobster *Homarus gammarus* is targeted within the WSA and was the 8^{th} most landed species (Table 14.6) between 2007 and 2011. This species have a preference for rocky reef habitats of mid to high energy environments (Galparsoro *et al.,* 2009) such as those that occur within the LSA (Chapter 13, Benthic Ecology) and therefore may be present.

14.3.27 Spawning occurs in late summer or autumn after which lobster eggs are carried by the female under the abdomen until they are ready to hatch usually in early summer. They are rarely thought to undertake any significant migrations (Fisheries Research Services, 2004).

Cod

14.3.28 Cod *Gadus morhua* is landed from within the WSA in small numbers, typically representing less than 0.25 of a tonne in live weight and a total of 1.1 tonnes over the six year period (**Appendix 14.1**). This may either be an indication of declining populations; the west coast stock has been defined as collapsed, or it may a function of reductions in TACs for this species over the same time period.

14.3.29 Juvenile cod are demersal, with nursery areas located in coastal waters from the Clyde northwards. Although they exhibit a preference for rocky shores it is not thought that Juvenile cod will favour the environment within the LSA due to its very strong tidal currents. Cod is listed as vulnerable in the IUCN Redlist and has been included in the list of PMF species (SNH, 2012).

Ling

14.3.30 Ling *Molva molva* were landed from the WSA during 2006 and 2011 (Appendix 14.1) however in both years this comprised less than a tonne a year. Ling is the largest species of the cod (gadoid) family and is widely recorded around the British Isles. It is a deep water species found at depths of up to 600m but juveniles and occasionally adults are found as shallow as 10m. This species is primarily solitary and benthic in habit, found amongst rocks, crevices and wrecks in deep water. Spawning occurs offshore between March and August (Rowley, 2008) at a depth of 100-300m and therefore will not occur within the LSA. The LSA is within a nursery ground for ling that has been identified as being of low intensity (Figure 14.4). This species has been recommended as a PMF (SNH 2012).

<u>Saithe</u>

14.3.31 Correspondence with local angling vessel operators revealed that saithe, also known as coley, *Pollachius virens* are caught by anglers from within the LSA. Very small quantities of saithe were landed from the WSA in 2009 but were not landed during any other years between 2006 and 2011 (**Appendix 14.1**)

14.3.32 Saithe are an active, gregarious species occurring both inshore and offshore. They usually enter coastal waters in spring and return to deeper waters (up to 350m) in winter (Barnes and Wilding 2008). This species has been recommended as a PMF (SNH 2012).

<u>Lemon sole</u>

14.3.33 Lemon sole *Microstomus kitt* is a commercially important flatfish occurring throughout Scottish waters, where it is in greatest abundance around the Outer Hebrides, Orkney and Shetland (Faber Maunsell, 2007). Less than 0.1 tonne of this species was landed from within the WSA in most years between 2006 and 2011 (**Appendix 14.1**).

14.3.34 This species is commonly found on stony substrates between depths of 20m and 200m (Barnes 2008c), conditions that do exist within the LSA (Chapter 13, Benthic Ecology). Spawning for lemon sole occurs from April to July in deep water and the pelagic eggs and larvae occupy progressively deeper water as they develop (Faber Maunsell, 2007).

<u>Anglerfish</u>

14.3.35 The anglerfish, also known as monk fish *Lophius piscatorius,* features in the landings from the WSA in all years but never comprises of more than 1.5 tonnes a year (**Appendix 14.1**). It should be noted that landings of other species such as *Squatina squatina* (also known as monk fish) may also be included within these statistics. The LSA is also within a large anglerfish nursery ground Figure 14.4.

14.3.36 Anglerfish which are UK BAP and recommended PMF species (SNH, 2012) inhabit waters from the low intertidal zone down to depths of 550m. It is uncommon to see an angler fish in water shallower than 18m though they may migrate down to as deep as 2000m in offshore waters in order to spawn. This species is found mostly on sandy or muddy bottoms but is also present on shell, gravel and occasionally rocky areas (Reeve, 2008).

<u>Herring</u>

14.3.37 Although Atlantic herring *Clupea harengus* were not recorded in the landings data of the WSA between 2006 and 2011 the LSA is within a nursery ground of high intensity for this species. The strong tidal currents that exist within the LSA mean that juvenile herring are unlikely to spend much time within Kyle Rhea however they may pass through with the tidal currents.

14.3.38 Atlantic herring, which are UK BAP and recommended PMF species (SNH, 2012), are pelagic in distribution and occurs in the surface waters down to a depth of around 200m. Outside of the spawning season (July to September), Atlantic herring stay away from the immediate coastal areas. They are often found in vast near-surface shoals covering an area of several square kilometres (Barnes, 2008d).

Sprat

14.3.39 Sprat *Sprattus sprattus* was only landed from the WSA in 2011, with no landings between 2006 and 2010 (**Appendix 14.1**) However a relatively large amount was landed in 2011 making it the 5th most landed species (Table 14.6). This indicates that sprat occasionally frequent the study area, there is currently no TAC for this species (www.ices.dk). Sprat 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 therefore may occur across the LSA.

14.3.40 Sprat is a batch spawner that spawns throughout the summer producing pelagic eggs. The LSA is within a sprat spawning ground (Figure 14.3), however it is unlikely that spawning occurs within Kyle Rhea as eggs and sperm would be rapidly transported out of the area by the strong tidal currents.

Mackerel

14.3.41 Mackerel was only landed from with the WSA in 2011, however, this one years' worth of landings resulted in them being the 7th most landed species from within the WSA between 2007 and 2011 Table 14.6. The LSA is also within a mackerel nursery ground of low intensity (Figure 14.5).

14.3.42 Mackerel is a pelagic species whose presence in Scottish waters is transitory. The spawning grounds for the western stock of mackerel lie to the south and west of the British Isles and after spawning the fish migrate northwards to feeding ground in the northern North Sea and the Norwegian Sea. The migration route generally follows the edge of the continental shelf; however some enter coastal waters in June and remain throughout the summer (Faber Maunsell, 2007).

Spurdog

14.3.43 The spurdog or spiny dogfish *Squalus acanthias* was 15th most landed species from within the WSA between 2006 and 2011 (**Appendix 14.1**). Landings of this species have markedly decreased over this period, which may indicate a declining trend in the abundance of this species over this time period. The species is protected under a number of of pieces of legislation and international agreements. The WSA and LSA form part of a large, high intensity, nursery ground for this species (Figure 14.6).

Thornback ray

14.3.44 The thornback ray *Raja clavata* was identified in the Scottish Marine Renewables SEA as potentially present within WSA (Faber Mansell, 2007) and if landed would have been recorded within either its own entry or within the "skates and rays" category along with common skate and the spotted ray. Skates and rays are ranked 9th in the landings data (**Appendix 14.1**). Thornback rays are found in a wide range of habitats from mud, sand, shingle and gravel. They are also found on patches of sediment among rocky outcrops and boulders, such as is present within the LSA (Chapter 13, Benthic Ecology). They are most commonly found between 10m and 60m water depth. Although mainly a non-migratory species, the fish often move closer inshore during the spring (Wilding & Snowden, 2008).

14.3.45 Spawning occurs in inshore waters between February and September, with a peak in May and June and a theoretical maximum of 140 to 160 eggs per individual laid per year (Shark Trust, 2009). Information regarding the nature of the substrate on which this species lays its eggs is not freely available and therefore it must be assumed that this species could potentially lay its eggs in the LSA. Tagging studies indicate that juveniles are non-migratory and remain on inshore nursery grounds, with adults undertaking seasonal migrations, moving into shallower water during summer, and offshore in the winter. Feeding migrations may also occur (ICES Fishmap undated).

Whiting

14.3.46 Whiting *Merlangius merlangus* was landed from the WSA in 2006 and in 2011, but not during 2007 to 2010; however landings were relatively small (below 0.2 tonnes) during these years (**Appendix 14.1**). This indicates that the abundance of this species within the region is very patchy. ICES concluded that stocks in west of Scotland are at a historical low despite decreases in fishing mortality (through fishing) since 2010 (ICES, 2011).

14.3.47 Whiting occur throughout the northeast Atlantic from shallow inshore waters down to 200m (ICES, 2011) near mud and gravel bottoms, and also above sand and rock (Barnes, 2008e). Whiting has a prolonged spawning period from February to June and the LSA is within an indicative spawning ground identified by Coull *et al.* (1998). The eggs and larvae are pelagic, and on the west of Scotland the young, often remain pelagic until they attain a length of about 10cm when they adopt a demersal habit. The nursery grounds tend to be located inshore (including the sea lochs) with the juveniles actively migrating to the sites. Whiting remain in these areas for one or two years (Faber Mansell, 2007). The LSA is within an area of high and low intensity nursery grounds, (Figure 14.6).

Salmon

14.3.48 Atlantic salmon *Salmo salar* is widely distributed in Scottish waters, with populations widely recognised as being of national and international importance, in terms of commercial resource and nature conservation. For these reasons a study area for this species has been identified which incorporates the west and north coast of Scotland. This study area is termed the Regional Study Area (RSA), and is approximately the extent shown in each of the boxes in Figure 14.7.

14.3.49 Atlantic salmon have been identified as a species of conservation importance; they are a UK BAP Priority species, a Scottish PMF (SNH, 2012) and are included on the OSPAR list of marine habitats and species considered to be under threat or decline in the north-east Atlantic.

14.3.50 Atlantic salmon is listed in Annex II of the EU Habitats Directive 92/43/EEC (as amended) and the nearest Special Areas of Conservation (SAC) for salmon, to the LSA is the Little Gruinard River SAC, approximately 106km north of the LSA (Figure 14.7 and Table 14.9). The Langavat, River Narver, River Thurso, Berriedale and Langwell Waters and River Bladnoch SACs are also designated for the primary reason of protection of salmon and their distances from the LSA are provided in Table 14.9. Three other SACs on the north and west coasts of Scotland also include salmon as “a qualifying feature, but not a primary reason for site selection”, these are also detailed in Table 14.9 below.

Table 14.9 SACs in the north west of Scotland that have been designated with salmon as a primary feature or as a qualifying feature.

SAC	Priority	Distance by Sea (km) from LSA
Langavat	Primary	190
North Harris	Qualifying	115
Little Gruinard River	Primary	106
River Borgie	Qualifying	240
River Naver	Primary	250
River Thurso	Primary	280
Berriedale and Langwell Waters SAC	Primary	360
Endrick Water	Qualifying	350km to the south (or 220 using the Crinan Canal)
River Bladnoch	Primary	380

14.3.51 The Little River Gruinard SAC conservation objectives for Atlantic salmon are aimed at avoiding deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and to ensure for the qualifying species that the following are maintained in the long term:

- Population of the species, including range of genetic types, as a viable component of the site;
- Distribution of the species within site;
- Distribution and extent of habitats supporting the species;
- Structure, function and supporting processes of habitats supporting the species; and
- No significant disturbance of the species

14.3.52 The condition of the Little River Gruinard SAC is currently said to be “Unfavourable, but “Recovering” (http://gateway.snh.gov.uk/sitelink). The Wester Ross Fisheries Trust has developed a management plan, which was put in place in 2011 with the aim of returning the river to favourable condition and maintaining this status (Cunningham, 2011).

14.3.53 Data sourced from the NBN gateway (NBN, 2012), which provides records from the Biological Records Centre database, indicate that salmon are, or have historically been, present within several rivers in the vicinity of Kyle Rhea, although none were present within the LSA itself (Figure 14.8). The Glenmore and Glenbeag rivers are located 1.6km and 3km to the south of the LSA and the Udaiain is located 5.9km to the north (Figure 14.8). The Glenmore and the Glenbeag rivers are both within the salmon fisheries district of Glenelg (The Scottish Government, 2012).

14.3.54 Adult salmon can enter Scottish rivers from the sea at almost any time of year, but the salmon within the Kyle Rhea area are known to enter the rivers mainly during June and July (Wester Ross Fisheries Trust Pers. Comm. and data provided by Marine Scotland). Salmon will generally then migrate into smaller spawning streams on elevated flows following rainfall in the autumn (September – November). After spawning in October to December the adult fish return seawards over a period of up to several months.

14.3.55 The juvenile life stage of salmon takes place in fresh water and typically lasts between 1 and 4 years before migrating down river to the sea as smolts. Atlantic salmon grow rapidly by feeding in the ocean but return to their native rivers to spawn.

14.3.56 There is little systematic information on the routes used by Atlantic salmon to migrate from Scotland to their distant ocean feeding grounds. Based on currently available information it is not possible to describe how migratory routes vary with river of origin, or to define the duration or extent of their initial dependence on near and off-shore areas (Malcolm *et al.*, 2010). Information presented in Malcolm *et al*., (2010) indicates that salmon migrating from rivers on the west coast of Scotland travel north toward the Norwegian Sea to feed. Although the report indicates that salmon from lower on the west coast are likely to travel around the western side of Skye and through the Minches it is likely that some salmon from rivers in the Sound of Sleet area will migrate up through the LSA passing close to the Project.

14.3.57 There are a number of distinct phases to the homeward migration. The first phase occurs in the sea and is rapid and highly directed, probably involving navigation or orientation using position of sun and reference to the Earth's magnetic field (Hansen & Quinn, 1998). The second phase is the upstream migration. Very little is understood of the phase of migration between location by salmon of the home land-mass and identification of the home river (Malcolm *et al*., 2010). It is, however, assumed that salmon migrating to and from their natal rivers swim along the coast seeking olfactory[31] cues that help them identify the correct river (Lockwood, 2005). Salmon, post-smolts, originating in Scottish rivers, are thought to use near-shore areas at the commencement of their marine navigation. Based on current information it is not possible to describe how migratory routes vary with river of origin, or to define the duration or extent of their initial dependence on near and offshore areas (Malcolm *et al*., 2010). Studies conducted in Canada show that smolts stay relatively close to shore, (Lacroix *et al.,* 2005); however, these studies have not been repeated in Scottish waters.

14.3.58 Smolts spend most of their time in the top 1 to 6m of the water column (Davidson *et al*., 2008; Plantelech Manel-La *et al*., 2009). Although these studies were conducted in Norweigian fjords rather than open water, the fact that many smolts are caught in surface trawls also suggests that they spend most of their time in the top few metres of the water column (Malcolm *et al*., 2010). In addition, artisanal fishing methods for salmon in Scotland and northern England, such as fixed engine and coastal drift netting, target fish within the top 2m of the water column, a strategy evolved over time to maximise catch and minimise effort, adding to the evidence that a significant portion of the fish tend of inhabit the upper water column.

14.3.59 Marine Scotland has provided salmon catch data, which has been use for this assessment. The data are divided into three categories, based on the method of fishing used, as follows:

- **Fixed engine fisheries** are restricted to the coast and must be set outside estuary limits. Within this category are bag-nets, stake nets and jumpers;
- **Net & coble fisheries** generally operate in estuaries and the lower reaches of rivers; and
- **Rod and line fisheries** comprise recreational angling activities which generally take place within rivers (rod and line catch data is discussed above).

14.3.60 Data are combined geographically into 109 Districts which the Glenelg and the Sligachan are most relevant to the project. Districts correspond either to a single river catchment together with adjacent coast, or to groups of neighbouring river catchments and associated coastline (The Scottish Government, 2012).

14.3.61 For the purposes of this assessment the rod and line data has been grouped together by the six districts that surround the LSA (Sligachan, Glenelg, Arnisdale, Kilchoan, Loch Long and Croe) and these data is displayed in Figure 14.9. These data show the total number of

[31] Olfactory: Of, relating to, or contributing to the sense of smell.

salmon (both caught and retained and caught and released) landed from all rivers within the six districts between 1952 and 2011. Total numbers of adult salmon and total number of grilse (a young salmon that returns to fresh water after one winter in the sea) are displayed separately. It should be noted that the distinction between caught and released and caught and retained was not included in the data collection until 1994 which may artificially affect any patterns apparent before and after 1994.

14.3.62 The data displayed in Figure 14.9 indicate that salmon abundance in Kyle Rhea area has experienced large fluctuations in the last 60 years. There was an apparent marked decline in both grilse and adult salmon during the late 1980s and the 1990s, however after 2005 the abundance has shown an increase.

14.3.63 The two closest rivers to the LSA which are known to support salmon are the Glenelg and the Glenbeag. These are both within the district of Glenelg. Catch data from this district (provided by Marine Scotland) indicates that since the early 90's very few adult salmon and grilse have been caught from this district (Figure 14.10). This may be as a result of a declining population within this area.

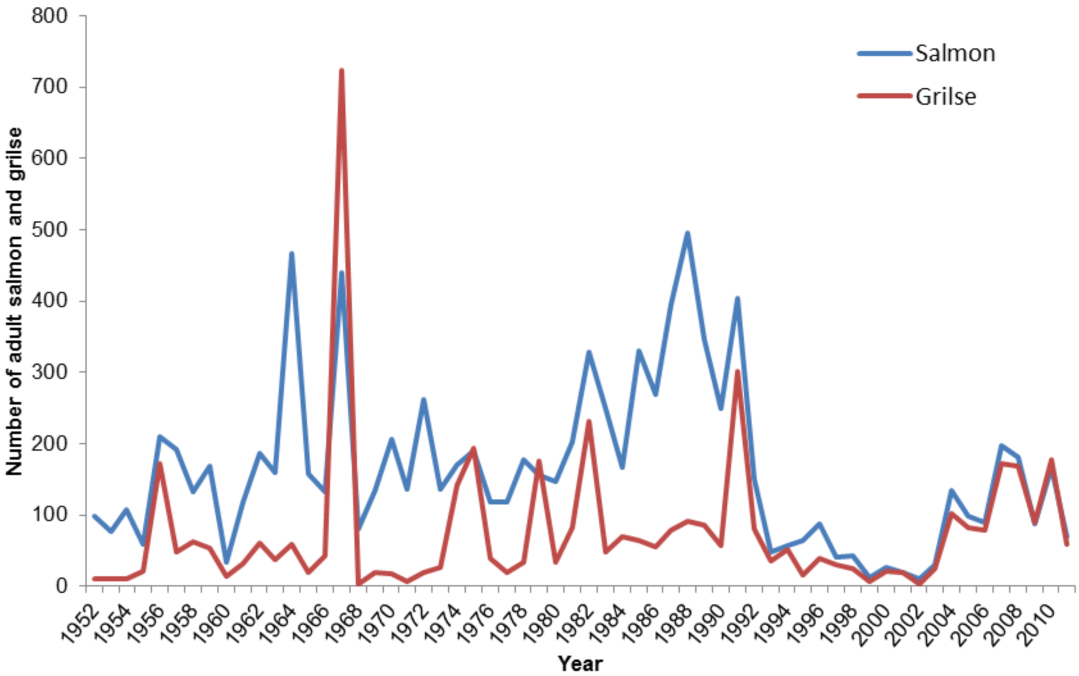

Figure 14.9 Rod and line collated salmon data (catch and retained and catch and release) from six districts surrounding Kyle Rhea 1952 to 2011. Data has been divided into adult salmon and grilse. Data source: Marine Scotland

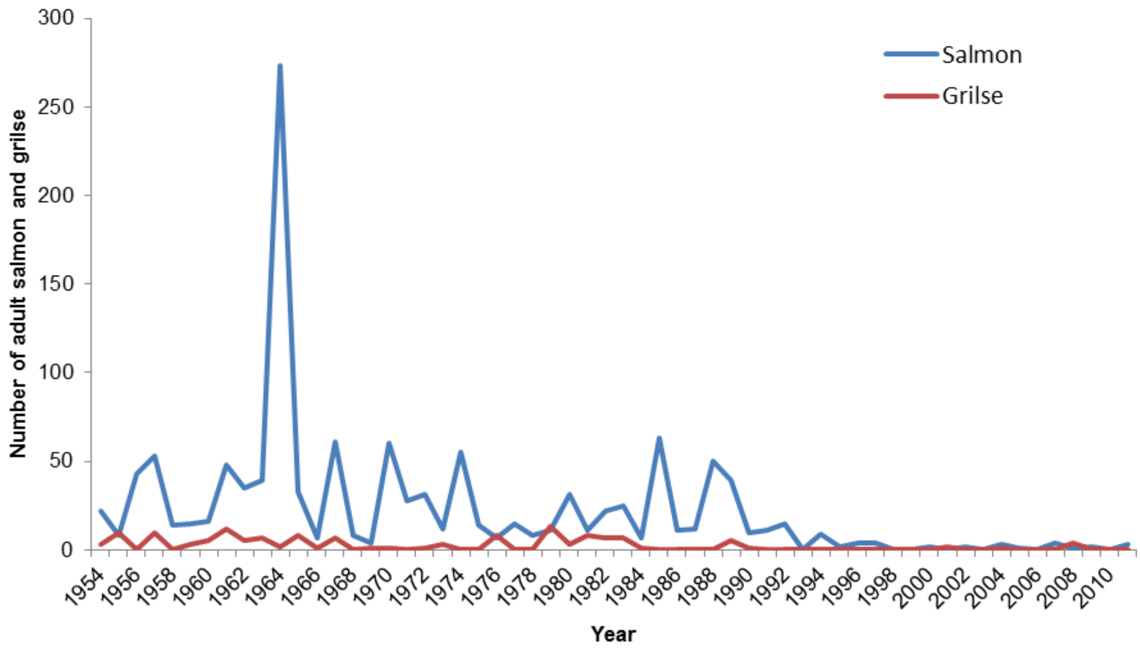

Figure 14.10 Rod and Line salmon data (catch and retained and catch and release) from the Glenelg district 1952 to 2011. Data has been divided into adult salmon and grilse. Data source: Marine Scotland

14.3.64 Historically there have been a number of salmon net fisheries (including the net and cobble and the fixed engine fisheries described above) based on the west coast of Scotland, over time these fisheries have rapidly declined to the extent that very few coastal net fisheries still operate (Malcolm *et al*., 2010). Catch data from these fisheries can provide an indication of the trends in salmon populations over the last 60 years.

14.3.65 When these data are collected the maximum number of people operating the fishery is also recorded. By dividing the number of salmon caught by the number of fishermen (the effort) it is possible to approximately compare data across years and between districts.

14.3.66 Figure 14.11 shows the number of salmon caught (per number of people operating the fishery) using net and cobble methods in the Glenelg and Sligachan districts (grouped together) as well as the Snizort district, which covers the western coast of Skye (The Scottish Government, 2012). The Snizort district is included in both Figure 14.11 and 14.12 to add context and to illustrate potential trends in salmon migrating around the island of Skye.

14.3.67 These data show that in general catch rates per amount of effort declined over the period for which data are available. They also indicates that more salmon were caught per fishermen in rivers and estuaries on the west coast of Skye than off the east coast.

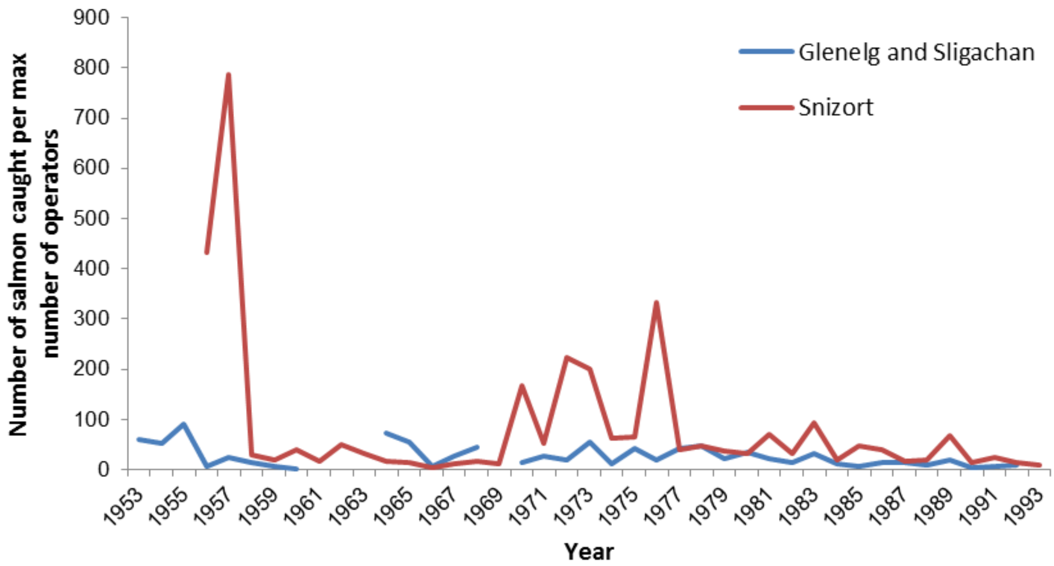

Figure 14.11 Salmon net and cobble landings from the salmon districts of Glenelg, Sligachan and Snizort. The data used in this graph are Crown copyright, used with the permission of Marine Scotland Science. Marine Scotland is not responsible for interpretation of these data by third parties.

14.3.68 Fixed engine data show that the number of salmon caught (per number of people operating the fishery) generally increased between the 1950s and 1990s on both the east and west coasts of Skye, peaking in 1974 on the east coast and in 1985 on the west coast. Then from the mid-1990s onwards there have been steady declines in the number of wild salmon caught using this method of fishing (Figure 14.12).

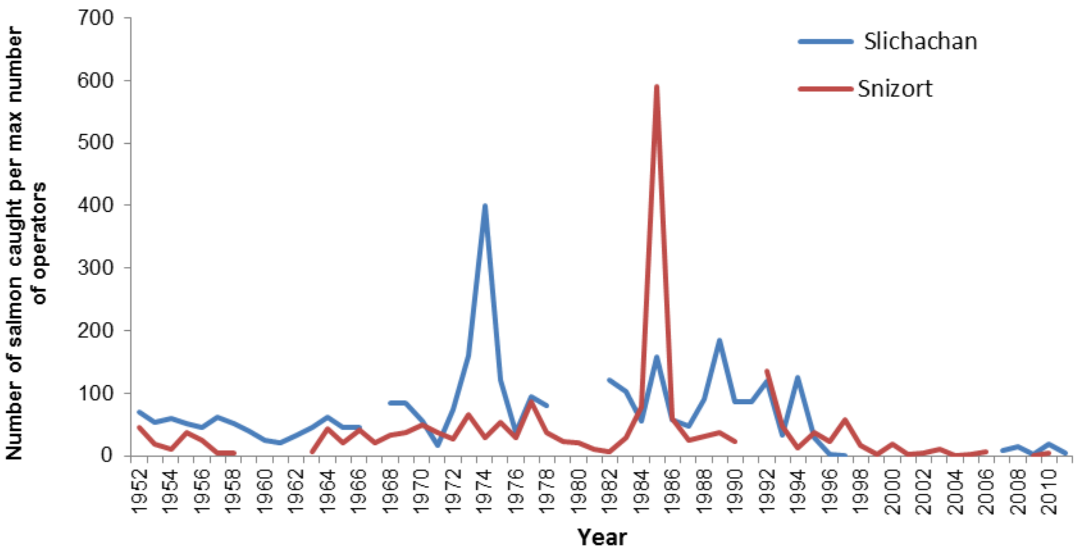

Figure 14.12 Fixed engine landings of salmon from the districts of Glenelg, Sligachan and Snizort. The data used in this graph are Crown copyright, used with the permission of Marine Scotland Science. Marine Scotland is not responsible for interpretation of these data by third parties.

14.3.69 One of the purposes of acquiring the above data was to investigate the migratory patterns of wild salmon when navigating around the island of Skye. The fixed engine data (which is best suited to answer this question) indicates that slightly more fish travel through Kyle

Rhea than around the west coast of Skye, although the difference is not great enough to be considered significant (3267 wild salmon caught per operator on the east coast compared with 2070 per operator of wild salmon caught on the west between 1952 and 2011).

14.3.70 Atlantic salmon is a host species for freshwater pearl mussels *Margaritifera margaritifera*, one of the most critically endangered molluscs in the world. Declines in salmon could therefore have a negative impact on any associated freshwater pearl mussel populations. The nearest SAC designated for freshwater pearl mussel are the River Kerry approximately 65km to the north and the River Moidart approximately 58km to the south of the LSA.

<u>Sea trout</u>

14.3.71 Data sourced from the NBN gateway show that sea trout *Salmo trutta* has been recorded in most of the major rivers surrounding the LSA (Figure 14.8). Trout spawn in winter from October to January. The eggs are shed in small depressions known as redds which are cut by the female in the river gravel, usually in upstream reaches.

14.3.72 Sea trout spend a variable number of years in fresh water before migrating to sea, where they spend variable periods of time before reaching maturity. In contrast to salmon, immature sea trout often return to fresh water to over-winter. Once sea trout reach the sea they appear to remain within nearshore waters rather than undergoing extensive migrations offshore (DECC, 2009). Malcolm *et al*. (2010) concluded that no reliable inferences can be drawn as to the marine distribution of adult sea trout. However it is likely that, as they are closely related to salmon (they are both of the same genus), that they will display similar behaviours.

14.3.73 Sea trout catch data provided by Marine Scotland indicate that for the districts that surround the LSA (Sligachan, Glenelg, Arnisdale, Kilchoan, Loch Long and Croe) sea trout populations steadily decreased from the late 1950s to the early 1990's after which they appear to show an increase in abundance. It should be noted however that caught and released data has only been recorded since 1994 and this may have artificially raised the trend from 1994 onwards (Figure 14.13).

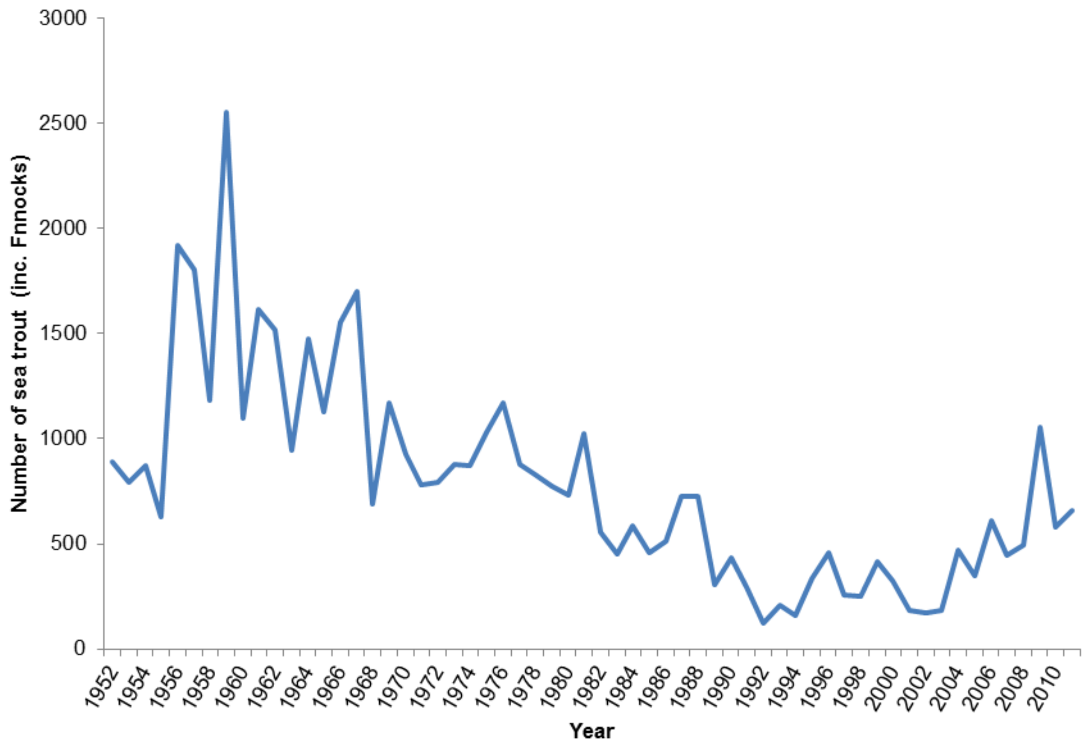

Figure 14.13 Collated sea trout catch data from the districts that surround the LSA. Data

Source Marine Scotland.

14.3.74 As with salmon, sea trout are also a host species for the freshwater pearl mussel and therefore decline in populations of this fish species is likely to have a negative impact upon the population of pearl mussels.

European eel

14.3.75 The European eel *Anguilla anguilla* has been recorded in many rivers in the vicinity of the LSA such as the Glenmore, approximately 1.6km, the Glenbeag approximately 3km and the Dalach approximately 3.5km from the LSA (Figure 14.8). European eels may therefore migrate through the LSA. The life-cycle of the European eel is partially understood; with spawning thought to occur in the vicinity of the Sargasso Sea after which the larval eels cross the Atlantic Ocean. By the time they reach the continental shelf of Europe the larvae metamorphose into un-pigmented “glass” eels, around 5cm in length. Some of these glass eels remain in the sea, some ascend the rivers of Europe, and others may move back and forth between marine, estuarine and freshwater environments.

14.3.76 After a growth stage, which can last from 3 to 60 years depending on environmental conditions, the eels metamorphose into “silver” eels and begin the return migration to the spawning grounds. It is possible that a significant proportion of the total European population may pass through the seas around Scotland.

14.3.77 Recruitment of juvenile eels to the European stock is presently at about 5% of levels that in the 1970s (ICES, 2009). This collapse threatens aquatic biodiversity and the socio-economic value of eel fisheries throughout its range. The problem is internationally recognized as a conservation priority: the IUCN assessed the European eel as ‘critically endangered’.

14.3.78 The absence of regulated eel fisheries in Scotland means that there is a lack of high quality data on stock and trends in stock. In particular, there is a lack of time series data covering the crucial recent general European eel population decline (Defra, 2010). This may indicate that, because there has not been a significant eel fishery within Scotland, that the Scottish populations are higher than those across the rest of Europe. However, without data it is impossible to ascertain if this is indeed the case.

Lamprey species

14.3.79 The sea lamprey *Petromyzon marinus* has been recorded in the black water river and near to Stornoway on Lewis approximately 120km north and west of the LSA and 50km offshore from mainland Scotland. The River Lamprey *Lampetra fluviatilis* have been identified in the River Sheil approximately 60km to the south of the LSA.

14.3.80 Both the sea lamprey and the river lamprey migrate up rivers to spawn and spend the larval stage buried in muddy substrates in freshwater. Both species need clean gravel for spawning, and silt or sand for the burrowing juveniles. Once metamorphosis takes place, the adults migrate to the sea where they live as a parasite on various species of fish (DECC, 2009).

14.3.81 Both species of lamprey are highly protected and are listed in Annex II of the EU Habitats Directive 92/43/EEC (as amended). In order to meet the requirements outlined in Article 3 of the Habitats Directive, SACs have been designated in Scotland the closest of which are River Spey on the east coast of Scotland and Solway (for Sea Lamprey) over 430km by water to the north and east and to the south respectively of the LSA and Endrick water (for river Lamprey) over 350km to the south (or 220 using the Crinan Canal) of the LSA.

Underwater noise

14.3.82 The degree to which fish species detect noise varies greatly between species. Noise sensitive species such as herring, have elaborate specialisations of their auditory apparatus. These species are characterised by the presence of *prootic bulla*, a gas-filled sphere which is connected to the swim bladder, which enhances hearing ability. The gas filled swim bladder in species such as cod and salmon may also be related to their hearing capabilities, although there is no direct link to the inner ear. These species are able to detect lower frequency sound and are considered to be of medium sensitivity to noise. Flat fish and elasmobranchs have no swim bladders and are considered to have low sensitivity to sound pressure (Nedwell *et al*., 2004).

14.3.83 **Appendix 12.5** provides the baseline noise conditions in Kyle Rhea from a site specific survey carried out by Subacoustech in July 2012. High levels of high frequency broadband noise (between 20 kHz and 150 kHz) were recorded and this high frequency noise was significantly greater when the tide was flowing, peaking approximately 100 to 200m north of the indicative array location. The levels of baseline noise recorded have been assessed against the likely perception for relevant species; this is measured as a dBht[32]. The following dBht categories are discussed further in **Appendix 12.5**.

- 0 – 50 dBht, low likelihood of avoidance;
- 75> dBht, mild avoidance with potential for habituation; and
- 90> dBht strong avoidance expected.

14.3.84 The baseline noise conditions for herring (representing hearing specialist fish species) were between 5.2 and 56.5 dBht, the higher limit (which was only found in one of seven transects) falling just within the category of mild avoidance The baseline noise conditions for cod and dab (representing hearing generalist fish species) were calculated to be a maximum of 49.2 dBht for dab and 31.6 dBht for cod indicating that these species and other hearing generalists, including salmon will not be affected by the background noise levels within Kyle Rhea.

Sensitivity

14.3.85 The Scottish Marine Renewables SEA (Faber Maunsell, 2007) identifies the sensitivity of fish and shellfish species to impacts associated with wave and tidal developments. Table 14.10 has been adapted from the information contained in the SEA and lists those fish and shell fish species that are assumed to be present within the study areas.

[32] dBht is a frequency weighted scale, used as metric for the assessment of the behavioural and audiological effects on underwater animals of man-made underwater noise. It is specific to the species under consideration, in other words dBht (Salmon) is the perceived noise level by salmon. Further explanation of this metric and its uses is detailed in (Nedwell *et al*. 2007)

Table 14.10 Sensitivity of fish and shellfish assumed to be present within the study area to possible impacts from tidal arrays (adapted from Faber Maunsell, 2007)

Species	Smothering	Change in suspended sediment	Increased turbidity	Substratum loss	Contamination	Underwater noise
Blue whiting	This species was not assessed in the SEA					
Anglerfish	This species was not assessed in the SEA					
Brown crab	Low	Not sensitive	Not sensitive	Unknown	Unknown	Unknown
Cod	Not sensitive	Not sensitive	Unknown	Not relevant		High
European eel	This species was not assessed in the SEA					
European spiny lobster	Not sensitive	Not sensitive	Not sensitive	Not relevant	Unknown	Not sensitive
Green crab	Not sensitive	Not sensitive	Not relevant	Low	Low/Very low	Not sensitive
Herring	High (demersal eggs)	Medium (filter feeder)	Medium	High (spawning areas)	Unknown	High
Lemon sole	Low	Low	Unknown	Not relevant		Low
Ling	This species was not assessed in the SEA					
lobster	Low	Not sensitive	Unknown	Medium	Unknown	Unknown
Mackerel	Not sensitive	Not relevant	Unknown	Not relevant	Unknown	Unknown
Norway pout	Not sensitive	Not sensitive	Unknown	Not relevant		Unknown
River Lamprey	No information					
Saithe	Not sensitive	Not relevant	Unknown	Not relevant	Unknown	Unknown
Salmon	Not sensitive	Not sensitive	Unknown	Not relevant		Low
Sea Lamprey	This species was not assessed in the SEA					
Sea trout	Not sensitive	Not sensitive	Unknown	Not relevant		Unknown
Sprat	Not sensitive	Medium (filter feeder)	Unknown	Not relevant	Unknown	High
Spurdog	Not sensitive	Not sensitive	Unknown	Unknown	Unknown	Unknown
Thornback ray	Low	Not sensitive	Unknown	Not relevant	Unknown	Low

Species	Smothering	Change in suspended sediment	Increased turbidity	Substratum loss	Contamination	Underwater noise
Velvet swimming crab	Low	Not sensitive	Unknown	Unknown	Unknown	Unknown
Whiting	Not sensitive	Not relevant	Unknown	Not relevant	Unknown	Unknown

14.4 Impact assessment

Do nothing scenario

14.4.1 During the do nothing scenario it is predicted that the same species as identified in Section 14.3 will continue to be present within the study area. If the Project does not proceed, it is expected that trends identified in the baseline will continue on their current path. It is likely that, providing fishing effort in the area remains low (see Chapter 15, Commercial Fisheries), abundance of commercial species will reverse the declines seen from 2006 to 2010 and will increase in line with that seen in 2011 (Figure 14.2). Although the salmon populations appear to fluctuate vastly, a trend which is likely to continue, the general declines seen since the 1950s appear to have stabilised and therefore salmon populations around the study area may remain approximately the same as they are currently.

Potential impacts during construction

14.4.2 This section contains an assessment of the impacts that the project may have on fish and shellfish during its construction.

Impact 1: Loss of spawning grounds

14.4.3 The LSA has been identified (using Coull *et al*., 1998 and Ellis *et al*., 2010 data provided by Cefas) as being within spawning grounds for nephrops, sandeel, sprat, and whiting (Figure 14.3 and Table 14.7). The Project has the potential to result in a temporary disturbance and loss of spawning grounds during installation as well as the permanent direct loss of parts of the spawning grounds during operation (considered below in Impact 10 under 'Potential impacts during operation) for these species.

14.4.4 Nephrops distribution is limited by the extent of suitable muddy sediment in which the animals burrow. This type of environment is not present within the LSA (Chapter 13, Benthic Ecology). After mating in early summer, the females spawn in September, and carry eggs under their tails (described as being 'berried') until they hatch in April or May. The larvae develop in the plankton before settling to a seabed of muddy sediment six to eight weeks later (The Scottish Government, 2011). Therefore neither berried females nor the larvae, nor potential settlement areas are likely to be impacted by the Project.

14.4.5 There are five different species of sandeel in Scottish waters, however, by far the most abundant is the lesser sandeel *Ammodytes marinus,* which comprises over 90% of sandeel fishery catches (The Scottish Government, 2010). Sandeels require relatively stable sandy sediments in which to lay their eggs and to burrow into. Studies show that their preference tends to be for medium and coarse grained sand (Greenstreet *et al*., 2010). Although there are pockets of sediment within the LSA most is gravel or coarse sand (Chapter 13, Benthic Ecology), considered too coarse and unstable for sandeel inhabitation. A single sandeel was identified at station 62 during the benthic survey (Chapter 13, Benthic Ecology) in a pocket of coarse sand located outside of the array area approximately 101.5m northeast of the nearest indicative device location and unlikely to be effected by the installation process. In conclusion it is unlikely that the Project will affect the spawning activity of sandeels.

14.4.6 The Project will be constructed within the indicative sprat spawning grounds outlined in Coull *et al*. (1998) of which the LSA comprises 0.0003% of the UK grounds. Sprat is a pelagic spawner releasing eggs into the water column which, when hatched as larvae remain in the water column. Eggs potentially released by female sprat into Kyle Rhea would rapidly be transported away from the area on the strong tidal currents which are a feature of the site (Chapter 7, Marine Physical Environment and Coastal Processes).

14.4.7 The LSA also overlaps with the indicative area for whiting spawning identified by Coull *et al* 1998, it should be noted that Ellis *et al*., 2012 were not able to confirm the presence of this spawning ground as there was a lack of data for this area. The LSA represents approximately 0.28% of this spawning ground. Whiting, like sprat are pelagic spawners and therefore any eggs and larvae deposited within Kyle Rhea during installation will be rapidly dispersed away from the site.

14.4.8 Despite the fact that the LSA has been identified as within the spawning grounds of nephrops, sprat, whiting and sandeel, the expert judgement regarding the ecology of these species (see Section 14.3 above) dictates that the sensitivity of the receptor is likely to be **negligible**. It is very unlikely that a change in spawning success of any of the four species would be on a measureable scale due to the small percentages of spawning areas which may be disturbed by the installation. Therefore the magnitude is considered to be **negligible**. As a result and in accordance with the matrix presented in Table 14.5 the loss of spawning grounds caused by the development is likely to be of **negligible** significance.

14.4.9 There is a high level of confidence in the assessment of this impact derived from the availability of spawning ground data combined with a high level of understanding of the seabed conditions across the study area. A higher level of confidence is applied to the assessment of sandeel as this species is included in the Ellis *et al.* (2010) data than sprat, nephrops and whiting as these species are included in the older, Coull *et al*. (1998) data.

Impact 1: Suggested mitigation
24. No mitigation measures are proposed

Residual impact:

As no mitigation measures are suggested the residual impact will remain of **negligible** significance.

Impact 2: Loss of nursery grounds

14.4.10 The LSA has been identified as being part of the indicative nursery grounds for eleven species of fish and shellfish. The area is part of: high intensity nursery grounds for; herring, spurdog and whiting, undefined intensity nursery grounds for; nephrops, cod and saithe and low intensity nursery grounds; for anglerfish, common skate, European hake, mackerel and spotted ray. Furthermore haddock, ling, sandeel, blue whiting, tope, thornback ray and cod all have nursery grounds within the vicinity of the WSA and LSA. Once again it should be noted that the nursery ground data are very broadscale and are more indicative of an area used as a nursery ground by the species rather than presenting a definitive distribution.

14.4.11 Many of the species described above require specific environmental conditions to progress through the juvenile stage of their lifecycles. The high energy environment and turbulent waters of Kyle Rhea are unlikely to provide high quality nursery areas for any of these species. As juveniles blue whiting, mackerel, cod, haddock, whiting, herring, ling, anglerfish, hake, thornback rays, spurdog and tope are highly mobile, and would be able to vacate the area once installation begins if affected. Because several species may be present, and taking a precautionary approach the sensitivity of the receptor has been assessed as being **low**.

14.4.12 The LSA represents less than 0.1% of any of the nursery grounds which overlap with the study area, and therefore the magnitude of the impact is considered to be low. Using the matrix presented in Table 14.5, a low sensitivity and **low** magnitude suggests that the impact of loss of nursery grounds will be of **negligible** significance.

14.4.13 There is a high level of confidence in the assessment of this impact due to the availability of high quality nursery ground data from authoritative sources. A higher level of confidence can be assumed using Ellis *et al.,* (2010) data related to anglerfish, blue whiting, common skate, European hake, herring, ling, mackerel, sandeel, spotted ray, spurdog, thornback ray, tope and whiting compared to saithe and nephrops as the nursery grounds for these species have been derived from older Coull *et al*. (1998) data.

Impact 2: Suggested mitigation
1. No mitigation measures are proposed

Residual impact:

14.4.14 As no mitigation measures are suggested the residual impact will remain as **negligible significance**.

Impact 3: Noise- causing damage to fish or affecting migration

14.4.15 The project installation will create noise which has the potential to affect behavioural patterns. The main noise sources associated with installation will be from; foundation drilling and the operation of installation vessels. The noise emitted from installation vessels can be generated through; propeller rotation, engine cylinder firing and flow through the water. A summary of hearing specialisation of key species potentially present in the LSA, is provided in Table 14.11.

14.4.16 Sea Generation (Kyle Rhea) Ltd. commissioned two studies into noise, the first made measurements of the background noise levels within Kyle Rhea and the second made an assessment of the potential impacts of noise created by the project on fish. These two reports can be found in **Appendices 12.5** and **12.6**). The assessment focusses on herring, as the most noise sensitive species potentially present in the LSA, to provide a worst case scenario. A number of less sensitive species, including salmon dab and cod, are also assessed.

Table 14.11 Summary of hearing specialisation levels in fish species potentially present in the LSA (Nedwell *et al*., 2004)

Species	Family	Swimbladder connection	Sensitivity
Atlantic salmon	Salmonidae	None	Medium
European eel	Anguillidae	None	Medium
Herring	Clupeoidea	Prootic auditory bullae	High
Cod	Gadidae	None	Medium
Haddock	Gadidae	None	Medium
Hake	Merluccidae	None	Medium
Plaice	Pleuronectidae	No swimbladder	Low
Common skate	Rajidae	No swimbladder	Low
Mackerel	Scombridae	None	Medium

14.4.17 It is anticipated that the device foundations will be installed using percussive drilling, with underwater noise generated primarily by interactions of the drill teeth with the substrate and the impact of the hammer. Vibrations will be transmitted through the drill string and surrounding structures.

14.4.18 Underwater noise modelling for the Project (**Appendix 12.6**) provides a detailed discussion regarding possible impacts during construction and operation of the project upon fish, marine mammals & basking shark (Chapter 12) based on the indicative locations of the devices displayed in Figure 5.1.

14.4.19 The impacts of underwater noise on fish and shellfish can be broadly summarised into three categories:

- Physical injury and fatality;
- Auditory damage (either permanent or temporary); and
- Behavioural avoidance

14.4.20 The installation of the four devices will require a maximum of 16 boreholes to receive the pin-piles that will secure the quadropods to the seabed. (Chapter 5, Project Description). The boreholes will be drilled one at a time, avoiding noise attenuation due to multiple drilling events.

14.4.21 The assessment of the underwater noise levels from drilling operations at Kyle Rhea has been based on recordings undertaken during similar drilling operations to install a prototype tidal turbine at the Falls of Warness, the European Marine Energy Centre (EMEC) tidal test facility in Orkney. The drill used at the Falls of Warness site was smaller than that proposed for the Kyle Rhea site (for further detail see **Appendix 12.6**).

Physical damage as a result of noise

14.4.22 Based on the noise studies the underwater noise levels created by foundation installation at Kyle Rhea are not expected to cause physical injury, fatality or auditory damage to any fish species present in the area (**Appendix 12.6**).

Behavioural response to noise

14.4.23 The noise assessment (**Appendix 12.6**) predicts no physical injury or auditory damage; however another possible impact is that of behavioural avoidance.

14.4.24 Various metrics have been proposed to assess behavioural avoidance in marine species. On the basis of a large body of measurements of fish avoidance of noise (Maes *et al.*, 2004), and from re-analysis of behavioural response to underwater sound, the following assessment criteria (see Table 14.12) were published by the Department of Business, Enterprise and Regulatory Reform (BERR) (Nedwell *et. al.*, 2007) to support the assessment of the potential impact of the underwater noise on marine species.

Table 14.12 Assessment criteria used in this study to assess the potential impact of underwater noise on marine species

Level in dBht(species)	Effect
0 – 50	Low likelihood of disturbance
75 and above	Mild avoidance reaction by the majority of individuals but habituation or context may limit effect
90 and above	Strong avoidance reaction by virtually all individuals
Above 130	Possibility of traumatic hearing damage from single event

14.4.25 As detailed earlier, variation in the anatomy and physiology of ears and associated structures in fish is extensive, determining the sensitivity of the species to sound and the range of frequencies at which they can detect sound. Herring has been used for assessment, as the most sensitive species present within the LSA.

14.4.26 When the drill is operating at maximum power it was concluded herring could detect the drill at a range of 120m. Therefore a mild avoidance response might be expected in herring or sprat to about 120m, however, the estimated perceived levels of noise are low enough at this range that habituation to the noise is likely, or, if animals have a strong motivation to enter the insonified[33] area (such as to spawn) there would probably be no avoidance behaviour. Strong avoidance behaviour (90dBht) in herring is predicted at 19m from the drill when operating at maximum power.

14.4.27 As previously determined in the assessment of Impact 1, spawning of herring and sprat is not likely to occur within the LSA both species may however pass through Kyle Rhea on route to other spawning grounds.

14.4.28 Salmon have little potential to be affected by the noise of drilling operations; even at maximum power salmon would have to be within nine meters of the drilling operation to show behavioural response (**Appendix 12.6**). The insonified area for salmon is limited to small cross sectional area of Kyle Rhea and therefore most salmon passing through the area should bypass the construction site, without being affected by the noise made during drilling operations.

14.4.29 Because no injury to fish or shellfish species is predicted as a result of construction noise, and with only mild behavioural changes predicted, the sensitivity of the receptor is assessed as **low.**

14.4.30 As previously discussed herring (the most noise sensitive species considered) may exhibit a behavioural response at 120m from the project. However, as Kyle Rhea is approximately 500m wide at the narrowest point of the array area (Figure 5.1), the insonified area for herring during drilling is approximately 24% of the Kyle. As a result, herring and sprat would be able to alter their behaviour to avoid the construction site by navigating around the drilling activities. This ability coupled with the temporary nature of the impact has resulted in a **medium** magnitude level being assigned to this impact. This is considered as the worst case scenario.

14.4.31 The rapid tidal currents in Kyle Rhea produce a high background noise levels (**Appendix 12.5**).The localised noise generated by installation vessels may not be apparent to fish and shellfish, above background noise. The magnitude of impacts from construction vessels is therefore anticipated to be **low**.

14.4.32 The magnitude of noise associated with drilling activity and installation vessels is assessed as low, the sensitivity of the most noise sensitive species is medium. Therefore the significance of the potential impact is predicted as **minor adverse**.

Impact 3: Suggested mitigation
1. No mitigation measures are proposed

Residual impact:

14.4.33 As no mitigation measures are proposed it is likely that the impact will remain of **minor** adverse significance

Impact 4: Increase in turbidity

14.4.34 The following installation activities may increase the turbidity of the surrounding water:

- Placing the base of the device on the seabed;
- Laying of the inter-array cables if required (See Chapter 5, Project description for explanation of the options to include inter-array cables);

[33] insonified is the term used to describe the region within which noise from the source is above ambient underwater noise levels).

- drilling the boreholes for the pin-piles ; and
- Horizontal Directional Drilling (HDD) of the boreholes for the export cables at the breakout point.

14.4.35 Increased turbidity can have impacts on foraging, social and predator/prey interactions (Faber Maunsell, 2007).

Placing objects on the seabed

14.4.36 The seabed across the majority of the LSA is hard (bedrock and boulders) with some coarse sediment at the northern and southern ends of the array area. Any sediment put into suspension during installation will settle out of suspension within a few meters of the disturbance (Chapter 7, Marine Physical Environment and Coastal Processes). Therefore impacts of placing objects (devices, inter-array cables and anchors) on the seabed will be short term and highly localised, creating a **negligible** impact magnitude.

Drilling foundation piles

14.4.37 It has been calculated that the volume of drill cuttings produced for each device foundation is approximately 125m^3 (Chapter 5, Project Description). No drilling fluids are required; seawater flush will be used for lubrication. In the worst case scenario drill cuttings will be recirculated back into the sea. Increases in turbidity caused by the drilling operations will be temporary and very localised, with the finer particles being widely dispersed and diluted rapidly. Only one pin-pile will be drilled at a time, and given the strength of the tidal currents in the area, any increases in turbidity will have time to clear between drilling operations. Assessment of the impacts to sediment transport patterns (incl. suspended sediment) in Chapter 7, Marine Physical Environment and Coastal Processes predict an impact of negligible significance. Therefore the magnitude of this impact is considered to be **low**.

Directional drilling of export cable borehole(s)

14.4.38 During the HDD for the export cable a small amount of sediment will be released to the marine environment, however this is expected to be a very small amount and will be less than that caused by drilling the holes for the pin-piles. During HDD the majority of the material will moved back to land for appropriate disposal and it is only at the breakout point, at the very end of the HDD operation, that some cuttings will be released. At breakout, localised, temporary increases in suspended sediment will occur, with coarse material settling out rapidly and fine material swiftly being dispersed. Because of the limited scale of this impact the magnitude of the predicted impact is considered to be **low**.

14.4.39 Using Table 14.10 the species most sensitive to increases in turbidity, which may potentially be present within the study area, are herring, which are of medium sensitivity. The assessment by Faber Mansuell (2007) as detailed in Table 14.10 does not include several species, particularly shellfish, which have been identified as present within the LSA. Therefore the Marine Life Information Network website (MarLIN[34]) has been used to fill this data gap with regards to species sensitivity to increases in turbidity. None of the species considered is likely to be as sensitive as herring.

Table 14.13 Sensitivity of species to increases in suspended sediment (source: MarLIN website)

[34] http://www.marlin.ac.uk/

Species	Sensitivity to increases in turbidity
Common shore crab	Not sensitive
European spiny lobster	Not sensitive
King scallop	Low
Edible crab	Low

14.4.40 Taking into account Tables 14.10 and 14.13 the maximum potential sensitivity of the receptors is assumed to be **medium**. In combination with a predicted worse case low magnitude of impact and based on the matrix outlined in Table 14.5, increases in turbidity are likely to cause impacts of **minor adverse** significance to fish and shellfish.

Impact 4: Suggested Mitigation
1. Allow sufficient time for any increases in turbidity to clear between drilling operations 2. Allow sufficient time for any increases in turbidity to clear between anchor laying operations.

Residual impact:

14.4.41 If the suggested mitigation is followed, the impact could be reduced to **negligible** significance.

Impact 5: Smothering

14.4.42 Installation activities which may cause smothering of fish and shellfish species and their habitats are the same as those that may increase turbidity (see Impact 4 above).

14.4.43 Suspended sediment available to smother fish and shell fish will include: a maximum of 500m^3 from pin-pile borehole drilling arisings, a small amount released during breakout of the export cable, and the disturbance of existing seabed sediments through positioning structures (devices, inter-array cables and anchors for an installation barge if required) on the seabed. An assessment of the impacts of these activities upon suspended sediment levels is provided in Chapter 7, Marine Physical Environment and Coastal Processes. The assessment concludes that there will be minimal sediment displacement around the foundation inter-array cables and anchors. The course sediment will settle in close proximity to their source following disturbance. Finer material will remain in suspension for longer; however the high current velocities will disperse sediment rapidly.

14.4.44 Experience from the MCT project in Strangford Lough (similar in scale and energy to Kyle Rhea) was that on completion of the drilling operations sediment deposition around the devise was not detectable (RPS, 2005).

14.4.45 The assessment of the impacts to sediment transport patterns (incl. suspended sediment) in Chapter 7, Marine Physical Environment and Coastal Processes concludes that the impact will be of negligible significance therefore the magnitude of impact of smothering of benthic species and habitats is considered to be **negligible**.

14.4.46 The MarLIN website indicates that for those species for which an assessment is available and are present within the LSA, have a low sensitivity to smothering. The Faber Maunsell (2007) study also suggests that the species present within the LSA have a **low** sensitivity to smothering (Table 14.10).

14.4.47 Faber Maunsell (2007) indicated that herring eggs are very sensitive to smothering, however, as discussed in Impact 1 Loss of spawning grounds, there is no herring spawning habitat within the study area, so herring eggs unlikely to be present.

14.4.48 A negligible impact magnitude and a low sensitivity of receptor results in a **negligible** impact significance.

Impact 5: Suggested Mitigation
1. Allow sufficient time for any increases in turbidity to clear between drilling operations, 2. Allow sufficient time for any increases in turbidity to clear between anchor laying operations.

Residual impact:

14.4.49 The residual impact will remain of **negligible significance** after the suggested mitigation, although the magnitude of the impact will be reduced

Impact 6: Release of sediment bound contaminants

14.4.50 Installation activities that may result in the release of sediment bound contaminants include the placing of the devices in the seabed, the laying of the inter-array cables and the positioning of anchors if required (see Chapter 5, Project Description). The devices will be located on substrate types defined as rugged bedrock and boulders or rugged bedrock (Figure 13.4) and installation will result in disturbance of only small amounts of sediments. However, the inter-array cables are likely to pass through areas of coarse sand (Figure 13.4 and Chapter 7: Marine Physical Environment and coastal processes) and the anchors used to position the installation barge (if used) may also be located in areas of sediment. The worst case scenario of an 8 point anchor spread for foundation drilling is provided in Figure 13.6. This may result in the disturbance of small amounts of sediment however the majority of this area is bedrock and boulders (see Chapter 13, Benthic Ecology). If sediment bound contaminants are released into the water column they may have detrimental impacts on fish and shellfish species.

14.4.51 The water and sediment quality within Kyle Rhea is generally good (Chapter 9, Water Quality). The area was designated as a Shellfish Water in 2002 which triggered a monitoring program that was implemented between 2003 and 2007. Contaminants were found in the tissue of the sampled mussels in 2003 believed to originate from a small number of septic tank point source discharges into Kyle Rhea, and discharge from the Glenelg public septic tank (Chapter 9, Water Quality). Since 2004 results for all parameters set out in the directive have been good, demonstrating that the overall water and sediment quality within Kyle Rhea is high.

14.4.52 As the levels of sediment bound containments within the LSA are predicted to be low and any released contaminants will be rapidly dispersed the magnitude of the impact is likely to be **negligible**.

14.4.53 Species likely to be present within the study area are assessed as having low sensitivity to contaminants (Table 14.10). In addition, those species which have not been assessed in Table 14.10 but are assessed by MarLIN have low sensitivity to contaminants. Therefore the sensitivity for this impact is considered overall to be **low**. In accordance with the impact matric in Table 11.5 the impact is considered to be of **negligible** significance.

Impact 6: Suggested Mitigation
1. No mitigation measures are proposed

Residual impact:

14.4.54 The impact will remain of **negligible** significance

Impact 7: Changes to prey species

14.4.55 Many fish potentially present in the LSA feed on smaller fish such as herring, sandeels and sprat and/or on benthic invertebrates such as; polychaetes worms and crustaceans and molluscs.

14.4.56 To ascertain the magnitude of this impact it is necessary to consider the magnitude of impacts to species that are prey for fish and shellfish. These can be found in both this chapter, where the greatest magnitude is low, and in Chapter 13, Benthic Ecology where the greatest magnitude of impact is also low. Therefore it can be assumed that the magnitude for this impact will also be **low.**

14.4.57 Most of the species identified as being present within the LSA are highly mobile or fairly mobile in the case of crabs and lobsters, and will be able to move small distances to areas where their prey species would not affected by the Project therefore the sensitivity of the receptor is predicted to be **low**. A low magnitude and a low sensitivity result in a impact of **negligible** significance.

Impact 7: Suggested Mitigation
1. No mitigation measures are proposed

Residual impact:

14.4.58 As no mitigation measures are proposed and the predicted impact will remain of **negligible** significance

Impact 8: Pollution from routine and accidental discharges.

14.4.59 The installation process will use a number of substances with the potential to have detrimental impacts on fish and shellfish species. The majority substances are unlikely to enter the marine environment and would only be released “accidentally” however other substances will be released as part of the installation process. These are described as routine discharges and include drilling fluids and grout.

14.4.60 As discussed previously the drilling fluids used for HDD will be nontoxic. HDD will create a small increase in turbidity at the point of breakthrough. Drilling of the rock sockets will use seawater flush for lubrication and will therefore have very little impact on marine organisms. During the grouting process (see Chapter 5, Project description) some grout will be lost to the marine environment. Non–toxic grout will be used and will not have a detrimental impact upon the marine environment. The amount of grout being used will be carefully calculated. Therefore the magnitude of pollution caused by routine discharges is likely to be **negligible**.

14.4.61 The device installation will involve a number of vessels, including an anchor barge or dynamic positioning (DP) vessel, and a number of tugs. All vessels carry fuel, oils, lubricants and are treated with antifouling paint (Chapter 5, Project description). The risk of the substances being released to marine environment as accidental discharges is small. All discharges would be rapidly dispersed by the strong tidal currents that are a feature of the site. Measures taken to reduce the risks will include:

- All vessels associated with Project operations will comply with IMO/MCA codes for prevention of oil pollution and any vessels over 400 GT will have onboard Ship Oil Prevention Emergency Plans (SOPEPs).
- All vessels associated with Project operations will carry on-board oil and chemical spill mop up kits.

- Where possible vessels with a proven track record for operating in tidal races s will be used.
- Vessel activities will occur in suitable conditions to reduce the chance of accidental discharge as a result of unfavourable weather conditions

14.4.62 A large DP vessel can carry up to 3,000,000 litres of marine diesel stored in a number of separate tanks (Technip web site). The worst case scenario from a single tank rupture is the release of approximately 600,000 litres of marine diesel into the marine environment. Hydrocarbon based spills have a number of potential environmental impacts depending upon a range of factors including; volume, type of hydrocarbon, location and the sea and weather conditions at the time of the spill.

14.4.63 Any spill either of a hydrocarbon or other liquid such as the drilling muds or grout would be rapidly dispersed. The risk of such a spill occurring is extremely low, and the magnitude of the potential impact is considered to be **low**.

14.4.64 Even in the event that an oil spill resulted in the loss of the entire fuel capacity of the DP vessel, fish are highly mobile, able to detect pollutants and are expected to avoid areas where pollution has occurred. Marine species are more likely to be sensitive during their juvenile life phase and as discussed earlier in Impacts 1 and 2, above, the area is not suitable for spawning or juvenile fish due to its the strong tidal currents.

14.4.65 Taking all of the above into account the sensitivity of fish and shellfish is considered **medium** as fish and shellfish are to some extent able to move away from polluted areas. In the event a large spill does occur. A medium impact and medium magnitude result in a predicted **minor adverse** significance.

Impact 8: Suggested Mitigation
1. A Safety and Environmental Management Plan will be produced to ensure that all risks of pollution are minimised and that there are robust plans to deal with any pollution events that may occur.

Residual impact:

14.4.66 If the suggested mitigation is implemented the risk of this impact occurring and therefore the magnitude of the impact will be reduced to negligible which will decrease the significance of the impact to **negligible**.

Potential impacts during the operation phase

14.4.67 This section of the chapter contains an assessment of the impacts that the Project may have on fish and shellfish during its operation.

Impact 9: Habitat Loss

14.4.68 The placement of foundations and inter-array cables on the seabed has the potential for long term (life span of the project) removal of habitat that may otherwise be used by fish and shellfish species for spawning, nursery grounds and for feeding. However as shown in impacts 1 and 2, spawning and nursery grounds of the potential receptor species are not likely to be affected. In addition the area of habitat that will be lost to these species will be small (198.99m^2) which is less than 0.001% of the LSA. Therefore the magnitude of habitat loss is considered to be **low.**

14.4.69 As the habitat loss is likely to have little or no impact on fish spawning and nursery behaviour and many of the species present are highly mobile and will be able to move around to find other sources of food the sensitivity of the receptor is considered **low.** The pile and blades of each device will be treated with antifoulants (Chapter 5, Project Description) to prevent colonisation. However it is anticipated that the foundations will become extensively colonised as has been experienced with the Strangford Lough device.

14.4.70 In accordance with Table 14.5 a low magnitude and a low sensitivity results in a predicted impact of **negligible** significance for this impact.

Impact 9: Suggested Mitigation	
1.	No mitigation measures are proposed

Residual impact:

14.4.71 As no mitigation measures are proposed it is likely that the impact will remain of **negligible** significance.

Impact 10: EMF

14.4.72 Many species of fish are able to detect Electromagnetic fields (EMF) associated with electrical cables in the marine environment. EMF will be generated by the inter-array cables, (if these are used, see Chapter 5, Project description), which will be 33kV, typically 3-core copper conductors with insulation/conductor screening and steel wire armouring. The cables will be protected by armouring (two layers of galvanised steel wire) and will be surface laid.

14.4.73 The array export cable will be directionally drilled through the bedrock from an onshore site to the array, essentially eradicating any EMF impacts produced by the export cables. Therefore only EMF effects caused by the inter-array cables will have the potential to impact on fish and shellfish species.

14.4.74 The EMF and their constituent fields; electric (E field), magnetic (B field) and associated induced electric fields (iE) produced by the inter-array cables could affect the behaviours of certain electro-sensitive species (Gill *et al*., 2009). A simplified overview of how induced electrical fields are produced by Alternating Current (AC) power cables is presented in Figure 14.14.

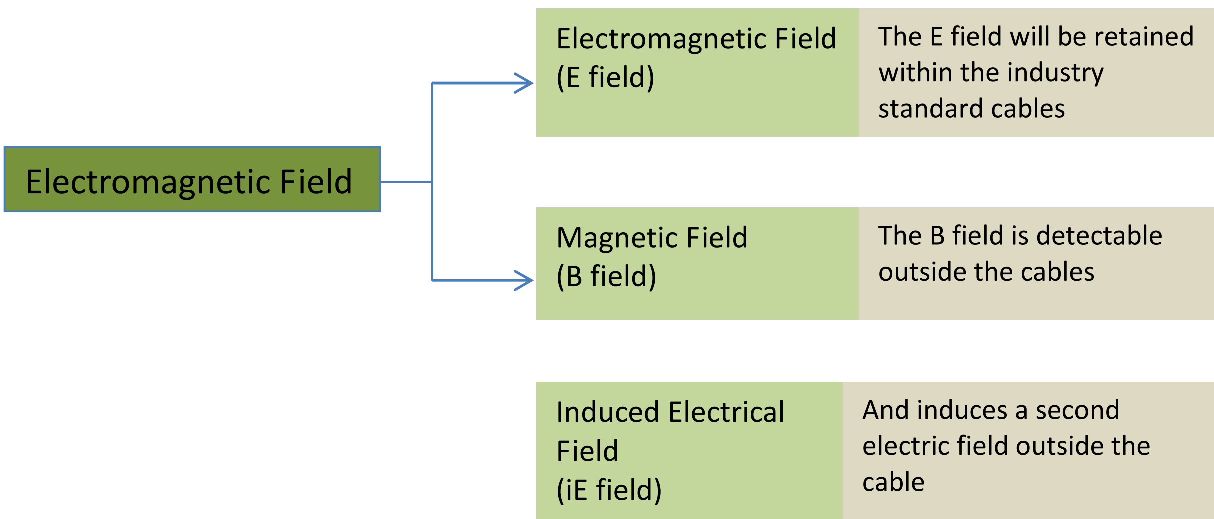

Figure 14.14 Simplified overview of how induced electrical fields are produced by AC power cables Source: Gill *et al* ., (2009)

14.4.75 The electrolytic properties of sea water create an electrical current, which induces an iE-field (Figure 14.14).

14.4.76 A number of fish species found in Scottish waters are known to be able to detect EMF and maybe influenced by the inter-array power cables, with elasmobranch species the main group known to be capable of detecting E-fields. They possess specialised electroreceptor pores in their skin from which they detect bioelectric emissions from prey, conspecifics[35] and predators/competitors. Available data suggests that the thornback ray is the only elasmobranch species regularly present within the LSA.

14.4.77 Other fish species, including migratory species, that are electro-sensitive do not possess specialised electroreceptors but are able to detect induced voltage gradients associated with water movements and geomagnetic emissions. These include European eel, cod, plaice and Atlantic salmon (Gill *et al*.,2005), all of which may be present in the LSA. However, open water species of fish, including salmonids, are not considered to be as reliant on this sense and are considered to be significantly less sensitive than elasmobranchs to EMF (Faber Maunsell, 2007).

14.4.78 The effects of B and iE fields on fish species depends on their physiology. Many species are sensitive to bioelectric fields or use magnetic fields to aid migration. Salmonids and eels are known to use this ability particularly during migration. The physiology of these sensory mechanisms for the detection of EMF is poorly understood, and is likely to vary on a species by species basis (Pals *et al*., 1982 as cited in Gill & Bartlett, 2010). It is likely that the species listed in Table 14.14 will respond to natural levels of EMF, associated with peak tidal movements, which can create fields in the range of 8-25 µv m-1. These species are also likely to be affected by EMF generated by anthropogenic sources (Barber & Longuet-Higgins, 1948; Pals *et al*., 1982 as cited in Gill & Bartlett, 2010). However Normandeau *et.al* (2011) indicated that the sensitivity of salmonids either to electric or magnetic fields produced by subsea cables would result in only “limited effects” on this group of fish.

14.4.79 European eel and some salmonids are known to have magnetic material (magnetite) within their organs which facilitate magnetic detection. Telemetry studies of migratory patterns of European eel in the vicinity of Wind Turbine Generators (WTG) in the Southern Baltic by Westerberg (as cited in Öhman *et al.,* 2007) did not show any altered migratory behaviour at a distance of 500m from the WTG. Catch statistics at eel pound nets in the area did, however, indicate a change in behaviour when the WTG was operating compare to when it wasn’t. Whether or not this should be attributed to the effect of acoustic or electromagnetic disturbances was unclear.

14.4.80 Elasmobranchs are known to respond to magnetic fields 25-100 µTesla; (Meyer *et. al.,* 2005) and are thought to use the Earth’s magnetic field (approximately 50 µTesla) for migration. They also respond to electric fields emitted by prey species and conspecifics[7] and this has raised concerns they may waste time and energy “hunting” E fields instead of their prey (Kimber, 2008). Such effects could reduce reproductive success and have wider population effects (Kimber, 2008). Only one species of elasmobranch, the Thornback ray is regularly present within the LSA.

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[35] Belonging to the same species

Table 14.14 Evidence based list of electromagnetic sensitive teleost fish species and their conservation status (according to the IUCN Red list) in UK coastal waters.

Superscript numbers show reference sources. E field = Electric Field; B field = Magnetic field

Species	Conservation status	Frequency in UK Waters	Evidence of response to E fields	Evidence of response to B fields
European eel *Anguilla anguilla*	Critically Endangered	Common	✓ 1,2	✓ 3,4
Atlantic salmon *Salmo salar*	Least Concern	Common	✓ 5,6x	✓ 5,6
Sea trout *Salmo trutta*	Least Concern	Occasional		✓ 7
European plaice *Pleuronectes platessa*	Vulnerable	Common	✓ 8	✓ 8
Yellowfin tuna *Thunnus albacares*	Least Concern	Occasional		✓ 9-12
European river lamprey *Lampetra fluviatilis*	Near Threatened	Common	✓ 13,14	
Sea lamprey *Petromyzon marinus*	Least Concern	Occasional	✓ 5-17	
1 Berge (1979); 2 Vriens & Bretschneider (1979); 3 Enger *et al* . (1976); 4 Westerberg (1999); 5 Moore *et al* . (1990); 6 Rommel & McCleave (1973); 7 Formicki *et al* . (2004) – juvenile fish; 8 Metcalfe *et al* . (1993); 9 Kobayashi & Kirschvink (1995); 10 Walker *et al* . (1984); 11 Walker (1984); 12 Yano *et al* . (1997); 13 Gill *et al* . (2005); 14 Akeov & Muraveiko (1984); 14 Bodznick & Northcutt (1981); 15 Bodznick & Preston (1983); 16 Bowen *et al* . (2003); 17 Chung-Davidson *et al* . (2004)				

Source: Gill & Bartlett, 2010

14.4.81 EMF modelling of cables at a series of wind farms (Gill *et al*., 2005) demonstrated that there was a linear relationship between current load and resultant B and iE fields. Therefore, when a wind farm is operating below maximum capacity (i.e. at average wind speeds) the resultant B and iE fields will be less than at full capacity. The 8MW capacity of the Project is well below that of most offshore wind farms, therefore the inter-array cables will carry far less current, and any impacts of EMF are anticipated to be significantly less than those observed in offshore windfarms.

14.4.82 COWRIE mesocosm studies into EMF effects proved inconclusive; the responses observed were not predictable and appeared to be species specific. There was no evidence to suggest any positive or negative impact on elasmobranchs that encountered the EMF (Gill and Bartlett, 2010). Research also suggests that marine species may be more likely to detect and react to magnetic fields from DC cables than AC cables (Normandeau *et.al* 2011). The Inter-array cables used in the Project will be AC (Chapter 5, Project description).

14.4.83 Although fish can detect EMF, the magnitude and extent of the B and iE fields generated by the inter-array cables are anticipated to be extremely localised. This is due to the fact that Electromagnetic fields are strongly attenuated and decrease as an inverse square of distance from the cable (Gill and Bartlett, 2010) meaning that the magnetic field decreases rapidly with vertical and horizontal distance from the cables (Normandeau *et.al* 2011). Furthermore, while the duration of the impact will be for the lifetime of the project, the intensity of EMF will vary depending on the operating capacity of the devices and will be far less than those associated with wind farm cables, on which much of the existing research has been conducted. In addition, the inter-array cables will only occupy a small section of Kyle Rhea (between the devices) and the export cable(s) will be drilled through the bedrock, significantly shielding EMF. The overall magnitude of potential impact is considered to be **low**.

14.4.84 Sensitive species would, not always be exposed to the highest levels of EMF because EMF fluctuates with tidal conditions. The inter-array cables will be protected by armouring (two layers of galvanised steel wire) which is likely to further reduce the intensity of the EMF. Furthermore all efforts will be made to lay the inter-array cables oriented to the direction of the tidal currents (i.e. north to south), minimising the cross sectional area which will receive EMF thus reducing the barrier effects.

14.4.85 Although there is still uncertainty associated with the behavioural response to EMF (Gill and Bartlett, 2010) a precautionary assessment of receptor sensitivity is **medium**.

14.4.86 A low magnitude and a medium sensitivity result in an impact of **minor adverse** significance.

Impact 11: Suggested Mitigation
1. SeaGen(Kyle Rhea) Ltd is aware that Marine Scotland and their advisors are conducting further research into the impacts of EMF on marine species. The results of this research will be monitored to inform mitigation strategies.

Residual impact:

14.4.87 The proposed mitigation is anticipated to reduce magnitude the EMF impact. However due to the lack of current knowledge related to the impacts of EMF upon fish and shellfish the predicted impact will remain at a precautionary **minor adverse** significance.

Impact 11: Noise

14.4.88 During operation the devices will create underwater noise as the rotors rotate. This may have impacts on fish and shellfish within the insonified areas. As discussed earlier (Impact 3) the impacts of noise can be categorised into three levels of severity either causing; death through fatal injury, damage to the fish, or changes in behaviour.

14.4.89 Underwater noise studies were commissioned by Sea Generation (Kyle Rhea) Ltd to model the predicted noise produced by the Kyle Rhea array and assess the impact upon fish. The report is available in **Appendix 12.6**. To predict the likely noise levels, noise measurements from two tidal devices were used. Two data sets were considered; one taken from the SeaFlow device off the coast of Lynmouth, Devon (Parvin *et. al.*, 2005) and the other from SeaGen in Strangford Lough, Northern Ireland by Kongsberg Maritime Ltd. (Needham, 2010). Each device was smaller than the 2.0MW device for Kyle Rhea. SeaFlow had a power output of 350kW and the SeaGen an output of 1.2 MW. The data were scaled up to predict the noise levels of 2.0MW Kyle Rhea devices.

14.4.90 The results of this assessment are shown in Table 14.15, and it was estimated that the underwater noise levels received by fish will be low. The maximum 75 dB_{ht} (weighted levels above hearing threshold) range of 16m was predicted for a mild behavioural avoidance for herring, which is the most noise sensitive species thought to be present within the LSA.

Table 14.15. Summary of source level at 1 m and dBht ranges for the selected species of fish for an operational 2.0 MW SeaGen device. Source Subacoustech Environmental Ltd.

	Cod	Dab	Herring	Salmon
Source Level	87 dBht @ 1m	61 dBht @ 1m	91 dBht @ 1m	54 dBht @ 1m
90 dBht RMS	< 1 m	< 1 m	1.3 m	< 1 m
75 dBht RMS	2 m	< 1 m	16 m	< 1 m

14.4.91 All other species would only be able to detect noise levels which would cause a mild behavioural avoidance at a distance of 2m or less.

14.4.92 There were concerns raised at the scoping stage and during consultation that the noise created by the project may act as a barrier to fish migrating through Kyle Rhea. As the minimum distance between devices is 60m (Chapter 5, Project description) and the maximum range for behavioural avoidance is 16m, the data indicate there will be no cumulative impacts between adjacent devices at the largest impact range predicted (**Appendix 12.6**). Any potential barrier impacts caused by the operational noise will be small in comparison to the overall cross-sectional area of the Kyle.

14.4.93 The magnitude of the noise impact is considered low, as mild behavioural changes are predicted only for herring. The sensitivity of the receptor is also considered low. This results in an impact of **negligible** sensitivity.

Impact 11: Suggested Mitigation
1. No mitigation measures are suggested

Residual impact:

14.4.94 As no mitigation measures are suggested it is likely that the impact will remain of **negligible** significance.

Impact 12: Collision with devices

14.4.95 The collision of fish with rotors is considered to be a hypothetical potential impact during operation (Faber Maunsell, 2007). Collision is defined as an interaction with a fish and a tidal device that may result in physical injury to the fish. Due to the low number of operating tidal devices data derived from monitoring programmes to directly quantify fish encounters with devices through collisions or near-misses are not yet available.

14.4.96 Environmental factors such as light, tidal flow and position in water column will all contribute to collision risk. Strong tidal flows, such as those found at the project site may also reduce the time a fish has to avoid the devices. Collisions may be avoided by fish that are able to detect the device through hearing or through startle responses initiated by sound or pressure. ABPMer (2010) suggested that noise sensitive fish (such as herring and sprat) may be able to detect and avoid operational tidal stream devices and the noise assessment undertaken for this project added further evidence that this could occur at a distance of approximately 16m for herring and less than 1mm for salmon (**Appendix 12.6**).

14.4.97 There are no published observation studies relating to fish collision with tidal devices (ABPMer, 2010). However, monitoring of Verdant Power's Roosevelt Island Tidal Energy Project in New York for fish collisions, using sonar techniques, revealed no observed collisions with the devices (Verdant Power, 2009). This suggests that fish avoided zones of potential impact, or did not encounter the devices.

14.4.98 The speed of rotation of SeaGen device rotors is fastest at the blade tip, where the speed is just under 12m/s. It has been suggested that there may be a risk of physiological damage should a collision occur at a blade tip, however, towards the proximal end of the blade, the relatively lower velocities pose a lesser risk of physiological damage (ABPMer, 2010; MCT, 2005).

14.4.99 Four SeaGen devices are planned for the Kyle Rhea project, each with two axial flow rotors. The diameter of each rotor is 20m (Chapter 5, Project Description) therefore the calculation of the maximum swept area is:

$$n(pr^2) = 2513m^2$$

14.4.100 Where n is the number of rotors and r is the radius of the swept circle.

14.4.101 The minimum width of the Kyle within the array area (Figure 5.1) where the array will be installed is approximately 500m. An approximate depth profile has been produced for this part of the Kyle using a nautical chart and an approximate cross-sectional area of the Kyle has been calculated. Using this method it has been estimated that at Lowest Astronomical Tide (LAT) the cross-sectional area of the Kyle will be 10,137m^2 and at the Highest Astronomical Tide (HAT) the cross sectional area will be 13,995 m^2.

14.4.102 If the devices were to be positioned in a row across the tidal straight they would sweep between 18% (at LAT) and 25% (at HAT) of the total cross sectional area leaving between 75 and 82% free for migrating fish. The devices are likely to be positioned in a configuration such as the indicative locations shown in Figure 5.1 which presents less of a cross sectional area to a passing fish than a row and therefore the swept area will in reality be less than 20% at HAT. The spatial impact is therefore assessed as being of **medium** magnitude.

14.4.103 The majority of fish and shellfish identified within the LSA such as cod, ling, skate, spurdog are demersal in habit, and all the crustacean species are benthic in habit. These species will transit along the seafloor passing under the rotor blades with 3m of clearance between the blades tips and the seabed. Pelagic species such as herring, sprat, mackerel and whiting have greater opportunity to interact with the rotors. Indicative device locations are shown in Figure 5.1. This configuration will reduce the barrier effect, therefore the sensitivity of the receptor is considered to be **low**.

<u>Salmon</u>

14.4.104 During scoping and consultation, concerns were raised about the potential for the Project to act as a barrier to salmon migration through the Kyle Rhea. As discussed previously in impacts 11 and 12, EMF and noise created by the array are unlikely to significantly deter salmon from migrating through the Kyle. A third mechanism that may reduce successful salmon migration through Kyle Rhea is that of collision with the rotors.

14.4.105 Although there are no studies available for the survivability of Atlantic salmon passing through tidal turbines, work has been conducted in the US which evaluates fish Injury and mortality of a number of other species when passing through hydrokinetic (the term used in the US to describe turbines that are driven by natural water flows) turbines.

14.4.106 A technical report compiled by the Electrical Power Research Institute (EPRI, 2011) discusses flume studies which were conducted by EPRI. Two species of fish (rainbow trout and largemouth bass) were exposed to two hydrokinetic turbine designs to determine injury and survival rates and to assess behavioural reactions and avoidance.

14.4.107 The flume tests were conducted with the Lucid spherical turbine (LST), a Darrieus-type (cross flow) turbine, and the Welka UPG, an axial flow propeller turbine. The latter is the most similar in design to the devices used in the current project and therefore it is only results associated with this device which are discussed below.

14.4.108 Survival and injury for selected species and size groups were estimated for the turbine operating at two approach velocities by releasing treatment fish directly upstream and control fish downstream of the operating units. Fish were assessed after one hour (immediate survival rate) of passing through the turbine and after 48hrs (total survival rate). Behavioural observations were recorded with underwater video cameras during survival tests and also during separate trials where fish were released farther upstream to allow them greater opportunity to avoid passage through the blade sweep of each turbine.

14.4.109 Of the two species used in the experiment, rainbow trout *Oncorhynchus mykiss* are the most analogous to Atlantic salmon being similar in size and body form. Two size groups of rainbow trout were subjected to the flume test the smaller group were between 124 and 125mm (fork length[36]) and the larger group were between 231 and 247mm (fork length)

14.4.110 The results of the experiment were that immediate (after 1 hour) and total (after 48 hours) turbine passage survival rates for rainbow trout were 100% for the smaller fish evaluated at both approach velocities and for the larger fish tested at the lower velocity (1.5 m/s). Immediate and total survival of the larger fish evaluated at the higher velocity (2.1 m/s) were both 99.4%. Data collected for the Project recorded maximum flow velocities of 4m/s (Chapter 7, Marine Physical Environment and Coastal Processes) ,however, flow velocities will be 2.5m/s or less for the majority (90% or more depending in device location) of the tidal cycle (Chapter 12, Marine Mammals and Basking Shark).

14.4.111 No significant difference was found between injuries in the treatment fish and the control fish indicating that any injuries to the fish were likely to have been caused by their handling rather than the turbine. Although the flume experiment did not use water flows as high as those which may be experienced in Kyle Rhea, the fish in the experiment had little opportunity to navigate around the device. Any fish passing through Kyle Rhea will however be able to pass around the devices as between 75 and 82% of the Kyle will not be swept by the rotors (see calculations above).

14.4.112 It has been suggested that injury may be incurred by fish due to the pressure changes created by turbine blades if they pass within close proximity of a passing fish. Such internal injuries might be expected to become apparent some hours after a fish has passed through a device. The EPRI research found that there was no difference in the immediate and total survival rates (including of rainbow trout providing evidence that, for the scale of turbine tested, there was no detectable evidence of this injury occurring.

14.4.113 Taking all of the above into account the magnitude of the impact of salmon collision and pressure changes caused by the devices is considered to be **low**.

14.4.114 Several rivers in the vicinity of the LSA support salmon populations (Figure 14.8). Salmon migrating from rivers to the south of the LSA such as the Glenmore, Glenbeag, Ceann-locha, Arnisdale, Gurserain and Inverie rivers are likely to pass through the Kyle to feeding grounds in the Norwegian Sea (Malcolm *et al*., 2010).

14.4.115 It has been shown that adult salmon generally inhabit the top few meters of the water column and tend to stay close to the coastline (Malcolm *et al*., 2010). Within Kyle Rhea it is also considered to be likely that salmon will attempt to conserve energy by avoiding those areas of the Kyle which experience the greatest tidal flow, while the devices are positioned within areas of greatest tidal flow, reducing the chances of collision. Furthermore, Malcolm *et al*., 2010 infer that as adult salmon return to their natal rivers they travel close to the coastline, using olfactory cues to home in on their destination. This is supported by the observations of Lacroix *et al.* (2005) regarding the coastal habits of Altlantic salmon smoults. Salmon may therefore be expected to migrate through the Kyle along each bank rather than the central channel where the devices are located, reducing the potential for encountering the rotors of the devices.

14.4.116 Smolts leaving their natal rivers are also known to swim in the top few meters of water, rarely swimming deeper than 6m (Davidson *et al*., 2008; Plantelech Manel-La *et al*., 2009). The tip of the blades will be a minimum of 3.8m below the sea surface on the LAT and will be up to 9.8m below the surface on high tides (Chapter 5, Project description). Consequently it is

[36] Length of a fish measured from the tip of the snout to the posterior end of the middle caudal rays

considered unlikely that the smoults will encounter moving parts of the devices.

14.4.117 Atlantic salmon, as discussed in Section 14.3 are important to Scotland and recent declines in wild populations are cause for concern. However, considering the behaviour patterns of salmon discussed above, the sensitivity of the salmon to the impact of collision is considered to be in **medium**.

14.4.118 Reviewing all the evidence presented above and considering a low magnitude and medium sensitivity, Table 14.5 indicates that the impact of collision risk for salmon and for other fish and shellfish species can be considered to be of **minor adverse** significance.

Impact 12: Suggested Mitigation
1. Sea Generation (Kyle Rhea) Ltd. will develop an appropriate monitoring and reporting programme to be implemented during the construction and operational phases to monitor the reaction of key sensitive receptors. The receptors to be included within the monitoring plan will be agreed with Marine Scotland and SNH.

Residual impact:

14.4.119 As no mitigation measures have been suggested at this stage it is likely the impact will remain of **minor adverse** significance.

Impact 13: Changes in hydrodynamics

14.4.120 The changes in hydrodynamics resulting from extraction of tidal energy may impact upon habitats and species. Evidence from Strangford Lough (Royal Haskoning, 2011) indicates that a single 1.2 MW SeaGen device does not alter the hydrodynamic conditions significantly within Strangford Lough. This project proposes to install four 2 MW devices, and consequently greater energy extraction. A predictive hydrodynamic model of the current Project shows minimal impact to water flow in the area (see Chapter 7, Marine Physical Environment and Coastal Processes) and the magnitude of impact is therefore considered to be **low.**

14.4.121 The most sensitive species to changes in water flow are herring (during spawning) and sandeel, which respectively exhibit high and medium sensitivity (Table 14.10). However, as discussed in Impacts 1 and 2 above herring spawning grounds and sandeels are thought to be present within the LSA. Therefore, the sensitivity of the receptor at a population level is considered **negligible**. In accordance with Table 14.5 it is predicted that the impacts caused by changes in hydrodynamic regime will be of **negligible** significance.

Impact 13: Suggested Mitigation
1. No mitigation measures are proposed

Residual impact:

14.4.122 As no mitigation measures are proposed it is likely that the impact will remain of **negligible** significance.

Impact 14: Changes to prey species

14.4.123 The success of fish and shellfish populations is heavily influenced by the availability of their prey. If the Project reduced prey availability this would have negative consequences for predator species however it is expected that fish will have available prey resource in the WSA which will not be impacted by the Project and therefore the sensitivity of this receptor can be considered **low**.

14.4.124 Several fish species potentially present within LSA primarily feed on other smaller fish or benthic species such as annelid worms, crustaceans and molluscs. However in this Chapter and Chapter 13, Benthic Ecology a minor level of significance is ascribed to the changes to prey species impact (post mitigation). Therefore the magnitude of this impact is predicted to also be **low**. It is consequently predicted that changes in prey species will have an impact of **negligible significance** on fish and shellfish.

Impact 14: Suggested Mitigation
1. No mitigation measures are proposed

Residual impact:

14.4.125 As no mitigation measures are proposed it is likely that the impact will remain of **negligible** significance.

Impact 15: Pollution from routine and accidental discharges.

14.4.126 The operations and maintenance (O&M) vessels will be the same size or smaller than the installation vessels and therefore will have similar inventories of potential pollutants. They will also be fewer in number reducing the likelihood of spillage. Mitigation measures are the same as those described for vessel spillage during installation (Impact 8). Therefore the impact is likely to be of **negligible** significance.

Impact 15: Suggested Mitigation
1. A Safety and Environmental Management Plan will be produced to ensure that all risks of pollution are minimised and that there are robust plans to deal with any pollution events that may occur.

Residual impact:

14.4.127 As no specific mitigation measures are proposed at this stage it is likely that the impact will remain of **negligible** significance.

Potential impacts during the decommissioning phase

14.4.128 The impacts produced during decommissioning are expected to be of similar nature and magnitude as those predicted for the construction phase, with the exception of drilling which will not occur during decommissioning. Therefore the impacts to fish and shellfish will at worst have the same significance as those assessed during construction.

Potential cumulative impacts

14.4.129 Sea Generation (Kyle Rhea) Ltd is aware of the proposal by Pulse Tidal to develop a tidal array in Kyle Rhea. Although a scoping report has been submitted it is understood that no agreement for lease is in place for this site an therefore it is not expected that this project will go ahead in the foreseeable future. Pulse Tidal is not assessed within the cumulative impacts for this project.

Sea Generation (Kyle Rhea) Ltd is not aware of any other proposed developments that will interact cumulatively with the Project that may impact upon fish and shellfish.

14.5 Summary

14.5.1 Many data sets were used to define the range of fish and shellfish species potentially present within Kyle Rhea. Due to the extreme nature of the site i.e. rapid tidal currents, and the rocky seabed, the site is unlikely to be used by fish and shellfish for spawning or nursery grounds.

14.5.2 The greatest impacts are predicted to occur during installation and are associated with drilling into the bedrock and potential accidental pollution events should an installation vessel be damaged. The drilling activity will create noise which is predicted to cause mild behavioural changes in some fish species, however this impact will be localised and temporary. The likelihood of an installation vessel being damaged during the construction process is very low, however if such an event were to occur the high tidal energy would help to disperse the contaminants. .

14.5.3 The operational impacts are generally considered to be less significant than construction impacts. It is not anticipated that the array will form a significant barrier to fish species migrating through the area.

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15 COMMERCIAL FISHERIES

15.1 Introduction

15.1.1 This chapter describes the key elements in relation to the current and future commercial fisheries activity and the potential interaction between the proposed Kyle Rhea Tidal Stream Array ('the Project'). In order to do so, this chapter begins by detailing the methodological process that has been undertaken to inform the conclusions in relation to commercial fisheries, before going on to detail the current (pre-development) commercial fisheries operations in the area, and finally highlighting the potential impacts and possible mitigations in relation to the installation, operation and decommissioning of the devices.

15.1.2 This chapter considers only commercial fisheries, focussing specifically on those fleets that either fish in the local area or those which regularly transit through the site. This includes both the fishery undertaken by the local inshore fleet as well as the fishery undertaken by the larger offshore fleet, which may be based (home port) elsewhere in Scotland or the UK.

15.1.3 This chapter will not seek to determine the biological impact of the Project on fish resources, as this has already been determined in Chapter 14, Fish and Shellfish. Instead this chapter will seek to highlight the potential social and economic consequences of any such biological change, as well as quantifying the impact on the fleet from loss of fishing grounds, displacement of fishing effort, loss of fishing gear or reduced access to fishing grounds.

15.1.4 This chapter has links with Chapter 10, Terrestrial and Intertidal Ecology, Chapter 14, Fish and Shellfish, Chapter 18, Shipping and Navigation, and Chapter 21, Socioeconomics.

Study area

15.1.5 In terms of the fisheries resource, the focus falls on that within and around the development site, and to a lesser extent, and only in event of clear evidence of displacement of effort, on other local fishing grounds.

15.1.6 Throughout this chapter the following definitions are used (Table 15.1), both to describe the area of impact / interaction and the fleet:

Table 15.1. Definitions used to describe the study area in relation to commercial fisheries

Geographic scale	**Wider Region**	Kyle Rhea narrows, plus Lochs Duich, Long and Alsh to the north and the Sound of Sleat to the south.
	Study Area	Kyle Rhea narrows
	Development Site	The actual proposed site of the devices, including any proposed

		exclusion zone as indicated by the box around the current proposed device location
Fleet Segment	**Inshore**	Local day boats (typically fished by 1 or 2 crew, targeting shellfish with creel gear from vessels under 10m)
	Offshore	Boats capable of multi-day offshore fishing (typically >10m, mobile gear)

15.1.7 From a commercial fisheries perspective the study must be sufficiently geographically spread to capture all possible impacts. Although from a purely biological perspective the impacts on commercial fisheries may appear fairly local, knock on effects as a result of displaced fishing effort or reduced access to fishing grounds may be felt at a wider scale – with potential upstream and downstream economic impacts being felt at some distance. With the nature of impact often being influenced as much by where vessels are based and fish are landed, as by where vessels actually fish.

15.1.8 The main fishing ports from which vessels engage in commercial fishery within the study area are outlined in Figure 15.1, below.

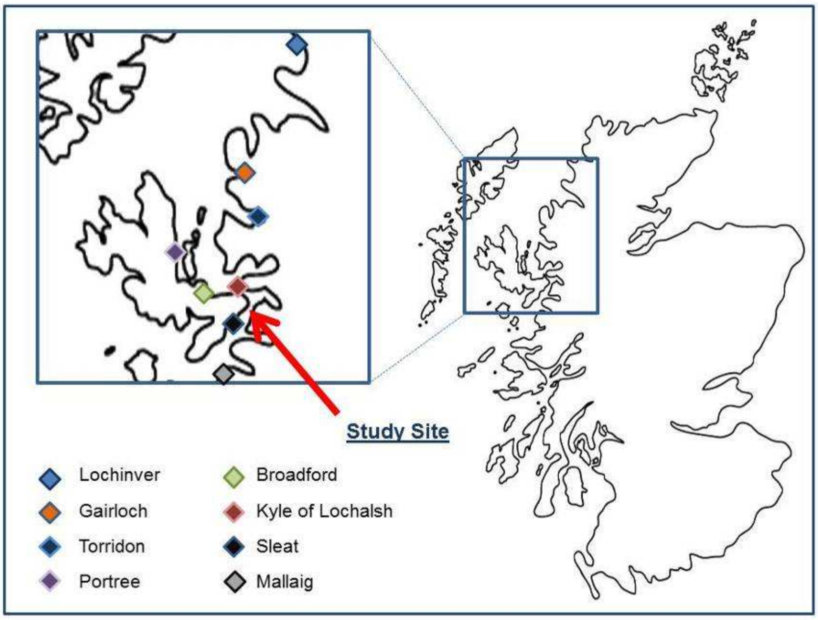

Figure 15.1: Chart showing location of fishing ports mentioned in the commercial fisheries chapter

15.1.9 From a fisheries management perspective, the Project is in International Council for the Exploration of the Sea (ICES) Division VIa, in the Celtic sea ecoregion. This division represents the scale at which pressure stocks are typically managed and quotas are allocated. However, for the purposes of data collection and analysis ICES also has a finer scale grid of statistical rectangles and the much of the data used for analysis in this chapter comes from the scale of the statistical rectangle. The study site in the Kyle Rhea narrows sits roughly in the middle of ICES statistical rectangle 43E4, as detailed in Figure 15.2, below.

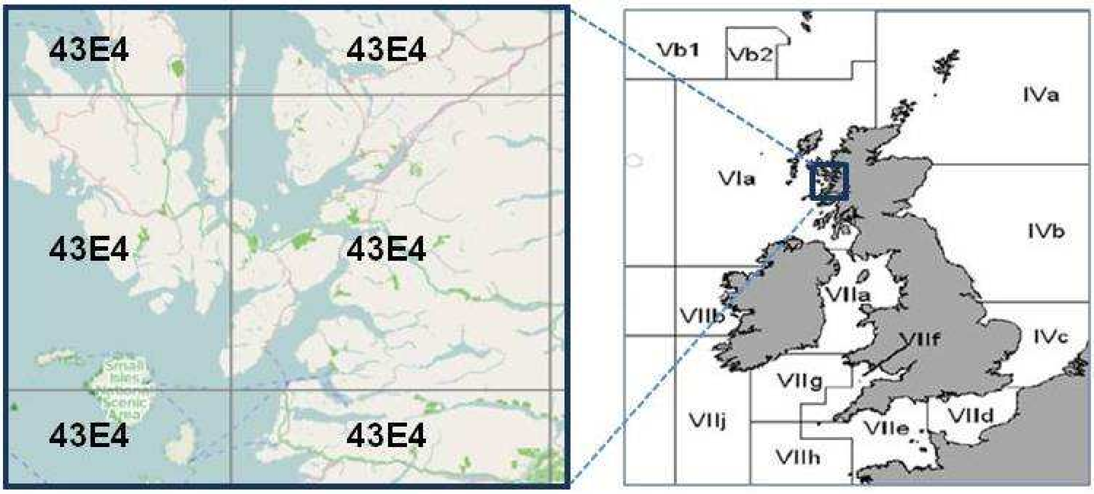

Figure 15.2: Chart showing relevant ICES fisheries management statistical rectangles (L) and Divisions (R).

Overview of potential impacts

<u>Fisheries</u>

15.1.10 The potential generic impacts of projects such as this on the commercial fishing industry are potentially wide ranging and include direct loss of earnings for the fishing sector due to loss of fishing grounds, or through biological impacts on target species leading to a fall in landings or a loss of product quality. Slightly more indirect, but still none the less potentially important impacts include the impact on other fishing grounds of displaced fishing effort, the impact on the fleet of restricted access to fishing grounds on either side of the development site and the impacts on the fleet of any direct contact between fishing vessels or fishing gear and project infrastructure.

15.1.11 In all cases these potential impacts apply, to a greater or lesser degree, during construction, project operational life and decommissioning.

15.1.12 Additionally, these impacts apply to a variety of fleet sectors – ranging from local inshore vessels to large vessels transiting the study area on route to distant fishing grounds.

15.1.13 The following chapter of the Environmental Statement (ES) maps the existing baseline conditions and explores all the potential impacts detailed above in more detail.

<u>Aquaculture</u>

15.1.14 There are no active aquaculture facilities within the study region. The strong tidal nature of the site means that it is unsuitable for either fish or shellfish aquaculture.

15.1.15 The two closest active salmon farms are the Ardintoul farm, situated around 1km north east of the Project site, and the Loch Alsh farm, around 1.3km north west of the Project site and direct impacts between the devices and farm infrastructure are not expected. Although there are some fish farming symbols shown in the Kyle Rhea narrows on the Admiralty chart (2540 Loch Alsh and Approaches), these are inactive and there is no farm infrastructure. The Crown Estate has confirmed that these locations are 'historic' shellfish sites – the leases were renounced a few years back, so there are no current fish farm leases at these locations.

15.1.16 Chapter 14, Fish and Shellfish) considered the biological impacts on fish populations of construction, operation and decommissioning and showed these to be of largely negligible significance. Given the distance of the 2 active salmon farms from the development site it is considered that any biological impacts on the farmed salmon, for example impacts of water quality or noise on farmed fish health, growth rates, or feed conversion ratios would be of negligible significance. The only remaining possible impact of the development on the local fish farming industry is as a result of restrictions to shipping and navigation, for example for farm well-boats which are used to both stock and harvest sea pens, or for towing of farm infrastructure (pens and feed barges). The scale of these shipping movements, potential consequences and possible mitigations are considered alongside other shipping and navigation under Chapter 17.

15.1.17 Aquaculture is therefore not considered further in this Impact Assessment.

Policy, legislation and guidance in relation to commercial fisheries

15.1.18 Schedule 3 of The Marine Works (Environmental Impact Assessment) Regulations 2007 sets out what should be included in the EIA. This is generalised and does not include anything specific to commercial fisheries. There is no legislation or statutory guidance specific to the assessment of the impact of marine projects on commercial fisheries.

15.1.19 Other relevant but non-statutory guidance documents have been referred to for structure and approach recommendations. These included CEFAS guidance on the assessment of offshore wind farms (CEFAS 2004) and more recently the European Marine Energy Centre (EMEC) has developed EIA guidance for local applications. In May 2012 the Scottish Government produced a Guide to Marine Licensing the Marine (Scotland) Act 2010 and The Marine and Coastal Access Act 2009, but this again this document does not give any specific guidance in relation to assessing the impact on fisheries.

15.1.20 The European Marine Energy Centre (EMEC) and Xodus Group environmental consultants were commissioned by Marine Scotland to produce a guidance document (in draft), to help developers with Environmental Impact Assessment (EIA) and Habitats Regulations Appraisal (HRA) for consenting marine renewable energy developments in Scotland. The draft version of this document provides some useful guidance with regard to commercial fisheries.

15.1.21 In response to this shortage of guidance for the assessment of marine developments on commercial fisheries the UK, the Fisheries Economist Network, in association with Seafish, commissioned Poseidon Aquatic Resource Management Ltd to chair a workshop for fishery economists to produce guidelines for fisheries impact assessments. The conclusions of this exercise are presented in Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments (Poseidon 2012).

<u>Fisheries management (EU)</u>

15.1.22 The UK is a Member State of the European Union, and its fisheries are therefore subject to the principles and practices of the Common Fisheries Policy (CFP) of the EU. Although there is reasonable scope for local management (see below), this must be done within the overarching context and rules of the CFP. The current policy (No.2731/2002) is under review, and a revised policy is likely to be enacted in 2013. The scope of the CFP extends to conservation, management and exploitation of living aquatic resources and aquaculture, as well as processing and marketing of fishery products, both within EU waters and by any member state vessel or national – with due regard to the UN Convention on the Law of the Sea (UNCLOS) and without prejudice to the primary responsibility of the flag State. Outside the CFP framework other EU legislation dealing with habitats and species protection also has binding relevance to fisheries management and to fishermen.

<u>National fisheries management</u>

15.1.23 The responsibility for implementation of the CFP in Scotland has been devolved to the Scottish Government (The Scotland Act 1998), meaning that Scottish ministers are responsible for the regulation (licensing & enforcement) of sea fishing within the Scottish Zone of the British Fishery Limits (200 mile zone). Within the 12nm zone, the Scottish

Government also has the ability to take non-discriminatory fishery conservation measures although the EU retains the right to undertake certain direct legislation, even in member states inshore waters.

15.1.24 In general, the only areas where the European Commission adopts measures which have effect within 12 miles are in relation to fleet, Total Allowable Catch (TAC) and gear – principally in relation to the management of pressure stocks. From the perspective of fisheries in the Kyle Rhea area, the EU would only play a key role in the determination of catch restrictions on a relatively limited relevant range of demersal species (cod, haddock, ling, Megrim, skates & rays etc – but landings of these, even in the wider area (43E4) are insignificant), pelagic species (e.g. sprat – but again, landings of pelagic species in 43E4 are insignificant) and finally shellfish (*Nephrops norvegicus)* is the only EU quota shellfish species caught in the wider area.

15.1.25 All the remaining species which are caught in the wider region (43E4) are not governed by quota (although some effort restrictions may apply) – these include – scallop, crab, velvet crab, lobster, spurdog, razor clam, queen scallop, whelks, monk / anglers. Of those species caught in the study area in any significant numbers, it only nephrops that is managed by EU quota restrictions. For this species the EU will play a lead and active role in determining gear specifications and catch limits, while Marine Scotland could play a supplementary role in non-conflicting management initiatives. For all of the other species, caught in anything like significant numbers in 43E4, the EU plays comparatively limited active role (other than generic fleet and gear rules) and any management initiatives would be most likely to come from Marine Scotland.

15.1.26 In practice, the tools available to Marine Scotland to undertake management initiatives are limited. The key statutory instruments available to Scottish ministers are the Inshore Fishing (Scotland) Act 1984, which enables ministers to prohibiting certain fishing activities, and the Sea Fisheries (Shellfish) Act 1967 which essentially allows areas of seabed (out to 6nm) to become an isolated management unit for shellfish species (either a several or regulating order), with management responsibility passing to a grantee. In the wider area of this study, there are only a few applicable management actions, under either of these instruments. As a result, the management for most relevant species in the wider region is mainly in the form of generic fleet and gear management, rather than fisheries specific management.

15.1.27 One exception to this, which applies across Scotland, is dredge fisheries for scallops, which are subject to specific Scottish legislation (The Prohibition of Fishing for Scallops (Scotland) Order 2003), restricting the number of dredges that can be used per side of a vessel.

15.1.28 A further exception which applies to the Southern Inner Sound including Lochs Carron Kishorn, Duich Alsh and Hourn (i.e. including the study site) is contained in the Inshore Fishing (Prohibition of Fishing and Fishing Methods)(Scotland) Amendment Order 2001. This prohibits fishing by trawlers either over 12m or using anything other than a single trawl, and secondly prohibits the use of all mobile gears from 1st January to 31st March, then from 1st October to 31st December. This restriction is non fishery / species specific and applies regardless of the target species.

15.1.29 Nephops can be described as the 'most managed' of the fisheries in the wider study region. It is therefore interesting to note that nephrops in the wider region (i.e. ICES rectangle 43E4) is managed based upon annual ICES advice which leads to the setting of a TAC for the whole of ICES division Via. However, within this division management advice (in terms of stock status and exploitation rate) is provided on a smaller scale 'functional units'. The wider region for this study falls into the South Minch functional unit (FU 12). This means that although a recommended catch is advised for a smaller functional unit, the overall catch restriction mechanism (TAC) will only be applied at a larger spatial scale (Division Via).

15.1.30 In the words of ICES: “Current management of Nephrops in Subarea VI (both in terms of TACs and effort) does not provide adequate safeguards to ensure that local effort is sufficiently limited to avoid depletion of resources in functional units. In the current situation vessels are free to move between grounds, allowing effort to develop on some grounds in a largely uncontrolled way and this has historically resulted in inappropriate harvest rates”.

15.1.31 This apparent weakness in management of the main pressure stock fished in the study region, does not directly impact upon the investigation of the impact of a potential tidal array in Kyle Rhea – given that it is not the task of an EIA to assess the overall status of resources fished in the area, and given that within the study area, it is not thought that fishing for nephops occurs nor does the benthic survey work (Appendix 13.1) suggest that nephrops or suitable habitats for nephrops exist in the kyle.

Local fisheries management

15.1.32 A new management structure is also evolving within the Scottish Inshore Zone; namely Inshore Fishery Groups (IFGs). These are local partnership led groups, designed to provide the fishing industry with a strong and effective voice in shaping management proposals. Although the groups do not have any statutory or regulatory power, management proposals which arise from the groups, and which have the consensus of the wide range of fishery and stakeholder groups are likely to be given favourable consideration by the Scottish Government. The IFGs have sought to develop management plans for inshore fisheries in their area out to 6nm, reflecting local priorities, but also incorporating national goals and obligations. This will be primarily shaped by the Executive committee of the IFG – essentially, commercial fishing interests drawn from Fishermen's Associations, and a spokesperson for non affiliated fishermen – with guidance from the Advisory Group, which comprises of Marine Scotland, Scottish Natural Heritage and other relevant bodies.

15.1.33 The study area is roughly on the boundary between 2 IFGs. With inshore fishing North of Kyle Rhea being covered by the North West IFG and inshore fishing to the south of Kyle Rhea being covered by the Mull & Small Isles IFG.

15.2 Methodology

15.2.1 The approach taken to the assessment of potential impacts on commercial fisheries is in line the guidance and legislation detailed above. Data have been collated from appropriate local, national and international sources and corroborated at a local scale through extensive stakeholder consultation. These data have been combined with expert knowledge and interpretation of research findings from other similar marine power generation scenarios.

15.2.2 Baseline information has been used to build a picture of the existing fishery in the study area and in the wider region. Aspects such as main fisheries activity, key landing ports, seasonality, revenue etc. are presented. The baseline also provides the assumed status quo, for the ‘do nothing scenario’.

15.2.3 The significance of potential impacts and the potential for mitigation of those impacts is considered during the impact assessment. All potential impacts are highlighted – detailing when and where any such impacts may occur and how they might be mitigated, with consequences quantified in relevant terms. The process used to assess the significance of impacts is detailed below, along with details of terminology.

Consultation in relation to commercial fisheries

15.2.4 The conclusions in this chapter have been shaped by widespread consultation with key stakeholders. This consultation exercise has built further on the initial consultation which had already been undertaken (in particular with statutory consultees) as part of the scoping exercise. The Scoping Opinion (**Appendix 4.1**) recommended early consultation with the 'local fishery board'. In this case, the 'local fishery board' can be considered to be local offices of Marine Scotland, and, to a lesser extent (because of their non-statutory role) the two Inshore Fishery Groups (North West IGF & Mull and the Small Isles IFG).These have been consulted as part of this commercial Fisheries EIA process.

15.2.5 The consultation to inform the commercial fisheries chapter was carried out by the author of the chapter, who was also appointed as a dedicated Fisheries Liaison Officer (FLO), prior to the commencement of the EIA process. By combining the fisheries EIA and FLO tasks, contact and consultation with the industry could be both clear and efficient.

15.2.6 Consultation has been carried out by e-mail, telephone and face to face meetings – both individual and group meetings. A questionnaire was also used to seek input from the local fleet on a series of key questions (anonymous responses are provided in **Appendix 15.1**). The key stakeholder groups consulted are:

- The local inshore fleet
- The offshore fleet (which may transit Kyle Rhea)
- Fisheries managers and regulators
- Associated businesses and services (harbour master, shellfish marketing and distribution)

15.2.7 Details of the consultation undertaken in relation to commercial fisheries are provided in Table 6.2 of Chapter 6. Table 15.2 provides a summary of the key issues raised during consultation.

Table 15.2: Summary of consultation relating to commercial fisheries

Key issues raised	Response
The key concern raised by a number of parties during the consultation process was with regards to navigation and safe passage through Kyle Rhea	A Navigational Risk Assessment (NRA) is provided in Appendix 17.1 and the impact on shipping for all relevant sectors including commercial fishing is discussed in Chapter 17. The potential impacts specific to commercial fishing are discussed in Section 15. 4 of this chapter.
'Sensitive water uses, such as fish farms, bathing waters and shellfish growing waters, and associated potential impacts should be assessed. The proximity to existing discharges and designated areas i.e. estuarine abstractions and cooling water discharges (where relevant), should also be assessed.' (SEPA)	Potential impacts to fish farms are considered, see section 15.4. Kyle Rhea is currently not a designated Bathing Water or Shellfish Water – see Chapter 9, Marine Water Quality.

Data collection

15.2.8 Table 15.3 below provides a summary of the key data sources used to inform the conclusions of the EIA chapter on commercial fisheries.

Table 15.3: Data sources to inform baseline & impact assessment

Data Source	Spatial coverage	Author	Year
Questionnaire	Sent to: Scottish Fishermen's Federation, Scottish Fishermen's Organisation, Mallaig & North West Fishermen's Association, West of Scotland Fish Producers Organisation, Scallop Association, Skye and Lochalsh Fishermen's Association, North West Inshore Fisheries Group, Small Isles and Mull Inshore Fisheries Group. In addition copies have been available at: Kyle of Lochalsh Harbour, Mallaig Harbour.	Responses from individual skippers	2012
VMS (spatial data)	ICES rectangle 43E4	Marine Scotland (Compliance)	2010
Landings	ICES rectangle 43E4	Scottish Government, Fisheries Statistics	2006-2011
Fleet register	UK wide over 10m and under 10m – refined by home port.	Marine Management Organisation Statistics and Analysis Team	2012
Fleet economics	Economic Survey of the UK Fishing Fleet	SEAFISH	2009

Data limitations and uncertainty

15.2.9 A key risk in assessing the current commercial fisheries in the study area, and assessment of potential impacts, is of failing to correctly interpret fisheries data relating to the wider area. Landing statistics are reported by ICES rectangles, an area approximately 30 nautical miles squared (30 minutes of latitude x 1° longitude). As such, any landings data for ICES rectangle 43E4 will relate to catches from a wide range of fishing grounds and a diverse range of fleets. While this will include landings from the study area, these will be hidden by larger scale landings (in both geographic and volume terms). ICES landings data can therefore only be used to provide important contextual information as well as valuable understanding of landing patterns, both within (seasonality) and between years (trends).

15.2.10 More detailed statistical understanding can be obtained from MMO data on recorded landings by local ports, however, this may also include landings by inshore and offshore vessels, so must again be carefully interpreted. Other data such as VMS traces or AIS signals (as picked up in the navigation survey) can provide a useful indication of fishing vessel movements, but as these are only in use on larger (+15m) vessels, this will not record movements of the local inshore fleet, operating in smaller vessels.

15.2.11 A further source of misinterpretation, which may be evident within VMS data is due to vessel speed. VMS data will be recorded as 'active fishing' when vessels are travelling at slower speeds, normally indicative of trawling. However, this speed filtering may mean that some vessels may be recorded as fishing, due to comparatively slow speed over the ground, when in fact the slow speed is caused by the slowing effect of the strong tidal stream in Kyle Rhea.

15.2.12 In order to get an accurate reflection of fisheries activity, it is important to speak to a wide range of fisheries interests, typically, through representative Fishermen's associations. Such representation has tended to be speak for larger offshore vessels as it is often not deemed cost effective for smaller inshore vessels to join Associations, which may also be based in a distant port.

15.2.13 Most under 10m vessels are in the so called "non-sector[37]", meaning that they do not require individual quota to access the fisheries resource (or may target non-quota species such as lobster and crab). For such vessels there may also be little value in joining the other key type of representative body, a Producer Organisation. Consequently, smaller inshore vessels are again often not formally represented, and it may not always be possible to liaise with a single representative.

15.2.14 In order to get a true picture of the fisheries activity, it was important to ensure that vessels operating in the study were consulted, even to the level of engaging those vessels directly. To obtain a good quantitative estimate of landings from the study area, a local ground truthing exercise was undertaken, informed by well structured consultation with the local industry, as part of this EIA.

15.2.15 In the study region (and indeed the wider area), many of the inshore vessels are members of the newly formed Skye & Lochalsh Fishermen's Association. This has been established in part as a result of the recent Scottish Government initiative to create Inshore Fisheries Groups (IFGs – see later section on management), which has in turn stimulated the inshore fleet to develop a more representative structure to engage in the development of management proposals.

Impact assessment

15.2.16 The key task of the commercial fisheries EIA is to assess the significance of any impacts on the commercial fishing industry. Where considered appropriate, mitigation measures are proposed for specific impacts, with the significance of those impacts reassessed once mitigation is in place.

15.2.17 The significance of impact is determined by combining the scale of impact, with the sensitivity of the receptor (in this case commercial fishing) and is supplemented by expert judgement.

Magnitude of Impact x Sensitivity of Receptor = Significance of Impact

15.2.18 The sensitivity of the receptor to the impact is determined. This essentially seeks to determine the capacity of the commercial fishing industry to accommodate the potential impacts of installation. The level of sensitivity is determined by considering likely change on fishing patterns, landing and fleet size, as set out in Table 15.4 below.

Table 15.4: Definition of terms relating to the sensitivity to an effect

	Fishing patterns	Landings	Fleet size
High	Change affecting a significant proportion (>30%) of the fleet	Significant change – composition and value.	Permanent change
Medium	Some change (1-30% of the fleet) – affecting a few	Some change –	Temporary change

[37] The "non-sector" is the name given to those which are not in "the sector". The sector refers to the over 10m PO members, who have a quota entitlement based on track record.

	Fishing patterns	Landings	Fleet size
	local boats.	composition, not value	
Low	Minor change (<1%) – occasionally affecting a few local boats.	Change undetectable in normal variations in landing patterns.	No change
Negligible	No change	No change	No change

15.2.19 Magnitude of impact is determined by examining both the spatial and temporal scale of impact along with the level of intensity, as detailed below in Table 15.5. From a commercial fisheries perspective, the scale of impact relates to impact on the fleet (such as fishing patterns, landings or fleet size).

Table 15.5: Definition of magnitude of impact upon receptors

	Spatial Scale	Temporal scale	Intensity
High	Impact within wider area.	Recovery > 15yrs	Very evident within space and time frame.
Medium	Impact within study region.	Reversible within 1-5 years	Some evidence within space and time frame.
Low	Impact at development site.	Reversible in less than 1 yr.	Low detectability
Negligible	Undetectable	Undetectable	Undetectable

15.2.20 Finally, the outcome of the magnitude of impact and the sensitivity of the fleet to that impact are combined to determine the overall significance levels. Significance is graded as being major, moderate, minor or negligible. The matrix for determining the level of significance is set out below in Table 15.6.

Table 15.6: The level of significance of an impact resulting from each combination of sensitivity and magnitude

	Magnitude			
Sensitivity	**High**	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

15.3 Existing environment

15.3.1 In this section the current status of regard commercial fisheries in the wider region, study area and development site is profiled and discussed. The situation that may be expected to continue in the absence of the installation of the Project is presented and this baseline provides the context against which future potential impacts are assessed in later sections of this chapter.

Key fishing ports and administrative centre

15.3.2 There are 2 landing districts within the study region – Mallaig and Portree. Although Mallaig is slightly closer, landings from boats to the north are likely to be registered to Portree, and boats from the south are likely to have landings registered to Mallaig – so to all intents and purposes, the study area forms a division between the two landing districts.

15.3.3 Within these 2 landing districts there are a number of registered ports – these are the main landing ports for catches in the wider region. These include, within the Portree district Broadford and Torridon, and within the Mallaig district – Mallaig itself, Kyle of Lochalsh and Sleat. Table 15.7 highlights the main landings from 43E4. This shows that the majority of the catch which is landed from 43E4 is landed to ports within 43E4. Kyle of Lochalsh handles the largest proportion of the landings caught in 43E4, with Mallaig, Broadford Torridon, Sleat and Portree collectively accounting for almost all landings from the area and ports such as Gairloch and Lochinver having steady, but much smaller landings from 43E4.

Table 15.7: Value of landings to main ports from 43E4 (£)

	2006	2007	2008	2009	2010	2011
Kyle of Lochalsh	1,452,329	1,505,477	1,648,695	1,349,639	1,151,632	1,190,395
Torridon	639,332	586,690	605,776	462,737	388,162	272,914
Broadford	438,133	516,445	441,970	401,579	409,022	316,849
Portree	205,935	243,683	315,747	270,126	233,263	224,370
Mallaig	151,568	345,247	118,130	238,290	241,379	313,694
Sleat	131,361	139,203	97,545	201,274	189,298	118,579
Lochinver	1,056	5,330	45,390	6,250	3,329	36,740
Gairloch	34,383	17,562	13,080	13,194	6,504	12,571

15.3.4 Although a further 17 ports appear in the landing statistics over a 5 year period for 43E4, the only other notable landings to ports outside of 434E were periodic landings of nephrops, landed at other west coast ports such as Barra or Stornoway. However, such landings are infrequent and account for considerably less than the ports already highlighted.

15.3.5 The value of landings to the main ports can be broken down in order to see the relative importance of different species to each port. This analysis is presented below in Figure 15.3.

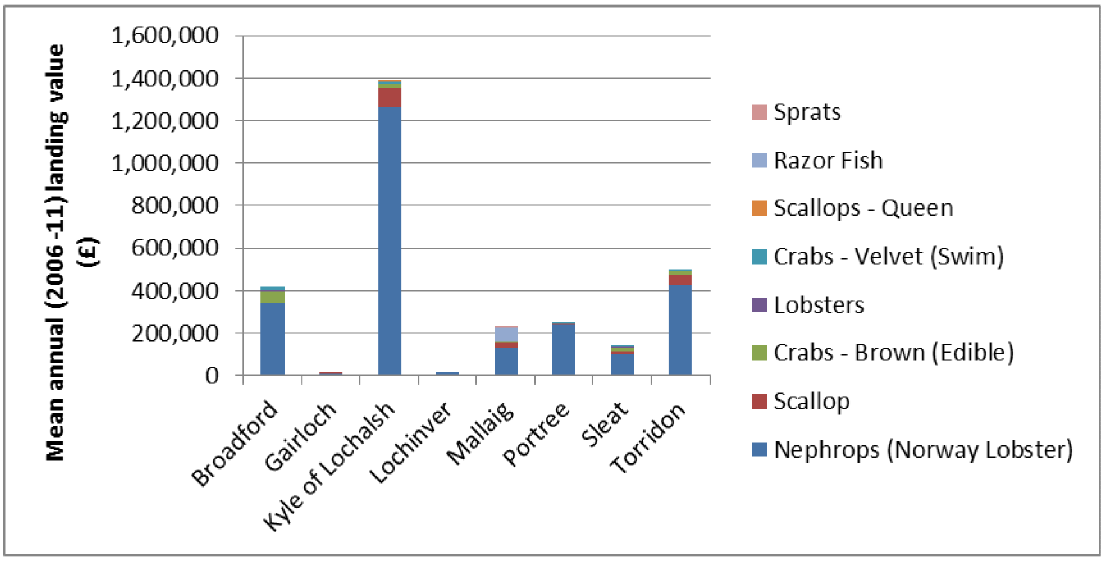

Figure 15.3: Main species landed at key ports from 43E4

15.3.6 This shows the importance of Kyle of Lochlash for landings caught in ICES rectangle 43E4.

15.3.7 Landings to Kyle of Lochalsh are dominated by nephrops from both trawl and creel vessels. There is a good local market for nephrops, primarily sold to export companies for live transport to the Spanish market. The level of landings of nephrops caught in 43E4 to Kyle of Lochalsh also far exceeds the level of local nephrops landings to any of the other 43E4 ports, indicating that this is the main port for local landings.

15.3.8 For the other local ports, nephrops is the main catch from local waters (43E4). After that, there are some slight variations in the pattern of landings. For example, for Kyle of Lochalsh, Mallaig, Portree and Torridon scallops is the 2nd most important fishery, whereas for Broadford there is an important local brown and velvet crab fishery, and for Sleat there is an important lobster fishery.

15.3.9 It should be noted that the above landing summaries do not provide a summary of everything landed to those ports – simply landings from the statistical rectangle. This is because the data profiling seeks to represent catches from the statistical square in which the development site, study area and wider region sit to demonstrate the relative local importance of the ports. Notably Mallaig and Portree would have significant landings from other statistical rectangles – far exceeding the value of landings from 43E4.

Landings

15.3.10 The total landings and the proportion of catches taken in 43E4 were 615 tonnes in 2011, slightly below the 6 year average of 625 tonnes. In 2011 this was worth a first sale value of just over £2.5 million.

15.3.11 As can be seen from Figure 15.4 (below), landings from 43E4 are dominated by shellfish. Catches of whitefish such a cod, haddock and pollack, other demersal species such as angelfish and skate, or small pelagics such as sprat are infrequent and sporadic by comparison.

15.3.12 In value terms, roughly 85% of landings from 43E4 are nephrops with the second most valuable fishery (scallops) representing just 7% of total landed value.

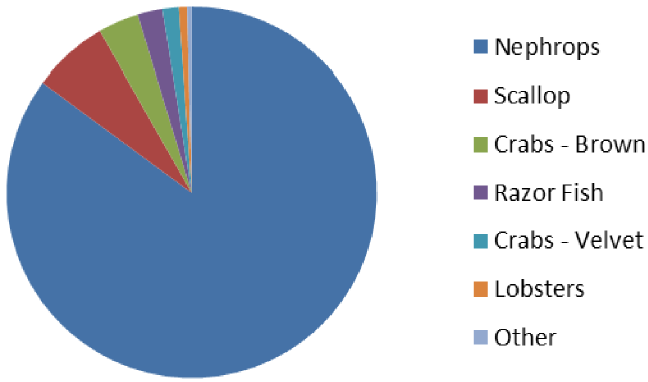

Figure 15.4: Proportion of species landed from 43E4 per annum (mean 2006 – 2011, by value)

15.3.13 The overall recent trend in landings from 43E4 has been downward, both in value and volume, as shown in Figure 15.5 (below). The majority of this declining trend is due to a fall in landings of nephrops. Although the under 10m vessels which target nephrops with creels are not affected by quota restrictions (these non-sector vessels benefit from a set aside pool from the overall quota), the larger vessels – typically trawlers, have been effected by a restriction in both quota and time at sea (associated with the cod recovery plan, but impacting upon the nephrops fishery due to bycatch restrictions). The agreed TAC for Division Via fell from 19,900 tonnes in 2007 to 13,700 tonnes in 2011.

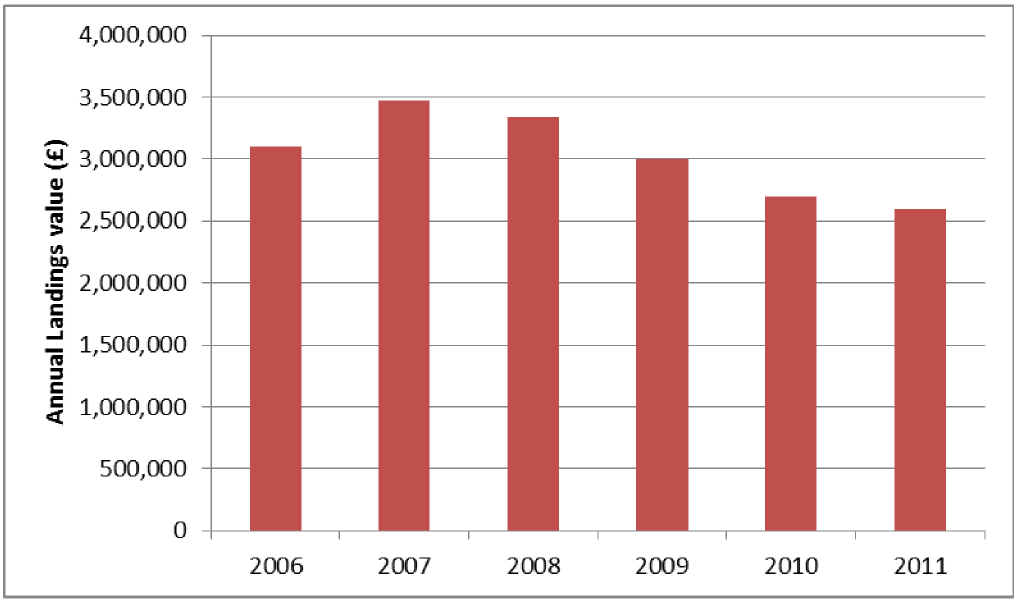

Figure 15.5: Overall trend in landings value from 43E4

Key species - nephrops

15.3.14 Nephrops is a key species fished within the wider region (Figure 15.4), alongside lobster, scallops, clams (including razor clam) and crabs (velvet and brown). Further information regarding nephrops biology and ecology can be found in Chapter 14, Fish and shellfish and in Appendix 15.2

15.3.15 The regional nephrops fishery is restricted by quota and minimum landing size, and (for larger vessels) effort restriction. However, in practice much of the fishing in 43E4 by creel is only affected by the minimum landing size.

15.3.16 Figure 15.6 shows the seasonality in the fishery, with landings peaking in the summer months; a reflection of the fewer days lost to creel fishermen due to bad weather and perhaps more significantly the fact that the waters of the inner sound are open to mobile gears.

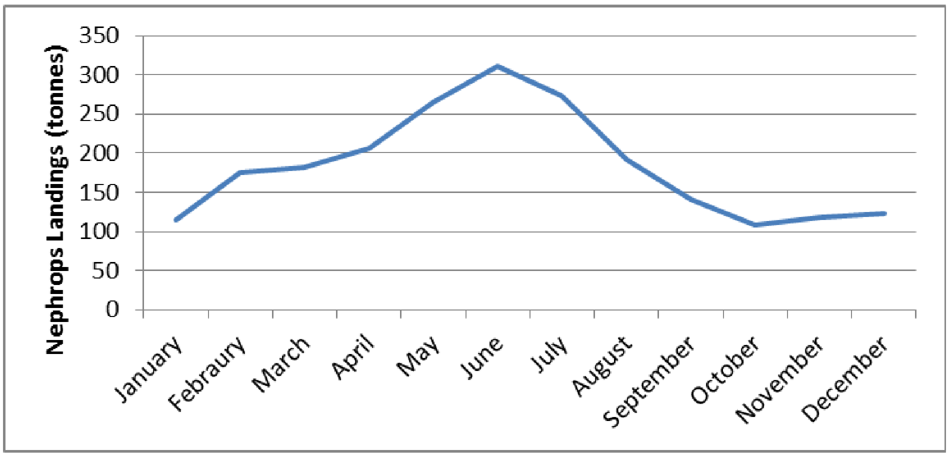

Figure 15.6: Seasonal patterns of Nephops landings from 43E4.

Key species - scallops

15.3.17 King scallop (thereafter scallop) also comprise an important part of the landings from 43E4 (Figure 15.4). Further information regarding scallop biology and ecology can be found in Chapter 14, Fish and shellfish and in Appendix 15.2. Figure 15.7 shows that the scallop fishery peaks in the spring time, when dredgers fish in the inner sound, after the closed winter season.

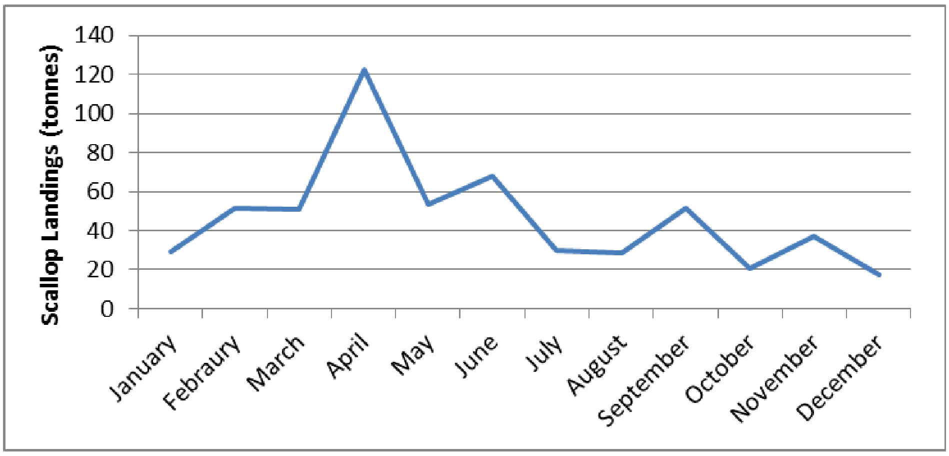

Figure 15.7: Seasonality patterns in the scallop fishery in 43E4

15.3.18 Scallops fisheries are not restricted by quota although scallops have a minimum EU landings size of 100mm. In Scotland, vessels fishing within 6nm are restricted in having no more than 8 dredges per side. There is also an overall effort cap (expressed in Kw/days) for vessels over 15m targeting scallops in western waters (including the 43E4).

Key species –brown crab

15.3.19 Brown or edible crab *Cancer pagurus* is the third most important species, in terms of value to the landings (Figure 15.4). Further information regarding brown crab biology and ecology can be found in Chapter 14, Fish and shellfish and in Appendix 15.2

15.3.20 As indicated in Figure 15.8 (below), the crab fishery becomes active in the later part of the year when both catches and prices are good.

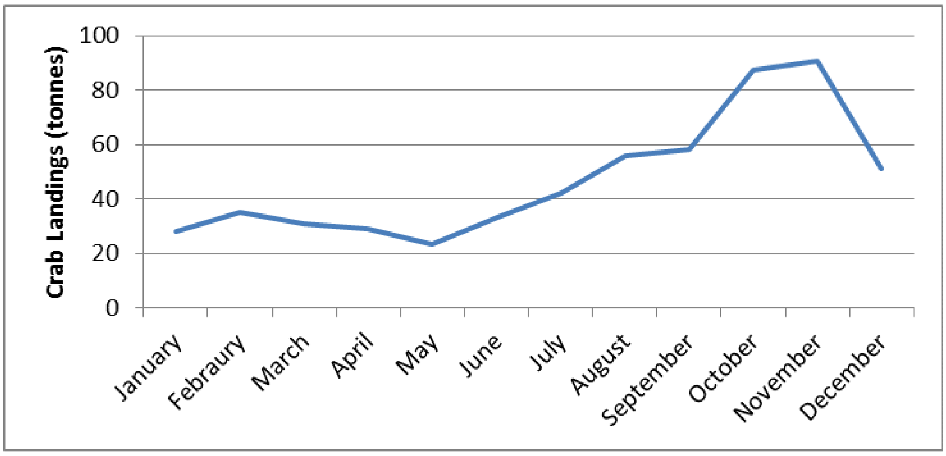

Figure 15.8: Seasonal landings patterns of brown crab from 43E4

Other locally important species

15.3.21 Other locally important species identified within the landings data (Figure 15.4) for 34E4 include:

- Lobster;
- Razor clam; and
- Velvet swimming crab

15.3.22 Further information on these species is provided in **Appendix 15.2**

Fishing gear characteristics

15.3.23 The only fishing taking place in the study area is by inshore vessels using static gear – pots or 'creels', used to target shellfish species such as nephrops, lobster or velvet crab. Fleets of baited pots (Figure 15.9) are placed on the seabed and fishermen will typically haul pots every 24hrs (weather permitting) to harvest any catch and replace bait. Gear will often be re-set in the same place for several days – although there is typically sufficient deck space to allow one or two fleets to be moved to new locations. Occasionally gear may be lost, particularly after prolonged periods of poor weather, or if gear becomes entangled with passing shipping or mobile fishing gears.

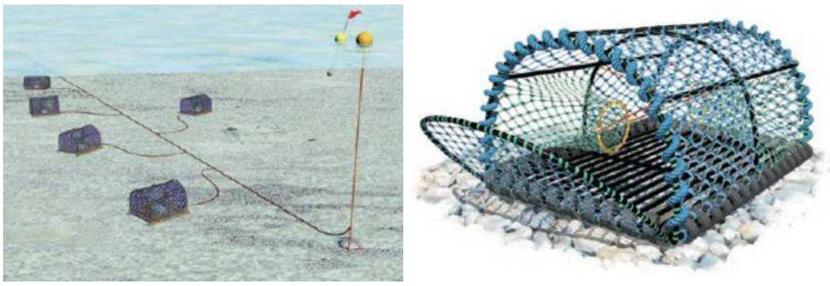

Figure 15.9: Image of typical individual creel and fleet configuration (Source: Galbraith & Rice 2004)

15.3.24 The target crustaceans crawl into the pots voluntarily, and cannot escape. Traditionally pots have been wood, but in recent years pots are metal, or increasingly plastic, with nylon netting. Fleets of pots will typically contain between 20 and 50 pots and a small inshore vessel may operate anything up to 20 fleets – depending on the crew size and vessel capability.

15.3.25 Small inshore potting vessels, which make short daily fishing trips, are typically less technologically equipped than their larger cousins in the demersal or, in particular, the pelagic fleet. Fish finding sonar is of little value for shellfish species targeted with static gear. Echo sounders and GPS have been common for many years but more recent advances allows data from the echo sounder to be used to build up a more comprehensive map of the seabed, which can be presented on the GPS chart plotter, thus providing the fishermen with a more detailed self-surveyed seabed chart. The position of fleets can readily be plotted on the electronic chart, meaning that fishermen can increasingly target particular seabed features, such as crevices, with static gear. (further information on the relevant fishing practices is provided in **Appendix 15.2**)

15.3.26 In the wider region fishing activity also includes demersal stern trawl and scallop dredge.

15.3.27 Scallops are caught using mobile gear-toothed spring-loaded. The dredge consists of a triangular frame leading to a mouth opening, a tooth bar and a bag of steel rings and netting back. The tooth bar rakes through the sediment lifting out scallops and the spring-loaded tooth bar swings back, allowing the dredge to clear obstacles on the seabed.

<u>Development site and study area fishing patterns</u>

15.3.28 The larger scale description derived from the raw data provides a good account of fisheries in the wider area, but because of the scale at which the data is recorded (ICES statistical rectangles) it does not provide the fine scale detailed insight into the local fishing patterns in and around the development site or study area, which have the potential to be most affected by any changes or restrictions related to the construction, operation or decommissioning of the Project.

15.3.29 Local survey work, and local ground truthing through consultation and questionnaires is therefore the only reliable way to build an accurate picture of fishing patterns at the development site and study area, to complement the information already presented at the level of the ICES statistical rectangle.

15.3.30 Consideration of local fishing patterns has therefore been informed by: (1) a navigation survey, carried out by MARICO (2010), of all vessel movements through the Kyle Rhea narrows, which included classifying and counting the number of fishing vessel movements; (2) a wildlife survey, which also recorded vessel movements including photographing the regular local fishing boats; (3) face to face meetings between the fisheries liaison officer and fishing industry representatives, (4) face to face meetings between the fisheries liaison officer and other local marine stakeholders, such as fisheries enforcement officers, harbour masters, ferry operators and fish farmers; and (5) a fishing industry questionnaire. The combined findings of this information gathering is summarised below.

15.3.31 Within the Kyle Rhea narrows there is a very low level of fishing activity and no fishing occurs at the development site itself.

15.3.32 There is no fishing with mobile gears in the Kyle Rhea narrows – either using a dredge for scallops, or using a demersal trawl for finfish species and nephrops (Figure 15.10). The closest fishing with mobile gears is in Loch Duich to the north and the Sound of Sleat to the south. Within the narrows the hard, rocky substrate is poor habitat for either of the main target fisheries of the main mobile gear fisheries – scallops or nephrops. Furthermore, the navigational restrictions and high tidal flow means there is little value in attempting to tow gears through the narrows and would risk gear damage. This is confirmed by surveys and consultations.

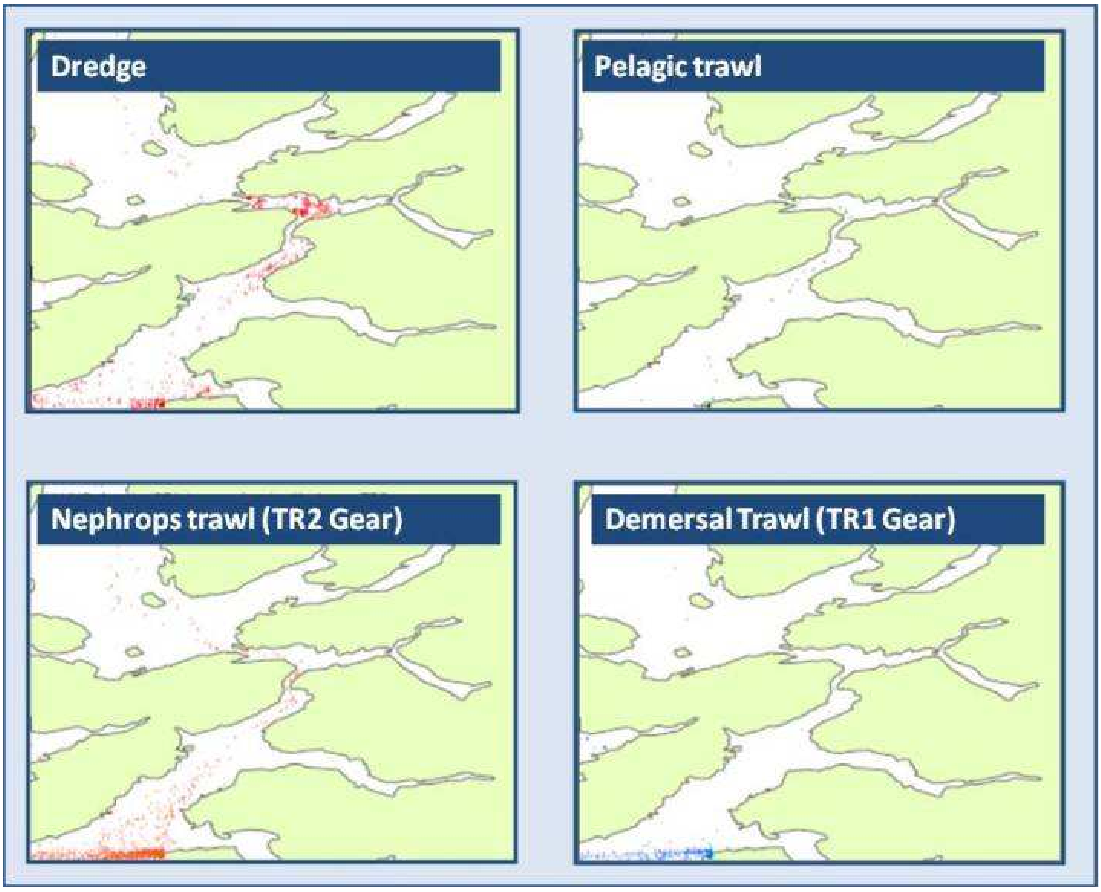

Figure 15.10: 2010 Aggregated VMS plots for 43E4 – of all VMS pings (both steaming and fishing) for over 15m vessels by fleet segment

15.3.33 Static gear fisheries targeting crab and lobster, with a bycatch of velvet crabs are the only fisheries within close proximity to the narrows. In the muddier substrates to the north and south of the narrows Nephrops may also be caught with static gear (creels).

15.3.34 For static gear fishermen wishing to target brown crab, lobster and velvet swimming crab in the narrows the potential benefits of lightly fished grounds are balanced against the technical difficulties of fishing in such fast tidal streams. Although there is no set maximum working tidal stream for static gear fisheries (CEFAS gear technologist *pers comm*.) in practice, the flow rate within the narrows presents a significant barrier to static gear fishing.

15.3.35 Where creels are set, they are most likely to be set toward the north or south entrances of the narrows, and tucked well into the sides, out of the main tidal flow. No static gear is deployed in the most tidal areas of the site where the tidal array will be installed.

15.3.36 The number of small inshore vessels attempting to fish close to the narrows is less than 5. Indeed most local marine stakeholders suggested only 1 vessel occasionally attempted to fish close to the narrows. That vessel was one of the ones which responded to the consultation and indicated that 0% of their fishing effort time was at the development site and that less than 10% of their fishing effort occurs in the wider Kyle Rhea narrows (excluding the development site). This equates to between 10 to 15 days a year for this vessel within the narrows with no particular patterns of seasonality.

15.3.37 There are a number of vessels that routinely transit the Kyle Rhea narrows, though not actually fishing in the narrows. The main fleet segments which transit the narrows are under 10m static gear vessels (potting), over 10m demersal trawl, and over 10m scallop dredge. An example or a small trawl vessel transiting the narrows is presented in Figure 15.11. More occasioning other fleet segments such as pelagic trawl may also transit the narrows.

Figure 15.11: A visiting 11m wooden demersal trawler transiting the Kyle Rhea Narrows. (Photo: A.Law)

15.3.38 A small group of local inshore static gear fishermen based in Kyle of Lochalsh or Kyleakin regularly fish to the south of the narrows, and so may regularly pass through the narrows twice a day. This is most likely to be during favourable times of tidal ebb and flow coinciding with preferred fishing and landing times. Less than 5 local boats would transit the narrows, each on around 100 days a year. A smaller number of vessels based to the south of the narrows may occasionally fish to the north of the narrows, for example perhaps 1 or 2 vessels out of Glenelg.

15.3.39 Local offshore mobile gear vessels based in ports in 43E4 such as Portree or Mallaig, less frequently, but none the less routinely, transit the narrows. For example many Kyle of Lochalsh trawl vessels will work grounds west of Skye so may transit the narrows twice weekly. Additionally Mallaig registered scallopers will also work the Portree scallop beds at certain times of the year, so may routinely transit. Mallaig registered whitefish / prawn trawl vessels may also transit the narrows between 5 to 10 times a year to access the North Minch or East coast fishing grounds.

15.3.40 Finally larger offshore vessels, both UK and EU registered vessels may transit the narrows on route to seasonal fishing grounds – particularly small numbers of large pelagic refrigerated seawater trawlers, whose high hold capacity often justifies increased steaming time to fishing grounds and markets. This could include Irish vessels bound for fishing grounds in the north of Scotland and Shetland or east coast Scottish boats bound for fisheries to the south and east. Some vessel may even potentially be *en route* to fisheries in West Africa where EU Fisheries Partnership Agreements are in place.

15.3.41 The VMS plots only provide information on any vessels over 15m (although the VMS requirement has recently reduced to 12m vessels, the results of this are not yet available in the data for analysis). As such VMS information is not helpful in interpreting the activities of smaller inshore vessels. In addition it does not differentiate between steaming and fishing, although in practice this can be interpreted by the concentration of pings, and their deviation from a direct steaming route.

15.3.42 The VMS plots do, however, clearly highlight a number of useful patterns of fleet activity. This confirms that pelagic vessels only occasionally transit the narrows, and do not fish in 43E4. It also demonstrates that the majority of whitefish demersal trawlers transit to and from Malliag via southern Skye, only rarely transit via the Kyle Rhea narrows, and do not fish in 43E4. By contrast nephrops trawl vessels are more likely to transit the Kyle Rhea narrows, however there are no concentrations of activity which would be indicative of fishing near the study area. Finally, scallop dredgers do show signs of fishing (concentration of activity, deviating from the main transit route) in 43E4, in particular north of the narrows in Lochs Duich and Alsh, but not in the study area or development site. Monthly plots for all fleets suggest that this activity by the dredgers north of the narrows occurred largely in April.

15.3.43 Additional fishing vessel activity survey data is provided by the vessel survey tracks and analysis carried out by MARICO to inform the navigational analysis for this project. In total 35 days of shipping survey was carried out on site, with 15 winter days (18 February to 4 March 2010) and 20 summer days (8-13 and 15-28 June 2010). From this survey, the results relating to commercial fishing have been summarised here.

15.3.44 All fishing vessel tracks through the survey gate in Kyle Rhea during the combined survey period are presented in Figure 15.12. The plot has been colour-coded to distinguish fish carriers and processing vessels from other fishing vessels.

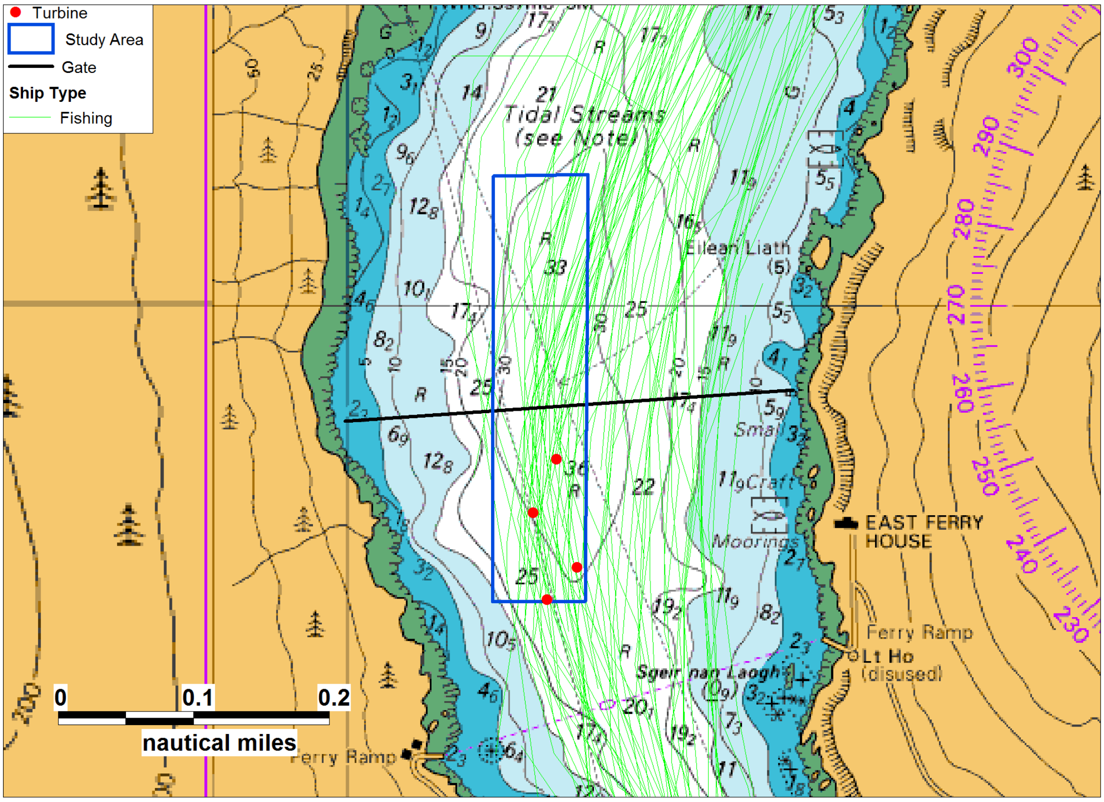

Figure 15.12: Fishing vessels tracked during surveys (2010)

15.3.45 Seventy-four tracks were made by fishing vessels during the survey – an average of just over 2 per day. Details of the vessels which were observed transiting the survey gate are presented below in Table 15.8.

Table 15.8 Fishing vessels observed passing through Kyle Rhea Narrows during the navigation survey

PLN	Name	Port	Gear Type	Transits
BRD90	Helen Bruce	Broadford	Pots and traps	19
OB164	Mairead M	Kyle	Pots and traps	11
BRD77	Our Catherine	Broadford	Bottom otter trawl	6
BRD642	Paulona II	Broadford	Bottom otter trawl	2
BA87	King Challenger	Kirkcudbright	Boat dredger	1
BA829	King Explorer	Kirkcudbright	Boat dredger	1
BRD200	Sangsara	Broadford	Pots and traps	1
BRD632	Sea Ranger	Broadford	Bottom otter trawl	1
BRD663	Silver Steele	Broadford	Pots and traps	1
CN777	Gleaner II	Campbeltown	Bottom otter trawl	1
FR237	Our Heritage	Fraserburgh	Boat dredger	1
OB79	Madalia	Oban	Bottom otter trawl	1
TT74	Village Belle IV	Tarbert	Mechanised dredger	1
BW186	Ellen Mac	Barrow	Bottom otter trawl	1
FY115	Nemesis	Fowey	Pots and traps	1
N102	Willing Lad	Newry	Bottom otter trawl	1
BRD67	--	Broadford	--	1
KY151	Radiant Way	Kirkcaldy	--	1

15.3.46 The results of this survey further confirm that the overall level of fishing activity in the Kyle Rhea narrows is low. No vessel was observed as engaged in fishing activity during the survey. Overall just 18 different boats were observed. Of these most only passed through a single time. The only vessels which passed through on more than 1 occasion during the survey period were locally based boats (either Bradford or Kyle). One vessel passed through 19 times during the survey period. This boat was one of those that responded to the questionnaire.

15.3.47 Additional local fisheries: Along the intertidal foreshore of the Kyle Rhea Narrows, in particular on the western (Skye) side of the channel, there is a small level of hand collecting of molluscs. Although technically this is a commercial activity, it is operated on a very small opportunistic scale and is largely unregulated with unlicensed collectors. Local buyers will purchase from a varying number of local part time collectors in order to aggregate a quantity sufficient to be sold on the wider market, and will arrange transport and sale.

15.3.48 Chapter 10, Terrestrial and Intertidal Ecology outlines the potential impacts on the intertidal ecology. It is expected that hand collecting of molluscs would be unaffected by the proposed tidal array. The export cable will be directionally drilled and therefore there will be no direct habitat loss in the intertidal area.

Fleet economics

15.3.49 The 2009 Economic Survey of the UK Fishing Fleet conducted by Seafish (Further detail is provided in **Appendix 13.2**) indicates that the under 10m pot and trap fishery has the highest net profit as a percentage of income, of the 5 fleet sectors which fish closest to Kyle Rhea. This is also the sector that is most likely to be fishing closest to the development site or routinely transiting the narrows. This implies that the sector is relatively resilient.

15.4 Impact assessment

Do nothing scenario

15.4.1 The existing environment section and **Appendix 15.2** detail the current level of activity and the relative patterns of activity at the current time. In the do nothing scenario it is not expected that the patterns presented in the exiting environment would change. In event of changes to fisheries management of biological stock changes, the current low level of activity in the study area would be unchanged. Furthermore, any changes in the wider region would not be impacted or exacerbated by the Project. There will therefore continue to be minimal commercial fishing in the study area and commercial fisheries and aquaculture vessels will continue to routinely transit the study area.

Potential impacts during the construction phase

15.4.2 Five potential impacts of construction on commercial fisheries have been examined during the EIA process: (1) exclusion from fishing grounds; (2) displacement of fishing effort; (3) physical interactions between fishing gear and construction works; (4) biological changes – abundance, range behaviour of target species; and (5) restricted access to fishing grounds on either side of the construction site.

15.4.3 Typically impacts during construction will be short lived and spatially restricted. Due to the varied nature of the fleet, the wide choice of local fishing grounds and the low level of existing activity in the Kyle Rhea narrows, the fleet is generally resilient to most potential impacts, as detailed below.

Impact 1: Exclusion from fishing grounds during construction

15.4.4 The only grounds actually closed to fishing during the construction phase would be at the development site. However, there is no evidence of this site ever being fished. No mobile gears (trawl / dredge) tow through the site and tide speed makes fishing with static gear (creels) highly problematic. The period of the development site closure during construction would be short. At most one or two boats would be affected and even then, this would affect less than 1% of their activity. The magnitude of this impact is therefore predicted to be **low**.

15.4.5 The development site is very small compared to the available fishing grounds, and is perhaps the location in the wider area most poorly suited to fishing (due to substrata and tidal strength). The loss of the development site fishing ground will not lead to any change in fleet size. It is possible that fishermen may choose not to fish the study area (i.e. shallower waters at the edge of the narrows) however; at worst only 1 or 2 boats could be affected. This would not lead to a detectable change in landings or effort. The sensitivity of the receptor is therefore considered to be **low.**

15.4.6 Taking into consideration the scale of the impact and sensitivity, the overall significance is considered to be **minor adverse** due to the short time of construction and the restricted space of any closure, combined with the low level of existing activity in the affected area and the plentiful alternative fishing grounds.

Impact 1: Suggested Mitigation
1. No mitigation suggested

Residual Impact:

15.4.7 As no mitigation measures are suggested the residual impact significance will remain **minor adverse**.

Impact 2: Displacement of fishing effort during construction

15.4.8 Any displacement of effort caused by construction would be short lived – during summer months for 1 or 2 years (see Chapter 5, Project Description). The area of potential fishing closed by the construction works will be small and the area where fishing effort may be displaced to is large. The amount of displaced effort will be small and given the low level and infrequent nature of the activity in the area which would theoretically be displaced the impact will be of only **low** magnitude.

15.4.9 Few if any boats will be displaced. Those that are displaced, would typically fish elsewhere in the wider area for most of the year anyway, so it would only be their occasional fishing in the study region which might be displaced. The resulting increase in effort in the wider area would be insignificant and perhaps undetectable. Certainly it would be undetectable from the perspective of overall fleet landings and would likely also be undetectable even at the point of view of individual vessel landings and would not impact on fleet earnings or fleet size. The sensitivity is therefore deemed to be **low**.

15.4.10 Given the spatially and temporally restricted nature of any impact and the very low level of vessels occasionally displaced and the fact that those vessels already routinely fish in a wide range of alternative places. Any displacement of effort would be of **minor adverse** significance.

Impact 2: Suggested Mitigation
1. No mitigation suggested

Residual Impact:

15.4.11 As no mitigation measures are suggested the residual impact significance will remain **minor adverse**.

Impact 3: Physical interactions between fishing gear and construction works

15.4.12 There is no reason for fishing gear to contact construction works as gear is not placed at the development site. However, vessels fishing within the study region - for example at either end of Kyle Rhea - may be exposed to increased risk of gear coming in to contact with construction works but only in event of mechanical problems, resulting in the vessel drifting with the tide. Alternatively a vessel may drift with the tide whilst attempting to sort a tangled fleet of creels, which could again result in contact between the vessel / gear with the construction work. The magnitude of potential impact is therefore **low**.

15.4.13 It is unlikely that perceived risk of contact between fishing gear and the construction work would cause any change in fleet fishing patterns. Therefore any change in behaviour resulting from the apparent risk of contact would not result in a detectable change in overall landings in the wider area, and would not affect the overall number of fishing days. However, it is possible that some local vessels may change fishing patterns during construction therefore the sensitivity of the fleet to the impact is **low**.

15.4.14 This is a low risk, with very few vessels exposed to the risk of contact between gear and construction works. Such contact would only be the result of rare mechanical failure, on a rare occasion when a vessel was fishing in the tidal influence of Kyle Rhea, and only if the tide was flowing in the direction to carry the boat toward the development site. The consequence of any such contact is unlikely to cause significant damage to the fishing vessel or gear - but may cause delay to construction operations. Overall the level of significance of the impact is considered **minor adverse**.

Impact 3: Suggested Mitigation
1. In spite of the only 'minor' status of significance, a potential mitigation to be considered would be a patrol vessel on standby during construction able to tow any vessel drifting with the tide and either without power or restricted in their ability to manoeuvre. 2. Clear announcement in the form of notice to mariners or contact via the FLO should reduce the risk further by discouraging fishing within the immediate tidal influence of Kyle Rhea during construction. 3. A precautionary no fishing area could be established in consultation with the industry during the main installation phases.

Residual Impact:

15.4.15 The mitigation suggested would represent best practice and the residual impact will be of **negligible** significance.

Impact 4: biological changes – abundance, range behaviour of target species

15.4.16 The impacts and commercial consequences of any biological changes resulting to fish populations as a result of construction are considered. These have been informed by the conclusions of the Fish and Shellfish Chapter (Chapter 14 of this EIA).

15.4.17 The greatest potential impacts on local fish populations are likely to be during construction as a result of drilling into bedrock creating localised noise pollution, minor changes to water chemistry, sedimentation patterns and turbidity. Chapter 14 also highlights the potential risk of pollution as a result of accidental damage of construction vessels.

15.4.18 The biological changes are deemed to be small, reversible and localised. This is both as a result of the low level of expected pollutant release but also due to the nature of the site i.e. rapid tidal currents with hard substrates means the site is unlikely to be used by fish and shellfish species for spawning and nursery grounds.

15.4.19 The commercial impact of any biological change would be felt in the study region only – not in the wider area – and would be reversible in under a year. However any such changes would likely be undetectable. Overall therefore the magnitude of impact is likely to be **low**.

15.4.20 Fishing patterns are unlikely to be affected by changes to species abundance, range or behaviour resulting from construction works. In the unlikely event of changes in the quality of 'fishing' in the study region (reduced catches or poorer catch quality), then any such changes could at worst lead to less fishing in the study region, but would have no overall impact at the wider area level or on overall fleet size or landings. As a result the sensitivity of the fleet to impact is **negligible**.

15.4.21 The overall significance of biological changes to fish populations as a result of construction works is therefore considered to be **negligible**.

Impact 4: Suggested Mitigation
1. Any mitigation is related to minimising the biological impact on fish and shellfish and is therefore outlined in Chapter 14, Fish and Shellfish

Residual Impact:

15.4.22 As no mitigation measures are suggested the residual impact significance will remain negligible.

Impact 5: Restricted access to fishing grounds on either side of the construction site

15.4.23 Chapter 17, Shipping and Navigation describes the potential for rerouting vessels during installation works, either using a channel through Kyle Rhea which is away from the centre of the kyle or travelling around the west of Skye, both of which are predicted to have a moderate risk[38]. Foundation installation will take approximately 2 months during the summer of the first year of installation works. Device installation will take approximately 3 months during the summer of the second year of installation. The impact of any restricted fishing vessel movements in the Kyle Rhea channel would have a noticeable impact for a few affected vessels, therefore the magnitude of impact is likely to be **medium**.

15.4.24 Any fishing boat which transits Kyle Rhea is potentially sensitive to restricted access during construction. Most affected are local inshore boats which routinely transit the narrows to access grounds, but larger offshore boats fishing outside 43E4 which more occasionally steam through may also be affected. Larger vessels may be able to travel west of Skye to access grounds, but inshore vessels may temporarily be prevented from accessing preferred grounds at preferred times of year, although they would likely still fish. So there would be no impact on fleet size. Overall the level of sensitivity of the fleet to this impact is considered to be **medium**.

15.4.25 From the perspective of commercial fishermen, this is potentially the biggest impact of the construction phase, risking an impact to inshore vessels - potentially even causing them to miss out on preferred fishing opportunities and forgo income. Overall, the number of vessels likely to be affected on a day to day basis is likely to be less than 5, and even then, the impact would only be felt if access through the narrows were prevented completely. These inshore vessels are also those with the best knowledge of the narrows so they may still be able to find clear passage even if the main channel is closed. For larger offshore vessels the impact is likely to be more of inconvenience and slight increase of costs due to increased fuel costs. Given the scale of impact and the sensitivity of the fleet to the impact the overall significance is considered to be **moderate adverse**.

Impact 5: Suggested Mitigation
1. Provide a support vessel to allow safe passage through Kyle Rhea

Residual Impact:

15.4.26 The mitigation suggested would reduce the residual impact significance to **minor adverse.**

Potential impacts during the operation phase

15.4.27 Five potential impacts of operation on commercial fisheries have been examined during the EIA process: (1) exclusion from fishing grounds; (2) displacement of fishing effort; (3) physical interactions between fishing gear and the Project; (4) biological changes – abundance, range behaviour of target species; and (5) restricted access to fishing grounds on either side of the Project.

15.4.28 Typically impacts during operation will be felt for the whole lifetime of the Project although

[38] Multiple moderate or single serious injury

they will still be spatial restricted. Due to the varied nature of the fleet and the wide choice of local fishing grounds and the low level of existing activity in the Kyle Rhea narrows, the fleet is generally resilient to most potential impacts, as detailed below.

Impact 6: Exclusion from fishing grounds during operation

15.4.29 The only potential grounds actually closed to fishing during the operational phase would be at the development site, which will be closed to fishing for the whole life of the Project. However, there is no evidence of this site being fished – either from survey work, industry questionnaires, or consultations. No mobile gears (trawl / dredge) tow through the site and tide speed makes fishing with static gear (creels) highly problematic. At most one or two boats would be affected in the study area (i.e. those fishing at the edges of the narrows) and even then, this would affect less than 1% of their activity. However any impact would be felt for the working life of the installation – therefore the magnitude of impact is considered to be **low**.

15.4.30 The development site is very small compared to the available fishing grounds, and is perhaps the location, in the wider area, most poorly suited to fishing (due to substrata and tidal strength). The loss of the development site fishing ground will not lead to any change in fleet size, at most 1 or 2 boats could be very occasionally affected - but these boats rarely (<10%) fish in the Kyle Rhea narrows, far less at the development site, with ample alternative fishing opportunities. This would not lead to a detectable change in landings or effort – either at a fleet or individual vessel level. Overall the sensitivity to the impact is considered to be **low**.

15.4.31 Although a small area will be closed for the life of the Project (the development site) this area is so rarely and so lightly fished that the change of effort to other local fishing grounds (where the inshore fleet already fishes) will have little impact on fleet landings, fleet size or fishing activity - therefore is of only **minor adverse** significance.

15.4.32 Conversely, as the area closed to fishing will be so small and an area that is not fished, there will be no benefit from the closure in terms of providing protected area or sanctuary for commercial species.

Impact 6: Suggested Mitigation
1. No mitigation suggested

Residual Impact:

15.4.33 As no mitigation measures are suggested the residual impact significance will remain **minor adverse**.

Impact 7: Displacement of fishing effort during operation

15.4.34 Potential for effort will be displaced from the development site – although as stated above there is thought to be zero effort currently, while to a lesser extent effort may be also displaced from the study area (Kyle Rhea narrows). Although any such potentially displaced effort would last the lifetime of the Project, given the small area closed to fishing, the low level of fishing in that area and the fact any displaced effort would be spread over the wider region, the overall impact is considered to be **low**.

15.4.35 The amount of displaced effort will be small. If any vessels are prevented from fishing at the development site, the amount of effort displaced into adjacent grounds will be tiny, with any affected vessels already spending the majority of their fishing time those same adjacent waters. This fractionally increased effort in adjacent waters will be largely undetectable and will have no detectable impact on stock status of target stocks in adjacent waters (no decrease in CPUE) and would be inconsequential in comparison to normal variations in natural mortality. Overall the sensitivity to the impact is rated as **low**.

15.4.36 Although the impact may be long lasting and widespread - it will be largely undetectable against background variations in landing patterns, and will therefore only be of **minor adverse** significance.

Impact 7: Suggested Mitigation
1. No mitigation suggested

Residual Impact:

15.4.37 As no mitigation measures are suggested the residual impact will be of **minor adverse** significance.

Impact 8: Physical interactions between fishing gear and the Project

15.4.38 The risk of impact between fishing gear and the devices will exist throughout the whole lifecycle of the Project, and although any contact will be restricted to the development site, concern over the potential for impact may influence fishing patterns in the study region. This may lead vessels fishing at either end of the Kyle Rhea narrows to adjust fishing patterns if concerned about unintended drift into the narrows. No vessels tow mobile gear in the narrows so there is no risk of contact between mobile gear and the Project. An inshore static gear vessel fishing within the study area (for example in waters to the north and south of the Kyle Rhea narrows, out of the main tidal stream), could potentially drift into contact with the devices in event of mechanical failure, or in event struggling to untangle a fleet of creels. A worst consequence of this would be creels potentially coming into contact with the rotors, leading to loss of gear. The magnitude of impact is therefore considered to be **medium**.

15.4.39 The small number of local inshore vessels who fish using fleets of creels in waters immediately north or immediately south of the study region is low. These vessels could choose to restrict fishing activity at certain tidal cycle times to avoid risk of accidental drift into the narrows, however, even if vessels altered their fishing patterns, it would only affect them on limited occasions (less than 10% of their fishing effort), that they fish these locations and only when the tide was foul. In each case, access to alternative fishing grounds should enable catches to be unaffected. The sensitivity of the fleet to the impact is therefore considered to be **low**.

15.4.40 Although the perceived risk of impact may lead to an adjustment in fishing patterns, due to the low numbers of vessels involved, and the small percentage of overall fishing time that would be affected the overall impact would only be of **minor adverse** significance. The overall fleet pattern of landings would be unchanged and individual vessel incomes should be largely unaffected. In the unlikely event of any contact between gear and the devices, it is possible that a whole fleet of creels may be lost, to the financial cost of the fishermen (estimated value of 1 fleet of 20 creels would be £1,500), although the gear may be recoverable during maintenance operations on the devices. Issues in relation to vessel safety are addressed in Chapter 17, Shipping and Navigation and **Appendix 17.1** Navigational Risk Assessment.

Impact 8: Suggested Mitigation
1. Although due to the very low risk of collisions and the minor conclusion of significance. Consider maintaining a register of any fishing gear lost in the

development site. In event of loss, provide opportunity for affected fishers to grapple for lost gear during routine maintenance operations.

Residual Impact:

15.4.41 The mitigation suggested would represent best practice and the residual impact will be of **negligible** significance.

Impact 9: Biological changes caused by operation – abundance, range behaviour of target species

15.4.42 The impacts and commercial consequences of any biological changes on fish populations as a result of operation are considered. These have been informed by the conclusions of the Fish and Shellfish Chapter (Chapter 14 of this EIA).

15.4.43 The potential biological and physical impacts on local fish populations are considered to be small, short lived and reversible. During routine operation, impacts such as noise pollution or changes to water chemistry, sedimentation patterns and turbidity are likely to be minimal. The consequences of any such impacts on populations is also considered to the minimal due to the nature of the site i.e. rapid tidal currents with hard substrates means the site is unlikely to be used by fish and shellfish species for spawning and nursery grounds.

15.4.44 The commercial impact of any biological change would be felt in the study region only, if at all – not in the wider area. Although the impact of any such changes would last the entire life of the Project, any such changes would be difficult to detect above natural variations therefore the scale of impact is considered to be low.

15.4.45 Biological changes in fish populations as a result of operation would have no change on either fleet size, landings or fishing patterns therefore the sensitivity of the fleet to biological changes caused by operation is considered to be **negligible**.

15.4.46 Overall, in spite of the high potential scale of impact (largely as a result of the long project timeframe), the low sensitively of the fleet to the impact means that the consequence of any biological changes is considered to be of only **negligible** significance.

Impact 9: Suggested Mitigation
1. No mitigation required

Residual Impact:

15.4.47 As no mitigation measures are suggested the residual impact will be of **minor adverse** significance.

Impact 10: Restricted access to fishing grounds on either side of the Project

15.4.48 Any impact caused by restricted access to fishing grounds either side of the Project would be felt, albeit at a low level, over the wider area and would last for the entire lifetime of the Project. This could cause a detectable change in vessel movements, with larger offshore vessels perhaps choosing to transit west of Skye. As a result the potential magnitude of impact is considered to be **high**.

15.4.49 Assuming some safe navigable passage is maintained, it is likely that local trawl vessels either based in Kyle of Lochalsh or Mallaig would continue to transit on a weekly basis to access fishing grounds and the small number of local inshore static gear vessels which currently routinely transit the kyle would continue to do so. This would not affect overall fleet size, and would not influence a decision whether to leave or join the industry. Nor is it expected to impact on overall landings value - although, as a worst case, it could cause some local vessels to remain on their home port side of the narrows, thus potentially causing a slight change in catch composition. The sensitivity of the fleet to this impact is therefore considered to be **low**.

15.4.50 Any restricted access to fishing grounds on either side of Kyle Rhea could have an impact of **moderate adverse** significance on the fishing fleet. Although only a small overall number of vessels could be impacted, these include a range of vessels from small local inshore vessels, to large non-local offshore vessels and any impact could be long lasting. By contrast the consequences of any restricted access would likely be small for the largest offshore vessels, which could simply divert west of Skye, whereas more local vessels may be impacted were there to be any restriction on access.

Impact 10: Suggested Mitigation
1. Ensure a clear safe navigable fairway, at all times (see Chapter 17, Shipping and Navigation.

Residual Impact:

15.4.51 Following the mitigation suggested would provide a residual impact of **minor adverse** significance.

Potential impacts during the decommissioning phase

15.4.52 The impacts produced during decommissioning are expected to be of the same nature and magnitude as those predicted for the construction phase with the exception of drilling which will not occur during decommissioning. Therefore the impacts to fish and shellfish will at worst have the same significance as those assessed during construction.

Potential cumulative impacts

15.4.53 Sea Generation (Kyle Rhea) Ltd is aware of the proposal by Pulse Tidal to develop a tidal array in Kyle Rhea. Although a scoping report has been submitted it is understood that no agreement for lease is in place for this site and therefore it is not currently assessed within the cumulative impacts for this project.

15.4.54 Sea Generation (Kyle Rhea) Ltd are not aware of any other existing of proposed developments that will interact cumulatively with the Project to produce impacts to fish and shellfish species.

15.4.55 Cumulative impacts of this project on top of existing or similar projects in the area have not therefore been assessed.

15.5 Summary

15.5.1 This EIA exercise and supporting matrix demonstrates that the majority of impacts are of either minor or negligible significance. In total 15 possible impacts were identified and examined and of these 12 (80%) were rated as being of either negligible or minor significance.

15.5.2 This grading of most potential impacts on commercial fisheries as minor or negligible, is largely a reflection on the fact that no fishing previously occurred at the development site and only very rare fishing occurs anywhere within the study region. Consequently any impacts through direct closure of grounds, or the resulting effects of any displaced effort would be minor – and in most cases undetectable at the fleet level.

15.5.3 The greatest potential impact of the Project is concluded to be in relation to possible restricted access to fishing grounds on either side of the Kyle Rhea narrows – during construction, operation and decommissioning.

15.5.4 The most important interaction with commercial fishing is therefore not considered to be a direct impact, such of loss of grounds of gear loss, but indirect – potentially impacting on other fishing patterns remote from the study area.

15.5.5 These conclusions are broadly in line with the findings of the consultation exercise (face to face meetings and industry questionnaire) which showed a relative lack of concern within the fishing industry about the direct effects on loss of grounds or consequential loss of earnings. By contrast, the primary and often repeated concern of the fishing industry, in relation to the Project, was in relation to ensuring the safety of all navigation through the Kyle Rhea narrows. These concerns have been passed on to the team undertaking the navigation risk analysis.

15.5.6 The main consideration of mitigation measures therefore relates to ensuring a safe and continued navigable passage for fishing vessels through the Kyle Rhea narrows throughout construction, operation and decommissioning, and at all tidal states.

15.5.7 Such mitigation may include consideration of a convoy vessel to facilitate safe fishing vessel passage at times of construction and decommissioning, a well lit and sufficiently wide navigable channel and consideration of an inshore passage on the opposite side to the Project for local, shallow draft inshore vessels – as is the focus of the Chapter 17, Shipping and Navigation.

15.5.8 Additionally, the EIA process has highlighted 2 possible considerations for mitigation – in spite of the fact that the impacts were rated as minor on account of the very low risk. These were both related to the possible accidental contact between fishing gear and either the construction works or the operating array.

15.5.9 Options to consider would be the maintenance of a register of any fishing gear lost in the development site. In event of loss, provide opportunity for affected fishers to grapple for lost gear during routine maintenance operations. Any patrol or convoy vessels used at the time of construction could also serve the function of towing any vessel with mechanical problems, being carried by the tide, to avoid contact with works.

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16 SEASCAPE, LANDSCAPE AND VISUAL IMPACT ASSESSMENT

Page

16.1 Introduction

16.1.1 This chapter presents the findings of a seascape, landscape and visual impact assessment (SLVIA) for the proposed Kyle Rhea Tidal Stream Array project ('the Project'). It considers the potential impacts of the Project on the seascape and landscape resource and visual amenity. It addresses the following issues:

- Direct impacts on the seascape and landscape resource;
- Impacts on the perception of the seascape/landscape; and
- Impacts on visual amenity.

16.1.2 Seascape and landscape impacts are direct changes in the baseline resource and perception of the seascape/landscape character. These differ from visual impacts, which relate to the appearance of these changes and the resulting impact on visual amenity.

16.1.3 The purpose of this assessment is to:

- determine the landscape, seascape and visual baseline for assessing to what degree the Project will fit into the receiving environment;
- identify the likely impacts of the Project on both the characteristic elements of that seascape/landscape and the quality of view, or visual amenity, currently experienced by local people and visitors;
- consider potential mitigation of effects in order to retain, protect and improve the seascape/landscape and visual amenity; and
- assess the predicted residual impacts that the Project will have on the landscape and visual amenity of the study area.

Study area

16.1.4 The assessment is focussed on a 5km radius centred on the Project area. The size of the study area has been based primarily on the main extent of predicted landward visibility. However, the assessment has been extended to take account of more distant and sensitive viewpoints i.e. Reraig and Meall Buidhe (on the edge of the Knoydart National Scenic Area).

Overview of potential impacts

16.1.5 The key objectives of this chapter are to assess the landscape, seascape and visual impacts of the Project. The key issues are likely to comprise potential impacts on:

- a relatively remote area that is used primarily for forestry, farming, tourism, recreational boating and fishing; and

- the perception of seascape/landscape character and visual amenity, once the Project is operational.

Policy, legislation and guidance in relation to seascape and visual impacts

16.1.6 The seascape/landscape and visual impact assessment (SLVIA) has been based on guidelines and information provided in the following publications:

- Guidelines for Landscape and Visual Impact Assessment 2nd Edition (Landscape Institute and Institute of Environmental Assessment, 2002);
- Guidance on Landscape/Seascape Capacity for Aquaculture (SNH, 2008)
- An assessment of the sensitivity and capacity of the Scottish seascape in relation to windfarms (SNH, 2005);
- Scottish Marine Renewables SEA, Environmental Report Section C SEA Assessment: Chapter C19: Seascape Assessment (Scottish Executive 2007);
- Guide to Best Practice in Seascape Assessment (Countryside Council for Wales, 2001);
- Landscape Character Assessment Guidelines (The Countryside Agency and Scottish Natural Heritage, 2002).
- Seascape and Visual Impact Assessment Guidance for Offshore Wind Farm Developers (DTI, 2005):
- Highland Wide Local Development Plan (The Highland Council, adopted 5th April 2012);
- The Highland Renewable Energy Strategy and Planning Guidelines (The Highland Council, 2006)
- Strategic Renewable Energy Resource Assessment for the Highland Area (Aquatera for The Highland Council, October 2005)
- West Highlands and Islands Local Plan (The Highland Council, adopted September 2010);
- Skye and Lochalsh Landscape Assessment (SNH, 1996);
- Assessment of Highland Special Landscape Areas (The Highland Council and SNH, 2010);
- Highland Coastal Development Strategy (The Highland Council, 2010);
- Visual Assessment of Wind Farms Best Practice, (SNH 2002);
- Visualisation Standards for Wind Energy Developments (The Highland Council, January 2010); and
- Photography and photomontage in landscape and visual impact assessment, Landscape Institute Advice Note 01/11 (Landscape Institute, 2011).

Key Relevant Policy

16.1.7 At a national level Scottish Planning Policy (SPP) sets out the Scottish Government's policy on nationally important land use planning issues, with the National Planning Framework (NPF) setting out the strategy for long term spatial development. SPP contains a specific section relating to coastal planning, recognising the special qualities of such areas, protecting them where appropriate, but also guiding new development. It also highlights the need for planning authorities to take account of potential impacts on the marine environment when determining planning applications. Consideration of landscape and natural heritage is also included in SPP, placing an emphasis on the protection of landscape character and quality, particularly in the most sensitive locations. It also reflects on the need to recognise and facilitate positive change in the landscape, whilst maintaining and enhancing character.

16.1.8 The NPF reinforces the key themes set out in SPP, particularly the need to protect and value landscape, including coastal landscapes and seascapes. It also highlights that landscapes evolve continuously in response to various factors and recognises the need to consider such change in decisions. The NPF also sets out the positive role played by renewable energy in Scotland, also specifically identifying the considerable potential for harness the energy of tidal streams off to the north and west coasts.

16.1.9 SNH has specific policy statements in relation to wild land, having also identified search areas for wild land (SAWL). These search areas have been reviewed and it has been identified that the Project is not located within or near any SAWL. There are also no SAWLs within the 5km study area, with the closest ones covering part of the Knoydart National Scenic Area and a second lying to the east of Loch Duich. The five maps associated with mapping Scotland's wildness[39] and wild land have also been reviewed. Each of these elements is challenging to describe in detail for the entire study area, but the following points summarise the maps:

- Wildness (the overall evaluation, factoring in the results of the following four individually mapped layers) is generally evaluated as low within glens and along parts of the coastal edge. This wildness evaluation increases to medium or above elsewhere in the study areas. The areas having high wildness evaluation within the study areas, are small, fragmented and dispersed;
- Perceived naturalness is generally relatively high, but with areas evaluated as low to medium within glens and along parts of the coastal edge;
- The presence of rugged or challenging terrain is quite variable, ranging from low to high;
- Remoteness from roads and ferries is generally evaluated as low to medium, increasing in the more elevated parts of the study area; and
- Absence of modern artefacts is generally evaluated as low to medium, but with some upland areas evaluated as high.

16.1.10 Analysis of the Proposals Map for the Highland Wide Local Development Plan (adopted 5th April 2012) identifies that the majority of land to either side of Kyle Rhea is defined as being of local/regional importance. Kyle Rhea itself is identified as being of international importance, although this is in relation to its Natura designation rather than landscape

39 http://www.snh.gov.uk/protecting-scotlands-nature/looking-after-landscapes/landscape-policy-and-guidance/wild-land/mapping/

character or quality. The wider landscape varies, with land to the west of Kyle Rhea (on the Isle of Skye) being of international importance, particularly the elevated ground (reflecting its Natura designation). The land to the east of Kyle Rhea is typically of local/regional importance, with some of the elevated land being designated as wider countryside. There are areas of national importance to the east and south of Kyle Rhea, with larger areas coinciding with the NSA.

16.1.11 The key policies of the Highland Wide Development Plan are Policy 36, 49, 57, 61 and 67. Policy 36 relates to development in the countryside, reinforcing similar principles to the other policies in relation to the design of new development, the need to consider local context and protect landscape character and quality. While Policy 36 excludes consideration of renewable energy development, it still contains themes that are relevant. Policy 49 also relates to coastal development, placing an emphasis on the need to protect coastal qualities, character and value from new development. This policy also refers to the Highland Coastal Development Strategy, which is considered further below. Policy 57 covers the protection of Natural, Built and Cultural Heritage that are identified as being or local/regional, national or international importance from changes associated with development proposals, with the level of protection afforded by the policy increasing with the defined importance. The protection of landscape character and the need evaluate the potential impacts of Project are also set out in Policy 61. Policy 61 also refers to the design of new development, including scale, form, pattern and materials. Policy 67 directly relates to renewable energy schemes, it identifies that the potential impacts of a Project will be balanced against the potential benefits. The policy goes on to make reference to landscape and visual impacts and repeats themes covered in other policies in relation to the need to consider design and context.

16.1.12 It is also noted that the Vision and Spatial Strategy for the West Highlands and Islands (Figure 2 within the Highland Wide Local Development Plan) suggests that Kyle Rhea forms a "renewable resource". There appears to be no other reference to this renewable energy resource within the Development Plan, with the exception of general comments in relation to the opportunities that renewable energy offers for economic diversification. The same diagram also identifies a "national/strategic footpath/cycleway" along the northern side of Loch Hourn, eastern side of the Sound of Sleat and crossing Kyle Rhea at the ferry crossing. However, no sources making reference to this long distance route can be found, therefore it is unclear if this is an aspiration rather than an established route.

16.1.13 The Highland Coastal Development Strategy (The Highland Council, 2010) has been reviewed in relation to the Project. This divides The Highland Council area into the east, north and west coast, with the Project lying in the latter of these areas. The west coast is noted in the Strategy for its strong identity and national, if not international reputation for scenic quality. The Strategy also identifies the qualities associated with remoteness and wild land that apply to this area, while at the same time recognising the pressures for development in more accessible and sheltered locations, with the balance between these different issues/qualities being highlighted as key challenges. It also identifies development opportunities for the Highland west coast, specifically mentioning both renewable energy and landscape. It refers to the potential for tidal energy but also suggests that the west coast is less conducive to large scale development than other areas. It also hints that smaller scale development may be more appropriate and suggests that sub-sea tidal power installations may be easier to reconcile with other interests than wind or wave power developments. In terms of landscape, the analysis of opportunities reiterates the value attached to the west coast, highlighting the importance of appropriate location, scale and design when safeguarding local character. The Strategy also provides an approach to and definitions for the classification of the coast, which are adapted from National Planning Policy Guidance Note 13 Coastal Planning, now superseded by Scottish Planning Policy (SPP). This identifies three categories:

- Developed coast (including towns, cities, industrial and energy developments etc.);
- Undeveloped coast (including forestry, agriculture, low intensity recreational use and smaller settlements, also reflecting on the protection that is often afforded to such areas through designations; and
- Isolated coast (being distant from centres of population and lacking signs of development, such areas are also likely to be relatively inaccessible, and again noting that such areas are likely to be protected through designation.

16.1.14 The policy approach applied to the coast is also set out in the Strategy, with the key objectives being the delivery of high standards in the design of new development and the protection of character, feature and areas of defined value (designations). It also sets out more specific objectives for the different categories. Given the characteristics of the study area, it is considered that much of it fits with the "undeveloped coast" category, particularly in close proximity to the Project. In addition, it is recognised that certain parts of the study area may also fit with the "isolated coast" category, particularly more exposed elevated locations. Within undeveloped coast development proposals should "yield social and economic benefits sufficient to outweigh any potentially detrimental impact on the coastal environment" and demonstrate that "there are no feasible alternative sites" that might be better suited. Within areas of isolated coast "there should be a presumption against new development" and such areas should be protected by "policies to safeguard their character".

16.1.15 The Highland Renewable Energy Strategy and Planning Guidelines (The Highland Council, 2006) cover similar themes to the other local policy documents (with regard to landscape and visual issues). They highlight the need to minimise potential landscape and visual impacts wherever possible, including wild land and wider amenity interests. These guidelines identify Kyle Rhea as a "primary development area" for tidal energy projects. In addition, the Strategic Renewable Energy Resource Assessment for the Highland Area (Aquatera, for The Highland Council, October 2005) also identifies Kyle Rhea as a potential site for tidal energy development.

16.1.16 The West Highland and Islands Local Plan (The Highland Council, adopted 2010) also seeks to protect landscape character, quality and value. The key policies that are relevant to this assessment being Policy 3 Wider Countryside and Policy 4 Natural, Built and Cultural Heritage. Policy 3 sets out that development proposals will be evaluated carefully, including consideration of design, relationship with the local context and compatibility with landscape character and capacity. Policy 4 sets out the decision making process and protection afforded to natural, built and cultural heritage assets, with an emphasis on providing protection from inappropriate development.

16.2 Methodology

Consultation

16.2.1 The original scoping report (Marine Current Turbines, 2010) suggested that the assessment would comprise a review of published landscape and seascape character assessments, together with an assessment based on professional judgement and visibility mapping. However feedback included in the Scoping Opinion from Marine Scotland (**Appendix 4.1**) identified that a seascape, landscape and visual impact assessment would be required to identify the potential impacts associated with the Project.

16.2.2 The detailed scope and approach to the assessment has been discussed with officers of The Highland Council (THC) and Scottish Natural Heritage (SNH). A copy of the detailed scoping note provided to these consultees is included in **Appendix 16.1**. The key comments made in relation to the proposed scope (and the corresponding responses) are set out in Table 16.1 below:

Table 16.1: Summary of Seascape/Landscape and Visual Impact Assessment (SLVIA) Consultee Responses (to detailed scoping note)

Comment	Summary of Response
General comment suggesting that the approach is reasonable, with some points of advice provided. (THC)	Points made acknowledged and factored into the assessment.
Some comments made in relation to colouring and lighting, particularly in relation to fact that requirements are likely to make the structures stand out. (THC)	Limited response can be made at this point, dependant on final outcomes with other consultees with regard to navigation.
Viewpoints seem okay, but suggestions made for viewpoints on Beinn Aslak's north east ridge and Beinn Bhuidhe. (THC)	Additional viewpoints suggested included in the assessment.
Illustrate main permutations in the assessment e.g. operational and maintenance positions of devices. (THC)	Factored into the assessment.
Positive comments regarding consideration of lighting, further comments about different types of conditions. (THC)	Factored into the assessment.
Comments about focal lengths and visualisations. (THC)	Factored into the assessment
General comment identifying that the approach is well considered, with some points of advice provided. (SNH)	Points made acknowledged and factored into the assessment.
Advice provided in relation to relevant guidance and policy documents. (SNH)	Factored into the assessment.
Comments in relation to viewpoint selection, including consultation with the Local Planning Authority. Also a specific comment in relation to views from "isolated coast", specifically the Knoydart National Scenic Area. (SNH)	The Highland Council (the Local Planning Authority) has been consulted, with comments detailed above. Viewpoint from the edge of the Knoydart National Scenic Area (Viewpoint 9, Meall Buidhe) is included in the assessment.
Identification of recognition as a Dark Sky Discovery Site, highlighting the need for evaluation of this. (SNH)	Factored into the assessment.
Comments about colouring and the need to explore options. (SNH)	Limited response can be made at this point, dependant on final outcomes with other consultees with regard to navigation.
Cumulative assessment; no other developments identified. (SNH)	Factored into the assessment.

General Approach

16.2.3 The general approach to the SLVIA includes the following key tasks:

- Desk study and preliminary site survey;
- Baseline SLVIA (consisting of desk study, field survey and reporting); and
- Assessment of residual seascape/landscape and visual impacts.

Baseline Assessment

16.2.4 The first stage of the assessment reviewed the existing seascape/landscape and visual resource of the study area in terms of its character, quality (i.e. condition) and sensitivity. The baseline assessment forms the basis against which to assess the magnitude and significance of the predicted seascape/landscape and visual impacts arising from the proposed development.

16.2.5 The baseline assessment has three elements as follows:

- Description – the process of collecting and presenting information about seascape/landscape and visual resources in a systematic manner;
- Classification – the more analytical activity whereby seascape/landscape resources, in particular, are refined into units of distinct and recognisable character; and
- Evaluation – the process of attributing a sensitivity to a given seascape/landscape or visual resource, by reference to specified criteria.

16.2.6 The baseline assessment process comprises three stages:

- Desk study;
- Field survey; and
- Analysis.

Desk Study

16.2.7 As part of the desk study, the baseline seascape/landscape and visual resource was defined within the area surrounding the Project and the main users of the area, key viewpoints and key features were identified. Existing map and written data about the site and its environs within the study area were reviewed, including:

- Ordnance Survey map data;
- Detailed survey data for the application site; and
- Plans, elevations and description of the proposed development.

16.2.8 The desk study also identified and classified potential visual receptors according to their associated land use (settlements, footpaths, roads etc.) The aim of the baseline visual assessment was to ensure that a representative range of viewpoints was included in the visual assessment. The potential extent of visibility of the Project was identified by the generation of a ZTV, reference to Ordnance Survey map data and observations made in the field. Following this, the potential visual receptors likely to be affected by the Project were identified. A preliminary selection of viewpoints was made to ensure that the viewpoint assessment included a representative range in relation to the following criteria:

- Type of receptor – based on above, and including different seascape/landscape character areas;
- Elevation;
- Distance of receptor from proposed development; and
- Direction of receptor from the Project, with the aim of achieving a distribution from different compass points around the Project.

16.2.9 The desk study provided the basis for subsequent field survey work. It enabled the delineation of draft seascape/landscape character areas within the study area and the identification of the principal viewpoints and receptors, which were subsequently confirmed during the field survey.

Field Survey

16.2.10 Field survey was undertaken during October 2011 and October 2012 to verify the seascape/landscape character within the study area and gain a full appreciation of the relationship between the Project and the receiving seascape/landscape.

16.2.11 Field survey work also verified the suitability of the proposed viewpoints. This involved checking the initial viewpoint selection on the ground, to ensure that there would be views of the Project from these locations. In some instances, this can be remedied by slight adjustments of the grid references, although this has to remain relevant to the particular receptor(s) for which the viewpoint was selected. It is also important to ensure that the selected viewpoints are a representative view, and demonstrate the maximum potential visibility of the Project for the selected location. Field survey work was also undertaken to establish the night time context of the site. This focussed on revisiting a selection of the viewpoints used in the day time assessment, together with general observations within the wider study area. The fieldwork was supported by analysis of Ordnance Survey maps and observations were recorded with photographs.

Analysis and Reporting

16.2.12 Analysis and reporting of the baseline environment took place after completion of the desk and field surveys. The baseline seascape/landscape assessment provided a description, classification and evaluation of the seascape/landscape of the study area, from which to assess the potential seascape/landscape impacts of the Project. The baseline visual assessment provided an initial list of locations for the viewpoint assessment, with details regarding grid reference, distance from the proposed development, receptors and rationale for selection, from which to assess the potential visual impacts of the proposed development. The baseline assessment is supported by Figures 16.1.1 to 16.1.4, which illustrate the seascape/landscape context of the Project Site and surrounding area.

16.2.13 The baseline assessment provides a robust description of the seascape, landscape and visual resource. This forms a basis from which to assess the seascape, landscape and visual impacts of the Project and advise on the acceptability of The Project in principle. The baseline assessment contributed to identifying the potential mitigation measures.

Impact Assessment

16.2.14 The impact assessment aims to:

- Identify systematically all the potential seascape, landscape and visual impacts of the

Project taking account of the proposed mitigation measures;

- Predict and estimate their magnitude as accurately as possible; and
- Assess their significance in a logical and well–reasoned fashion.

16.2.15 The assessment describes the changes in the character and quality of the seascape/landscape and visual resources that are expected to result from the Project. It covers both seascape/landscape impacts, i.e. changes in the fabric, character and key defining characteristics of the seascape/landscape; and visual impacts, i.e. changes in available views of the seascape/landscape and the significance of those changes on people.

16.2.16 In assessing seascape/landscape impacts, the potential direct impacts on the fabric of the seascape/landscape are considered, together with the potential impacts on the perception of seascape/landscape character. The latter depends on a number of factors:

- The nature of the seascape/landscape character area, including factors such as the nature of views and sense of enclosure;
- The extent of the potential visibility of the Project (e.g. the number and extent of the development seen);
- The proportion of character area with potential visibility; and
- The distance to the Project.

16.2.17 The baseline seascape/landscape character assessment together with an assessment of the potential impacts on each character area, along with consideration of the extent of potential significant impacts on the seascape/landscape, is included in the assessment.

16.2.18 Indicative device locations were provided in WGS84, UTM30N co-ordinates which have been converted using the Franson Coordinate Transformer (version 2.3). These device locations were used in the preparation of zones of theoretical visibility and visualisations.

16.2.19 Computer generated zones of theoretical visibility (ZTV) have been generated in order to ascertain the potential extent of visibility of the Project within the surrounding area. The ZTVs have been modelled using a computer based visibility analysis package and are based on Ordnance Survey Profile digital height data and details of the Project.

16.2.20 The ZTVs of The Project are typically based on the analysis of the height of the main structure of each device above Ordnance Datum (15.35m), which is 18m above Chart Datum. In addition, a ZTV has also been prepared for the top of the isolated hazard marker (19.8mAOD) to demonstrate the potential visibility of this element of the Project (Figure 16.2.4). The ZTVs are included in Figures 16.2.1 to 16.2.4. In addition, the footprint of the ZTV is also included in Figures 16.1.1 to 16.1.4 in order to demonstrate the extent of visibility in relation to character areas/types and designations.

16.2.21 The ZTVs are based on digital terrain data (10m grid) and do not take account of local landforms, buildings or vegetation. Actual visibility on the ground is predicted to be less than that indicated on the ZTV due to the screening effects of surface features. The ZTV has been used to identify the general extent of visibility of the devices within the study area. This also allowed the initial selection of representative viewpoints, which are then checked in the field for their suitability.

16.2.22 A viewpoint analysis has been carried out to identify and evaluate the potential impacts on and visual amenity arising from the Project at specific representative locations in the study area. The viewpoints selected are considered to be representative of the spectrum of receptors in the study area, located at different distances, directions and elevations relative to the Project. The locations of all the viewpoints included in the assessment are shown in Figure 16.3.1. The overall approach to the assessment, including the viewpoints selected, was agreed with statutory consultees.

16.2.23 Visualisations (photomontages and wireframes) have been prepared for the Project when devices are in operational and maintenance positions. Photographs were typically taken using a 35mm equivalent digital SLR camera (Canon 5D mark II) with a 50mm lens (Canon f1.4). The only exception to this was viewpoint 4, where a 20mm focal length (20mm on a Canon 17-40mm f4.0 lens) was used due to the location of the viewpoint relative to the Project (explained in more detail in the analysis of this viewpoint). The use of a 20m lens has been discussed with officers of The Highland Council. They appreciate the technical constraints and accept that an alternative approach may be required in certain circumstances. They also requested that an explanation for the approach taken be included in the assessment; this is provided in the analysis of viewpoint 4. The camera was mounted in landscape format on a tripod and levelled Manfrotto 303SPH panoramic head at 1.5m above ground level for all viewpoint photography.

16.2.24 Night time photomontages have been prepared for Viewpoints 1 (Figures 16.4.1i and 16.4.1j) and 6 (Figure 16.4.6h and 16.4.6i). The night time photomontages have been prepared to provide an indication of how the device (and associated lighting) may be perceived at night. The preparation of night time photomontages requires a degree of judgement and the depiction of the lighting has been informed by a photograph of MCT's operational device at Strangford Lough. It should also be note that while the photomontages provide an indication of the likely light requirements these will be finalised post submission (in consultation with the Northern Lighthouse Board and Maritime and Coastguard Agency).

16.2.25 The Visualisation Standards for Wind Energy Developments (The Highland Council, January 2010) refer to the preparation of A3 black and white transparencies (based on single frame 50mm photomontages). These have not been prepared for this assessment due to the different characteristics of the Project (compared with a wind energy development) and the local context. The position of the Project, within Kyle Rhea and surrounded by landforms, means it would be typically seen against the landscape, which would limit the use of transparencies unless certain elements of the landscape are removed from the images. The approach taken has been discussed and agreed (verbally) with officers of The Highland Council.

16.2.26 A limitation of the digital terrain data is that it is set at (approximately) Ordnance Datum for offshore areas. The consequence of this is that the wireframes do not reflect the maximum extent of each device that would be visible at low tides. The difference between Ordnance Datum and Chart Datum (CD) is 2.65m. While more of the structures would be visible at low tides than is shown in the photomontages and wireframes, it is not anticipated that this would influence the findings of the assessment.

16.2.27 The photomontages have been prepared to try to depict the realistic extent of the devices that would be theoretically visible at the time and day the photography was taken. This involved estimating the tide height based on data obtained from the UK Hydrographic Office. The photomontages also incorporate a wake around each of the devices, this has been based on images of the existing SeaGen installation in Strangford Lough. It should be noted that this is an impression of how the wake may appear.

16.2.28 The visualisations are presented in Figures 16.4.1 to 16.4.9 and include a series of images for each viewpoint. The first of these images comprises a map showing the viewpoint location, direction of view and angle of view included in subsequent photographs/visualisations. The direction of view/included angle has been selected for each viewpoint to ensure that all four devices are visible. In some instance the devices are positioned towards one side of the view to ensure that local references (e.g. slipways) were included. This was done to assist the interpretation of the relative position of the devices at each viewpoint.

16.2.29 The existing view for each viewpoint is included to show the baseline. Panoramic images have been created using frames joined using a combination of Ptgui and Adobe Photoshop CS6 and projected cylindrically. Single frame images are planar projection and use individual frames from the 35mm camera/50mm lens combination described above (or an extract from them). Visualisations comprise both wireframes and photomontages or wireframes over the photographs (depending on the distance between the viewpoint and the Project), initially showing the devices within a panorama or wide angle view, then showing the devices in a 50mm single frame (with no cropping) and an equivalent 70 or 75mm single frame (cropped from the 50mm single frame). The only exception to this is viewpoint 4, where a slightly different set of images is presented due to the use of the 20mm lens. The focal length, included angle, camera details and other viewpoint information is included within the figures. The night time view has also been recorded with photographs at several viewpoints. These were recorded using the same camera and lens combination as the day time photographs and presented in panoramas.

16.2.30 The visualisations have been prepared using a combination of ReSoft WindFarm and Rhino 3D modelling software. The viewing distance has been calculated using ReSoft WindFarm. The visualisations have been also prepared with reference and cognisance of relevant guidance, including that published by The Highland Council, Scottish Natural Heritage and the Landscape Institute.

<u>Assessment criteria</u>

16.2.31 The aim of the environmental assessment is to identify, predict and evaluate potential key impacts arising from the Project. Identified impacts are quantified wherever possible, however the nature of seascape/landscape and visual assessment requires an element of interpretation using professional judgement. In order to provide a level of consistency to the assessment, the prediction of magnitude and assessment of significance of the residual seascape/landscape and visual impacts have been based on pre–defined criteria.

<u>Seascape/landscape sensitivity</u>

16.2.32 The capacity of the seascape/landscape to accommodate change of the type and scale associated with the installation of the Project has to be assessed. Part of this process involves a baseline assessment of seascape/landscape sensitivity, or vulnerability to change, in the context of these proposals.

16.2.33 According to the Landscape Institute guidelines: ‘The degree to which a particular [seascape or] landscape type or area can accommodate change ….. will vary with:

- existing land use;
- the pattern and scale of the [seascape or] landscape;
- visual enclosure/openness of views, and distribution of visual receptors;
- the scope for mitigation, which will be in character with the existing [seascape or] landscape;
- the value placed on the [seascape or] landscape.’

16.2.34 Key characteristics likely to be affected by the Project are evaluated, taking into account ‘quality, value, contribution to landscape character, and the degree to which the particular element or characteristic can be replaced or substituted'.

16.2.35 In order to evaluate the sensitivity of the landscape the criteria outlined in Table 16.2 have been used, based on the Landscape Institute's guidelines.

Table 16.2: Landscape Sensitivity

Description	Sensitivity
Seascape/landscape with important components, usually of particularly distinctive character and high quality, susceptible to relatively small changes and for which mitigation will be difficult or not possible. Some less distinctive or lower quality seascapes/landscapes may also fall into this category where characteristics are such that mitigation of negative changes will be difficult.	High Sensitivity
Seascape/landscape with characteristics reasonably tolerant of changes or for which mitigation is likely to be possible. These seascapes/landscapes may be of high quality or of distinctive character but will usually be relatively ordinary and moderately valued.	Medium Sensitivity
A less distinctive or relatively poor seascape/landscape with few features of quality or interest, potentially tolerant of substantial change and with scope for mitigation of any negative changes.	Low Sensitivity
Considerably modified or degraded seascape/landscape, with few/no features of quality or interest e.g. heavily industrialised landscapes	Negligible Sensitivity

16.2.36 As mentioned above, in some instances a seascape/landscape with important components and high quality may be of a lower sensitivity as a result of its potential tolerance to change and opportunities for mitigation, e.g. a variable landform or high levels of tree cover. Conversely a landscape with few features of interest may be of a higher sensitivity because it is vulnerable to change, e.g. a flat landscape with an open character providing little opportunity to mitigate change. Change in this context can be either positive or negative.

16.2.37 Having described the seascape/landscape resource and the key components that contribute to the character of the seascape/landscape type, and having categorised the sensitivity of each seascape/landscape type to change, the probable magnitude of change sustained as a result of the Project is assessed. This change could be adverse, neutral or beneficial, the assessment of the magnitude of change is described below.

Visual receptor sensitivity

16.2.38 The sensitivity of a visual receptor is based on the viewers' familiarity of the scene, the activity or occupation that brings them in contact with the view and the nature/frequency of the view, whether full, filtered or glimpsed. Visual receptor sensitivity is defined as high, medium, low or negligible as shown in Table 16.3 below:

Table 16.3: Definition of visual receptor sensitivity

Sensitivity of receptor	Definition
High	Users of outdoor recreational facilities whose attention may be focused on the seascape/landscape e.g. people using Public Rights of Way or cruising/sailing in yachts; important seascape/landscape features with physical, cultural or historic attributes; Residents; beauty spots and picnic areas.
Medium	People travelling through or past the seascape/landscape on roads, train lines or

Sensitivity of receptor	Definition
	ferry routes.
Low	People engaged in active outdoor sports or recreation (other than appreciation of the seascape/landscape), commercial buildings, ships or commercially engaged pedestrians, whose attention may be focused on their work or activity rather than the wider seascape/landscape.
Negligible	Views from heavily industrialised areas.

16.2.39 Having identified the theoretical extent of visibility for the Project and categorised the sensitivity of likely visual receptors to changes in visual amenity, the probable magnitude of change sustained is assessed. This change could be adverse, neutral or beneficial. The analysis of the magnitude of change is described below.

Magnitude of change

16.2.40 The magnitude of visual change is determined by the perceived contrast or integration with the existing features and aesthetic character of the seacape/landscape or view in terms of its form, line, texture and scale. Change is also influenced by intervening screening elements, distance and the duration of the change.

16.2.41 The **magnitude of change** arising from the Project at any particular viewpoint is described as substantial, moderate, slight or negligible based on the interpretation of a combination of largely quantifiable parameters, as follows:

- Distance of the viewpoint from the Project;
- Duration of impact;
- Nature and extent of the impact
- Angle of view in relation to main receptor activity;
- Proportion of the field of view occupied by the Project; and
- Context of the development.

16.2.42 The definition of levels of magnitude are provided in Table 16.4.

Table 16.4: Definitions of magnitude

Level of Magnitude	Definition of Magnitude
Substantial	Total loss or major alteration to key elements / features / characteristics of the baseline (pre–development) conditions such that post development character/composition of baseline will be fundamentally changed.
Moderate	Partial loss or alteration to one or more key elements / features / characteristics of the baseline (pre–development) conditions such that post development character/ composition/ attributes of baseline will be partially changed.
Slight	Minor loss of or alteration to one or more key elements / features/ characteristics of the baseline (pre–development) conditions. Change arising from the loss / alteration will be discernible but underlying character / composition of the baseline condition will be similar to pre development circumstances / patterns.
Negligible	Very minor loss or alteration to one or more key elements/ features / characteristics of the baseline (pre–development) conditions. Change barely distinguishable, approximating to the "no change" situation.

Impact on seascape/landscape character and visual amenity

16.2.43 The significance of any identified seascape/landscape or visual impact has been assessed as major, moderate, minor or no impact. These categories have been determined by consideration of seascape/landscape or visual sensitivity and predicted magnitude of change as described above, with the following matrix (Table 16.5) used as a guide to correlating sensitivity and magnitude to determine significance of impacts.

Table 16.5: Correlation of sensitivity and magnitude of impact to determine the significance of impacts

Seascape / Landscape and Visual Sensitivity	Magnitude of Change			
	Substantial	**Moderate**	**Slight**	**Negligible**
High	Major	Major/moderate	Moderate	Moderate/minor
Medium	Major/moderate	Moderate	Moderate/minor	Minor
Low	Moderate	Moderate/minor	Minor	Minor
Negligible	Moderate/minor	Minor	Minor	Minor

16.2.44 Where the seascape/landscape or visual impacts have been classified as major or major/moderate, this is considered to be a significant impact. This varies slightly from the basis of assessment used in the other chapters in this Environment Statement where significance is deemed to occur for moderate potential impacts. The key consideration in the identification of potential significant impacts reflect professional judgments in relation to the magnitude of the change and how these relate to the sensitivity of a particular receptor. The evaluation of significance in the context of this SLVIA is based on established guidance for the assessment of such impacts, particularly the recommended criteria for sensitivity of receptors and magnitude of change which are used to derive significance as set out in the Guidelines for Landscape and Visual Impacts Assessment (Landscape Institute and Institute of Environmental Management and Assessment, 2002). In this regard the assessment is considered to be consistent with the consensus of professional best practice and is therefore a method which can be repeated and understood by fellow Landscape Architects. It should be noted that significant impacts need not be unacceptable or necessarily negative and may be reversible. The potential impacts associated with the Project are referred to as adverse, neutral or negative where applicable.

16.2.45 The matrix is not used as a prescriptive tool, and the methodology and analysis of potential impacts at any particular location must make allowance for the exercise of professional judgement. Thus, in some instances a particular parameter may be considered as having a determining impact on the analysis.

Limitation of the assessment

16.2.46 Key limitations of the assessment are outlined as follows:

- The assessment has been based on a combination of desk study, and fieldwork carried out primarily from publicly accessible areas;
- Field work has only taken place at one time of year;
- While the study area has been visited at various times and days, observations have only been made during limited weather and sea conditions;
- No offshore survey work has been undertaken as part of the study.

Basis for this assessment

16.2.47 For the purpose of this assessment the Project comprises three distinct phases:

- A temporary installation phase;
- The completed/operational development; and
- Decommissioning

16.2.48 This section should be read in conjunction with Chapter 5, Project Description and Figure 5.1 which illustrates the Project. This section summarises how the main aspects of the Project may affect the landscape and visual amenity of the area, and sets out the parameters that have formed the basis of the assessment.

16.2.49 The following aspects of the Project have been factored into the assessment:

- Consideration of the installation phase (including onshore and offshore activities);
- Consideration of all four devices;
- The maximum anticipated height of the main structure of the devices based on normal operation (15.35m AOD or 18m above Chart Datum);
- Assume all the structures would be coloured yellow and lit at night;
- Consideration of the impacts associated with maintenance works to the devices;
- Consideration of onshore components, including substation and cable connection options;
- The four devices would be positioned towards the southern end of the Array Area (as indicated on Figure 1.1); and
- The operational life of the Project will be 25 years.

16.2.50 Options to minimise potential seascape, landscape and visual impacts are considered and identified in the assessment.

16.3 Existing environment

16.3.1 This section provides a general description of the seascape/landscape and visual context of the Project and study area.

The array area and onshore components

16.3.2 The Project would be located within Kyle Rhea, a narrow straight water between the Isle of Skye and the west coast of mainland Scotland. Kyle Rhea is between approximately 450m and 700m wide, with the narrower part being at the southern end of the channel. The Project will be positioned approximately 200m from the Isle of Skye and 300m from mainland Scotland. The array area is orientated in line with the channel. The Project area is described further (with associated drawings) in Chapter 5 (Project Description).

16.3.3 The Project will also require the installation of a cable to connect the devices to the electricity distribution network. Further details and associated plans are included in Chapter 5, Project Description.

The study area

16.3.4 The SLVIA focuses on a 5km radius area extending from the devices (based on the device locations rather than being site centred). The definition of this study area has been informed by the ZTVs for the devices, included in Figures 16.2.1 to 16.2.4, together with an evaluation of the scale of the proposed devices. The ZTVs identify the potential visibility of the devices and demonstrates that a 5km study area would encompass a large proportion of the land and sea based view shed. The area of potential visibility is largely defined by the channel of Kyle Rhea and the adjacent landform.

16.3.5 It is acknowledged that potential visibility would extend beyond the 5km from the Project area, however increasing separation distance is likely to be a key factor in reducing the potential seascape/landscape and visual impacts of the Project proposed development. The greatest potential impacts are likely to occur at locations in close proximity to The Project, therefore to concentrate the assessment on the area in which the more significant impacts are likely to occur a 5km radius provides the focus for the assessment. In order to acknowledge that the Project will be potentially visible at locations beyond this, the ZTV for the top of the devices (excluding the isolated hazard markers) has also been presented at a smaller scale to show potential visibility over a wider area. Two viewpoints have been included to the north and south of the Project at distances of approximately 6km (Viewpoint 8, Reraig) and 7km (Viewpoint 9, Meall Buidhe).

16.3.6 The land area within 5km of the Project is not designated specifically for its landscape character or quality. However, it is acknowledged that such landscapes lie at greater distance with Knoydart, Kintail and The Cuillin Hills National Scenic Areas (NSA) at approximately 6.5km, 7km and 16km from the Project respectively. Review of the Inventory of Gardens and Designed Landscapes has identified no such designations within 5km of the Project. Two gardens and designed landscapes have been identified in the wider area, with Balmacara Estate (Lochalsh Woodland Garden) and Kyle House, located approximately 5.8km to the north and 6.7km to the north west of the Project respectively. The relevant landscape planning context is described further in paragraphs 16.1.5-16.1.14. Figure 16.1.4 illustrates the key designations relevant to this assessment.

<u>Topography</u>

16.3.7 The 5km study area primarily comprises a mix of rolling uplands, coastal edge and open water. Kyle Rhea forms a distinctive channel between mainland Scotland and the Isle of Skye that is strongly defined by the adjacent topography. To the west are Ben Aslak (610m AOD), Sgurr na Corinnich (739m AOD), Beinn Bhuidhe (488 mAOD) and Beinn na Caillich

(732m AOD), which form prominent local landforms. To the east the topography is less dramatic, but the hills of Glas Bheinn (394m AOD) and Druim na Leitre (240m AOD) reinforce the upland character.

16.3.8 The coastal edge varies, ranging from steep drops that descend into the sea to glens where rivers and streams flow into the sea and a narrow inhabited coastal shelf. The open water varies in its scale, from the increasing large (further south) Sound of Sleat to the more enclosed Kyle Rhea and Loch Alsh. The adjacent landform forms a defining component of the character of the areas of open water.

16.3.9 The Sandaig Islands comprise distinctive features just to the south of the 5km area. Although they are relatively limited in extent and small in elevation, they form key focal and reference points.

Land cover, land use and sea use

16.3.10 The majority of the land cover within the study area comprises open moorland and plantation woodland. Enclosed fields, set to pasture are found along the coastal edge and within glens. Fields are medium to small in size, regular in shape and with enclosure typically provided by a combination of stone walls and post and wire fences. Some areas of broadleaved woodland are found on the sides of the glens, but in the main woodland comprises large scale conifer plantation, with such woodland focussed on more elevated land. Other tree cover is limited, although there are some trees associated with field boundaries, settlements and rivers.

16.3.11 Land use is primarily woodland and pasture, with open moorland grazed by deer in elevated areas. Residential development is fairly limited, primarily comprising Glenelg on the east side of Kyle Rhea and the settlement of Kylerhea itself on the east. There are also a number of dispersed farmsteads and individual dwellings are located within the 5km study area, although these are all located on the east side of Kyle Rhea.

16.3.12 In close proximity to the Project, use of the local inshore waters is associated with a range of vessels, including fishing boats, fish farm vessels, recreational boats, other commercial and naval vessels. The number of vessels that travel through Kyle Rhea varies greatly throughout the year from approximately 5 per day to over 25 per day during summer months. The Glenelg to Kylerhea Community Ferry is a key vessel in the local area, providing a seasonal crossing between mainland Scotland and the Isle of Skye to the south of the Project. The ferry boat itself (the Glenachulish) is distinctive, being the last manually operated turntable ferry in Scotland. The slipways (Category B Listed Buildings) at either side of the ferry crossing are also notable, being built with two separate slips to allow cattle to swim across the strait.

Infrastructure/transport routes

16.3.13 Infrastructure within the 5km study area is limited, with no primary or secondary roads and occasional minor roads. The road through Glen More links Glenelg with Shiel Bridge. There is the road link from Glenelg to the east side of the ferry crossing. At the west side of the ferry crossing there is a road from Kylerhea to Ashaig, through Kylerhea Glen and Glen Arroch. The community ferry itself is also a key part of the local infrastructure, operating between Easter and October. There is also a road from Glenelg to Arnisdale and Corran, which is positioned close to the coastal edge. The A87 is located beyond the 5km study area, routes around the north side of Loch Alsh.

16.3.14 Other infrastructure is also limited in extent. The most conspicuous element being the electrictity transmission lines (carried on metal pylons) which cross Kyle Rhea to the north of the Project and are routed around the south west side of Loch Alsh and towards/across Glen More and Gleann Beag in a south easterly direction.

Tourism and recreation

16.3.15 There are opportunities for outdoor recreation throughout the 5km study area and beyond, with walking and cycling being key recreational activities. While the location is potentially less popular than surrounding areas such as Knoydart, Kintail and the Cuillin Hills, there are numerous opportunities to enjoy the landscape. There are no specific long distance routes through the 5km study area. Travelling along the roads to appreciate the scenery is also popular. The otter hide on the Isle of Skye, to the north of the settlement of Kylerhea is also popular with visitors.

16.3.16 The settlements also include facilities for visitors with bed and breakfast and self catering accommodation, including the Glenelg Inn. Camping (including caravans and campervans) is permitted on the beach to the north of Glenelg.

16.3.17 As stated above (in relation to infrastructure and transport) Kyle Rhea is a popular route for recreational boat traffic. The ferry is also a draw for visitors as well as providing a valuable transport link for local residents.

Remoteness

16.3.18 The Project would lie in a relatively remote location, away from large scale development and infrastructure. Noise sources are limited, associated with natural processes (e.g. wind and water) and intermittent human activity (e.g. road and boat traffic). There are few sources of artificial light at night. Key light sources are residential properties, together with road and boat traffic (discussed further below).

16.3.19 The Project will add new structures to the location and for the majority of the time these will appear as static elements. Navigation lights will introduce an additional light source to this rural seascape/landscape, which has the potential to have an adverse impact. The assessment considers the potential impact on remoteness in relation to both the seascape/landscape resource and visual receptors. It also relates to the policy context and the protection of character.

Night time context

16.3.20 The study area was visited during the evening to establish current sources of night time lighting. The context of the Project is a remote seascape/rural landscape and the number of light sources is extremely limited. Key light sources are primarily associated with the dispersed residential properties, occasional street lights at Reraig, Kylerhea Minor Light and occasional road and boat traffic.

16.3.21 It is also noted that Kylerhea is recognised as a Dark Sky Discovery Site[40]. The UK Dark Sky Discovery partnership comprises a network of astronomy and environmental organisations, aiming to increase awareness of dark sky places and increase interest in the night sky. Kylerhea is identified as being a "Milky Way" site, a location where the Milky Way is visible to the naked eye. The study area is generally consistent with category E1; intrinsically dark landscapes, as defined by the Institution of Lighting Engineers (The Institution of Lighting Engineers (2005) Guidance Notes for the Reduction of Obtrusive Light).

Seascape/landscape character

16.3.22 The assessment of the Project on the seascape and landscape character utilises published information where available. This includes the Skye and Lochalsh Landscape Assessment

[40] www.darkskydiscovery.org.uk

(SNH, 1996) and An Assessment of the Sensitivity and Capacity of the Scottish Seascape in Relation to Wind Farms (SNH, 2006). Both of these documents provide valuable information about baseline seascape/landscape character. It should be noted that the sensitivity analysis included in An Assessment of the Sensitivity and Capacity of the Scottish Seascape in Relation to Wind Farms has not been used in this assessment as the visual characteristics of wind farms are very different to the Project.

16.3.23 The published assessments have been supplemented with more detailed analysis of character based on field survey work. The baseline assessment uses the defined landscape character types, but builds on this with Coastal Character Areas and Local Coastal Character Areas (as per the approach set out in Guidance on Landscape/Seascape Capacity for Aquaculture (SNH, 2008)).

16.3.24 The seascape and landscape character of the study area is illustrated by Figures 16.1.1 to 16.1.4.

National seascape character

16.3.25 At a national/strategic scale the Assessment of the Sensitivity and Capacity of the Scottish Seascape in Relation to Wind Farms divides the 5km study area (and wider area) into two, with Kyle Rhea forming the boundary between the two seascape character types. To the north is Area 11: Inner Sound/Sound of Raasay and to the south is Area 19: Sound of Sleat – Point of Ardnamurchan.

16.3.26 The national/strategic seascape context of the Project is described in more detail below. However, the assessment concentrates on a more detailed evaluation of local character.

Seascape Area 11: Inner Sound/Sound of Raasay

16.3.27 This strategic seascape area predominantly comprises two key types; “sounds, narrows and islands”, and “low rocky island coast”. The key characteristics are described as:

- An area of two sounds, divided by the Island of Raasay and bordered by the east coast of Skye and the west coast of the Scottish mainland;
- The coastline is typically rocky, rising steeply from the sea in places;
- The coastline is fragmented and indented in places, islands also form focal points;
- The area includes long sea lochs, including Kishorn, Torridon, Carron and Alsh.

16.3.28 It is described as a semi-enclosed seascape, with slotted views out to sea. The vertical scale of the mountainous coastlines is distinctive. It is a complex seascape area, including layered headlands, lochs, mountains and islands, with all these forms linking with water. Settlement is limited and typically small scale, the toll bridge to Skye and some telecommunications add to development in localised areas. There is limited lighting, typically associated with settlements and fish farms. The seascape is typically experienced from roads, ferries, mountains and settlements. There are glimpsed views from the A87, but the potential is often restricted by landform. The characteristics of the area, particularly the form, land cover and settlement pattern gives rise to strong sense of remoteness in places. Potential forces for change include oil and gas exploration, Loch Kishorn yard, tourism, onshore wind energy development and fish farming.

Seascape Area 19: Sound of Sleat – Point of Ardnamurchan

16.3.29 This strategic seascape area predominantly comprises sounds, narrows and islands”. The key characteristics are described as:

- Indented, rocky coastline with some extensive sandy bays;
- Islands and mainland provide a strong sense of enclosure;

- Settlement is concentrated on the coastal edge;
- Hinterland comprises moorland and hills;
- Views of Rum and Skye; and
- Coastlines are similar in character, meaning distractive peaks form important landmarks.

16.3.30 Large vertical scale, results from the combination of mountains, deep glens and sea lochs, although there are smaller elements along the coast, including indentations, sheltered bays and lochs. The mountains and glens constrain views in the hinterland, but these views are much more open at the coast. There is varied form, with striking serrated mountain profiles and more gently undulating landforms, craggy promontories and some small cliffs. The sea is broken by many islands and views to distant islands. Settlement is small scale and limited in extent; focussed along the coast. Lighting is similar, primarily associated with the settlement pattern. The coast can be busy in summer months, but movement is restricted to distinct corridors, typically linked with the coastal edge. Travel is often lengthy, heightening the sense of isolation. Views from elevated land can comprise panoramic vistas. The sense of exposure varies between the mountains and the coast. The coast is exposed to the open sea, although some shelter is afforded by the Outer Hebrides. The mountains are highly exposed to westerly winds. Potential forces for change include new housing and tourist facilities, upgrading/construction of new infrastructure including roads ferry terminals, power lines and renewable energy developments.

<u>Coastal Character Areas, Local Coastal Character Areas and Landscape Character Types</u>

16.3.31 This section examines seascape and landscape character in more detail, subdividing the regional character areas/units and evaluating sensitivity in relation to the Project. Again, this analysis focuses on the 5km study area and the location and extent of each character area is shown in Figures 16.1.2 and 16.1.3.

16.3.32 The 5km study area has been divided into three coastal character areas (and subsequently local coastal character areas). The three coastal character areas comprise; Kyle Rhea, the Sound of Sleat and Loch Alsh. In addition some of the coastal character areas are sub-divided into local coastal character areas. The coastal character area of Kyle Rhea is not sub-divided as its strength of character is distinctive and relatively consistent at both a larger and smaller scale.

16.3.33 As well as the coastal character areas, the study area is divided into landscape character types. There is some overlap between the landscape character types and the coastal character areas, with the latter being defined at a more local level for the purpose of this assessment. Where there is overlap this is stated and the assessment is based on one scale to avoid duplication and possible confusion.

16.3.34 The following table outlines the key characteristics and sensitivity of each of the coastal character areas and landscape character types.

Table 16.6: Local seascape/landscape areas/units

Coastal Character Area	Key Characteristics	Sensitivity to proposed development
Kyle Rhea (coastal character area and local coastal character area), note this also comprises part of the fjord landscape character sub-type	A distinctive, relatively narrow channel between mainland Scotland and the Isle of Skye. It comprises a fjord, formed though glacial processes, with relatively steep sided landforms on either side (more so on the west side). The key characteristics of this coastal character area are: ▪ Relatively narrow, deep channel, between approximately 500m and 700m wide; ▪ The landform on either side of the channel rises steeply, with higher landform on the west side of Kyle Rhea; ▪ The coastal edge is rocky, creating a jagged, uneven edge to the channel; ▪ The narrow channel and movement of tides creates very strong currents; ▪ The nature of landform limits access, resulting in a largely uninhabited landscape, creating a perception of remoteness; ▪ The slopes on either side of the channel are dominated by conifer plantation; ▪ Particularly distinctive features comprise the ferry crossing and associated slipways and the electricity transmission lines; ▪ Views are constrained by the landform and are focused along the channel and to the surrounding elevated land; ▪ Dark sky at night, with few light sources.	Medium, due to scale of landscape, presence of existing human features e.g. plantation woodland, electricity transmission lines etc.
Sound of Sleat (Coastal Character Area) and sub divisions; Glenelg Bay, Kylerhea Glen and Sound of Sleat (local costal character areas), note this also comprises part of the fjord landscape character sub-type	This coastal character area comprises the northern sections of the Sound of Sleat. While still part of the fjord, the channel is much wider and adjacent landform more diverse. The key characteristics of this coastal character area are: ▪ More open channel, being up to approximately 2km wide; ▪ The landform on either side of the channel still rises steeply in places, but there is more diversity to this, with glens leading the coastal edge and small bays; ▪ The slower, less apparent tidal currents give rise to gentler appearance to the water (although this very much depends on the prevailing weather conditions); ▪ The more diverse landform increases access, with more settlement on the coastal edge at Glenelg and Kylerhea. ▪ There is some agriculture (pasture) on the narrow coastal edge and lower parts of the adjacent glens; ▪ The settlement and roads reduces the sense of remoteness	Medium to high, depending the scale of the surrounding landscape and human influences Medium for the Sound of Sleat local coastal character area High for the Glenelg Bay and Kyerhea Glen local coastal character areas

Coastal Character Area	Key Characteristics	Sensitivity to proposed development
	experienced elsewhere in the study area (although note the limited scale of such development does mean that is still relatively remote); ▪ Steeper slopes back the coastal edge, with some plantation woodland present particularly further to the south; ▪ Dark sky at night, with few light sources. The coastal character area is sub-divided into three local coastal character areas: *Glenelg Bay*, a gently curving bay at the western end of Glen More. It includes the small estuary associated with the Glenmore River, a sandy beach at Glen Bernera and stony beach at Glenelg. It is the most settled part of the 5km study area, with the village of Glenelg positioned along the coastal edge. Bernera Barracks and the war memorial in Glenelg (both Category A Listed Buildings) are distinctive features and focal points. *Kylerhea Glen*; a low lying area at the eastern end of Kylerhea Glen, where the associated small river flows into the sea. The coastal edge is rocky and stony. The small settlement of Kylerhea is concentrated in the low lying area. It has an increased sense of isolation (particularly when the ferry is not in operation) due to the reduced scale of settlement and narrow, winding road that provides connection with the A87. *Sound of Sleat*; comprises the more southerly section of the Sound of Sleat (both sides of the channel), away from the settlement and where the landform increases in steepness. Here the coastal edge is typically rocky and the landform rises from the sea. The slopes are frequently covered with conifer plantations, although this is a feature that is changing through extensive clearance (particularly to the south of Eilanreach).	
Loch Alsh (coastal character area) also South Loch Alsh (local coastal character area), note this also comprises part of the sounds and narrows landscape character type	This coastal character area comprises Loch Alsh, with the local coastal character area being more specifically the southern side of the Loch. The overall nature of the space within this character is linear, with the key direction of flow (in terms of landform, shape of the space and movement) being east to west. It gives rise to quite a large scale and simple landscape, with open water, and high landforms in most directions. The key characteristics of this landscape character type are: ▪ Open water, over 3km wide in places, which is dominant in views and a key attraction; ▪ Occasional islands form focal points; ▪ The landform rises steeply in places, but there is some	Medium, reflecting the scale of the surrounding landscape and human influences

Coastal Character Area	Key Characteristics	Sensitivity to proposed development
	diversity to this, particularly on the north side of Loch Alsh; ▪ The north side of Loch Alsh is much less remote, being accessed by the A87 (which follows close to the edge of the Loch) and A890; ▪ There is also much more settlement and development on the north side of Loch Alsh, concentrated along or close to the Loch shore and key roads. ▪ The south side of Loch Alsh, by contrast, is much more remote, with either a narrow road or no vehicle access; ▪ The coastal edge is backed by agricultural land (pasture) where the adjacent landform is gentler, or plantation woodland or moorland where steeper; ▪ Conifer plantation is more dominant on the south side of Loch Alsh, broken by areas of moorland; ▪ The coastal edge is varied, with rocky sections, together with sandy or stony beaches; ▪ Aquaculture and fishing is associated with the Loch; ▪ More light sources at night, particularly on the northern side of Loch Alsh.	
Rugged Massif (landscape character type)	This landscape character type makes up the largest component of the onshore part of the study area. It comprises elevated moorland on both sides of Kyle Rhea and the Sound of Sleat. The landform, itself is the dominant feature; large in mass, with broad bases and relatively gentle slopes. The key characteristics of this landscape character type are: ▪ Extensive ranges, with fairly indistinct peaks, which it can be difficult to perceive the scale of; ▪ Elevated, open moorland is the primary land cover; ▪ Settlement is very sparse; ▪ The hills can have a mottled texture, reflecting the different underlying ground conditions and variable landform; ▪ Hill ranges are typically divided by broad valleys; ▪ Dark sky at night, with few light sources.	Low, reflecting the scale of the landscape relative to the Project and expansive nature of views
Forest Slopes with Moorland Mosaic (landscape character type)	This landscape character type lies to the east and west of Kyle Rhea and also comprises a narrow strip of land south of Eilanreach. Coniferous plantation is the dominant land cover, which while not always continuous it still influences the character of the adjacent moorland. The key characteristics of this landscape character type are:	Low, particularly reflecting the plantation land cover and the scale of the landscape relative to the proposed

Coastal Character Area	Key Characteristics	Sensitivity to proposed development
	▪ Dominant conifer plantation, while elements of this are changing through felling, design, species composition etc. it still forms a defining component of this landscape type; ▪ Landform is a key feature, with this landscape type comprising more steeply sloping land close areas of open water; ▪ Areas of moorland break up the woodland cover; ▪ Settlement is very sparse; ▪ The woodland can be valued for its perceived shelter (in contrast to open moorland); ▪ It is a landscape type in change in places, most notably to the south of Eilanreach where extensive woodland clearance has been taking place; ▪ Dark sky at night, with few light sources.	development.
Coastal Strath (landscape character type)	There are several coastal straths within the 5km study area. These are to the south of Kyle Rhea and fall towards the Sound of Sleat. The key characteristics of this landscape character type are: ▪ Wide, flat bottomed valleys, leading to the sea and contained by steep slopes; ▪ Distinct linear space, with key views being in line with the landform; ▪ Containing a central watercourse, with associated vegetation/ribbon of tree cover; ▪ Typically agricultural land (pasture) within the valley floor, divided in regular small to medium sized fields; ▪ More marginal agricultural land on the valley sides; ▪ Often containing rural estates or agricultural settlements; ▪ Key local features of note within the study area are the Brochs within Gleann Beag; ▪ Dark sky at night, with few light sources.	Low, primarily reflecting the enclosed nature of the landscape, however this sensitivity could increase considerably depending on the visual relationship with the Project (e.g. if the Project becomes a key focal point.
Rocky Undulating Plateau (landscape character type)	This comprises a relatively peripheral landscape character type with a small part of it position towards the south east edge of the study area. It comprises an open, upland landscape type with an abundance of exposed rock. It has a relatively random pattern and composition and there is no obvious foci. There are also few indicators of scale, making it difficult to perceive scale or distance. There is no settlement within this landscape type within the study area.	Low, reflecting the scale of the landscape relative to the Project and expansive nature of views

Coastal Character Area	Key Characteristics	Sensitivity to proposed development
Rural Estate Settlement (landscape character type)	One example of this landscape type lies towards the south east edge of the 5km study area, located at Eilanreach. This landscape type is typically focussed around large, prominent house, which forms a focal point. The main house is often surrounded by a cluster of associated buildings, forming a group. The main house typically occupies a sheltered location, often surrounded by mature trees to the rear and open views to the front. The house is frequently surrounded by grazing land. Typically portrays a positive image of human impact, despite its dominant scale. Private areas of this landscape type can be quiet and tranquil, but this can contrast with areas used for tourism and recreation.	Low, reflecting the scale of the landscape relative to the proposed development, the visual enclosure provided by vegetation and the human influence on the landscape.

Seascape/Landscape Designations

16.3.35 Analysis of national and local designations has identified that the Project site does not lie within and national or local landscape designation. The key landscape designations that lie closest to the Project are Knoydart, Kintail and The Cuillin Hills National Scenic Areas (NSAs). The closest of these is Knoydart the boundary of which lies approximately 6.5km to the south. The closest parts of Kintail and The Cuillin Hills lie approximately 7km to the east and 16km to the west respectively. Analysis of the terrain and ZTV suggests that the array would be visible from the northern edge of the Knoydart NSA. There will be no, or extremely limited visibility from Kintail and The Cullin Hills, and the separation distance will also severely limit any potential impacts. Therefore the assessment only considers potential impacts on the Knoydart NSA.

16.3.36 The location of the site in relation to Special Landscape Areas (SLAs) has been reviewed (Assessment of Highland Special Landscape Areas, The Highland Council and Scottish Natural Heritage, 2011) in relation to the Project. There are no SLAs within the 5km study area, with the closest ones being Kyle-Plockton (over 6km to the north west), South West Applecross and the Crowlin Islands (over 14km to the north west), Strathconnon, Monar and Mullardoch (over 17km to the north east) and Moidart, Morar and Glen Sheil (over 18km to the east). Analysis of the ZTV identifies that the Project would not be visible from the Kyle-Plockton SLA. While the other three SLAs referred to above are not covered by the ZTV, the separation distance is so great that no impacts are likely to occur, if the Project is visible at all.

16.3.37 The Inventory of Gardens and Designed Landscapes has been consulted; there are no gardens or designed landscapes included in the inventory within the 5km study area. Two gardens and designed landscapes have been identified in the wider area; Balmacara Estate (Lochalsh Woodland Garden) and Kyle House, located approximately 5.8km to the north and 6.7km to the north west respectively. Analysis of the ZTV identifies that the devices would not be visible from either of these locations.

16.4 Assessment of Seascape, Landscape and Visual Impacts

16.4.1 This section identifies the potential impacts on the seascape/landscape resource and visual amenity of the study area. It is sub-divided into the following sections:

- Do nothing scenario;

- Potential impact during the installation phase;
- Potential impacts during the operational phase;
- Potential impacts during the operational phase;; and
- Potential impacts during the decommissioning phase.

Do Nothing Scenario

16.4.2 If the Project is not implemented there will be no change to the baseline conditions and the receiving seascape will remain undeveloped.

Potential impacts during installation

16.4.3 Offshore, there will be changes to the seabed, and the foundations will be installed in advance of the devices. However these changes would not be visible from above the sea surface and thus would not have a significant impact on features that conspicuously contribute to character. The potential effects on the marine environment are considered in the relevant detailed assessment sections within this Environmental Statement.

16.4.4 During installation it is anticipated that a large crane barge or similar jack up type vessel will be required. It is also anticipated that during installation the vessels will need to work 24hrs a day and may require flood lighting to permit save night time working. These activities are anticipated to take place in two successive years and for approximately 3 months (per year) However, the impacts will be temporary, for a comparatively short duration and reversible on completion of the installation. Construction impacts are considered for specific viewpoints which are presented later in this chapter e.g. viewpoint assessment.

16.4.5 Onshore, the cable routing has potential to have a direct permanent as well as a temporary effect on seascape/landscape features. As outlined in the Chapter 5, Project Description, the export cable route will be directionally drilled from either the FC car park or from the location at Kylerhea (Figure 5.1) to the array. The directional drilling activities would require an area of approximately 40x40m.

16.4.6 For the FC car park option (option 1) there may be a requirement to adjust the existing area of hard standing, but it is expected that this would have a minimal impact. There would also be a trenched cable from the drilling pit at the car park connection pit to the substation, following the existing track. The substation would be located at the existing toilet block, which is positioned at the edge of conifer plantation and options would be explored to ensure that the detailed design minimises any potential impacts.

16.4.7 The location at Kylerhea (option 2) requires a temporary area of hard standing to be created and, depending on the location of the compound a temporary access track to it. The area would be restored on completion of the works, with compaction relieved, the ground cultivated and seeded with an appropriate grass mix. The substation associated with this option would be positioned in an existing building at the ferry slipway. The cable connection between the drilling area and substation would be trenched along existing roads.

16.4.8 It is therefore acknowledged that the onshore and offshore elements of the Project would have direct impacts on landscape during the installation phase, but that the scale of the works would be temporary and short term.

16.4.9 Overall, due to the factors outlined above, it is anticipated that the direct impacts would not be significant and could be readily assimilated into the existing landscape.

Potential impacts during operational phase

Visibility analysis

16.4.10 The visibility analysis is described first as it relates to the evaluation of both landscape and visual potential impacts. If the Project is not visible the potential landscape or visual impacts are extremely limited.

16.4.11 The Project will be theoretically visible from numerous locations within the surrounding area, both within and beyond the 5km study area. Reviewing the ZTV it is clear that the landform has the primary influence on the potential visibility of the Project. The local topography on either side of Kyle Rhea concentrates the potential visibility to the north and south, considerably restricting the extent of visibility from locations in the surrounding area. A large proportion of the footprint of the ZTV comprises areas of open water.

16.4.12 Within the 5km study area the ZTV clearly demonstrates almost continuous visibility of the Project throughout Kyle Rhea and considerable potential visibility across the northern part of the Sound of Sleat. The position of the array, towards the southern end of Kyle Rhea results in greater potential visibility across the Sound of Sleat, rather than Loch Alsh. Conversely, the position of the array means potential visibility is focussed in much narrower corridor across Loch Alsh. Sea based visibility is almost completely contained within the 5km study area, with this extending close to the coast to both the north and south. The exception to this being is an area of potential visibility to the south of Reraig (on the north side of Loch Alsh).

16.4.13 Onshore within 5km of the Project the pattern of theoretical visibility is more fragmented. The areas of sea are bordered by a rising landscape, the footprint of the ZTV rises with the landform, until high points truncate it. Close to the array there is greater theoretical visibility on the west side of Kyle Rhea compared with the east; a result of the larger scale landforms lying on this side of Kyle Rhea. The Project would be theoretically visible from the east facing slopes of outlying hills to the east of Sgurr na Coinnich and much of this area comprises commercial forestry plantation. To the east of Kyle Rhea, the lower hill of Druim na Leitire cuts of visibility closer to the Project, part of this land also comprises forestry plantation. At slightly greater distances there would be visibility from the north facing slopes of the ridge that extends to the east of Ben Aslak. On the south east side of the Sound of Sleat there would be visibility from the north west facing slopes of the rising land to the south of Glen More.

16.4.14 With regard to settlements, there would be visibility of the Project from Glenelg, although a combination of landform and vegetation would reduce this from northern parts of the village. Potential visibility from Kylerhea is predicted to be more limited. Analysis of the ZTV identifies that visibility of the devices would be extremely limited, restricted to a narrow strip of land adjacent to the coastal edge. A ZTV has also been prepared for the Isolated Hazard Markers that would be attached to the tops of the devices, visibility of this would be greater, but would be limited in both the extent of the ZTV footprint and the number of markers visible. It is also acknowledged that the devices would also be seen from dispersed residential properties, most notably the properties close to the ferry slipways.

16.4.15 Beyond 5km the ZTV pattern becomes increasingly fragmented. To the south the Project would be seen from elevated land (north facing slopes) to the south of Eilanreach. The Project would also be visible from the north side of Loch Alsh (in the vicinity of Reraig) and the south facing slopes of hills further north, such as Auchtertyre Hill.

Assessment of Potential Impacts on Seascape/Landscape Character

16.4.16 This section of the assessment describes the potential impact of the Project on seascape and landscape character. This analysis focuses on the 5km study area surrounding the Project.

The baseline assessment identified a number of coastal character areas and landscape character types.

Kyle Rhea Coastal Character Area

16.4.17 The array will be constructed within Kyle Rhea Coastal Character Area. It will lead to the introduction of up to four tidal stream devices set towards the centre of the southern end of the channel. The potential direct impacts of the Project have been discussed above. This section considers the perceptual changes to this coastal character area that will result from the Project.

16.4.18 The array will be seen throughout much of this coastal character area, with potential visibility predicted for almost the entire area. The array will contrast with the relatively remote, rural nature of the character area. It will form a new and distinct element that will influence the perception of character. The colouring and lighting requirements, required for marine safety, will also make the structures stand out, which will adversely affect tranquillity (although the experience of the night time light element will be very limited). The coastal character has a relatively enclosed feel, resulting from the adjacent landform and the tidal array will have a relationship with this aspect. The scale of the surrounding landscape will reduce the apparent scale of the proposed development. It is also a landscape that is not devoid of human influence; the forestry plantation, ferry crossing and electricity transmission lines are all human influences on the local character. A key way in which the Project will affect seascape character is in the views along the channel. The scale of these views is quite large and the Project will comprise an additional element of relatively limited size within them. The devices will not prevent these views, but they will form new elements within them. The Project would also allow a ready and very visible interpretation of a key aspect of this coastal character area; the tidal currents and the energy that they contain. After 25 years all readily visible elements will be removed and impacts reversed.

16.4.19 The Project will result in some adverse changes, and it is anticipated that the magnitude of this will vary, as at close proximity the proposed structures will be prominent and a key feature of the coastal character. However, this prominence will reduce with distance. At close proximity the potential change would be **major**. However, taken in the context of the overall character area the magnitude of change is predicted to be **moderate**, this is largely a result of the extent of the change and its reversibility, combined with the height of the proposed structures and scale of the landscape in which they will be experienced. The sensitivity of this seascape character area to the Project is medium. This will result in a generally **moderate** impact on seascape character, which in the context of this assessment is not significant. However it is acknowledged that there will be some locally **major/moderate** (significant) impacts on seascape character.

Sound of Sleat Coastal Character Area (including Local Coastal Character Areas)

16.4.20 The relationship of the Project with this coastal character area is more limited, but there would still be visual connections. The tidal stream devices would be seen throughout much of this character area, although increasing separation distance will greatly reduce their relative scale.

16.4.21 Parts of this coastal character area are less remote, as they are more accessible by road. The sense of enclosure, orientation and nature of the views within this character area are quite different to the Kyle Rhea Coastal Character Area. The character is more open and the Project's position in Kyle Rhea will appear less prominent. There are smaller scale elements, particularly within the Glenelg Bay and Kylerhea Glen Local Coastal Character Areas. The orientation of these, combined with limited visibility and an increased separation distance is likely to mean that the Project will not be a not a defining feature of character. The array will form a new and distinct element, and the colouring and lighting requirements will also make the structures more obvious. The Project will affect the views towards Kyle Rhea. However, the Project will be a small scale component in the view and would not be the focal point given the large scale of the adjacent landscape and the resulting views. Following 25 years the Project will be decommissioned and the devices will be removed and impacts reversed.

16.4.22 Overall, while the Project will result in some adverse changes, the overall magnitude of change will be **slight**, this is largely a result of the relationship of the Project with this coastal character area and its reversibility. This will result in a **moderate** or **moderate/minor** impact on seascape character, which in the context of this assessment is not significant.

<u>Loch Alsh Coastal Character Area (including Local Coastal Character Area)</u>

16.4.23 The relationship of the Project with the coastal character area is more restricted than that associated with the two character areas evaluated above, but there would still be some connections. The devices would be visible from a limited part of the character area, where the channel of Kyle Rhea (and adjacent landforms) would frame views towards the Project.

16.4.24 The orientation, focus and nature of views associated with this coastal character area are different to the character areas evaluated above. Kyle Rhea has a much more limited role in defining character and the emphasis is much more on east west form, movement and views. In addition, parts of this coastal character area are less remote, as it is more accessible by road. It has a much more open character and the Project in Kyle Rhea would be much less prominent. The orientation of the character area, limited visibility and separation distance is likely to mean that the Project has a very limited influence on character. It is acknowledged that the colouring and lighting requirements will make the structures more distinctive. The Project will affect views towards Kyle Rhea. However these views only comprise one component and will not be the focal point. In addition, the scale of these views is large, as is the adjacent landscape, and the Project will comprise a relatively small scale element within them. Following the 25 year operational period the devices will be removed and impacts reversed.

16.4.25 Overall, while the Project will result in some adverse changes, the overall magnitude of change will be **negligible**, this is largely a result of the relationship of the Project with this coastal character area. This will result in a **minor** impact on seascape character, which in the context of this assessment is not significant.

<u>Rugged Massif Landscape Character Area</u>

16.4.26 The Project will be visible from a relatively small proportion of this landscape character type. This character type comprises open and exposed moorland which is remote and simple in form. The openness of the landscape combined with the landform, results in a high degree of exposure and often affords large scale, expansive views. The Project's influence on the character area will be related to its visibility, compared to the sense of remoteness and the large scale views.

16.4.27 The Project will contrast with the remote, rural nature of this character area, forming a new and distinct element that will influence the appearance of Kyle Rhea. The colouring and lighting requirements will also make the devices stand out, which will adversely affect remoteness (although the experience of the night time lighting will be extremely limited). The scale of the views seen from/within this character area is large and long distance and the Project will only comprise a minor additional element. The Project will not prevent these views, although it will form a new element within the coastal views. Following the operational period the devices will be removed and impacts reversed.

16.4.28 The Project will result in some adverse changes, the overall magnitude of change will be **slight**, this is largely a result of the extent of potential visibility and the reversibility of the change. In addition, the scale of the devices will be small in relation to the landscape and nature of the views in which they are seen. The sensitivity of this landscape character area to the Project is low. This will result in a **minor** impact on landscape character, which in the context of this assessment is not significant.

Forest Slopes with Moorland Mosaic Landscape Character Type

16.4.29 Although this landscape character type is in close proximity to the Project, the relationship between the two is likely to be relatively limited. The plantation woodland is the dominant component of the landscape type and by its nature creates enclosed views and limits the contribution that adjoining landscape types make to its character. The wooded character may change over time through deforestation and, if so, such areas are likely to become more consistent with the Rugged Massif landscape type. While there is theoretical visibility of the Project from this landscape character type, actual visibility would be more restricted. There would be some views from the peripheral parts of the character type, together with some intermittent views within it, but these will be limited in extent.

16.4.30 Overall the magnitude of change associated with the Project in relation to this landscape character type will be will be **slight**. The overriding features are the plantation woodland and the landform. The Project will not influence these elements and it will not become a defining component of this landscape type. Where visible (or should deforestation occur) the scale of the proposed structures will be small in relation to the landscape and nature of the views in which they will be experienced. The sensitivity of this landscape character area to the Project is low. This will result in a **minor** impact on landscape character, which in the context of this assessment is not significant.

Other Landscape Character Types

16.4.31 The potential impacts of the Project in relation to other landscape character types are briefly assessed in this section. These impacts are limited due to factors such as separation distance, visibility and scale of the landscape.

16.4.32 The Coastal Straths within the 5km study area are all located to the south of the Project. The enclosure provided by the local landform limits the contribution that surrounding landscape types make to this character area (i.e. these are more contained landscape character types). In addition none of these landscape types are orientated towards the Project, consequently the potential visibility of the proposed devices will be extremely limited. Overall it is predicted that the magnitude of change associated with this landscape type will be **slight**. As the sensitivity of the landscape is low, there would be a **minor** impact on landscape character, which in the context of this assessment is not significant.

16.4.33 The Rocky Undulating Plateau landscape type is limited to the south east edge of the study area. The openness of this landscape is likely to provide views towards the Project. However, the scale of the landscape and separation distance is likely to diminish any potential impacts. It is predicted that the magnitude of change associated with this landscape type will be **slight**. As the sensitivity of the landscape is low, there would be a **minor** impact on landscape character, which in the context of this assessment is not significant.

16.4.34 The Rural Estate Settlement landscape type comprises one small area towards the south east edge of the study area. There is some predicted visibility of the Project from this landscape type, however intervening vegetation would limit this. The limited extent of visibility, together with the separation distance and scale of the Project relative to the surrounding landscape reduces the potential change. It is predicted that the magnitude of change associated with this landscape type will be **negligible**. As the sensitivity of the landscape is low, there would be a **minor** impact on landscape character, which in the context of this assessment is not significant.

Night time character

16.4.35 Night time character is considered in the above analysis of potential impacts on seascape and landscape character, particularly in relation to remoteness and isolation. However, the context of the site is worthy of specific mention, being that it is generally a very dark seascape/landscape. There are occasional light sources, particularly associated with settlements and residential properties. The most conspicuous light sources are at Reraig, where the street lighting is an obvious component (and is seen from locations within Kyle Rhea and further south). There are also occasional light sources within Kyle Rhea, including the individual residential properties, Kylerhea Minor Light and occasional boat traffic. The dark sky is a recognised component of the character and night time photographs have also been recorded for certain viewpoints (Viewpoints 1, 2, 6 and 8).

16.4.36 The installation of the devices and operational phase would introduce new lit elements. During the installation there would be two periods in successive years when flood lighting would be used for approximately 3 months (during each year). This lighting would contrast with the baseline character, however any impacts would be temporary, short term and reversible. In addition, it intended to undertake this work during summer/autumn months when day length is greater and the need for lighting would be reduced. The lighting required during the operational phase would be much smaller in scale. The details of these requirements are still to be finalised through consultation with the Northern Lighthouse Board and the Maritime and Coastguard Agency, however it is anticipated that they will comprise navigations lights on the devices.

Potential impacts on relevant designations

16.4.37 The review of the baseline context identified a number of relevant designations within the surrounding area. However none of these are located within the 5km study area. Analysis of these designations in relation to the ZTVs identifies that the key landscape designation from which the Project would be seen is the Knoydart National Scenic Area (NSA). The devices would be visible from the northern edge and summits of this NSA, particularly in the vicinity of Meall Buidhe and Beinn a Chapuill. The closest part of the Knoydart NSA is located approximately 6.5km from the Project. This separation distance, together with the scale of the landscape and expansive views within which it would be seen considerably restricts the Project’s potential impact. The Project would only be visible from a very small proportion of the NSA. It is anticipated that the magnitude of change would be negligible, assuming that the sensitivity of the landscape is high, this would result in a moderate/minor impact, which in the context of this assessment is not significant.

Relationship with relevant planning policy

16.4.38 The key objectives of the relevant planning policy are to protect the natural environment and the scenic qualities of the seascape/landscape. These are set out at a national level and local level in the relevant planning policy documents (as set out in Paragraphs 16.1.5-16.1.14).

16.4.39 The Project could conflict with relevant policy objectives and have an adverse impact on the seascape/landscape character and visual amenity. The Project will be decommissioned after 25 years, the devices and substation will be removed, which would reverse potential impacts to pre-development conditions. The SLVIA has identified that while there will be some adverse impacts, in the majority of cases the impacts will not be significant (the key exceptions to this are certain visual impacts, which are assessed in the following sections). It is not anticipated that the Project would have any significant impacts with regard to relevant designations (e.g. Knoydart NSA). It should also be acknowledged that the Project could allow a degree of interpretation of some of the characteristics of the coastline, reflecting the energy inherent in the tides.

Assessment of potential visual impacts

16.4.40 The potential visual impacts arising from the Project have been assessed throughout the study area and in the detailed analysis of the potential visual impacts from nine viewpoints.

16.4.41 The potential visual impact of the Project is closely related to a range of parameters, one of the most important of which is distance. The ZTV clearly demonstrates that, within 5km, the potential visibility of the Project is variable, and primarily associated with the channel of Kyle Rhea and the areas to the north and south of it. Beyond 5km potential visibility becomes increasingly fragmented.

16.4.42 The potential visibility in relation to visual receptors is outlined below.

<u>Settlements</u>

16.4.43 The Project would be visible from the village of Glenelg, a small settlement on the north eastern edge of the Sound of Sleat. Glenelg is positioned approximately 3km from the Project. Potential visibility from Glenelg is particularly associated with the southern part of the village, where the strip of properties are closely aligned with the coastal edge and have open views over the Sound of Sleat. It is predicted that all four devices would be visible from this part of the village as shown in (Viewpoint 6). Visibility from the northern part of the village (from the church northwards) is more limited; the intervening landform reduces the number of devices that would be seen and visibility is further reduced by intervening vegetation and buildings, particularly for properties to the east of the road.

16.4.44 The other key settlement within 5km is Kylerhea, on the north west side of the Sound of Sleat. This comprises a small group of properties on the coastal edge at the bottom of Kylerhea Glen. It is predicted that the intervening landform will limit visibility to the very edge of the coastline. Further analysis of the ZTV for the Isolated Hazard Marker (Figure 16.2.4) suggests slightly greater visibility , indicating that the intervening landform is just high enough to truncate views from the majority of properties. This also suggests that only the upper sections of the devices will be visible, and vegetation/local landform may further reduce this potential visibility.

16.4.45 Other settlements within 5km comprise small clusters of houses (e.g. Galltair and Eilanreach) and dispersed properties. Analysis of the ZTV identifies that visibility is likely to be very limited for the majority of these. However, there are two particular properties from which the Project will be clearly visible on either side of the ferry crossing (represented by Viewpoints 1 and 2).

16.4.46 Beyond 5km, the main settlement from which the Project will be seen is Reraig, on the north side of Loch Alsh. There are open views over Loch Alsh, towards the Project from Reraig. However, the separation distance between the properties and the closest device will be approximately 6km. A viewpoint (Viewpoint 8) is included at Reraig, which reflects the potential view from this distance and direction.

<u>Transport Routes</u>

16.4.47 Roads within 5km of the Project are limited to minor roads. Analysis of the ZTV and field survey identifies that potential visibility of the array will be limited to short, isolated sections of road, particularly the minor road through Glenelg (corresponding with the visibility described for the village). Travelling northwards potential visibility is also associated with a section of the road to the south of Eilanreach (towards Arnisdale and Corran). However in reality plantation woodland restricts visibility and only relatively isolated views are possible (see Viewpoint 7).

16.4.48 At distances greater than 5km the key road from which the Project would be visible is the A87, to the north of Loch Alsh. However potential visibility is limited to a short section of this road, which coincides with Reraig (and Viewpoint 8, where there is a layby and marked viewpoint on Ordnance Survey mapping.

16.4.49 Kyle Rhea is used by a range of vessels, particularly fishing boats, vessels serving the fish farm industry and recreational vessels. Craft also travel through Kyle Rhea, the Sound of Sleat and Loch Alsh, including commercial and naval vessels, and occasional cruise ships, such as the Hebridean Princess. The Project will be visible from offshore locations, however because of the nature of the coastline it is possible to include a good range of onshore viewpoints that represent close and distant views. Therefore, no offshore viewpoints are included in the assessment.

Recreational Resources

16.4.50 Recreational vessels are discussed above, but in addition to these there are various land based recreational resources. It is also noted that people travel through the landscape on the roads (by car and bicycle) to appreciate the scenery. The potential visibility from roads is also described above (Viewpoints 1, 2, 6, 7 and 8). Other recreational resources are primarily associated with walking and visiting the beaches (including camping). The upland areas are used for walking and visibility associated with such areas has already been described. The most popular routes observed during field survey work were to and from the otter hide (to the north of Kylerhea) and the footpath that leads from the car park near the east side of the ferry crossing to Ardintoul and Totaig. Both these routes are largely through areas of forestry, which restricts visibility (although there are occasional views towards the Project). There are views across Kyle Rhea from the otter hide (viewpoint 3). The Project would be visible from the beaches at Kylerhea and Glenelg, however views from the larger sandy bay north of Glenelg would be prevented by intervening landform.

16.4.51 Other specific features that attract visitors include the War Memorial at Glenelg, Bernera Barracks (to the north of Glenelg) and the Brochs within Gleann Beag. All four devices would be visible from the War Memorial (Viewpoint 6). Views of the Project would be more limited from Bernera Barracks, the ZTVs showing that only one device would be visible . The Brochs are positioned within the bottom of Gleann Beag, with the intervening landform preventing views towards the Project.

Viewpoint Assessment

16.4.52 The viewpoint assessment has been carried out to identify and evaluate the potential impacts on visual amenity arising from the Project at specific representative locations in the study area. The location of viewpoints was initially determined as part of the desk study. Initial field work was undertaken in 2011, which identified a range of receptors which might be affected by the Project.

16.4.53 Having identified key sensitive receptors in the study area, those likely to be affected by the Project were derived through the study of Ordnance Survey mapping information. In order to confirm the suitability of the viewpoint selection, field survey verification was carried out. This involved checking the viewpoint locations on the ground to ensure that there would be views of the Project. The viewpoint selection process also involved consultation with The Highland Council and Scottish Natural Heritage. The types of receptors considered in the viewpoint assessment include the following:

- Residents;
- Road users; and
- People engaged in outdoor recreation.

16.4.54 The final viewpoint selection comprises 9 viewpoints which represent views from a range of representative landscape and visual receptors. These viewpoints reflect different distances, elevations and directions from the Project. The viewpoint locations are identified on the various figures that support this assessment e.g. Figure 16.3.1. The viewpoint analysis is supported by the detailed viewpoint location plans, photographs and computer generated visualisations/photomontages (Figures 16.4.1 to 16.4.9). The visualisations have been prepared to conform with the guidelines published by The Highland Council (The Highland Council, 2010, Visualisation Standards for Wind Energy Developments). The viewpoint photography and approach taken for the preparation of the visualisation is explained in more detail in the methodology section. The detailed viewpoint location plans (e.g. Figure 16.4.1a) show the included angles in the subsequent photographs/visualisations. The visualisations/photomontages typically show the Project in the operational position. Photomontages showing a device in the maintenance position have been included for viewpoints 1 and 2.

16.4.55 It is noted that the Project may appear more or less prominent in different lighting conditions. In poor visibility the devices may be difficult or impossible to discern. The visibility conditions experienced during the fieldwork were generally very clear. The relatively sheltered and enclosed position of the Project (primarily due to the surrounding landform) means opportunities for the devices to be either front lit or back lit when the sun is at low angle in the sky (e.g. at sunrise and sunset) are limited.

16.4.56 For the purposes of assessing the impacts on visual amenity, the sensitivity of the receptors is as defined within the method of assessment (Table 16.3). Visual receptor sensitivity to change is defined as being high, medium, low or negligible depending upon the activity of the receptor. It should also be noted that the assessment of potential impacts at any viewpoint cannot be extended to conclude the same impacts on the whole of the landscape character area within which the viewpoint occurs.

Viewpoint 1: Ferry Crossing, West	
Associated Figures:	Figures 16.4.1a-16.4.1j
Grid Reference:	178890, 821151
Distance and direction to Project (to closest device):	293m, north east
Receptors and sensitivity:	Residents, road users approaching ferry (high)
Description, nature and magnitude of change:	
The viewpoint is positioned on the road leading the slipway on the west (Isle of Skye) side of Kyle Rhea. It was located here to provide sufficient context to help place the Project in the landscape. In addition, the view included in the photographs was also selected (including clear features) to assist with understanding the orientation of the array and relative position in the view. The tidal array will be seen as a series of four structures extending above sea level. It is anticipated that the wake that will be created around each device will be visible, but this will vary in different tidal sea conditions. The proximity of the devices also means that that the detail of the devices can be discerned, including during periods of maintenance. The installation phase will also be clearly visible from this location. However, the installation and maintenance periods will be short in duration. The devices will be seen as part of the medium to long distance view that can be obtained in a northerly direction, framed by the landform to either side of Kyle Rhea. The tidal array will contrast with the relatively remote nature of this section of coastline. However, it should be noted that this view is not devoid of human influence. There is a residential property and the ferry slipway in the foreground, the landscape to either side of Kyle Rhea is covered by plantation woodland. The electricity transmission lines that cross the channel are visible in the middle distance. During summer months, when the ferry is in operation it can be a popular crossing point between the Isle of Skye and mainland Scotland, adding to the activity levels at this location. The Project will not fundamentally change the baseline conditions, adding a series of new elements, but will not prevent long distance views. In addition, the scale of the surrounding landform will help reduce the apparent size of the devices. While these changes will be long term, they will not be permanent. On decommissioning, the visual change at this location will be reversible. At night the context of this location is dark, with few light sources (as illustrated by Figure 16.4.1g. There are some lights present in the view, including Kyle Rhea Minor Light and, more conspicuously Reraig on the north side of Loch Alsh. The devices would have navigation lights attached to them (as indicated in Figure 16.4.1i and j), but these would be relatively discrete elements compared with the devices themselves and the associated change would be more limited. Overall, the magnitude of change at this viewpoint, caused by the Project will be **substantial.**	
Potential impacts:	
As the sensitivity of the receptor is **high**, the impact of the Project will be **major**. The nature of these impacts will be adverse.	
Significance:	**Significant**

Viewpoint 2: Ferry Crossing East	
Associated Figures:	Figures 16.4.2a – 16.4.2h
Grid Reference:	179462, 821292
Distance and direction to Project (to closest device):	380m, north west
Receptors and sensitivity:	Residents, road users approaching ferry (high)
Description, nature and magnitude of change:	
The viewpoint is positioned on the road leading the slipway on the east (mainland Scotland) side of Kyle Rhea. It was located here to provide sufficient context to help place the Project in the landscape. In addition, the view included in the photographs was also selected (including clear features) to assist with understanding the orientation of the array and relative position in the view. The array will be seen as a series of four devices extending above sea level. It is anticipated that the wake created around each device will be visible, but this will vary in different tidal sea conditions. The proximity of the devices also means that that the detail of the devices can be discerned, including during periods of maintenance. The installation phase will also be clearly visible from this location. However, the installation and maintenance periods will be short in duration. The devices will be seen as part of the medium distance view that can be obtained in a westerly direction, framed by the landform to either side of Kyle Rhea. The array will contrast with the relatively remote nature of this section of coastline. However, it should be noted that this view is not devoid of human influence; there is the ferry slipway in the foreground, a residential property and Kylerhea Minor Light to the right. The landscape to either side of the channel is covered by plantation woodland. During summer months, when the ferry is in operation it can be a popular crossing point between the Isle of Skye and mainland Scotland, adding to the activity levels at this location. The Project will not fundamentally change the baseline conditions, adding a series of new elements, but not preventing views across the channel. In addition, the scale of the surrounding landform will help reduce the apparent size of the structures. While these changes will be long term, they will not be permanent. On decommissioning, the visual change at this location will be reversible. At night the context of this location is dark, with few light sources (as illustrated by Figure 16.4.2h. There are occasional lights present in the view, including Kyle Rhea Minor Light and those associated with residential properties. The devices would have navigation lights attached to them, but these would be relatively discrete elements compared with the structures themselves and the associated change would be more limited. Overall, the magnitude of change at this viewpoint, caused by the Project will be **substantial.**	
Potential impacts:	
As the sensitivity of the receptor is **high**, the impact of the Project will be **major**. The nature of these impacts will be adverse.	
Significance:	**Significant**

Viewpoint 3: Otter Hide	
Associated Figures:	Figures 16.4.3a – 16.4.3f
Grid Reference:	178773, 822152
Distance and direction to Project (to closest device):	653m, south east
Receptors and sensitivity:	Visitors to the otter hide (high)
Description, nature and magnitude of change:	
The viewpoint is positioned at the otter hide to the north of the ferry crossing, on the Isle of Skye. It is located outside, but in close proximity to the hide. Potential visibility of the Project will be much more limited on the approach to the otter hide due to intervening forestry (allowing occasional, more intermittent views). Also note that more open views towards the Project would be obtained from the car park to the south. The array will be seen as a series of four devices extending above sea level. It is anticipated that the wake that will be created around each SeaGen Device will be visible, but this will vary in different tidal sea conditions. The proximity of the devices also means that that the detail of the devices will be discernable, including during periods of maintenance. The installation phase will also be clearly visible from this location. However, the installation and maintenance periods will be short in duration. They will be seen as part of the medium distance view that can be obtained in a southerly direction, framed by the landform to either side of Kyle Rhea. The tidal array will contrast with the relatively remote nature of this section of coastline. However, it should be noted that it is a view that is not devoid of human influence; the eastern ferry slipway and plantation woodland is visible. In addition, Kylerhea Minor Light and the electricity transmission lines that cross the channel are visible from within the hide. During summer months, when the ferry is in operation it can be a popular crossing point between the Isle of Skye and mainland Scotland, adding to the activity levels in the view. The Project will not fundamentally change the baseline conditions, or prevent views across/along the channel. In addition, the scale of the surrounding landform will help reduce the apparent size of the devices. While these changes will be long term, they will not be permanent. On decommissioning, the visual change at this location will be reversible. Lighting has not been assessed at this location. While it would be visible it is anticipated that very few people would visit this location at night. Overall, the magnitude of change at this viewpoint, caused by the Project will be **substantial.**	
Potential impacts:	
As the sensitivity of the receptors is **high** (visitors to the otter hide), the impact of the Project will be major The nature of these impacts will be adverse.	
Significance:	**Significant**

Viewpoint 4: Beinn Bhuidhe	
Associated Figures:	Figures 16.4.4a – 16.4.4f
Grid Reference:	178204, 821512
Distance and direction to Project (to closest device):	842m, east
Receptors and sensitivity:	Walkers (high)
Description, nature and magnitude of change:	
The viewpoint is positioned on the east facing slope of Beinn Bhuidhe, an outlining hill to Sgurr na Coinnich. The relative location to the Project, steepness of the landform and elevation of the viewpoint resulting in an alternative approach needing to be taken for the visualisations presented for this viewpoint. It was not possible to include the site in a photograph taken using a 50mm lens on a 35mm camera body, in landscape format and with the camera horizontal as this omitted the site from the frame/field of view. Therefore, in order to include the site with the camera level it was necessary to use a focal length of 20mm. This departs from the guidance for the preparation of visualisations, but has been discussed with officers of The Highland Council (who suggested the viewpoint). The officers appreciate the technical limitations and have requested that an explanation be included in the assessment (provided above). This has resulted in a slightly different sequence of images being presented in the associated figures. The 50mm and 70mm equivalent focal lengths that have been extracted from the original wide angle photographs result in the corresponding figures being relatively low resolution (compared with similar figures for the other viewpoints). It was noted that there are no distinct routes to the summit of this hill. Although it is acknowledged that this represents a suitable viewpoint it is anticipated that relatively few people visit this location. The array will be seen as a series of four devices extending above sea level. It is anticipated that the wake that will be created around each device will be visible, but this will vary in different tidal sea conditions. The proximity of the devices also means that that the detail of the devices will be discernible, including periods of maintenance. The installation phase will also be clearly visible from this location. However, the installation and maintenance periods will be short in duration. They will be seen as part of the long distance, open view that can be obtained in an easterly direction. The array will contrast with the relatively remote nature of this section of coastline. However, it should be noted that it is a view that is not devoid of human influence. The eastern ferry slipway, plantation woodland, Kylerhea Minor Light and the electricity transmission lines that cross the channel are all visible. During summer months, when the ferry is in operation it can be a popular crossing point between the Isle of Skye and mainland Scotland, adding to the activity levels in the view. The Project will not fundamentally change the baseline conditions. The scale of the surrounding landform will help reduce the apparent size of the devices, this is reinforced by the elevation of the viewpoint and the scale of the view that can be obtained from this location. While these changes will be long term, they will not be permanent. On decommissioning, the visual change at this location will be reversible. Lighting has not been assessed at this location. While it would be visible it is anticipated that very few people would experience this element of the Project. Overall, the magnitude of change at this viewpoint, caused by the Project will be **moderate.**	
Potential impacts:	
As the sensitivity of the receptors is **high**, the impact of the Project will be **major/moderate.** The nature of these impacts will be adverse.	
Significance:	**Significant**

Viewpoint 5: Ben Aslak	
Associated Figures:	Figures 16.4.5a – 16.4.5f
Grid Reference:	177528, 819418
Distance and direction to Project (to closest device):	1.9 km, north east
Receptors and sensitivity:	Walkers (high)
Description, nature and magnitude of change:	
The viewpoint is positioned on the ridge that extends to the east of Ben Aslak. It was noted that there are no distinct routes to the summit of this hill. Although it is acknowledged that this represents a suitable viewpoint, it is anticipated that relatively few people visit this location. The proposed tidal array will be seen as a series of four structures extending above sea level. It is anticipated that the wake that will be created around each device will be discernible, but this will vary in different tidal sea conditions, with this feature being more visible during calmer conditions (but when the tide is flowing). The distance to the devices also means that that the detail of the structures, including during periods of maintenance, will be less apparent than at other viewpoints. The installation phase will also be visible from this location. However, the installation and maintenance periods will be short in duration. The Project will be seen as part of the long distance, open view that can be obtained in a north easterly direction. The array will contrast with the relatively remote nature of this section of coastline. However, it should be noted that it is a view that is not devoid of human influence; the eastern ferry slipway, settlement of Kylerhea, plantation woodland, Kylerhea Minor Light and the electricity transmission lines that cross the channel are all visible. During summer months, when the ferry is in operation it can be a popular crossing point between the Isle of Skye and mainland Scotland, adding to the activity levels in the view. The Project will not fundamentally change the baseline conditions, adding a series of new elements within the channel. In addition, the scale of the surrounding landform will help reduce the apparent size of the structures and this is reinforced by the elevation of the viewpoint and the scale of the view that can be obtained from this location. The separation distance between The Project and the viewpoint will reduce its prominence in the view. While these changes will be long term, they will not be permanent. On decommissioning, the visual change at this location will be reversible. Lighting has not been assessed at this location. While it would be visible it is anticipated that very few people would experience this element of the Project. Overall, the magnitude of change at this viewpoint, caused by the Project will be **moderate.**	
Potential impacts:	
As the sensitivity of the receptors is **high**, the impact of the Project will be **major/moderate**. The nature of these impacts will be adverse.	
Significance:	**Significant**

Viewpoint 6: Glenelg – War Memorial	
Associated Figures:	Figures 16.4.6a – 16.4.6i
Grid Reference:	180967, 819177
Distance and direction to Project (to closest device):	2.92km, north west
Receptors and sensitivity:	Residents, visitors, road users (high)
Description, nature and magnitude of change:	
The viewpoint is positioned on the coastal edge in Glenelg at the War Memorial. The array will be seen as a series of four structures extending above sea level. It is anticipated that, at this distance, the wake associated with each device will not be discernable. The separation distance between the viewpoint and the Project will mean that the degree of detail that will be visible will be limited, including during periods of maintenance. While the installation phase will be visible, the prominence of this will also be limited due to the intervening distance. In addition, the installation and maintenance periods will be short in duration. The devices will be seen as part of the medium distance view that can be obtained in a north westerly direction. The array will contrast with the relatively undeveloped nature of the coastline. However, as the viewpoint is located within Glenelg there is human influence clearly visible in the immediate vicinity. The Project will form a relatively discrete element in the view, with the scale of the surrounding landform helping to reduce the apparent size of the structures. It will not fundamentally change the baseline conditions, adding a series of relatively small scale new elements to the view. While these changes will be long term, they will not be permanent. On decommissioning, the visual change at this location will be reversible. At night the context of this location is dark, with few light sources (as illustrated by Figure 16.4.6g. There are occasional lights present in the view, associated with residential properties and a boat travelling through the left side of the photograph. Light sources are visible within Glenelg (residential properties), but these are beyond the field of view presented in the photograph. The devices would have navigation lights attached to them (as indicated in Figure 16.4.6h and i), but these would be relatively discrete elements likely to be no more prominent than the lights associated with residential properties. Overall, the magnitude of change at this viewpoint, caused by the Project will be **slight.**	
Potential impacts:	
As the sensitivity of the receptors is **high**, the impact of the Project will be **moderate**. The nature of these impacts will be adverse.	
Significance:	**Not significant**

Viewpoint 7: Road to Corran/Arnisdale	
Associated Figures:	Figures 16.4.7a – 16.4.7e
Grid Reference:	179614, 817154
Distance and direction to Project (to closest device):	4.27km, north
Receptors and sensitivity:	Road users (high)
Description, nature and magnitude of change:	
The viewpoint is positioned just off the road that links Glenelg and Corran/Arnisdale. It represents one of very few open views in a northerly direction from this road, as these are typically restricted or prevented by intervening woodland. However, it is acknowledged that extensive felling of the forestry in this area in taking place, which could open up more views in the future. The sensitivity of receptor is defined as being high as it is noted that people travel along the road to appreciate the scenery. The array will be seen as a series of four structures extending above sea level. It is anticipated that, at this distance, the wake associated with each Device will not be discernable. The separation distance between the viewpoint and the Project will mean that the degree of detail that will be visible will be limited, including during periods of maintenance. While the installation phase will be visible, the prominence of this will also be limited due to the intervening distance. In addition, the installation and maintenance periods will be short in duration. The devices will be seen as part of the long distance view that can be obtained in a northerly direction. The array will contrast with the relatively undeveloped nature of the coastline. Human influence is visible throughout the view e.g. residential development and forestry plantations. The Project will form a relatively discrete element in the view, depending on the light and weather conditions. The scale of the surrounding landform would also reduce the apparent size of the structures. It will not fundamentally change the baseline conditions, but will add a series of relatively small scale new elements to the view. While these changes will be long term, they will not be permanent. On decommissioning, the visual change at this location will be reversible. Lighting has not been assessed at this location. While it would be visible the viewpoint represents a very intermittent view that would only by experienced by road users. In addition, at this distance the lighting is expected to form a discrete element likely to be no more prominent than the lights associated with residential properties. Overall, the magnitude of change at this viewpoint, caused by the Project will be **negligible.**	
Potential impacts:	
As the sensitivity of the receptors is **high** the impact of the Project will be **moderate/minor**. The nature of these impacts will be adverse.	
Significance:	**Not significant**

Viewpoint 8: Reraig	
Associated Figures:	Figures 16.4.8a – 16.4.8f
Grid Reference:	181396, 827133
Distance and direction to Project (to closest device):	6.01km, south west
Receptors and sensitivity:	Residents (high), visitors (high) road users (medium)
Description, nature and magnitude of change:	
The viewpoint is positioned on the A87 at Reraig, to the north of Loch Alsh. It is beyond the 5km study area, but it is included in the assessment because the A87 comprises the closest primary road and is the main route to/from the Isle of Skye. The array will be seen as a series of four structures extending above sea level. However, at this the wake and detail associated with each device will barely be discernable (including during periods of maintenance). While the installation phase will be visible, the prominence of this will also be limited due to the intervening distance. In addition, the installation and maintenance periods will be short in duration. The devices will be seen as part of the long distance view that can be obtained in a south westerly direction. The tidal array will contrast with the relatively undeveloped nature of the coastline. However, human influence is visible within the view, and more noticeably at the viewpoint itself. The Project will form a relatively discrete element in the view, with the intervening distance and scale of the surrounding landform reducing the apparent size of the structures. It will not fundamentally change the baseline conditions, adding a series of relatively small scale new elements to the view. While these changes will be long term, they will not be permanent. On decommissioning, the visual change at this location will be reversible. At night the context of this location is dark, with few light sources (as illustrated by Figure 16.4.6f. There are occasional small lights present in the view. Far more noticeable are the lights at the viewpoint itself, but these are beyond the field of view presented in the photograph. The devices would have navigation lights attached to them, but these would be relatively discrete elements particularly compared with the lights at the viewpoint. Overall, the magnitude of change at this viewpoint, caused by the Project will be **negligible.**	
Potential impacts:	
As the sensitivity of the receptors is **high** (residents and visitors) and **medium** (road users) the impact of the Project will be **moderate/minor** or **minor**. The nature of these impacts will be adverse.	
Significance:	**Not significant**

Viewpoint 9: Meall Buidhe	
Associated Figures:	Figures 16.4.9a – 16.4.9e
Grid Reference:	180596, 814534
Distance and direction to Project (to closest device):	7.02km, north
Receptors and sensitivity:	Walkers (high)
Description, nature and magnitude of change:	
The viewpoint is positioned on Meall Buidhe, a hill on the northern edge of the Knoydart National Scenic Area. It was noted that there are no distinct routes (after forest tracks) to the summit of this hill. The array will be seen as a series of four devices extending above sea level. However, at this distance the wake and detail associated with each device will barely be discernable (including during periods of maintenance). While the installation phase will be visible, the prominence of this will also be limited due to the intervening distance. In addition, the installation and maintenance periods will be short in duration. The devices will be seen as part of the long distance view that can be obtained in a northerly direction. The array will contrast with the relatively undeveloped nature of the coastline. The Project will form a relatively discrete element in the view, with the scale of the surrounding landform and intervening distance reducing the apparent size of the structures. It will not fundamentally change the baseline conditions, adding a series of relatively small scale new elements to the view. While these changes will be long term, they will not be permanent. On decommissioning, the visual change at this location will be reversible. Lighting has not been assessed at this location. While it would be visible it is anticipated that very few people would experience this element of the Project. Overall, the magnitude of change at this viewpoint, caused by the Project will be **negligible.**	
Potential impacts:	
As the sensitivity of the receptor is **high** (walkers) the impact of the Project will be **moderate/minor**. The nature of these impacts will be adverse.	
Significance:	**Not significant**

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Potential impacts during decommissioning

16.4.57 The decommissioning phase would comprise a partial reversal of the installation phase, noting that certain elements are likely to remain *in situ* e.g. the underground cable and device foundations. There will be an impact related to the presence of working vessels associated with Project during decommissioning. However, any potential impacts associated with this phase will the short term and temporary. In addition, this phase will involve the removal of the key visible components of the project, reversing the seascape, landscape and visual impact associated with the operational phase.

16.4.58 Overall, due to the factors outlined above, it is anticipated that the direct impacts would not be significant.

Potential cumulative / in-combination impacts

16.4.59 The Project will add to the existing development in this part of Scotland. Although the Project will be located within a relatively remote, undeveloped and rural context, it will not sit as an isolated example of human activity, it will be seen in the context of forestry plantation, electricity transmission lines, the ferry crossing, roads, settlements/residential properties and vessels travelling through Kyle Rhea. No other proposed developments likely to give rise to cumulative impacts have been identified during the course of the assessment, including discussions with consultees.

Mitigation measures

16.4.60 Mitigation measures in relation to this assessment comprise those measures that are already incorporated in the proposed development, together with those that could offer further mitigation, should it be possible to consider them later in the design process. The incorporated mitigation comprises aspects of onshore elements/operations. The further mitigation that may be possible to incorporate at a later date includes aspects of the detailed design of the devices e.g. colouring and lighting, however these are largely constrained by shipping and navigation requirements (see Chapter 17).

16.4.61 The directional drilling element of the Project will be short term and temporary works. Reinstatement of the ground will be carried out to ensure any direct impacts are reversed and mitigated e.g. vegetation reinstated where areas of hardstanding is removed (incorporated mitigation).

16.4.62 Careful design of the substation, including the materials used in its construction and/or the reuse of an existing building would reduce any associated visual impacts. The location within the FC land is in a visually discrete place, set at the edge of plantation woodland. The substation would still be seen by people walking the FC track (route to the otter hide). The replacement of the existing structures with a new single structure would further help to reduce the potential visual impacts associated with this element. The alternative option, placing the substation within an existing building at the ferry slipway would result in no obvious changes to the current baseline.

16.4.63 It may also be possible to provide further measures to mitigate potential seascape/landscape and visual impacts associated with the devices. These would be defined through further consultation and would influence the detailed design of the devices where possible. As certain specific details of the Project have not been fully defined e.g. requirement for the colouring of the devices, this assessment is based on a realistic worst case scenario.

16.4.64 Alterations to the colouring, height and lighting of the devices could reduce the potential impact. Darker colouring than the yellow assumed for the purpose of this assessment would make the proposed structures more recessive. However, the colouring requirements will be largely defined through navigation requirements and safety (with consultation with the Northern Lighthouse Board and Maritime and Coastguard Agency. The height of the devices used in the assessment is anticipated to comprise a worst case and may be less. Reducing the lighting requirements (or limiting the areas from which they would be seen through design or the use of shields) could also help to mitigate the potential impact. Again, these measures involve judgements around safety and any decision would have to be informed through consultation with the relevant navigation consultees.

16.4.65 Education about the Project may increase its acceptance. The ferry crossing points and/or elevated locations such as the car park near the otter hide will offer good opportunities to view the Project. Sea Generation (Kyle Rhea) Ltd. will seek to support opportunities for visitor education.

16.5 Summary of impacts

16.5.1 This assessment has examined the potential impacts of the Project on seascape, landscape and visual amenity within the study area (and beyond). The SLVIA has considered the potential direct impacts on the seascape and the potential impacts on the perception of seascape and landscape character. The assessment has also considered the potential impacts of the Project on visual amenity for a range of sensitive receptors.

16.5.2 The seascape/landscape setting of the Project is that of a dramatic and relatively remote coastline. However it is not recognised for its scenic beauty through any national or local designations. There is a range of potential visual receptors located within the surrounding area, including residents, road users, ferry users and people engaged in both land and sea based recreation.

Impacts on the Landscape Resource

16.5.3 The perception of direct impacts on the fabric of the seascape will be limited. The devices will be attached to foundations secured to the seabed. The devices would be removed on decommissioning. While it may not be possible to remove all the elements of the Project, all visible components will be removed and the visual characteristics of the seascape will revert to pre-development conditions. There will be some impacts on the fabric of the seascape and landscape resulting from the installation of the cable connection; these impacts will be short term changes during the installation phase. The substation would be the most conspicuous land based element of the Project, but this would be located in a relatively discrete area on the edge of plantation woodland (option 1) or in an existing building (option 2) and may replace existing structures. Impacts on landscape resource will be minor and, in the context of this assessment, not significant.

16.5.4 The array will be seen throughout the surrounding area, and has the potential to affect the perception of seascape and landscape character. The sense of remoteness and tranquillity of this area accentuates its sensitivity. In addition Kyle Rhea, and the association between the Isle of Skye and mainland Scotland, is a key aspect of local and regional character. However, this is offset by the large scale of the landscape compared with the Project, together with the largely reversible nature of the development.

16.5.5 Overall, the SLVIA has identified that there will be some adverse impacts as result of the Project, but in most cases these are not predicted to be significant. There are predicted to be some locally significant impacts in relation to the Kyle Rhea coastal character area. However, beyond this the predicted impacts on seascape/landscape character are not predicted to be significant. In addition, the assessment is based on certain aspects that represent a perceived realistic worst case scenario, which for many parameters, height, colour etc., will be conservative. As a result the Project when built may have impacts of less significance than has been assumed in this chapter.

Impacts on Visual Amenity

16.5.6 The scale and nature of the Project compared with the receiving environment means that there will be some adverse impacts on visual amenity. These potential impacts will be mitigated by the restricted potential visibility and scale of the Project, together with reversible characteristics of the Project.

16.5.7 The key visual receptors that will be able to view the Project at relatively close range include residents of individual properties, ferry users, walkers and visitors to the otter hide. Notably all viewpoints where significant impacts are predicted are all within 2km and positioned adjacent to, or on landform adjacent to (or in close proximity to), Kyle Rhea. The key visual receptors are likely to be those at low elevation e.g. residents, ferry/road users and visitors to the otter hide. While it is acknowledged that there will be potential views from the hillsides above Kyle Rhea, these are unlikely to be experienced by many people. It is predicted that the introduction of the array could have some significant effects on these receptors. The Project will be decommissioned after 25 years and the devices and substation removed, reversing the potential impacts.

16.6 References

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17 SHIPPING AND NAVIGATION

Page

17.1 Introduction

17.1.1 This chapter of the Environmental Statement (ES) describes the current shipping and navigation activity within the proposed Kyle Rhea Tidal Array ('the Project') and associated study area. The impact of the potential interaction between the Project and vessel activity is assessed for the installation, operation (and maintenance) and decommissioning phases of the Project. Where appropriate, mitigation measures are proposed to ensure the identified effects are avoided, removed or minimised, where possible. Potential cumulative impacts are also considered.

17.1.2 More details of the baseline data collected and the assessment undertaken are provided in the Navigation Risk Assessment (Anatec, 2012) in Appendix 17.1.

17.1.3 This chapter has links with Chapter 15 Commercial Fishing, Chapter 22 Tourism and Recreation and Chapter 23 Military Activity.

Study area

17.1.4 The wider study area considered for the shipping and navigation assessment included Kyle Rhea and extended to include navigational features to the north, in Kyle Akin, and to the south, in the Sound of Sleat, allowing Kyle Rhea to be placed into a wider context. Figure17.1 shows the Array Boundary defined by Sea Generation (Kyle Rhea) and the cross section across Kyle Rhea used to carry out detailed traffic analysis.

Overview of potential impacts

17.1.5 The main navigational effects of the Project are assessed as:

- Obstruction to vessel navigation; and
- Increased risk of vessel collision, between vessels and the devices (surface and subsea elements) and between vessels due to reduced sea room (the area available to shipping).

Policy, legislation and guidance in relation to shipping and navigation

17.1.6 The assessment was carried out in accordance with the following primary guidance:

- Maritime and Coastguard Agency (MCA) Marine Guidance Note (MGN) 371 (M+F) Offshore Renewable Energy Installations (OREIs). Guidance on UK Navigational Practice, Safety and Emergency Response Issues (MCA, 2008a); and
- Department for Energy and Climate Change (DECC) Methodology for Assessing the Marine Navigational Safety Risks of Offshore Wind Farms (DTI, 2005).

17.1.7 Other relevant guidance and references used in the assessment included:

- MCA Marine Guidance Note 372 (M+F) Offshore Renewable Energy Installations (OREIs). Guidance to Mariners Operating in the Vicinity of UK OREIs (MCA, 2008b);
- DECC Guidance Notes on Safety Zones (DECC, 2011);
- International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) Recommendation O-139 on the Marking of Man-Made Offshore Structures (IALA AISM, 2008); and
- International Maritime Organisation (IMO), Guidelines for Formal Safety Assessment (FSA) For Use in the IMO Rule-Making Process MSC/Circ. 1023 and MEPC/Circ. 395 (IMO, 2002).

17.2 Methodology

17.2.1 The methodology was based on the MCA and DECC guidance listed above. The key elements are detailed below.

Consultation in relation to shipping and navigation

17.2.2 A number of users of Kyle Rhea and other relevant bodies, including vessel operators, emergency services and national organisations have been consulted about the Project. A Hazard Review Workshop was also carried out with stakeholders, to identify and discuss potential hazards and associated risk control measures. Comments regarding navigation were also made within the Scoping Opinion.

17.2.3 Table 17.1 presents a summary of the key issues raised in the Scoping Opinion and in the consultation carried out as part of the Navigation Risk Assessment (NRA), with reference to the ES sections relevant to the specific comment.

Table 17.1: Summary of consultation relating to shipping and navigation

Key issues raised	Response
The NRA should be carried out in accordance with the guidance and methodology in Marine Guidance Note 371 (M). (Scoping Opinion – Scottish Ministers, Marine Scotland, MCA)	NRA carried out in accordance with MGN 371. Section 17.1 Introduction
We do not agree with the subsequent assessment in Table 6.1 b for Shipping and Navigation. For installation we would consider the "disruption to search and rescue" as red with "increased journey time" and "collision with array as orange" (Scoping Opinion – MCA)	NRA Hazard Review Workshop has superseded the previous assessment. Section 17.4 Impact Assessment
The 14 days March 2010 traffic survey provides an inaccurate representation of recreational traffic in Kyle Rhea, as many recreational vessels will remain laid up for the winter. It would be expected that an additional survey would be carried out during the high season of May to September in order to gauge the full extent of recreational vessel numbers. (Scoping Opinion – MCA, Royal Yachting Association (RYA) Scotland)	Summer data has been collected in June 2010. Section 17.3 Existing Environment
The majority of summer recreational traffic is on passage north or south, to save time rounding Skye. More study of traffic patterns and examinations of the effect of currents on the passage of small craft is required, taking into account the proposed siting of the devices. (Scoping Opinion – MCA, RYA Scotland)	Section 17.3 Existing Environment, Section 17.4 Impact Assessment

Key issues raised	Response
Method Statement to form part of the Coast Protection Act (CPA) Application, and note that any devices deployed as part of the technology assessment, permanent installation and eventual decommissioning will require careful planning to minimise the hazards posed by permanent moorings, or temporary moorings deployed during any installation and decommissioning activities. (Scoping Opinion – Northern Lighthouse Board (NLB))	Section 17.4 Impact Assessment
Cable route to shore to be given separate comment within the NRA. UK Hydrographic Office (UKHO) to be informed of the route and landfall location in order that Admiralty Charts are updated. (Scoping Opinion – NLB)	Section 17.4 Impact Assessment
The ES should address the RYA's concerns regarding recreational boating and offshore energy developments which are included in their position statement. (Scoping Opinion – RYA Scotland)	RYA Scotland has been consulted during the NRA. Section 17.4 Impact Assessment
The ES should take into account and represent Geographical Information System (GIS) data from the UK Coastal Atlas of Recreational Boating. (Scoping Opinion – RYA Scotland)	Section 17.3 Existing Environment
Devices will pose collision risk to transiting vessels. (Scoping Opinion – RYA Scotland, Scottish Ministers. NRA Consultation – Clyde Cruising Club (CCC), Cruising Association (CA), Ferguson Transport, Gordonstoun School, Master of Hebridean Princess, Kyle Harbour, Lochalsh Fisherman's Association, Mallaig Harbour Authority, Mallaig Marine, Marine Harvest, NLB, Royal National Lifeboat Association (RNLI) Mallaig, RYA Scotland, Skye Ferry)	Collision risk hazards covered in Section 17.4 Impact Assessment
Under-water clearance of subsea rotors. (Scoping Opinion – MCA, RYA Scotland, Scottish Ministers. NRA Consultation – Clyde Cruising Club (CCC), Cruising Association (CA), Ferguson Transport, Master of Hebridean Princess, Kyle Harbour, Lochalsh Fisherman's Association, Mallaig Harbour Authority, Mallaig Marine, Marine Harvest, NLB, Royal National Lifeboat Association (RNLI) Mallaig, RYA Scotland, Skye Ferry)	Section 17.3 Existing Environment, Section 17.4 Impact Assessment
Loss of navigable sea room and re-routeing within Kyle Rhea or west of Skye. (NRA Consultation – CCC, CA, Gordonstoun School, Ferguson Transport, Marine Harvest, Master of Hebridean Princess, Kyle Harbour, Lochalsh Fisherman's Association, Mallaig Harbour Authority, Mallaig Marine, NLB, RYA Scotland, Scottish Ministers, Skye Ferry)	Section 17.4 Impact Assessment
Risk management and emergency response. (Scoping Opinion – RYA Scotland, Scottish Ministers. NRA Consultation – CCC, CA, Master of Hebridean Princess, Kyle Harbour, Lochalsh Fisherman's Association, Mallaig Marine, NLB, RNLI Kyle of Lochalsh, RNLI Mallaig, RYA Scotland, Skye Ferry)	Section 17.4 Impact Assessment

Key issues raised	Response
Marking and lighting, e.g. impact on existing leading light at Kyle Rhea Lighthouse. (Scoping Opinion – NLB, RYA Scotland, Scottish Ministers. NRA Consultation – Mallaig Harbour Authority, Marine Harvest, NLB, RNLI Mallaig, RYA Scotland, Skye Ferry)	NLB have been consulted on this issue. Section 17.4 Impact Assessment
Weather / sea state (influence on navigation) (NRA Consultation - CCC, Ferguson Transport, Lochalsh Fisherman's Association, Master of Hebridean Princess, Kyle Harbour, Mallaig Harbour Authority, Mallaig Marine, Marine Harvest, RNLI Mallaig, RYA Scotland, NLB, Skye Ferry)	Section 17.4 Impact Assessment

Data collection

17.2.4 The main data sources used to identify the baseline navigational features and activity in Kyle Rhea are presented in Table 17.2.

Table 17.2: Data sources to inform the existing environment

Data Source	Spatial coverage	Author	Year
Admiralty Charts	2540 – Loch Alsh and Approaches 2540_2 – Kyle Rhea	UKHO	2012
Admiralty Sailing Directions NP66 West Coast of Scotland	West coast of Scotland from Mull of Galloway to Cape Wrath including the Hebrides and off-lying islands	UKHO	2011
Automatic Information System (AIS) and radar data, supplemented with visual observations	Kyle Rhea	Marico Marine	2010
Fishing vessel surveillance sightings GIS data	International Council for the Exploration of the Sea (ICES) Subsquares 43E4/1 and 43E4/3	Marine Scotland Compliance	2011
Fishing vessel surveillance satellite data in digital image format	International Council for the Exploration of the Sea (ICES) Subsquares 43E4/1 and 43E4/3	Marine Scotland Compliance	2011
RNLI maritime incident GIS data	Within 5nm of Project	RNLI	2011
Marine Accident Investigation Branch (MAIB)	Within 5nm of Project	MAIB	2011
UK Coastal Atlas of Recreational Activity and GIS data	Kyle Rhea and surrounding area	RYA and CA	2009
Clyde Cruising Club Sailing Directions and Anchorages	Ardnamurchan to Cape Wrath	Clyde Cruising Club Publications Ltd.	2011
The Cruising Almanac	Shetland Islands to Gibraltar – West Ireland to Southwest Baltic	Imray Laurie Norrie & Wilson	2012

Data Source	Spatial coverage	Author	Year
		Ltd and the Cruising Association	

Impact assessment

17.2.5 The shipping and navigation impacts assessment methodology follows the IMO's Formal Safety Assessment (FSA) process and the DECC / MCA Guidelines.

17.2.6 A Hazard Review Workshop was carried out to identify and review the potential navigational hazards associated with the Project. Stakeholders representing the various types of vessel activity and emergency response organisations in the area were invited to ensure the review took into account local factors and benefitted from local knowledge and experience. Hazards (impacts) have been categorised using the frequency (likelihood of impact occurring) and consequence (expected outcome of the impact occurring) categories in Table 17.3 and Table 17.4.

Table 17.3: Frequency bands

Rank	Description	Definition
1	Negligible	< 1 occurrence per 10,000 years
2	Extremely Unlikely	1 per 100 to 10,000 years
3	Remote	1 per 10 to 100 years
4	Reasonably Probable	1 per 1 to 10 years
5	Frequent	Yearly

Table 17.4: Consequence bands

Rank	Description	Definition
1	Negligible	No injury
2	Minor	Slight injury(s)
3	Moderate	Multiple moderate or single serious injury
4	Serious	Serious injury or single fatality
5	Major	Multiple fatalities

17.2.7 The frequency and consequence scores are multiplied together to obtain an overall ranking which determined the hazard's position within the risk matrix shown in Table 17.5.

Table 17.5: Risk matrix (definitions provide below)

Risk		Frequency				
		Negligible	Extremely Unlikely	Remote	Reasonably Probable	Frequent
Consequence	Major	Moderate	Moderate	High	High	High
	Serious	Low	Moderate	Moderate	High	High
	Moderate	Low	Low	Moderate	Moderate	High
	Minor	Low	Low	Low	Moderate	Moderate
	Negligible	Low	Low	Low	Low	Moderate

	Broadly Acceptable Region (Low Risk)	Generally regarded as insignificant and adequately controlled. None the less the Law still requires further risk reductions if it is reasonably practicable. However, at these levels the opportunity for further risk reduction is much more limited.
	Tolerable Region (Moderate Risk)	Typical of the risks from activities which people are prepared to tolerate to secure benefits. There is however an expectation that such risks are properly assessed, appropriate control measures are in place, residual risks are ALARP (As Low As Reasonably Practicable) and that risks are periodically reviewed to see if further controls are appropriate.
	Unacceptable Region (High Risk)	Generally regarded as unacceptable whatever the level of benefit associated with the activity.

17.2.8 Selected hazards were also subject to quantitative collision risk modelling. All the quantified risk assessments were carried out using Anatec's COLLRISK software which conforms to the DECC guidance. Full details on the approach taken are provided in the NRA (Anatec, 2012).

17.3 Existing environment

17.3.1 Description of the existing environment presents an assessment of the existing navigational features and shipping activity recorded within Kyle Rhea.

Navigational features

17.3.2 Kyle Rhea separates the east coast of the Isle of Skye from the mainland of Scotland. The minimum width of the channel at any potential device location is 550m between landfalls (440m between the charted 5m contours) at the indicative location of Device 1 (see Figure 17.1). This compares to 420m between landfalls (260m between 5m contours) at the narrowest part of the channel. The Kyle is approximately 2nm (4km) long and connects the Sound of Sleat with Loch Alsh, forming part of an inshore traffic route along the west coast of Scotland, as described in the Admiralty Sailing Directions (UKHO, 2011). This route is recommended only for small vessels, due to the limiting conditions that the Skye Bridge imposes in Kyle Akin.

17.3.1 The main aid to navigation within Kyle Rhea is the Kyle Rhea Sector Light, a white tower 7m high. This is a three-colour directional sectored light designed to keep vessels in the centre of the channel, indicated by the white ('safe') sector. At present, three of the four proposed device locations are within the current white sector of this light, as shown in Figure 17.2. The southernmost device is in the red sector to the west of the white sector. (Note, as part of the mitigation plan the sector light would be changed and/or additional lighting introduced based on NLB guidance).

17.3.2 The Admiralty Sailing Directions state that while waiting for a favourable tidal stream, mariners may obtain anchorage at the south end of the Kyle, in Bàgh Dùnan Ruadh and, for small vessels, in Glenelg Bay and Bernera Bay. At the north end of Kyle Rhea, anchorages suitable for coasters[41] may be obtained off Rubha Buidhe and in Balmacara Bay. It also states that it is not advisable to proceed through Kyle Rhea at night without local knowledge.

17.3.3 There are charted cables spanning the north end of the Sound of Sleat, approximately 1,880m south of the Project study area. In Kyle Rhea itself, approximately 950m north of the study area, there is an overhead power cable with pylons, which has 60m safe vertical clearance above Height Datum. To the north, in Kyle Akin, there are a number of submarine cable areas and submarine power cables. The Skye Bridge, with a vertical clearance of 29m and navigable width of 80m, spans the west entrance to Kyle Akin.

Metocean data

17.3.4 Admiralty Sailing Directions provide a detailed description of the tides, eddies and overfalls in the area, and notes that the strong tidal streams may at times constitute a hazard to vessels on passage through the Kyle. Tidal stream data for the area are presented in Chapter 5.

17.3.5 For the modelling of under keel clearance of the device rotors, tidal and wave height data were analysed. Waves in the area are locally generated and ocean swell is negligible and on an annual basis, the probability of the significant wave height exceeding 0.5m is 1.3%. The 100-year extreme significant wave height was estimated to be 1.3m. Tidal data analysis indicated that 96% of the time the tidal height is at least 1m above LAT, 77% of the time it is at least 2m above LAT with mean sea level being 3m above LAT.

Survey data analysis (overview)

17.3.6 The baseline maritime traffic survey (Appendix 17.1) for the Project comprised of 35 days of data, collected using radar, AIS and visual observations (Marico Marine, 2010). This was made up of 15 days winter data (Feb / Mar 2010) and 20 days summer data (Jun 2010).

17.3.7 During the winter period, there was an average of five to six vessels per day tracked by the survey. In the summer period, this increased to an average of 23 vessels per day. This difference was mainly due to increased recreational vessel activity in the summer period, as illustrated by the vessel type distribution presented in Figure 17.3.

[41] Coastal trading vessels with generally shallow draughts.

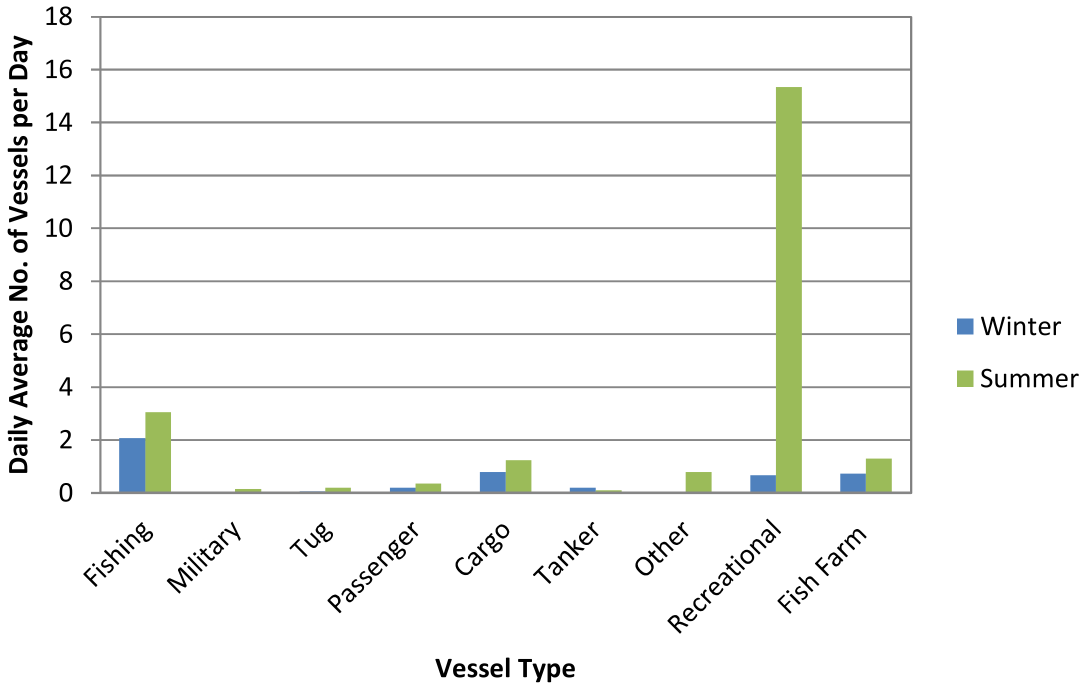

Figure 17.3: Vessel type distribution

17.3.8 In the winter period, fishing vessels (including fish farm support vessels), made the majority of transits, an average of three per day. This was fairly consistent in the summer period, with an average of four per day.

17.3.9 Figure 17.4 and Figure 17.5 present an overview of the vessel tracks observed during the winter and summer periods, thematically mapped by vessel type. More detailed plots of the tracks in the vicinity of the device locations, which were observed to be crossing the gate at Kyle Rhea, are presented in Figure 17.6 and Figure 17.7.

17.3.10 In terms of vessel size, a large proportion of vessels tracked on radar were unspecified. However, excluding these, the average vessel length was 31.4m and the longest vessel was the passenger ferry *Sea Discoverer* at 91m.

17.3.11 Draught information was only available for a minority of vessels. A combined plot of the transiting traffic, thematically mapped by draught, is presented in Figure 17.8. The majority of vessels did not broadcast draught information. These were mainly recreational vessels and local fishing vessels which typically have draughts below 3m. Deeper draughts were associated with fish farm vessels and merchant / passenger vessels. The deepest draught vessel was the 87m long general cargo vessel *Alholmen,* with a draught of 6m, bound for Finland.

Kyle Rhea ferry

17.3.12 A ro-ro ferry service operates between Glenelg on the mainland and Kylerhea on the Isle of Skye. The *Glenachulish* manually operated turntable ferry runs daily from Easter to mid-October. Sailings are every twenty minutes, or as required, from 10:00 to 18:00 (April / May / October) and 10:00 to 19:00 (June / July / August).

17.3.13 The ferry route is only 500m long and, therefore, the radar equipment during the survey was unable to track and identify the target before it had completed the crossing. However, based on visual observations during the survey, the ferry was not seen to deviate from the rhumb line (the straight line between the ferry landing points) route, such that it would interact with the nearest device location 160m to the north. Consultation with the ferry company indicated they may transit as far north as the devices in extreme flood tides, but this would be rare and could be managed.

17.3.14 The design draught of the ferry is approximately 1.3m and therefore it is not capable of interacting with the subsea rotors.

Fishing vessel activity analysis

17.3.15 During the combined 35 day survey period, there were 63 transits by fish farm support vessels and 74 by traditional fishing vessels. All of the tracks recorded are presented in Figure 17.9. Fishing vessels tracked more than five times include *Helen Bruce* and *Mairead M*, which use creels, and *Our Catherine*, a bottom 'otter trawler'. All fishing vessels were transiting the site and not fishing.

17.3.16 Sightings data based on over-flights and patrols were obtained from Marine Scotland Compliance and analysed for the period 2007 to 2011. No vessels were tracked within Kyle Rhea. Vessel monitoring system (VMS) data were also obtained from Marine Scotland Compliance for 2010-11. This data covers UK-registered fishing vessels of 15m length and over, with position reports received every two hours on average. This showed a number of vessel positions in the area, those vessels in the immediate vicinity of the Project appeared to be steaming on passage rather than fishing.

17.3.17 Local consultation indicated no commercial fishing in the immediate vicinity of the Project. This agrees with the commercial fisheries work reported in Chapter 15. There is no aquaculture in Kyle Rhea but fish farm well boats (vessels which contain vats of water in which to transport live fish prior to harvest) do transit when heading north or south, as identified in the survey. Transits are also made by vessels towing fish cages of up to 50m wide. It is estimated from consultation that approximately 40 of these tows are made per year.

Recreational vessel activity analysis

17.3.18 The tracks of recreational vessels recorded during the combined summer and winter period are presented in Figure 17.10. There were 278 transits of Kyle Rhea during the traffic survey, with all but two of these occurring during the summer period.

17.3.19 The RYA Coastal Atlas data indicates that Kyle Rhea is a General Sailing Area and also a heavy-use[42] cruising route. The closest marina is in Kyleakin on the Isle of Skye.

Concurrency analysis

17.3.20 Concurrency analysis was carried out of the winter and summer data to identify any periods when two or more vessels were in Kyle Rhea (1km section containing the devices) in the same 5-minute interval. The results are graphed in Figure 17.11.

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[42] Recreational boating, both under sail and power, is highly seasonal and highly diurnal. A heavy use route is classified by the RYA as a very popular route on which a minimum of 6 or more recreational vessels will probably be seen at all times during summer daylight hours.

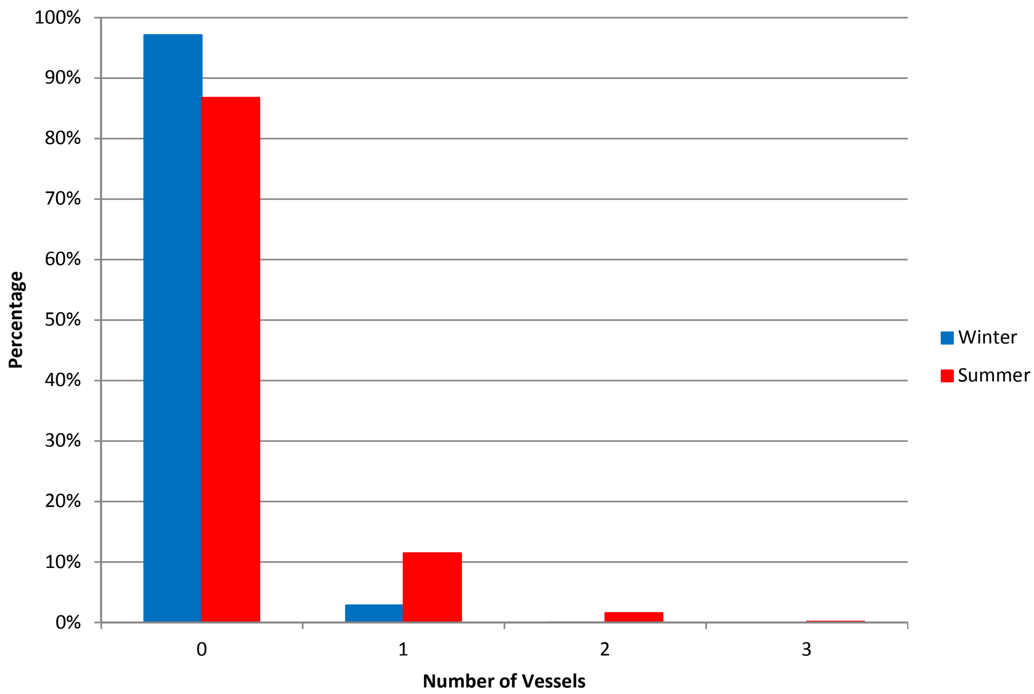

Figure 17.11: Winter and summer concurrency analysis results

17.3.21 It can be seen that there is more likelihood of two or more vessels transiting during summer than winter, although the probability is still relatively low (1.8% in summer versus 0.02% in winter). In the majority of cases with two or more vessels using Kyle Rhea, they were heading in the same direction

Tidal Influences

17.3.22 By cross-referencing the times of transits from the survey data with the tidal state, it was found that 68% of vessels transited with the tidal stream, 11% transited at around slack water and 21% transited against the tidal stream. Further analysis indicated that the vessels making passage against the tidal stream tend to use the back eddies (particularly local vessels using the eastern side) or transited when the tidal stream had not built up to maximum velocity. It was also found that fish farm vessels tended to run to a timetable rather than time their passages through Kyle Rhea with the tidal stream, i.e., these vessels have sufficient engine power to transit against the tide.

17.3.23 Detailed analysis of selected tracks recorded on AIS (i.e., larger vessels) showed that vessels tended always to be set to the west whether making passage either to the north or to the south or when the tidal stream is with them or against. Some vessels were set markedly to the west in the narrows, crossing into the red sector of the Kyle Rhea sector light, i.e. indicating the vessel is off the centreline in the direction of shallow water.

Maritime incidents

17.3.24 Maritime incidents recorded by the MAIB and RNLI, within 5nm of the Study Area, between 2001 and 2010, have been analysed (some were recorded by both sources). The majority of incidents were found to have occurred to the north, in Kyle Akin and Loch Alsh.

17.3.25 MAIB incident locations in Kyle Rhea are presented in Figure 17.12, thematically mapped, by cause. (Note, the 'contact' incident was logged as occurring on land according to the coordinates provided by the MAIB. This has been corrected using the RNLI coordinates for this incident.)

17.3.26 RNLI incident locations, thematically mapped by casualty type, are presented in Figure

17.13. Most responses in the area were by the Kyle of Lochalsh Inshore Lifeboat (ILB) although the larger Mallaig All-Weather Lifeboat (ALB) responded to one incident involving the ferry.

17.3.27 Further details of the incidents are provided in the NRA (Appendix 17.1). In general the baseline level of incidents and accidents in Kyle Rhea is relatively low, taking into account the strong tidal flows and relatively high vessel density, particularly in summer. Consultation indicated that, although vessels can have difficulties controlling their heading in Kyle Rhea, the tide tends to push them through the centre of the channel, avoiding the rocks and reefs near the shoreline. No fatalities were recorded in any incidents.

Search and rescue

17.3.28 A review of the assets in the Project area identified that the closest Search and Rescue (SAR) helicopter base is located at Stornoway, approximately 62nm north-northwest of Kyle Rhea. This base is operated by Her Majesty's Coastguard (HMCG) and has Sikorsky S92 helicopters capable of travelling up to 165 knots and a range of 539nm. One helicopter is available at 15 minutes readiness between 0800 and 2200 hours. Between 2200 and 0800 hours, one helicopter is held at 45 minutes readiness. Up to 22 persons can be carried, however, this is dependent on weather conditions and the distance of the incident from the helicopter's operating base. All SAR helicopters are equipped with VHF (Marine and Air Band), UHF and HF radios. They are also capable of homing to all international distress frequencies.

17.3.29 The RNLI has stations at Kyle of Lochalsh and Mallaig. From the RNLI incident review it was identified that the majority of incidents at Kyle Rhea were responded to by Kyle of Lochalsh RNLI, which is the closer station (approximately 15 minutes for inshore lifeboat to reach the site). However, incidents involving larger vessels would be responded to by Mallaig, which has a more powerful, all-weather lifeboat (approximately 30 minutes to reach the site).

17.3.30 Lifeboats may also transit Kyle Rhea on occasion, either north or south, when responding to other incidents or when carrying out exercises. From this point of view they can be considered as high-powered transiting vessels, as discussed below.

17.4 Impact assessment

Do nothing scenario

17.4.1 Section 17.3 details the baseline level of vessel activity within Kyle Rhea. In the do nothing scenario it is not expected that the present scenario will change significantly. Consultation identified that new facilities in western Scotland for fish farms and recreational sailing (e.g., Sail West funding) could lead to a potential increase in traffic levels. For recreational vessels it was suggested that this may just affect calling points along the coast rather than overall numbers.

Potential impacts during installation

17.4.2 Installation will involve one of the following vessel types: jack-up barge, moored barge or a DP vessel.

17.4.3 In terms of navigation, a moored barge is considered to be the worst-case option as this would require a significant mooring spread of up to 8 anchors.

17.4.4 The foundations will be installed one year preceding the device installation. The most likely method for foundation installation utilises a subsea drilling template and subsea drill.

17.4.5 Installation of individual foundations could take up to 18 days per device, or an estimated total of three months for all four devices. Weather delays may extend this programme. Once the foundations are installed, there will be steel piles protruding 5-6m from the seabed.

17.4.6 Each device will require four days for installation, with just over two weeks required to install all four devices.

17.4.7 Marine operations are expected to run 24 hours per day. Foundation installation is planned for 2014 and devices will be installed the following year. Installation works will be subject to weather conditions.

17.4.8 It is recognised that impacts associated with the installation phase of the Project would be temporary.

17.4.9 Assessments were based upon the baseline analysis, outcomes from the Hazard Review Workshop and stakeholder consultation. The suggested mitigation will require further investigation in terms of practicability and cost to implement.

17.4.10 Full details on the assessments can be found in the NRA (Appendix 17.1) and the Hazard Review Appendix to the NRA.

Impact 1: Collision with work vessel

17.4.11 The potential for a transiting or drifting vessel to collide with a work vessel or associated mooring line was assessed.

17.4.12 Based on the Hazard Review, it is estimated that the frequency of a transiting vessel collision with a work vessel without mitigation measures would be **reasonably probable**, with **serious** consequence and **unacceptable (high)** risk.

17.4.13 Standard measures and additional mitigation identified during consultation and at the Hazard Review Workshop are presented below.

Impact 1: Suggested Mitigation
25. Minimise duration of installation activity. 26. Timing of activity to be off-season, with work in early spring, prior to the Skye ferry resuming operations in Easter. 27. Pilot vessel / escort boat system to guide vessels past mooring lines. 28. Support vessel(s) on site. 29. Appropriate marking and lighting to ensure visibility of working vessels. 30. Regular broadcasts on VHF Channel 16 from Stornoway Coastguard and intermediate broadcasts from working site. 31. Liaison with local RNLI stations. 32. Emergency Response Cooperation Plan (ERCoP) to be developed and agreed with the MCA prior to installation.

17.4.14 **Residual impact**: Based on applying these mitigation measures, and by following industry good practice, such as that specified within MGN 371, it is considered the collision frequency would reduce to **remote**, consequence would reduce to **moderate** and residual impact would be **tolerable (moderate)**.

Impact 2: Increased risk to re-routed vessels

17.4.15 This impact considers re-routing of vessels during installation work within Kyle Rhea due to the obstruction / hazard caused by work vessels and associated mooring lines. Two scenarios were considered: re-routing within Kyle Rhea and re-routing west of Skye.

17.4.16 Re-routing within Kyle Rhea, which is considered most likely, leads to a danger of routing too far away from the centre of the Kyle and grounding. Sea room would reduce from the present 440m (between 5m contours) to 250m (between the eastern 5m contour and the maximum extent of Device 2). The eastern shore is also known to be ‘dirty’, with rocks posing a grounding hazard. Potential mitigation could include marking a safe inshore passage for smaller vessels to follow.

17.4.17 Re-routing to the west of Skye would mean vessels taking a longer and more exposed route, which increases the risk of experiencing rougher sea conditions, as well as of encountering heavy traffic in The Minches. The increased voyage time leads to more exposure to maritime risk in general, as well as having commercial consequences in terms of time, fuel consumption and inconvenience to recreational users. Major re-routing to this extent is more likely for vessels with restricted manoeuvrability, such as towing cages, as well as any vessel whose Master considers it prudent to avoid Kyle Rhea in the anticipated conditions, e.g. strong spring tides.

17.4.18 Based on the Hazard Review, it is estimated that re-routing within Kyle Rhea, without mitigation measures, would create a hazard with **reasonably probable** frequency, **moderate** consequence and **tolerable (moderate)** risk. Re-routing west of Kyle Rhea would create a hazard with **remote** frequency, **moderate** consequence and **tolerable (moderate)** risk.

17.4.19 Standard measures and additional mitigation identified during consultation and at the Hazard Review Workshop are presented below:

Impact 2: Suggested Mitigation
1. Distribution of information about devices, e.g. depiction on charts, to allow vessels to pre-plan voyage. 2. Marker buoys off eastern shore to indicate safe inshore passage. 3. Hydrographic data collected by project to be shared with MCA / UKHO to allow update of charts (currently based on lead-line surveys). 4. Minimise duration of installation activity. 5. Timing of activity to be off-season, with work in early spring, prior to the Skye ferry resuming operations in Easter. 6. Pilot vessel / escort boat. 7. Support vessel(s) on site. 8. Appropriate marking and lighting to ensure visibility of working vessels. 9. Regular broadcasts on VHF Channel 16 from Stornoway Coastguard and intermediate broadcasts from working site. 10. Improved VHF reception in the area. 11. Suitable guidance in Sailing Directions to assist mariners in timing their passage, where considered necessary, taking into account tide times and daylight hours.

17.4.20 **Residual impact**: Based on applying these mitigation measures, and by following industry good practice, such as that specified within MGN 371, it is considered that the frequency would reduce to **remote**, consequence would reduce to **minor** and residual impact would be broadly **acceptable (low)** for the re-routing scenario within Kyle Rhea. The frequency and consequence would remain the same for the scenario of re-routing west of Skye, leaving the residual impact as **tolerable (moderate)**.

Impact 3: Working vessel in difficulty

17.4.21 The impact of a working vessel getting into difficulty due to the tide or weather conditions was assessed. This hazard is under the control of Sea Generation (Kyle Rhea) Ltd, and is therefore not a direct third party impact. However, it could lead to an increase in potential for call-outs for the emergency services, such as the RNLI.

17.4.22 Based on the Hazard Review, it is estimated that without mitigation this would create a hazard with **reasonably probable** frequency, **moderate** consequence and **tolerable (moderate)** risk.

17.4.23 Standard measures and additional mitigation identified during consultation and at the Hazard Review Workshop are presented below:

Impact 3: Suggested Mitigation
1. Contractors vetted and audited prior to appointment to ensure they are suitably qualified and experienced for the purpose of the task and are reputable. 2. Industry standard operating and safety procedures / safety management systems, such as that specified within MGN 371, in place. 3. Support vessel(s) on site 4. Site personnel trained in first aid and offshore survival. 5. Personal protective equipment to be worn by all people working on site. 6. Timing of activities in suitable tides. 7. Weather forecasts and adverse weather working policy to be in place. 8. Temporarily suspend operations until more suitable conditions. 9. Liaison with local RNLI stations. 10. ERCoP to be developed and agreed with the MCA prior to installation.

17.4.24 **Residual impact**: Based on applying these mitigation measures, and by following industry good practice, such as that specified within MGN 371, it is considered that the frequency would reduce to **remote**, with the residual impact remaining as **tolerable (moderate)** for working vessels in difficulty.

Potential impacts during the operation phase

17.4.25 The impacts on shipping and navigation during the operational phase of the Project have been assessed. Assessments were based on the baseline data analysis, Hazard Review Workshop discussion, stakeholder consultation and collision risk modelling of selected hazards.

Impact 4: Transiting vessel collision with device

17.4.26 A vessel transiting through Kyle Rhea may collide with either the tower or the underwater rotors while on passage. This impact has been divided into three scenarios to cover three types of vessel: sailing vessel, low-powered vessel and high-powered vessel.

17.4.27 Sailing vessels include a small minority of yachts that do not have auxiliary engines and therefore would be sailing under the influence of wind and tide. The draughts of these rare vessels are such that they are only likely to interact with the surface towers. However, it was identified during consultation that such sail-only vessel may feel that they no longer have the option to pass through Kyle Rhea due to the constricted space.

17.4.28 Based on the Hazard Review, it is estimated that without mitigation the frequency of a transiting sailing vessel collision with a Project device would be **reasonably probable**, with **major** consequence and **unacceptable (high)** risk.

17.4.29 Low-powered vessels include the majority of yachts as well as local fishing vessels and small merchant craft. These will have more control of their heading by using their engines but their course and speed over ground may still be significantly affected by the conditions in Kyle Rhea, especially if transiting during strong tides.

17.4.30 There is a low potential risk of collision with subsea rotors in certain wave and tidal conditions.

17.4.31 Collision of a low-powered transiting vessel with a device without mitigation was assessed to be **reasonably probable** frequency, with **major** consequence and **unacceptable (high)** risk.

17.4.32 More powerful vessels, such as fish farm well boats, were seen from the survey analysis to have more control over their course when transiting the channel. Consultation indicated less concern about the devices amongst these Vessel Masters, although their vessel draughts are such that interaction with subsea rotors is possible for a higher proportion of the time.

17.4.33 Collision of a high-powered transiting vessel with a device without mitigation was assessed to be **reasonably probable** frequency, with **serious** consequence and **unacceptable (high)** risk.

17.4.34 Standard measures and additional mitigation identified during consultation and at the Hazard Review Workshop are presented below.

Impact 4: Suggested Mitigation
1. The Project will be depicted on Admiralty Charts produced by UKHO with an associated note on the available underwater clearance. 2. Information about the devices will be distributed, e.g. liaison with local harbours, clubs and associations; Coastguard Maritime Safety Information broadcasts; Notices to Mariners; inclusion in Clyde Cruising Club Sailing Directions and other almanacs, etc. 3. Marking and lighting of the Project will be decided by NLB once they have reviewed the NRA and consulted on the appropriate scheme to ensure devices are conspicuous and / or to mark a safe passage. The existing leading light will need to be altered. 4. Fendering of towers (if practical) (a bumper surrounding the device to absorb the kinetic energy of a vessel in the event of a collision) could potentially mitigate the impact if a small vessel collided with a device. This would be effective only in a glancing collision with the device. 5. VHF broadcasts on Channel 16 by vessels prior to transit. Improved VHF reception in the area. 6. Traffic management / reporting system including VHF broadcasts on Channel 16 by vessels prior to transit to limit passage to single transits at a time (details of system to be agreed with MCA following assessment of options and

Impact 4: Suggested Mitigation
consideration of practicality and cost). 7. Timing of passage to transit near slack water during daylight hours. 8. AIS as aid to navigation on device. 9. Dedicated guard vessel on station in the initial operating period (e.g. first year of installation). 10. ERCoP to be developed and agreed with the MCA prior to installation. 11. Regular liaison with local RNLI stations. 12. Broaden functionality of maintenance RIB to act as an emergency response vessel. 13. Marker buoys off eastern shore to indicate safe inshore passage. 14. Relocation of device 2 to the west (as far as practicable, subject to resource constraints).

17.4.35 **Residual impact:** Based on applying these mitigation measures, and by following industry good practice, such as that specified within MGN 371, it is considered that for transiting sail-only vessel collision with Project device, the frequency would decrease to **remote** and consequence reduce to **serious**, making the residual impact **tolerable (moderate)**. For low-powered transiting vessel collision with a Project device, the frequency would decrease to **remote** and consequence lessen to **serious**, with the residual impact being **tolerable (moderate)**. For high-powered transiting vessel collision with Project device, the frequency would lessen to **remote**, the consequence would reduce to **moderate** and residual impact would become **tolerable (moderate)**.

17.4.36 Separate to the workshop rankings using the semi-quantitative risk matrix, the risk of transiting vessel collision has been predicted using Anatec's COLLRISK software. Inputs to the model included traffic levels by type/size based on the survey, device locations and dimensions, wave height and tidal data. The annual powered ship collision frequency with the devices was estimated to be 0.21 per year, corresponding to an average of one powered ship collision in 5 years. The majority of this frequency was associated with smaller vessels (i.e. low powered fishing and recreational vessels). In terms of point of impact, 98% of collisions were predicted to be with the surface towers, with only 2% associated with the subsea rotors.

17.4.37 The model assumes basic mitigation in the form of chart depiction, information circulation and marking and lighting of devices (measures 1-3 above). It does not take into account the effect of the enhanced mitigation measures suggested above, such as marker buoys off the eastern shore and timing of passages by certain vessels. It does not take into account the effect of the enhanced mitigation measures suggested at the workshop, such as marker buoys off the eastern shore (which would assist vessels keeping further east of the devices) and timing of passages by certain vessels (i.e., at or near slack water when tides are less likely to affect their planned course). These are anticipated to lower the collision frequency, in-line with the workshop review, although there is insufficient data to quantify the level of benefit.

Impact 5: Drifting vessel collision with device

17.4.38 The impact of a powered vessel going adrift in the vicinity of the devices, being swept through Kyle Rhea under the influence of tide (and / or weather) and colliding with a device was assessed. The Skye ferry would have the most prolonged exposure to this hazard. In the recent past it has suffered engine failure but was able to anchor and rectify the problem. The ferry draught is approximately 1.3m so it will not be able to collide with the subsea rotors.

17.4.39 Other transiting vessels are typically in the area for only a few minutes per transit, therefore, have a lower exposure to this hazard.

17.4.40 Based on the Hazard Review, it is estimated that without mitigation the frequency of this impact would be **remote**, with **serious** consequence and **tolerable (moderate)** risk.

17.4.41 Standard measures and additional mitigation identified during consultation and at the Hazard Review Workshop are presented below:

Impact 5: Suggested Mitigation
1. ERCoP to be developed and agreed with the MCA prior to installation. 2. Regular liaison with local RNLI stations. 3. Broaden functionality of maintenance RIB to act as an emergency response vessel. 4. Fendering of towers (if practical) could potentially mitigate the impact if a small vessel collided with a device. This would be effective only in a glancing collision with the device. 5. Devices designed to be accessible, e.g. with ladders for people and moorings for vessels. 6. Devices to provide first aid equipment onboard and means of raising alarm. 7. Relocation of device 2 to the west (as far as practicable, subject to resource constraints).

17.4.42 **Residual impact**: Based on applying these mitigation measures, and by following industry good practice, such as that specified within MGN 371, it is considered that the frequency would remain **remote**, consequence would reduce to **moderate** and residual impact would be **tolerable (moderate)** for drifting vessel collision with Project device.

17.4.43 Separate to the workshop rankings, the risk of a drifting vessel collision was also modelled using Anatec's COLLRISK software. The annual drifting ship collision frequency with the devices was estimated to be 0.013 per year, corresponding to an average of one drifting ship collision in 79 years. Just over half the estimated collision frequency was associated with the Glenelg-Kylerhea ferry which spends the most time in the vicinity of the devices. The draught of the ferry (1.3m) is such that it is only capable of interacting with the surface towers. Taking into account all vessels, 98% of drifting collisions were estimated to be with surface towers, with only 2% associated with the subsea rotors. (The suggested workshop mitigation is mainly focused on reducing the consequences of a drifting collision which does not affect the model frequency result.)

Impact 6: Increase in vessel-to-vessel encounters / collisions

17.4.44 The Project could impact vessel-to-vessel collision risk, due to reduced sea room in Kyle Rhea, making close encounters and therefore collisions more likely. This is particularly the case in a head-on encounter as opposed to an overtaking encounter.

17.4.45 The survey analysis and consultation indicated that encounters within Kyle Rhea are rare but they have been observed on occasion, especially in summer when recreational traffic is much busier.

17.4.46 Based on the Hazard Review, it is estimated that the frequency of this impact without mitigation would be **reasonably probable**, with **serious** consequence and **unacceptable**

(high) risk.

17.4.47 Standard measures and additional mitigation identified during consultation and at the Hazard Review Workshop are presented below:

Impact 6: Suggested Mitigation
1. VHF broadcasts on Channel 16 by vessels prior to transit. 2. Improved VHF reception in the area. 3. Traffic management / reporting system including VHF broadcasts on Channel 16 by vessels prior to transit to limit passage to single transits at a time. (details of system to be agreed with MCA following assessment of options and consideration of practicality and cost). 4. Marker buoys off eastern shore to indicate safe inshore passage. 5. Timing of passage to transit near slack water during daylight hours. 6. Relocation of device 2 to the west (as far as practicable, subject to resource constraints).

17.4.48 **Residual impact**: Based on applying these mitigation measures, and by following industry good practice, such as that specified within MGN 371, it is considered that the frequency would reduce to **remote**, bringing the residual impact to **tolerable (moderate)** for vessel-to-vessel encounter / collision.

17.4.49 As well as the workshop rankings, Anatec's COLLRISK model was also used to separately predict the change in vessel-to-vessel collision risk within Kyle Rhea. The rate of collisions was estimated to increase from 1 in 103 years (baseline) to 1 in 102 years (following development). This is a relatively small change which reflects the low occurrence of vessel-to-vessel encounters in the area.

17.4.50 It is noted that the model is calibrated based on historical data, and takes into account traffic density and sea room, but it does not take into account the effect of strong tidal streams in Kyle Rhea. User feedback indicated this is a complicating factor, which increases the hazard of an encounter, Therefore, the model results should be treated with caution for this location.

Impact 7: Increased risk to re-routed vessels

17.4.51 Re-routing of vessels due to the location of Project devices could lead to additional impacts. Two scenarios were considered: re-routing within Kyle Rhea and re-routing west of Kyle Rhea.

17.4.52 If re-routing within Kyle Rhea there is a danger of routing too far away from the central channel and increasing the risk of grounding. Re-routing west of Skye would entail vessels taking a longer and more exposed route through The Minches, increasing the risk of experiencing rougher sea conditions resulting in potential damage. The Minches experiences heavy vessel traffic. (See Impact 2 for more discussion.)

17.4.53 Based on the Hazard Review, it is estimated that re-routing within Kyle Rhea without mitigation would create a hazard with **reasonably probable** frequency, with **moderate** consequence and **tolerable (moderate)** risk. Re-routing west of Kyle Rhea would create a hazard with **remote** frequency, with **moderate** consequence and **tolerable (moderate)** risk.

17.4.54 Standard measures and additional mitigation identified during consultation and at the Hazard Review Workshop are presented below:

Impact 7: Suggested Mitigation
1. Distribution of information about devices, e.g. depiction on charts, to allow vessels to pre-plan voyage. 2. Marker buoys off eastern shore to indicate safe inshore passage. 3. Hydrographic data collected by project to be shared with MCA / UKHO to allow update of charts (currently based on lead-line surveys). 4. Improved VHF reception in the area. 5. Timing of passage to transit near slack water during daylight hours. 6. Relocation of device 2 to the west (as far as practicable, subject to resource constraints).

17.4.55 **Residual impact**: Based on applying these mitigation measures, and by following industry good practice, such as that specified within MGN 371, it is considered that the frequency would decrease to **remote** and residual impact would be **tolerable (moderate)** for re-routing within Kyle Rhea. The frequency and consequence would remain the same for the scenario of re-routing west of Skye, leaving the residual impact as **tolerable (moderate)**.

Impact 8: Loss of station of device or component

17.4.56 If part of a device loses station, it could pose a risk to other vessels navigating through Kyle Rhea. Most components are negatively buoyant and therefore should sink rather than pose a floating hazard to passing vessels. A small object is likely to be swept through Kyle Rhea but then wash ashore.

17.4.57 Devices will be engineered to withstand extreme tidal flows and are subject to third party verification. Component parts will be made negatively buoyant where possible and foundations would be piled. Regular maintenance visits would be carried out. A similar device has been trialled and tested at Strangford Lough for four years.

17.4.58 Based on the Hazard Review, it is estimated that the frequency of this impact without mitigation would be **remote**, with **minor** consequence and **broadly acceptable (low)** risk.

17.4.59 Standard measures and additional mitigation identified during consultation and at the Hazard Review Workshop are presented below:

Impact 8: Suggested Mitigation
1. Supervisory Control and Data Acquisition (SCADA) should provide a prompt alert if part of a device loses station. 2. Component parts made negatively buoyant where possible. 3. Regular maintenance visits carried out. 4. ERCoP will have provisions for emergency response, such as informing the Coastguard who can broadcast warnings to vessels if required, and recovery of any debris.

17.4.60 **Residual impact**: Based on applying these mitigation measures, and by following industry good practice, such as that specified within MGN 371, it is considered that the frequency would lessen to **extremely unlikely** and the residual impact would remain as **broadly acceptable (low)** for loss of station of device or component.

Impact 9: Vessel collision with device when crossbeam raised for maintenance[43]

17.4.61 The potential of a transiting or drifting vessel colliding with the crossbeam when raised out of the water for maintenance was assessed. This is expected to be a relatively infrequent occurrence (estimated at four times per year for scheduled maintenance).

17.4.62 Based on the Hazard Review, it is estimated that without mitigation the frequency of a vessel collision with a device during major maintenance (cross-beam raised) would be **remote**, with **serious** consequence and **tolerable (moderate)** risk.

17.4.63 Standard measures and additional mitigation identified during consultation and at the Hazard Review Workshop are presented below.

Impact 9: Suggested Mitigation
1. Marking and lighting of device, e.g. floodlights on top of tower to light up crossbeam and blades. 2. Planned maintenance to be carried out during neap tides when possible, so that exposed crossbeams are raised only when tides are weaker. 3. Regular broadcasts of warnings that the crossbeam is raised. 4. Advance notifications to local users, harbours, clubs and associations if works are to be of significant duration and / or overnight. 5. Improved VHF reception in the area. 6. Timing of passage to transit near slack water during daylight hours. 7. Support vessel(s) on site. 8. Marker buoys off eastern shore to indicate safe inshore passage. 9. Relocation of device 2 to the west (as far as practicable, subject to resource constraints).

17.4.64 **Residual impact**: Based on applying these mitigation measures, and by following industry good practice, such as that specified within MGN 371, it is considered the frequency would remain as **remote** and consequence would reduce to **moderate**, with the residual impact remaining as **tolerable (moderate)** for vessel collision with device when crossbeam raised.

Impact 10: Fishing gear or anchor interaction with subsea cables and rotors

17.4.65 This hazard did not merit significant discussion or ranking at the Workshop. There is no commercial fishing identified in the vicinity of the array, and vessels are not expected to anchor (except in an emergency). The export cable will be HDD and thus will not be exposed. Inter-array cables will be surface-laid, with protection likely to be double armoured. Therefore, the frequency of cable interaction without mitigation is assessed as **extremely unlikely**, with **minor** consequence and **broadly acceptable (low)** risk.

17.4.66 Standard measures and additional mitigation identified during consultation and at the Hazard Review Workshop are presented below.

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[43] Note, some routine maintenance will take place when the cross-beam is under the water. This involves a RIB which is kept on station at the device and therefore does not pose a significant additional collision risk compared to normal operations.

Impact 10: Suggested Mitigation
1. Appropriate cable protection. 2. As-laid coordinates to be marked on charts and provided to FishSafe. 3. Post-installation survey of cable to ensure it has not moved

17.4.67 **Residual impact**: Based on applying these mitigation measures, and by following industry good practice, such as that specified within MGN 371, it is considered the residual impact would remain as **broadly acceptable (low)** risk.

Potential impacts during the decommissioning phase

17.4.68 Decommissioning impacts are considered to be equal or less than installation impacts. The frequency, consequence and risk of decommissioning impacts upon shipping and navigation are the same as those presented in the section outlining potential impacts during the installation phase. It is assumed the same level of mitigation would be applied.

Potential cumulative impacts

17.4.69 There are no potential cumulative impacts associated with the Project.

17.5 Summary

17.5.1 Kyle Rhea separates the east coast of the Isle of Skye from the mainland of Scotland. It forms part of an inshore traffic route which allows vessels to avoid the more exposed passage west of Skye. The route is recommended only for small vessels, due to the limiting conditions of the Skye Bridge. It is known for its strong tidal stream rates.

17.5.2 The baseline maritime traffic survey identified an average of five to six vessels per day transiting Kyle Rhea in winter and 23 in summer, with the difference being largely due to increased recreational vessel activity in summer. The Glenelg-Kylerhea ferry was visually logged in the summer survey crossing to the south of the device locations (this ferry typically operates from April-October).

17.5.3 The device locations will reduce the sea room available in this part of the channel from approximately 440m (between 5m contours) to 250m (east of device 2). Consultation with stakeholders representing the different users of Kyle Rhea identified concerns the devices would pose a navigation hazard due to the reduced sea room and the fact the tidal streams make it difficult for vessels (especially sailing or low-powered vessels) to control their heading within the channel and will tend to sweep vessels towards the devices. The reduced sea room will also make avoiding action more difficult in the case of a vessel-to-vessel encounter, although the survey analysis indicated that such situations are relatively infrequent.

17.5.4 The hazards were reviewed and ranked at the Hazard Review Workshop attended by a range of stakeholders. Before applying mitigation, a number of the hazards were judged to have unacceptable risk. Separate quantitative modelling of the collision risks (taking into account basic mitigation such as chart depiction and marking and lighting) also predicted the risk of collision was relatively high, especially for transiting vessels with the surface towers.

17.5.5 By applying appropriate mitigation identified at the workshop, the residual risk rankings were estimated to reduce to a moderate level (tolerable with mitigation). Further investigation of the suggested mitigation measures will be needed to determine if they can be implemented, in practice, to achieve the assumed benefit. Higher priority measures included a traffic management / reporting system, improved VHF coverage and relocation of device 2 as far west as practicable (taking into account resource constraints). The specific details of a traffic management system would need to be agreed with MCA following assessment of options and consideration of practicality and cost. Specific measures were also recorded for when there is work on the site, i.e., installation, major maintenance and decommissioning.

17.6 References

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18 TRAFFIC AND TRANSPORT

Page

18.1 Introduction

18.1.1 This chapter of the Environmental Statement (ES) describes the traffic and transport impacts associated with the Project and associated study area.

18.1.2 It presents the findings of an assessment of potential impacts arising from the construction, operation and decommissioning phases of the Project in relation to traffic and transport

18.1.3 This chapter looks at the potential impacts from onshore traffic only. For the purposes of this assessment it is assumed that the majority of the construction materials will be transported to site by sea. Impacts associated with the vessels involved in transport of construction materials are discussed in Chapter 17, Shipping and Navigation. This chapter also has links with Chapter 20: Onshore Noise.

Study area

18.1.4 The study area is defined by the local roads which may be used during construction, operation and decommissioning of the Project. This includes the small roads between the potential landing sites for materials and equipment brought in by sea i.e. the existing ferry slipway and the onshore works sites for Option 1 (see Chapter 5, Project Description), for which works will be undertaken in the Forestry Commission (FC) land . The A87 is also likely to be a main route for construction staff to access Kylerhea for both Option 1 and Option 2) and is also considered.

Overview of potential impacts

18.1.5 The slight increase in traffic, particularly during construction of the Project has the potential to cause some disruption to local traffic and a slight increase in the risk of accidents.

Policy, legislation and guidance in relation to traffic and transport

18.1.6 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 Project and during the impact assessment process.

Legislation

18.1.7 The following legislation is applicable:

- Part II of the Road Traffic Act 1988,
- the Road Vehicle (Construction & Use) Regulations 1986 and
- the Road Vehicle (Authorisation of Special Types) (General) Order 2003 (the commonly referred to as S.T.G.O.)

Planning policies

18.1.8 Pertinent points from relevant national, regional and local planning policies are briefly summarised below.

National

18.1.9 Scottish Planning Policy (SPP) - Developments 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 offer mitigation measures where practicable.

18.1.10 Policy Advice Note 75 (PAN 75) Planning for Transport – identifies good practice and 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

18.1.11 Policy 18 of the West Highland and Islands Local Plan (adopted 2010) is in relation to travel. The policy requires development proposals which generate travel to provide sufficient information to the Council to make an informed decision about any likely on and off site transport.

Local

18.1.12 Policy 57 of the Highland Wide Local Development Plan (Proposed Plan – September 2010) echoes the West Highland and Islands Local Plan. Development proposals will need to incorporate mitigation on site and off site where appropriate.

Guidance

18.1.13 In undertaking the assessment of the potential transport and traffic impacts on the local road network the following guidance documents were referred to:

- Guidelines for the Environmental Assessment of Road traffic, Institute of Environmental Management and Assessment (IEMA) 1993; and
- Transport Assessment Guidance, Transport Scotland 2012.

18.2 Methodology

18.2.1 This section reports the consultation, data collection including review of existing information as well as the approach and rationale behind the impact assessment.

Consultation in relation to traffic and transport

18.2.2 Table 18.1 presents the relevant issues raised in the Scoping Opinion Response (**Appendix 4.1**).

18.2.3 In general, few responses related specifically to onshore traffic. The predominant concerns relating to the Project came from vessel traffic, which is assessed separately in Chapter 17, Shipping and Navigation.

18.2.4 Many of the issues raised are directly in response to the Scoping Opinion document. Further information is provided for this in Chapter 6, Consultation.

18.2.5 In addition the Highland Council were consulted by email on the 4th October 2012 to provide an update of the Project and discuss the approach to ES.

Table 18.1: Summary of consultation relating to traffic and transport

Key issues raised	Response
Marine Scotland (MS) advised that the Environmental Statement (ES) provide information relating to the preferred route options for delivering equipment etc. via the trunk road network, and address potential access issues. They advised that particular attention be paid to potential stress points at junctions, approach roads, borrow pits, bridges, site compound and batching areas etc.	Equipment and materials will be brought in by sea, therefore avoiding trunk road networks. Should issues arise with the existing plan to use the ferry slipway and road to the onshore site, alternative options will be considered in an ES addendum.
Highland Council advised that all public roads affected by the Project be identified. In addition to transportation of all abnormal loads & vehicles (delivery of components) this should also include routes to be used by local suppliers and staff. It is expected that the developer submits a preferred access route for the Project. All other access route options should be provided, having been investigated in order to establish their feasibility. This should clearly identify the pros and cons of all the route options and therefore provide a logical selection process to arrive at a preferred route. Swept path and gradient analysis where it is envisaged that transportation of traffic could be problematic	A detailed traffic assessment will be provided once further information is gathered regarding the onshore works and required vehicles.
Highland Council requested the following information be provided and considered within the ES: • Nos. of light and heavy vehicles including staff travel; • Abnormal loads; and • Duration of works.	See Chapter 5, Project Description and Section 18.4
Highland Council asked to be provided details of: • Current traffic flows including use by public transport services, school buses, refuse vehicles, commercial users, pedestrians, cyclists and equestrians; • Assessment of structural strength of carriageway including construction depths and road formation where this is likely to be significant in respect of proposed impacts, including non-destructive testing and sampling as required; • Road surface condition and profile; • Assessment of structures and any weight restrictions; and • Road widths, vertical and horizontal alignment and provision of passing places	High level baseline conditions are described in Section 18.3, Existing environment. A detailed study of the relevant roads will be undertaken as part of the traffic assessment, to be provided at a later date once details of the onshore work are finalised.

Key issues raised	Response
Highland Council – requested that the following potential impacts be considered: • Impacts of the proposed traffic; • Impacts on carriageway, structures, verges etc.; • Impacts on other road users; and • Impacts on adjacent communities.	See section 18.4: Impact assessment.
The Highland Council suggest mitigation measures to be considered, including: • Carriageway strengthening; • Strengthening of bridges and culverts; • Carriageway widening and/or edge strengthening; • Provision of passing places; • Road safety measures; • Traffic management including measures to be taken to ensure that development traffic does not use routes other than the approved routes; and • Details of residual impacts.	Appropriate mitigation will be considered once a detailed traffic assessment has been carried out.
Trunk Road Network Management Directorate (Transport Scotland) stated that 'The Project represents an intensification of the use of this site however the percentage increase in traffic on the trunk road is such that the Project is likely to cause minimal environmental impact on the trunk road network. On this basis TRNMD have no comment to make.'	No further response.

Data collection

18.2.6 The following data sets were used to inform this chapter of the ES (**Table 18.2**).

Table 18.2: Data sources to inform the existing environment

Data Source	Spatial coverage	Author	Year
www.skyeferry.co.uk	Glenelg – Skye Ferry	www.skyeferry.co.uk	undated
Department for Transport	Highlands of Scotland	Department for Transport	2007-2011
Skye ferry	Glenelg – Skye Ferry	Jim Coomber (pers.comms)	2012

Impact assessment

18.2.7 The sensitivity/value/importance of the receptor for each impact is characterised as one of four levels, high, medium, low or negligible. The impact assessments are made following the guidance outlined in Chapter 4, EIA Methodology and using the expert judgement of suitably qualified and experienced specialists. The definition of each level is given below in Table 18.3.

Table 18.3: Definition of terms relating to the sensitivity to an impact

Sensitivity	Definition
High	Traffic and transport are vital. For example, “lifeline” traffic links for which there are no alternatives.
Medium	Traffic and transport facilities are important e.g. major routes for which the alternative adds significantly to journey time and cost.
Low	Traffic and transport facilities are in regular use e.g. routes for which the alternative will provide a slight inconvenience
Negligible	Traffic and transport facilities are in low use e.g. rarely used routes or routes which are easily diverted

18.2.8 The significance of the potential impact as a result of the Project 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 18.4.

Table 18.4: Definition of magnitude of an impact upon receptors

Magnitude	Definition
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.

18.2.9 Table 18.5 combines the definitions of magnitude with the level of sensitivity/value/importance of receptor to provide a prediction of overall significance of the impact.

Table 18.5: The level of significance of an impact resulting from each combination of sensitivity and magnitude

Sensitivity	Magnitude			
	High	Medium	Low	Negligible
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

18.3 Existing environment

18.3.1 The onshore works for option 1 will be situated approximately 500m north of Kylerhea village, while option 2 is located immediately to the east of the village, both on the Isle of Skye. The road which passes through Kylerhea is ungraded and single track, with passing places. It extends from the A87 in the west, at Drochaid Lusa (between the Skye Bridge and Broadford) to the ferry slipway for the crossing from Kylerhea to Glenelg.

18.3.2 The main route into Skye from the mainland is along the A87 and over the Skye Bridge. The road which runs north of Kylerhea village is a second route onto the island, but requires the ferry to cross Kyle Rhea strait. This service is only operational from Easter to mid-October (www.skyeferry.co.uk).

18.3.3 The links between the A87/A851 to Broadford, Lochalsh and Sleat have been identified in the West Highlands and Islands local plan as areas for future growth. These places are already important economic areas being in close proximity to existing major road and rail links, and being the connection between the mainland and the Isle of Skye.

Traffic counts

18.3.4 Data from the Department for Transport were obtained for the Highlands region (www.dft.gov.uk). No count points are made for the area, which includes the ungraded road which runs through Kylerhea. However traffic count points are available along the A87 and those data are presented in **Appendix 18.1**.

18.3.5 The Department for Transport statistics were obtained for the stretch of the A87 running east to west from near Sgurr Aoide (on the mainland by Loch Duich) through to Drochaid Lusa on Skye. These statistics show annual average daily traffic (AADT) figures for four count points on the major road for different modes of transport, and the total for all modes of transport. The stretch of road at which the road to Kylerhea joins the A87 has around 3200 (AADT) motor vehicles. The numbers have remained relatively consistent from 2007 to 2011. (**Appendix 18.1**)

18.3.6 Transport for Scotland statistics were also obtained for the stretch of the A87 between Broadford (on Skye) and Dornie (on the mainland near Loch Duich). These are provided in **Appendix 18.1**. This shows AADT for August which is significantly higher (around 5000 AADT for the stretch of the A87 where the road to Kylerhea joins) compared with the rest of the year (around 3400). This is likely to reflect an increase in the number of tourists in the area. Onshore construction works are scheduled for winter and so will not coincide with this peak. The AADT of 3400 is relatively consistent with the 3200 provided by the Department for Transport.

18.3.7 No traffic count information was available from Transport Scotland or the Department for Transport for the single track road which runs from Kylerhea ferry slipway to the A87. Therefore the current level of traffic using this road is not known. There are approximately 22 houses in Kylerhea and it is estimated that of this population all have a car and make one return journey per day. Therefore the amount of traffic using this road is low in comparison to the main route from the mainland onto Skye via the A87 and Skye bridge.

18.3.8 The number of visitors to Kylerhea is estimated to be 20,000 per annum (Taylor 2010 pers. comm, cited in Hibberd, 2011). It is expected that the peak season for visitors is in the summer and therefore the volume of traffic will be greatest in the summer months. The Kyle Rhea ferry is operational from Easter to October. Information obtained from Jim Coomber at the Glenelg-Skye Ferry service (pers.comms) suggests the average numbers of vehicles using the ferry per day is approximately 100. The maximum numbers of vehicles per day experienced using the ferry is 240, however this is a rare occurrence associated with a road traffic accident in which the road to the Skye bridge is closed).

18.3.9 The key receptors of changes to traffic levels will therefore be Kylerhea residents and tourists.

18.4 Impact assessment

Do nothing scenario

18.4.1 Traffic is expected to increase in the local region, as the West Highland and Islands Local Plan has identified areas for growth around Broadford, Lochalsh and Sleat. Additionally, the Highland Wide Local Development Plan has identified Kylerhea as a settlement development area (policy 1). Traffic is also expected to increase in the area as a result of the implementation of these long-term development plans.

Potential impacts during the construction phase

18.4.2 The amount of onshore traffic is estimated to be around 20 HGV loads and 4 personnel vehicles for option 1. Deliveries of major pieces of plant and equipment will be made by sea and brought to the existing ferry slipway, subject to access agreement.

18.4.3 Option 2 involves bringing all material and equipment by boat to the shore, east of Kylerhea village where the directional drilling would take place, avoiding the need to use the local roads for anything other than a low level of personnel movements.

18.4.4 The substation will be a prefabricated container which will be brought in by sea to the ferry slipway. For option 1 this will then be transported a short distance by road to the FC land. For option 2 this will be installed in an existing building at the ferry slipway.

Impact 1: Temporary disruption and congestion

18.4.5 Access to the Project site will be required for the directional drilling and substation installation. Materials for onshore construction work are likely to be brought in by sea to the ferry slipway and then transported along the existing public road, a short distance to the onshore site (option 1) or brought in directly to the shore east of Kylerhea (option 2) (see Chapter 5, Project Description).

18.4.6 The proposed drill site would require 20 HGV loads. The largest piece of equipment would be the drill rig(15 m long and weighing 28Ts), which would be brought to site on a low loader wagon. Also required at site would be a suitable mobile crane to offload and position the drilling spread. The size of crane would be a minimum 50 Tonne configuration, but might need to be larger depending on the stability of the ground conditions. A HGV will be required to transport the substation container.

18.4.7 The volume of hard standing material to be transported to the site is not yet known. As previously discussed materials are expected to be brought to the site by sea to either the ferry slipway (option 1) or the shore east of Kylerhea (option 2).

18.4.8 Personnel vehicles required during the drilling operations are anticipated to include a minibus, two cars. A fuel tanker will also be required approximately 3 to 4 times per week for both options 1 and 2.

18.4.9 These movements have the potential to cause some inconvenience to Kylerhea residents, tourists, and Forestry Commission (FC) staff, as they will affect single track roads. These movements may also cause damage to the roads. The village of Kylerhea is accessible from one road only and the road is not a through-road and ends in the south-west of the village. Therefore, in order to leave or enter the village, traffic must come via the road from the Kyle Rhea ferry slipway to the A87.

18.4.10 During drilling there will also be occasional movements of personnel vehicles along the road to the A87 for both options 1 and 2. However, personnel involved in the onshore works are likely to seek accommodation as close to the site as possible (similar to the Strangford Lough development site), thereby minimising traffic impacts.

18.4.11 For option 1, the duration of the disruption on the short stretch of road between the ferry and the onshore site will be temporary, particularly during the mobilisation and demobilisation periods. This is anticipated to be an impact of **low** magnitude. Option 2 requires no road movements for equipment and materials and so the magnitude of this impact will be **negligible.** Drilling works will be undertaken during a period of up to 75 days, operating 12 hours per day and 7 days per week.

18.4.12 Assuming the majority of onshore works are undertaken over winter, as anticipated, the volume of construction traffic passing Kylerhea will be lower than the average numbers of vehicles passing during operation of the Glenelg-Skye ferry in the summer. Therefore the magnitude is expected to be **low.**

18.4.13 The local residents of Kylerhea are considered to be of **medium** sensitivity because there is only one route out of the village, but the disruption will be temporary and no road closures are planned.

18.4.14 For Option 1, the onshore site will be accessed by the existing FC track. Access for FC personnel and tourists will be maintained. Because much of the construction is planned for the winter months, and numbers of tourists are expected to be lower than in summer, this receptor is considered to be of **low** sensitivity. Although FC personnel will need to access the site all year round, there is no planned closure of the road, so this receptor is also considered to be of **low** sensitivity.

18.4.15 As a result the overall impact significance is predicted to be of **minor adverse** significance for option 1 or **negligible** significance for option 2.

Impact 1: Suggested Mitigation
33. Movement of Abnormal Indivisible Loads (AILs) will conform to relevant legislation as outlined above in section 18.2: Legislation; and where required the appropriate number of days' notice shall be given to the Northern Constabulary. 34. A Construction Traffic Management Plan (CTMP) will be produced: a. To include a deflectograph survey (a survey to assess the condition of a road) pre and post-construction and temporary signal control during construction.

Impact 1: Suggested Mitigation
b. To provide the notifications and procedures that road hauliers must adhere to when delivering to the site to conform to legislation; including Abnormal Indivisible Loads (AILs). 35. Consider haulage logistics at an early stage in the procurement process.

Residual impact:

18.4.16 The residual impact is predicted to be of **minor adverse** significance for option 1 or **negligible** significance for option 2.

Impact 2: Increased risk of road accidents

18.4.17 For option 1, the increased number of vehicles coming from the slipway into the FC site and along the single track road near Kylerhea increases the potential risk of road accidents. Since a low number of additional vehicles is expected, the risk is considered to be low and thus the magnitude of this impact is assessed as **low**. As option 2 will require minimal road use the magnitude of this would be **negligible.**

18.4.18 The road to the A87 and to the otter hide does not have a pavement therefore increased traffic may pose an increased risk to pedestrians. Information regarding equestrian use is limited, but there are no bridleways, as identified from OS mapping in the onshore study area. The number of other road users is expected to be low and so these receptors are considered to be of **medium** sensitivity.

18.4.19 Overall the impact significance is predicted to be of **minor adverse** significance.

Impact 2: Suggested Mitigation
1. Measures agreed within a comprehensive CTMP; and 2. Traffic control and the use of a banksman at the site access will mitigate the potential for accidents occurring in the area used by the construction vehicles.

Residual impact:

18.4.20 Following the implementation of the mitigation measures above, the magnitude of the impact is anticipated to remain low and the impact significance is predicted to remain of **minor adverse** significance.

Potential impacts during the operation phase

Impact 3: Temporary disruption and congestion

18.4.21 Once the devices, export cables and substation are installed the majority of the scheduled maintenance will be located in the marine environment, where the devices are located. Planned maintenance for the substation is anticipated to be on an annual basis and is likely to require one to two small vehicles to access the site using existing roads.

18.4.22 Unplanned maintenance will be on an ad hoc basis and is likely to require one to two small vehicles to access the site. Therefore the magnitude of this impact is deemed to be **negligible**.

18.4.23 The receptors will mainly be tourists and FC staff using the road to the otter hide and encountering the maintenance vehicle. The sensitivity of these receptors is deemed to be

low and thus results in an impact of **negligible** significance. No further mitigation is suggested.

Potential impacts during the decommissioning phase

18.4.24 After the planned lifetime of operation of the Project (25 years), SeaGeneration (Kyle Rhea) Ltd will decommission all devices, and, associated infrastructure where appropriate.

18.4.25 Decommissioning of the Project, including the onshore infrastructure, is anticipated to produce similar impacts to construction and therefore is expected to require similar mitigation measures.

18.4.26 As mentioned in the Project Description (Chapter 5), a detailed plan for decommissioning will be submitted for approval by the regulatory authorities.

18.5 Summary

18.5.1 The main potential impact on traffic is disruption and congestion to the local roads when construction traffic is required to access the Project onshore option 1 site. In particular, the residents of Kylerhea village may be affected. Tourists and Forestry Commission Scotland personnel may be also affected, particularly on the track towards the otter hide. These potential impacts were considered to be of **minor** to **negligible** significance. Key mitigation includes the development of a CTMP.

18.5.2 If option 2 is used there will be minimal road use and the impacts will be of **negligible** significance.

18.5.3 No significant impacts are posed by the operation of the Project, and potential decommissioning impacts were considered to be similar to those of construction.

18.6 References

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19 ARCHAEOLOGY AND CULTURAL HERITAGE

Page

19 CONTENTS

19.1 Introduction

19.1.1 This chapter of the Environmental Statement (ES) describes the existing features within the study area, identifies potential impacts on archaeology and cultural heritage assets and proposes a strategy to mitigate any such impacts.

19.1.2 The assessment has considered the potential impact of the Project on the following cultural resources:

- Designated cultural heritage assets, comprising designated wrecks, scheduled monuments listed buildings; designed landscapes & gardens; inventory battlefields;
- Undesignated cultural heritage assets, including non- designated terrestrial assets, maritime losses such as wrecks, aircraft and their associated debris; and
- Submerged archaeology and palaeoenvironmentally significant deposits.

19.1.3 All figures referred to in this chapter can be found in Appendix 19.1. This chapter of the ES has been produced by Headland Archaeology (UK) Ltd.

19.1.4 This chapter has links with Chapter 7, Marine Physical Environment and Coastal Processes and Chapter 16, Seascape Landscape and Visual Impact Assessment.

Study area

19.1.5 Two study areas have been examined for the assessment of physical effects, the Offshore Study Area and the Onshore Study Area (Appendix 19.1, Figure 1). Within this area all cultural heritage assets and potential cultural heritage assets have been considered for direct and indirect impacts. A Wider Study Area of 5 km encompassing the onshore and offshore study areas has also been examined in order to inform of the archaeological potential of the area.

19.1.6 The ‘setting’ study area was determined by the Zone of Theoretical Visibility (ZTV) provided in the Seascape Landscape and Visual Impact Assessment (SLVIA) in Chapter 16. All scheduled monuments and Category A listed buildings within the ZTV have been considered for potential impacts on their setting.

19.1.7 The offshore study area represents the array area shown in Appendix 19.1, Figure 2. Within the offshore study area (Appendix 19.1, Figure 2) four devices are proposed at locations with a minimum tidal flow of 2.5m/s in water depths of 26 to 35m (see Chapter 3, Site selection). The devices will be linked by interarray cabling that will be laid on the seabed, with an export cable directionally drilled between the array and the onshore substation..

19.1.8 Onshore, a substation measuring approximately 6m x 3m is proposed to provide a link to the grid network(Figure 2). Two options for the substation are considered. Option 1 would see the substation constructed in the vicinity of an existing toilet block, while Option 2 would see the use of an existing building at the ferry slipway. A trenched cable will be routed between the HDD pit and the substation, most likely following the road/ track where possible for both options.

19.1.9 A detailed methodology for the offshore and onshore installation is set out in Chapter 5.

Overview of potential impacts

19.1.10 Potential impacts of the Project upon cultural heritage assets may include:

- Physical effects 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 effects 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
- Effects upon the setting of onshore cultural heritage assets. Largely, this relates to visual impacts but may also include noise in some instances.

Policy, legislation and guidance in relation to archaeology and cultural heritage

19.1.11 This assessment has been compiled in line with industry best practice and the relevant offshore renewables and marine historic environment guidance. These include:

- Institute for Archaeologists (IfA) guidelines: Standard & Guidance for Archaeological Desk Based Assessment (2008);
- Joint Nautical Archaeology Policy Committee (JNAPC) Code of Practice for Seabed Development (2008);
- COWRIE Historic Environment Guidance for the Offshore Renewable Energy Sector (2007);
- COWRIE Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore renewable Energy (2008);
- COWRIE Guidance for Offshore Geotechnical Investigations and Historic Environment Analysis: guidance for the renewable energy sector (forthcoming);
- The Crown Estate (2010). Offshore Renewables Protocol for Archaeological Discoveries;
- The Crown Estate (2010). Round 3 Offshore Renewables Projects Model Clauses for Archaeological Written Schemes of Investigation; and
- Towards a Strategy for Scotland's Marine Historic Environment (Historic Scotland 2009).

19.1.12 This assessment takes account of the following legislative procedures and guidelines:

- Marine (Scotland) Act 2010;
- Protection of Wrecks Act 1973;
- The Protection of Military Remains Act 1986;
- Ancient Monuments and Archaeological Areas Act 1979;

- Merchant Shipping Act 1995;
- Valetta Convention
- ICOMOS;
- UNESCO;
- Ancient Monuments and Archaeological Areas Act 1979;
- Scottish Planning Policy (2010);
- The Scottish Historic Environment Policy (SHEP);
- Listed Buildings and Conservation Areas (Scotland) Act 1997;
- Planning Advice Note 2/2011.

19.1.13 Full details of these legislative and guidance procedures are given in **Appendix 19.1**.

19.2 Methodology

Consultation in relation to archaeology and cultural heritage

19.2.1 Table 19.1 summarises issues that were highlighted by Historic Scotland in the Scoping Opinion (**Appendix 4.1**) and indicates which sections of the Chapter address the issues raised. Having studied the proposal in their correspondence Historic Scotland considered that it was unlikely that there would be significant adverse impacts on historic environment features. However the assessment should address the possibility of onshore and offshore effects.

Table 19.1: Summary of consultation relating to archaeology and cultural heritage

Effects	Key issues raised	Response
Onshore	Impacts on the setting of category A listed buildings and Inventory designed landscapes should be considered.	Paragraphs 19.4.6 to 19.4.9
Offshore	Direct impacts on to marine historic assets which could result from the construction, operation and decommissioning of the tidal array and associated operations	Paragraphs 19.4.2 to 19.4.5
Offshore	Indirect impacts to historic assets on the seabed or at the coast edge within the Project area, and possibly beyond, which may be caused by alteration to tidal currents and sedimentary regimes and by changes to the chemical balance of the water and seabed sediments.	Paragraph 19.4.12
Onshore and Offshore	The potential for discovery of unknown sites and artefacts located in the vicinity of the Project area, be assessed within the ES	Paragraphs 19.3.25 and 19.4.4

Data collection

19.2.2 The cultural heritage baseline review comprises the results of a desk based study and site visit; and the analysis and assessment of marine geophysical and geotechnical survey data. The data was gathered in order to identify all cultural heritage assets within the study area, including the potential for the discovery of previously unrecorded archaeology and cultural heritage assets. Full details of archaeology and cultural heritage review are given in **Appendix 19.1**.

19.2.3 All sites identified in the assessment are accompanied by a unique number and the prefix HA. The sources consulted are illustrated in Table 19.2 below.

Table 19.2: Data sources to inform the existing environment

Title	Source	Year	Reference
Designated Cultural Heritage	Historic Scotland	2012	Database of designated sites; Listed Buildings; designed Landscapes & Gardens; Inventory Battlefields
Maritime Records	The Royal Commission on the Ancient and Historical Monuments of Scotland (RCAHMS)	2012	Maritime Database PASTMAP; Canmore
NMRS	National Monuments Record of Scotland (NMRS)	2012	PASTMAP; Canmore
SMR/ HER	Moray and Angus Sites and Monuments Record (SMR)	2012	Archaeological records for the Highland Council Archaeological Service Historic Environment Record (HER)
SeaZone	UK Hydrographic Office Wrecks and Obstructions Database	2012	SeaZone wrecks and obstructions layer and add-on from hydro-spatial data
Phase 1 Geophysical Survey Data	Osiris Projects	2010	Hill, R, 2010. KYLE RHEA MARINE CURRENT TURBINES GEOPHYSICAL SURVEY OPERATIONS REPORT – VOLUME 1 C10015 September 2010. Osiris Projects Unpublished Client Report. Walters, J, 2010. KYLE RHEA MARINE CURRENT TURBINES GEOPHYSICAL SURVEY REPORT – VOLUME 2 C10015 September 2010. Osiris Projects Unpublished Client Report.
Designated Cultural Heritage	Historic Scotland	2012	Database of designated sites; Listed Buildings; designed Landscapes & Gardens; Inventory Battlefields

Impact assessment

19.2.4 The construction, operation and decommissioning of the Project and associated activities, including the deployment of construction and operational vessels, have the potential to damage or destroy cultural heritage assets. This may occur either as a result of the design, or as an accidental consequence of development activities. The impacts may be direct or indirect.

19.2.5 The type and description of effects used for the purpose of the assessment are presented in Table 19.3 below.

Table 19.3: Cultural heritage asset impact description

Impact Type	Definition
Direct Impact	Direct impacts on archaeology and cultural heritage assets during construction could comprise damage, disturbance, or destruction of submerged prehistoric archaeology, shipwrecks, and crashed aircraft from seabed preparation prior to installation; installation of device foundations; installation of offshore substation and collector platforms; installation of meteorological masts; placing of scour protection; installation of the array cabling, inter-connecting cabling; seabed preparation and installation of export cable; installation of cable in the intertidal zone and directional drilling ducts around Mean High Water Springs (MHWS). Direct impacts might also include the direct effects of the deployment of jack-up legs or anchoring of vessels during construction, operation and decommissioning activities. It is noted that although secondary impacts are considered separately from direct impacts in the COWRIE guidance (COWRIE 2007) the direct impacts for this assessment are considered together.
Indirect Impact	Indirect effects are those which are not a result of the Project directly and can be associated with other induced changes, for example changes to wave and tidally induced currents or sediment transport regimes, which can result in increases in erosion of, or disturbance to archaeological sites. Indirect effects also include the disturbance or destruction of relationships between structures, features, deposits, and artefacts and their wider surroundings, such as effects on the setting of onshore and island cultural heritage assets.
Cumulative Impact	Cumulative impacts include those within the Project such as interference through development activities upon a relict landscape surface or deposit. Impacts outside the offshore site and export cable route may include the effects of several developments within the same locality on the cultural heritage resource.

EIA methodology for the assessment of sensitivity of cultural heritage assets

19.2.6 The sensitivity of a cultural heritage asset to an effect reflects the level of importance assigned to it. This is the product of a number of factors, including;

- The potential of the asset as a resource of archaeological data;

- The association of the asset with significant historical events;
- The role of the asset as a local focal point with cultural associations; and
- The aesthetic value of the asset.

19.2.7 Official designations applied respectively to cultural heritage assets have been taken as indicators of importance as they reflect these factors. Sensitivity is assigned to undesignated cultural heritage assets according to the professional judgment of the assessor.

19.2.8 The criteria used for defining a cultural heritage asset's sensitivity to direct and indirect physical impacts is summarised in Table 19.4 below.

Table 19.4: Definition of terms relating to the sensitivity to an effect

Value / Sensitivity	Definition
High	Designated wrecks; Scheduled monuments; Category A-listed buildings; Inventory gardens and designed landscapes; Inventory battlefields; Undesignated assets of national importance; Maritime losses where the position is known and positively identified; and Targets of high archaeological potential identified in the geophysical survey
Medium	Category B listed buildings; Conservation areas; Targets of medium archaeological potential identified in the geophysical survey; Obstructions that could be indicative of wreckage or submerged features; and Undesignated assets of regional importance
Low	Category C(S)-listed buildings; Undesignated assets of local importance; and Targets of low potential identified in the geophysical survey.
Negligible	Assets of less than local importance

19.2.9 In determining the magnitude of impact, the value of the assets 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.

19.2.10 The magnitude of the impact may be large, for instance where there is a total loss or major alteration of the cultural heritage asset; medium, for example the loss or alteration to one or more key elements or features of a cultural heritage asset; or small, where there is a slight but perceptible alteration of the cultural heritage asset. The criteria used for assessing the magnitude of impacts on cultural heritage is summarised in Table 19.5 below

Table 19.5: Definition of magnitude of an effect upon receptors

Magnitude	Definition
High	Total loss or major alteration of the cultural heritage asset. Impact certain or likely to occur.

Magnitude	Definition
Medium	Loss of, or alteration to, one or more key elements of the cultural heritage asset. Impact certain or likely to occur.
Low	Slight alteration of the cultural heritage asset. Impact will possibly occur.
Negligible	Very slight or negligible alteration of the cultural heritage asset Impact unlikely or rarely to occur.

EIA methodology for the assessment of historical setting

19.2.11 During the construction, operation and decommissioning phases of developments, the setting of cultural heritage assets may be affected. There is considerable debate over definitions of setting and approaches to the assessment of setting impacts (Lambrick, 2008), with no standardised industry-wide approach. Historic Scotland has produced a guidance note on setting as part of its 'Managing Change in the Historic Environment' series of documents. This states that

"Setting should be thought of as the way in which the surroundings of a historic asset or place contribute to how it is experienced, understood and appreciated".

19.2.12 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 cultural significance of the asset. 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. Some assets' cultural significance will relate to an aesthetic relationship with their surroundings which may result from design or be fortuitous. In such instances the relevant landscape elements will be considered to form part of the asset's setting. The cultural significance of assets has been considered in terms of the values described in Scottish Historic Environment Policy (SHEP Annex 1, para 5):

- Intrinsic - those inherent in the monument;
- Contextual – those relating to the monument's place in the landscape or in the body of existing knowledge; and
- Associative – more subjective assessments of the associations of the monument, including with current or past aesthetic preferences.
- Most setting impacts will relate to contextual and associative values.

19.2.13 The sensitivity of a cultural heritage asset to changes in its setting can be evaluated in the first instance by reference to any relevant designation, whereby assets designated as nationally important will generally be considered the most sensitive. Consequently, the assessment has focussed on nationally important cultural heritage assets in the study areas, which are considered in relation to impacts upon setting, with other assets being considered where, in the assessor's professional opinion, there is potential for significant impacts or where they have been raised by consultees. Following reference to the designation of the asset, 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.

19.2.14 Table 19.6 is a general guide to the attributes of cultural heritage assets of high, medium, low or negligible sensitivity to setting impacts. 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 19.6: 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 significance or the appreciation thereof. The asset will generally be readily appreciable on the ground.
Medium	The asset's significance 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 significance 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 significance or the appreciation thereof does not relate to its surroundings.

19.2.15 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 19.7. 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.

19.2.16 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 such as that proposed outside a key view may also distract from them and make them difficult to appreciate on account of their prominence. 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 assets 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.
- Reversibility of Impacts Readily reversible impacts are generally of lesser magnitude than those that can not be reversed.
- Impacts upon a 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.

19.2.17 It should be noted that the assessment of magnitude will be based on the interplay of these factors. No single factor will be taken to over-ride other factors, for instance an adverse impact that would be of high magnitude will not generally be reduced to low magnitude, simply on the grounds that it is reversible. It should also be noted that whilst the development may be present within the visual envelope of an asset this does not automatically mean there is an impact on the setting of the asset. Where this is the case, the reasoning behind this will be given.

Table 19.7: Criteria for assessment of magnitude of an impact on the setting of a cultural heritage asset

Magnitude	Guideline Criteria
High beneficial	The contribution of setting to the cultural heritage asset's significance is considerably enhanced as a result of the development; a lost relationship between the asset and its setting is restored, or the legibility of the relationship is greatly enhanced. Elements of the surroundings that detract from the asset's cultural heritage significance or the appreciation of that significance are removed.
Medium beneficial	The contribution of setting to the cultural heritage asset's significance is enhanced to a clearly appreciable extent as a result of the development; as a result the relationship between the asset and its setting is rendered more readily apparent. The negative impact of elements of the surroundings that detract from the asset's cultural heritage significance or the appreciation of that significance is appreciably reduced.
Low beneficial	The setting of the cultural heritage asset is slightly improved as a result of the development, slightly improving the degree to which the setting's relationship with the asset can be appreciated.
Negligible	There are changes in the surroundings of the asset, however these do not effect its cultural significance.
Low adverse	The contribution of the setting of the cultural heritage asset to its significance is slightly degraded 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.

Magnitude	Guideline Criteria
Medium adverse	The contribution of the setting of the cultural heritage asset to its significance is reduced appreciably as a result of the development and cannot easily be reversed to approximate pre-development conditions. Relevant setting characteristics can still be appreciated but less readily.
High adverse	The contribution of the setting of the cultural heritage asset to its significance is effectively lost or substantially reduced as a result of the development, the relationship between the asset and its setting is no longer readily appreciable.

19.2.18 The significance of an effect on a cultural heritage asset is assessed by combining the magnitude of the effect and the sensitivity of the cultural heritage asset. The Evaluation of Significance matrix presented in Table 19.8 below, provides a guide to decision making, but is not a substitute for professional judgment and interpretation, particularly where the sensitivity or effect magnitude levels are not clear or are borderline between categories. Predicted effects of major or moderate significance are considered significant for the purpose of the impact assessment on cultural heritage.

Table 19.8: The level of significance of an impact resulting from each combination of sensitivity and magnitude

Sensitivity	**Magnitude**			
	High	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

19.3 Existing Environment

Bathymetry, geology, geomorphology & sedimentology

19.3.1 Kyle Rhea is a narrow strait of sea that lies between the Scottish mainland and the Isle of Skye and located within Scottish territorial waters. The water strait is around 4km in length and orientated north to south against the mainland with an approximate width of 0.7km. The name Kyle Rhea comes from King Hakon of Norway's expedition in 1262 and is translated as 'the King's Strait' (Groome, 1882).

19.3.2 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 Kyle Rhea 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 10 m below sea level may contain submerged archaeological remains of Mesolithic (c. 8000BC-4000BC) or early Neolithic (4000BC-2500BC) date.

19.3.3 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 array area is intrinsically linked to this maritime landscape.

19.3.4 The array area is located within the narrows that run between Loch Alsh to the north and Sound of Sleat to the south. These narrows are between 500m and 650m wide and run from NNE-SSE, through N-S to NNW-SSE, forming a curved feature. Geological mapping and sonar survey indicates that the basal sediments of the channel are sands and gravels, often with outcroppings of bedrock. The seabed levels within the array area range from 25m below CD in the northwest, to deeper than 33.0m below CD.

19.3.5 The strait of sea and recurrent exposed bedrock indicates a rapid current, capable of shifting suspended material. Such an environment would be highly erosive of any relatively soft material, such as peat or submerged topsoil. On this basis, the survival of in situ submerged archaeological remains is highly unlikely. However, durable redeposited material, such as lithics, may survive.

Relative sea level change

19.3.6 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. Sea-level studies on Skye at Inver Aulavaig have been completed based on radiocarbon dates and borehole samples that have revealed three episodes of high sea-level changes recorded in the bio-stratigraphic record (Selby *et al*, 2000).

19.3.7 In a study on relative sea level change focussed on the Isle of Skye, three episodes of high sea-level changes were recorded in the bio-stratigraphic record. The first appears to have occurred within the Late Devensian before c. 12600 before present day (BP) or soon after, possibly relating to regional deglaciation. The second high sea-level stand is recorded at 8850 ± 170 to 5440±50 BP in the early to middle Holocene period and relates to the Main Postglacial Transgression. The last recorded high relative sea level change in Inver Aulavaig Skye occurred in the late Holocene period at 3160±40 to 3070±60 BP, with the sea then falling rapidly after 2850±100 BP to the present day level (Selby *et al*, 2002;). The records for the Holocene period correspond more closely to the sea level models made by Shennan *et al* (2002) than the Late Devensian record.

19.3.8 During the last glacial maximum most of the development area would have been covered by ice and uninhabitable, Following this is the Devensian glacial maximum when human occupation in the British Isles is re-established, However, the chances of survival of archaeological remains for any human occupation during these periods are low (Wessex Archaeology, 2006). This is due to the repeated ice sheet succession and retreat that may have destroyed or buried evidence of such remains. However Wickham-Jones and Dawson (2006) state that “There is a high likelihood of surviving prehistoric archaeology (10,000 – 5000 years old) in certain areas … and in and among the islands elsewhere (particularly around Islay, Jura, Mull and the Small Isles) along the coast and between South Scotland and Northern Ireland” due to the highly variable sea-level changes across the Western coast of Scotland and thus the likelihood of submerged prehistoric landscapes existing.

19.3.9 The Project lies in a highly mobile environment and the seabed surrounding it may well have been exposed a number of times during repeated glacial periods. The material accumulated during these periods is known as Marine Aggregate Deposits (MAD) which are comprised of sands and gravels that make up the top layer of highly variable sediments on the seabed. Survival of archaeological remains is possible in these, though repeated deposition and reworking of sediments, particularly in the strait, could have also destroyed them.

19.3.10 Later Prehistoric sites are no less important, there is a great likelihood of finds relating to the Mesolithic (10,000BP – 6,000BP) and Neolithic (6,000BP – 4,000BP) periods on the shallower parts of the Scottish continental shelf (down to c.-45m) in the SEA7 area. There is a possibility of finds relating to the Palaeolithic period, prior to the Mesolithic, though it is difficult to pinpoint hotspots for these grab samples, and site investigation (Wickham-Jones & Dawson, 2006).

19.3.11 Kyle Rhea is a deep and narrow stretch of water subject to fast flowing tidal streams. 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 Strait and its proximity between Skye and the mainland at this point makes it useful as a crossing point and harbour and the channel represents a natural maritime passage, suitable for smaller vessels.

Desk based review

19.3.12 The baseline environment has been sub-divided into the following categories, each of which is addressed individually below. These are as follows:

i. Known wrecks and obstructions from UKHO Database/ Receiver of Wreck and from the RCAHMS;
ii. Documented maritime sites and losses listed by the RCAHMS/ HER (position unconfirmed);
iii. Maritime archaeological sites, features and deposits identified through the assessment of marine geophysical and geotechnical data.
iv. Onshore cultural heritage assets listed in the National Monuments Record of Scotland (NMRS) and Historic Environment Record (HER).
v. Onshore key receptors.
vi. Archaeological potential.

Known wrecks & obstructions

19.3.13 The desk based assessment established that there are no designated wrecks or other offshore cultural heritage assets with legal designations within the offshore study area.

19.3.14 One obstruction (**HA131**) has been identified within the Offshore Study Area (Table 19.9, Appendix 19.1, Figure 3). This obstruction was first reported in 1990 and is reported to be sunken fishing cages with debris spread over an area of 20- 40m.

Table 19.9: Known Wrecks and Obstructions

HA No	SeaZone ID	Status	Description	Long	Lat
131	UKHO-WO-2023	Live	Obstruction	5.664992	57.236632

Documented maritime losses

19.3.15 Documented maritime losses have been taken from the RCHAMS and HER records (Table 19.10). Although numerous stranding's and wrecking episodes are recorded around Kyle Rhea, accurate co-ordinates are not available for these loss events, the NMRS record their locations as arbitrary or tentative, and it is likely that many of the vessels involved were later recovered or dispersed. Further, an extensive geophysical survey within the Offshore Study Area has failed to positively locate any associated remains. Therefore these sites will not be carried forward for impact assessment but will be used as indicators of the archaeological potential of the Offshore Study Area.

Table 19.10: Documented maritime losses

HA No	NMRS REF	HER REF	Description	Position
101	NG72SE.8001	MHG27587	Unknown Steamship (20th Century)	arbitrary
102	NG72SE.8003	MHG47225	*William Akins*: Brigantine (19th Century)	tentative
103	NG72SE.8004.	MHG48360	*Harmony:*Craft (19th Century)	arbitrary
104	NG72SE.8005.	MHG48462	*Richard:* Craft (19th Century)	tentative
105	NG72SE.8006.	MHG48742	Bromley: Craft (19th Century)	tentative
106	NG72SE.8007.	MHG49883	*Countess Of Liverpool*: Schooner (19th Century).	tentative
107	NG72SE.8008.	MHG50304	*Alliance:* Schooner (19th Century)	tentative
108	NG 79 22	MHG52128	*James Renwick:* Smack (19th Century .: Kyle Rhea	tentative
109	NG72SE 8010 c. 79	MHG52129	*Ocean Gleaner:* Drifter (20th Century).	tentative
110	NG72SE 8011 c. 7922	MHG52130	*Grantley*: Steamship (20th Century)	tentative
111	NG72SE 8012 c. 7922	MH52131	*Albertine:* Yacht (19th Century. Kyle Rhea	tentative
112	NG82SW.8001.	MHG14809	*Deerpark [Possibly]:* Steamship (20th Century)	tentative

Results of the archaeological assessment of geophysical survey data

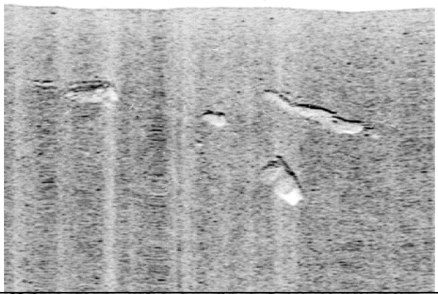
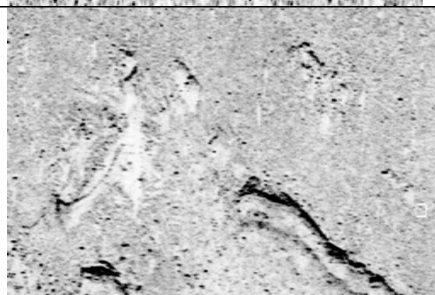
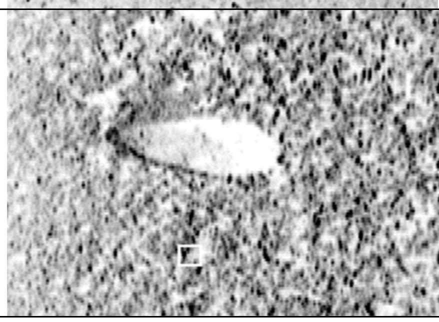
Anomalies with high archaeological potential

19.3.16 No targets of high archaeological potential were identified in the Kyle Rhea geophysical survey.

Anomalies with medium archaeological potential

19.3.17 Five targets of medium archaeological potential were identified within the survey area (Appendix 19.1, Figure 4). These are detailed in Table 19.11 below.

Table 19.11: Geophysical anomalies of medium archaeological potential

Ha No.	Description	Image
2	HA2 is a dark and light reflector identified in the central area of the survey site at coordinates 339433.19mE and 6346404.92mN. The target is linear in shape and slightly fragmented with dimensions of 11.82m length, 2.98m width and a geophysical height of 0.57m. The seabed surrounding the debris also has two low potential sidescan targets associated with it.	
6	HA6 is located in the northern half of the survey area at coordinates 339526.35mE and 6346874.61mN and exhibits anthropogenic qualities. The target is triangular in shape and made up of individual pieces and possible scattering across the seabed. The target has dimensions of 2.2m length, 1.55m width and a geophysical height of 0.12m.	
8	HA8 and HA9 are within 30m of one another to the south eastern extent of the survey area, coordinates 339601.75mE and 6346145.31mN. HA8 is a dark and long linear debris remain with measurements of 21.77m length, 0.83m width and geophysical height of 1.16. The debris looks a bit like the remains of a chain.	
9	HA9 is located at coordinates 339598.73mE and 6346110.44mN. The remains are slightly curvilinear shaped with a rectangular edge and dimensions of 3.31m length, 0.65m width and geophysical height of 0.13m. The remains could be associated with HA8 given that they are within 30m of one another.	
13	HA 13 appears to be a partially buried debris remains identified at coordinates 339309.5mE and 6346925.47mN. The debris has dimensions of 5.72m length, 2.63m width and a geophysical height of 0.59m. This target is located within the Array ISA in the central western area of the survey.	

19.3.18 A further 10 anomalies considered to be of low archaeological potential were identified within the ISA (Appendix 19.1, Figure 4). These have been identified as small and large boulders that were seen scattered across the area and frequently found around the edges of outcropping rocks. A table of all geophysical anomalies is provided in Annex D (Geophysical Targets Identified by Headland Archaeology) of Appendix 19.1.

Results of the archaeological assessment of geotechnical data

19.3.19 There were no deposits of palaeoenvironmental potential identified in any of the samples taken. Six grab samples were taken within the Offshore Study Area (Appendix 19.1, Figure 5), two of which had no recovery (Grab 5 and Grab 6). The results are presented in Table 19.12. The sediments recovered from the grab samples consisted of gravels, sands and shells.

Table 19.12: Grab Samples

Sample	Sediment	X	Y
Grab 1	Limited recovery of medium to coarse gravel	339439	6346815
Grab 2	Grey brown medium to coarse sand, with a little fine to medium gravel and broken shells.	339449	6346215
Grab 3	Grey brown medium to coarse sand and fine to medium gravel and broken shells	339508	6346292
Grab 4	Limited recovery of coarse gravel.	339522	6347064
Grab 5	No recovery	339265	6346796
Grab 6	No recovery	339273	6346355

Onshore cultural heritage assets

19.3.20 Two sites with legal designations were identified within the Onshore Study Area (Table 19.13). These consist of two Category B Listed Buildings, Kylerhea Pier Slipway (HA113) and Kylerhea Old Inn (HA115) (Appendix 19.1, Figure 3). Kylerhea Pier Slipway was one of two slipways constructed by the Highland Road Commission in 1818 (the other being Glenleg Ferry Slipway, Site HA115 in WSA). The design of the slipways is quite unique as they were built with a separate slip to allow cattle to swim across the strait annually. The ferry boat that uses the crossing with its swivel deck is also rare. HA 115 is an old inn house built on the ferry slipways in 1801-3 and was a template of the old ferry house on the Glenelg side of the strait (HA 116 in WSA). The inn was constructed by James Gillespie who was known as one of Scotland's most fashionable architects by the second decade of the 19th Century.

Table 19.13. Designated onshore cultural heritage

HA REF	NMRS REF	HER REF	Type	Designation	NGR_E	NGR_N
113	**NG72SE. 35.-**	MHG5370	Kylerhea Pier Slipway	Category B Listed	178891	821183
115	**NG72SE. 42.-**	MHG1679 6	Kylerhea Old Inn	Category B Listed	178862	820912

19.3.21 HA 122 (Table 19.14) is a township comprising two roofed, three unroofed buildings and a head-dyke that are shown of the 1st edition of the OS 6-inch map (Inverness-shire, Isle of Skye 1876-80, sheet xlviii). One unroofed building and a head-dyke are shown on the current edition of the OS 1:10560 map (1968). During the walkover survey the location of these buildings was examined. Foundations of at least three roofless coursed structures were identified above ground.

Table 19.14. Undesignated onshore cultural heritage

HA REF	NMRS REF	HER REF	Type	Designation	NGR_E	NGR_N
122	**NG72SE.39**	MHG27856	Head Dyke/ Township	None	178800	821200

Onshore key receptors

19.3.22 There is one Scheduled Ancient Monument (SAM) and two Category A Listed Buildings within 5 Km of the Project and within the Zone of Theoretical Visibility (ZTV) (see Table 19.15 and Appendix 19.1, Figure 6). Bernera Barracks is listed as an SAM and as a Category A Listed Building. Nearby Glenelg War Memorial is also a Category A Listed Building.

Table 19.15. Onshore key receptors

SM No	HB No	Name	NGR E	NGR N
950	7252	Bernera Barracks	197410	815180
-	7236	Glenleg War Memorial	191980	809720

19.3.23 Bernera Barracks which was constructed between 1719 and 1723. These barracks were the last of the four Highland forts built by the government at strategic points across the Highlands, in this case to guard the Skye crossing. The barracks were partially constructed from stone plundered from the numerous Glenelg brochs in the area. The barracks were built to accommodate regular garrisons patrolling potential nests of insurrection after the Jacobite risings of the early 1700s. The remains of the Bernera barracks today are still very impressive structures.

19.3.24 Category A Listed Building (HB 7236) Glenelg War Memorial was made in 1920 by Sir Robert Lorimer and Louis Reid Deuchars. The monument is situated south of the village of Glenelg and on the shores of Glenelg Bay, facing the land. The sculpture is made of Bronze and is representative of a Cameron Highlander, together with a kneeling female Appendix 19.1, Figure and winged Peace raised upon a stone plinth against the Sound of Sleat. The soldier is said to look more forlorn than victorious and winged victory is holding her laurel wreath well out of reach. There is a bronze inscription panel at the front of the pedestal and the memorial stands some 18 feet high.

Archaeological potential

19.3.25 It is considered that there is at least moderate potential for the discovery of unexpected cultural heritage remains within the Offshore Study Area. The study area has been used as a crossing point since at least the 17th century and in 1818 Kylerhea Pier Slipway was one of two slipways constructed by the Highland Road Commission. The strait is also a natural safe haven or anchorage that would have attracted vessels in heavy weather. A total of 12 maritime losses have been recorded in offshore study area with several other recorded as having being lost in the wider area but their exact locations is unknown.

19.3.26 Onshore, two options are considered for the substation location and onshore cable route. Option 1 will be on the FC track at the site of an existing toilet block or in an existing building close to the slipway. Here the potential for previously undiscovered cultural heritage assets is considered to be moderate along the coastal strip which is likely to have been particularly attractive for settlement from the Mesolithic onwards owing to the range of resources available. Fourteen undesignated sites from different periods have been identified in the WSA (Appendix 19.1, Figure 19.2 consisting of cultivation remains, farmsteads, townships, enclosures, a mound, a cairn and an axe head findspot. Prehistoric sites are clearly represented in the archaeological record here. Further, the substation site and export cable route are located at the location of a post medieval township and the location of a historic crossing point that would have been a hub of social, cultural and economic activity in this region.

19.4 Impact assessment

19.4.1 This section assesses potential impacts during construction of the Project.

Offshore study area

19.4.2 Site HA131 (obstruction) has been identified as a site of medium sensitivity in this assessment. In the absence of mitigation the magnitude of the impact on this site could be high. Therefore the significance of the impact could be **major**.

19.4.3 Sites HA2, HA6, HA8, HA9 and HA13 (geophysical targets of medium archaeological potential) have been identified as sites of medium sensitivity in this assessment. In the absence of mitigation the magnitude of the impact on this site could be high. Therefore the significance of the impact could be **major**.

19.4.4 The archaeological potential within the Offshore Study Area is considered to be moderate and there is medium potential for the discovery of hitherto unrecorded cultural heritage remains within the offshore study area. Should sites be discovered in the offshore area one would expect them to be of high/ medium sensitivity. In the absence of mitigation the magnitude of the impact could be medium to high. Therefore the significance of the impact could be **moderate to major**.

Offshore Study Area: Suggested Mitigation
All sites of cultural heritage interest included in this assessment will be avoided where possible. At present the following mitigation is proposed: 36. Where cultural heritage assets or potential cultural heritage assets may be subject to direct impacts, infrastructure will be micro-sited and temporary exclusion zones will be implemented to prevent invasive activities, such as devices and inter-array cable installation, and anchoring or deployment of jack-up legs. 37. In order to mitigate the risk of damage to any previously unrecorded archaeological remains, a Written Scheme of Investigation (WSI) and Protocol for Archaeological Discoveries (PAD) will be prepared for the approval of Historic Scotland/ Highland Council Archaeological Service to mitigate construction effects in the event of any unexpected archaeological discoveries during installation (see **Appendix 19.1** for more information). 38. These measures will form part of the Construction Environmental Management Plan (CEMP).

Residual impact:

19.4.5 Following the application of the mitigation measures outlined above it is likely that cultural heritage assets can be avoided, where known, and in the event that unrecorded assets are uncovered, appropriate measures are in place to deal effectively with any such eventuality. As such, the residual impacts of the Project on the archaeology and cultural heritage resource during construction would be reduced to **negligible** significance. Effects of negligible significance are not significant in the terms of the EIA Regulations

Onshore study area

19.4.6 Two sites with legal designations were identified within the Onshore Study Area. These consist of two Category B Listed Buildings, Kylerhea Pier Slipway (HA113) and Kylerhea Old Inn (HA115). The sites are of regional importance and are therefore considered to be of medium sensitivity in this assessment. In the absence of mitigation the magnitude of the impact on this site could be high. Therefore the significance of the impact could be **major.**

19.4.7 HA 122 (township) is considered to be of medium sensitivity in this assessment. In the absence of mitigation the magnitude of the impact on this site could be medium. Therefore the significance of the impact could be **moderate**.

19.4.8 The archaeological potential within the Onshore Study Area is considered to be medium and should hitherto unrecorded cultural heritage assets be discovered they could be of high to moderate sensitivity. In the absence of mitigation the magnitude of the impact on these sites could be medium to high. Therefore the significance of the impact could be **moderate to major**.

Onshore Study Area: Suggested Mitigation
1. All sites of cultural heritage interest included in this assessment will be avoided where possible. At present the following mitigation is proposed: 2. Where designated cultural heritage assets may be subject to impacts, Listed Building Consent will be required to carry out any works that would alter these sites. 3. If impacts on cultural heritage assets cannot be avoided they will be mitigated through the implementation of a programme of appropriate archaeological works. The work will be undertaken in compliance with a Written Scheme of Investigation (WSI) agreed with the Highland Council Archaeological Service and the results of the programme of works reported appropriately. 4. These measures will form part of the Construction Environmental Management Plan (CEMP).

Residual impact:

19.4.9 It is considered that through the programme of mitigation offered for construction that all potential effects will be reduced to **negligible** significance, as where assets are lost or partially removed there will be no perceptible loss to the historic environment and the potential of the assets as a data source will be realised, thus off-setting their physical loss. Effects of negligible significance are not significant in the terms of the EIA Regulations.

Potential impacts during the operation phase

19.4.10 Potential direct and indirect impacts on archaeology and cultural heritage assets considered here include those highlighted in the construction impact assessment above

19.4.11 The offshore operation phase may result in impacts on the sites of cultural heritage interest identified in the direct impacts during construction noted above. Potential effects may include anchoring of maintenance vessels although this is unlikely. In line with the construction phase, the identified sites are of high to medium sensitivity and in the absence of mitigation the magnitude is considered to be high. The significance of the potential effect in the absence of mitigation is therefore regarded as **major adverse**.

19.4.12 The potential for indirect effects on archaeology and cultural heritage assets through change and alterations in sedimentary regimes caused primarily by the development is considered to be low. Within the vicinity of the indicative device locations and across the inter-array cable route) there is a lack of significant ‘soft’ sediments. It is therefore unlikely that the physical disturbance to the seabed will have any significant impact on sediment distribution patterns and effects will be limited to local disturbance of the exposed bedrock within the immediate confines of the seabed works (see Chapter 7, Marine Physical Environment and Coastal Processes).

19.4.13 Potential impacts during the operational phase of the Project comprise changes to the setting of cultural heritage assets with statutory designations within the study area caused by the presence of the devices and the new building for the option 1 substation. The devices will be visible from one Scheduled Ancient Monument (SM858: Bernera Barracks) and one Category A Listed Building (HB7236:Glenleg War Memorial). The Barracks were built in the 1720s-30s to control the narrow crossing from the mainland to Kyle Rhea and are one of four such structures in Scotland during this period. The ZTV (see Chapter 16, Seascape and Landscape Visual Impact Assessment) indicates that one of the likely indicative device locations will be visible from Bernera Barracks which is located 2.8km to the southeast of the turbine site. When built the 3m high substation (option 1) will not be visible from the Bernera Barracks..Therefore it is considered there would be an impact of **negligible** significance on the setting of Bernera Barracks. The substation for option 2 will be in an existing building and so there will be no impact

19.4.14 All four indicative device locations will be visible from Glenleg War Memorial located 3.3 Km from the closest device. These devices will only be visible when looking at the memorial from south- southeast to north- northwest and the closest turbine will be 3.3 Km from the site and visible in the background of the monument. There will be no views interrupted looking from or to the monument. The monument was built to commemorate the members of the elite commando units who trained at nearby Achnacarry during WW2, there is no visibility between the two sites.When built the 3m high substation will not be visible from Glenleg War Memorial Therefore, it is considered that there would be an impact of, at worst, **minor adverse** significance on the site. Effects of negligible and minor significance are not significant in the terms of the EIA Regulations.

Operation: Suggested Mitigation
All sites of cultural heritage interest included in this assessment will be avoided where possible. At present the following mitigation is proposed: 1. Where cultural heritage assets or potential cultural heritage assets may be subject to direct impacts, infrastructure will be micro-sited and temporary exclusion zones will be implemented to prevent invasive activities, such as devices and inter-array cable installation, and anchoring or deployment of jack-up legs. 2. In order to mitigate the risk of damage to any previously unrecorded archaeological remains, a Written Scheme of Investigation (WSI) and Protocol for Archaeological Discoveries (PAD) will be prepared for the approval of Historic Scotland/ Highland Council Archaeological Service to mitigate construction effects in the event of any unexpected archaeological discoveries during installation. These measures will form part of the Construction Environmental Management Plan (CEMP).

Residual impact:

19.4.15 Following the application of the mitigation measures outlined above it is likely that cultural heritage assets can be avoided, where known, and in the event that unrecorded assets are uncovered, appropriate measures are in place to deal effectively with any such eventuality. As such, the residual impacts of the Project on the archaeology and cultural heritage resource would be reduced to minor and negligible significance. Effects of minor and negligible significance are not significant in the terms of the EIA Regulations

Potential impacts during the decommissioning phase

19.4.16 Direct and indirect impacts arising from the decommissioning are considered to be analogous to those arising in the construction phase and are not discussed further.

Potential cumulative effects

19.4.17 This section presents the results of the assessment of the potential cumulative effects upon cultural heritage assets arising from the Project in conjunction with other existing or reasonably foreseeable marine developments and activities in the region. The approach to the assessment of cumulative effects is described in Chapter 4, EIA Methodology of this ES. There are no cumulative effects to be considered for this project

19.5 Summary

19.5.1 The known cultural heritage assets within the study area have been identified, and the archaeological potential for the discovery of previously unknown remains has been considered. Impacts of negligible to major significance have been identified.

19.5.2 Offshore - Site HA131 (obstruction) has been identified as a site of medium sensitivity in this assessment. In the absence of mitigation the magnitude of the impact on this site could be high. Therefore the significance of the impact could be major. The mitigation measures for this asset are; that infrastructure will be micro-sited and temporary exclusion zones will be implemented to prevent invasive activities, such as devices and inter-array cable installation, and anchoring or deployment of jack-up legs.

19.5.3 Sites HA2, HA6, HA8, HA9 and HA13 (geophysical targets of medium archaeological potential) have been identified as sites of medium sensitivity in this assessment. In the absence of mitigation the magnitude of the impact on this site could be high. Therefore the significance of the impact could be major. The mitigation measures for these assets are; that infrastructure will be micro-sited and temporary exclusion zones will be implemented to prevent invasive activities, such as devices and inter-array cable installation, and anchoring or deployment of jack-up legs.

19.5.4 The archaeological potential within the Offshore Study Area is considered to be moderate and there is medium potential for the discovery of hitherto unrecorded cultural heritage remains within the offshore study area. Should sites be discovered in the offshore area one would expect them to be of high/ medium sensitivity. In the absence of mitigation the magnitude of the impact could be medium to high. Therefore the significance of the impact could be moderate to major. The mitigation measures for these impacts are; to implement a Written Scheme of Investigation (WSI) and Protocol for Archaeological Discoveries (PAD) for the approval of Historic Scotland/ Highland Council Archaeological Service to mitigate construction effects in the event of any unexpected archaeological discoveries during installation.

19.5.5 Onshore - The two Category B Listed Buildings, Kylerhea Pier Slipway (HA113) and Kylerhea Old Inn (HA115) are of regional importance and are therefore considered to be of medium sensitivity in this assessment. In the absence of mitigation the magnitude of the impact on this site could be high. Therefore the significance of the impact could be **major**. HA 122 (township) is considered to be of medium sensitivity in this assessment. In the absence of mitigation the magnitude of the impact on this site could be medium. Therefore the significance of the impact could be **moderate**. The archaeological potential within the Onshore Study Area is considered to be medium and should hitherto unrecorded cultural heritage assets be discovered they could be of high to moderate sensitivity. In the absence of mitigation the magnitude of the impact on these sites could be medium to high. Therefore the significance of the impact could be moderate to **major**.

19.5.6 Mitigation measures for these onshore assets include; Listed Building Consent will be required to carry out any works that would alter these sites. Construction effects will be mitigated through the implementation of a programme of archaeological works, which may comprise evaluation trenching in those areas considered to have archaeological potential; and/ or archaeological monitoring of topsoil stripping during construction, which will allow for any further assets present to be recorded appropriately. The work will be undertaken in compliance with a Written Scheme of Investigation (WSI) agreed with the Highland Council Archaeological Service. The results of the programme of works will be reported appropriately

19.5.7 Setting - The devices will be visible from one Scheduled Ancient Monument (SM858: Bernera Barracks) and one Category A Listed Building (HB7236:Glenleg War Memorial). The ZTV indicates that one device will be visible from Bernera Barracks which is located 2.8 Km to the southeast of the device site. When built the 3m high substation (option 1) will not be visible from the Bernera Barracks. Therefore it is considered there would be an impact of **negligible** significance on the setting of Bernera Barracks. Option 2 will be in an existing building and so will be no impact.

19.5.8 All four devices will be visible from Glenleg War Memorial located 3.3 Km from the closest device. These devices will only be visible when looking at the memorial from south-southeast to north- northwest and the closest device will be 3.3 Km from the site. When built the 3m high substation (option 1) will not be visible from Glenleg War Memorial Therefore, it is considered that there would be an impact of, at worst, **minor adverse** significance on the site.

19.5.9 The mitigation that has been outlined is considered to completely mitigate residual impacts.

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20 ONSHORE NOISE

20.1 Introduction

20.1.1 This chapter of the Environmental Statement (ES) describes the existing environment in relation to onshore noise, within the proposed Kyle Rhea Tidal Stream Array ('the Project') and associated study area.

20.1.2 Subsequently, it presents the findings of an assessment of potential impacts arising from the construction, operation and decommissioning phases of the Project.

20.1.3 This chapter considers potential noise and vibration impacts caused by the Project. It considers noise generated above the surface of the sea as opposed to underwater noise, and considers only human receptors. The potential impacts from underwater noise on terrestrial and marine organisms are considered in Chapter 10, Terrestrial and Intertidal Ecology and Chapter 12, Marine mammals & basking sharks respectively.

20.1.4 This assessment is a primarily a qualitative assessment, as it has not been considered necessary, through the scoping and consultation stages of this Environmental Impact Assessment, to undertake dedicated noise surveys.

20.1.5 Importantly, no widening of the roads or building of access roads is proposed for the construction of the Project.

Study area

20.1.6 The onshore study area in depicted in Figure 1.1 of Chapter 1, Introduction. This area has been used as the basis for this assessment.

Overview of potential impacts

20.1.7 The following potential impacts have been identified from the Project.

- Noise and vibration from the use of horizontal directional drilling (HDD) during the installation of the export cables;
- Temporary increased levels of noise and vibration from construction traffic;
- Temporary increase in noise from construction and operation of the substation;
- Temporary increase in surface noise from vessels during installation and operation; and
- Noise generated by SeaGen devices during operation.

Policy, legislation and guidance in relation to onshore noise

20.1.8 A range of legislation is in place to control noise levels at International, European Union (EU) and United Kingdom level. The control of noise from construction activities, in Scotland, is achieved through the following Instruments:

- The Environmental Noise (Scotland) Regulations 2006
- Control of Pollution Act 1974 [COPA] ; Section 60 and 61
- Scottish Statutory Instrument (SSI) 2002/104 The Control of Noise (Codes of practice for construction and open sites) (Scotland) Order 2002.

20.1.9 The Environmental Noise (Scotland) Regulations 2006 is the transposition of the European Directive 2002/49/EC (the Environmental Noise Directive). It applies to major transport corridors, airports and urban areas.

20.1.10 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.

20.1.11 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 5228 (Parts 1, 3,4 & 5, 1992 – 1997) for the control of noise and vibration from such sites (these documents have been superseded by BS 5228-1&2 in 2009).

20.1.12 Planning Advice Note (PAN) 56: Planning and Noise provides advice on the role of the planning system to assist the prevention and limit the adverse effects of noise. The note raises issues that should be considered in when planning a development. The note provides some details on acceptable noise levels near dwellings. 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 impacts 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.

20.1.13 The Highways Agency guidance Design Manual for Roads and Bridges (DMRB), 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 or re-radiated 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 (re-radiated noise) from 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).

20.1.14 BS 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 impacts of vibration on humans within dwellings. It is referenced with regard to potential ground-borne vibration from construction-related traffic moving on the road between Kylerhea village and the FC access track.

20.1.15 BS 4866:2010 Mechanical vibration and shock - Vibration of fixed structures - Guidelines for the measurement of vibrations and evaluation of their effects on structures. 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 road between Kylerhea village and the FC access track.

20.2 Methodology

20.2.1 This section reports the consultation, data collection including review of existing information as well as the approach and rationale behind the impact assessment.

Consultation in relation to onshore noise.

20.2.2 Table 20.1 presents the relevant issues raised below (and originally detailed in the Scoping Opinion Response – see **Appendix 4.1**) along with the response from the consultee.

20.2.3 In general, few responses were received relating specifically to onshore noise. The predominant concerns relate to underwater noise, which is assessed separately in Chapter 12, Marine Mammals & Basking Shark.

20.2.4 Many of the issues raised are directly in the response to the Scoping Opinion document (**Appendix 4.1**).

Table 20.1: Summary of consultation relating to onshore noise

Key issues raised	Response
Marine Scotland advised that reference should be made to Planning Advice Note (PAN) 56: Planning and Noise.	This PAN has been taken into account in the writing of this Chapter.
SEPA advised that the proposed development be assessed alongside other developments likely to contribute to an increase in road traffic, which may further increase noise levels.	See section 20.4: Cumulative Impacts.
SEPA advised that excavation works, particularly through drilling and blasting, may cause nuisance to adjacent land users due to the generation of dust and noise. Comments from the local authority environmental health officers should be sought on the potential nuisance to adjacent land users during the construction and decommissioning phases of the Project.	No excavation works are planned, see Chapter 5, Project Description.
RYA Scotland stated that 'In summary the RYA's concerns with offshore energy developments and recreational boating relate to…visual intrusion and noise.'	See section 20.4: Impact Assessment.

Key issues raised	Response
Marine Scotland – 'Details of any noise pollution due to construction and its possible effects seem sufficient for the environmental statement'…'The proposed plans for the studies into the effects of noise during the operation phase should be sufficient to enable an assessment of impacts.'	See section 20.4: Impact Assessment.

Data collection

20.2.5 The following data sets were used to inform this chapter of the ES (Table 20.2).

Table 20.2: Data sources to inform the existing environment

Data Source	Spatial coverage	Author	Year
Annex C of BS 5228-1	N/A	British Standards Institution	2009
Aerial photography	UK wide	Bing Maps, Microsoft	2012

Impact assessment

20.2.6 The setting of 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.

20.2.7 PAN 56 states that "For noise of a similar character, a change of 3dB(A) is the minimum perceptible under normal conditions, and a change of 10dB(A) 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.

20.2.8 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 LAeq limit for construction noise measured at 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 20.3.

Table 20.3 Suggested acceptable construction noise limits

Assessment period	Acceptable noise level, in decibels (dB LAeq)		
	Category A[A]	Category B[B]	Category C[C]
Night-time (23.00–07.00)	**45**	**50**	**55**
Evenings, Weekends and Public/ Bank Holidays	**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 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			

20.2.9 The sensitivity of receptors to noise is has been defined as in Table 20.4.

Table 20.4: Definition of terms relating to the sensitivity of receptors

Receptor Sensitivity	Description
High	Hospitals and care homes at night.
Medium	Residential accommodation, private gardens, hospitals, care homes, schools, universities, research facilities, national parks, during the day; and temporary holiday accommodation at all times
Low	Offices, shops, outdoor amenity areas, long distance footpaths, doctors surgeries, sports facilities places of worship
Negligible/no impact	Warehouses, light industry, car parks, agricultural land

20.2.10 The definition of the magnitude of an impact is given in Table 20.5 below.

Table 20.5: Definition of terms relating to the magnitude of an 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).
Negligible/no impact*	Changes in steady noise of less than 3dB, or changes of less than 1dB if noise is particularly intrusive.

20.2.11 The sensitivity of the receptor and the magnitude of the predicted impact can be combined to find the overall significance of the potential impact, as outlined on the matrix below (Table 20.6). This process has been supplemented by the use of expert judgement.

Table 20.6: The level of significance of an impact resulting from each combination of sensitivity and magnitude

Sensitivity	Magnitude			
	High	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

20.3 Existing environment

20.3.1 Option 1 of the Project (see Chapter 5, Project Description) will be situated in the Kylerhea Forestry Commission (FC) site. It will be constructed predominantly within an existing area of hard-standing to the side of an existing access track on the site. The track runs north (through the FC land) to south (to the road which runs between the A87 and Kylerhea village).

20.3.2 The site currently attracts visitors to a newly renovated otter hide, as well as for other wildlife and natural features, mountain walking and recreational sailing, sea kayaking (see Chapter 22, Recreation and Tourism).

20.3.3 The site is surrounded predominantly by young coniferous plantation and heathland. It is lies at the bottom of and to the east of Beinn Bhuidhe, and to the west of the Kyle. The ambient noise climate is likely to be composed of a high proportion of natural sounds. These include wildlife and water courses, as well as human sources from a small number of walkers and cars coming up the access track, and FC activities on site.

20.3.4 Option 2 of the Project will be situated in an area of open grassland between the Kyle and Kylerhea village.

20.3.5 The ambient noise climate for option 2 is similarly likely to be predominantly composed of natural sounds from the coast and wildlife. Some noise is likely to come from human sources including small vehicles and pedestrians from nearby houses and the road in Kylerhea village.

20.3.6 Recreational users of Kyle Rhea including for kayaking, and sailing (see Chapter 22, Tourism and Recreation) are potential receptors of airborne noise. Recreational passage through Kyle Rhea is heavy (RYA, 2008). Kyle Rhea is encompassed by an RYA UK sailing area. This area is extensively used for general day-sailing by all types of recreational craft, particularly smaller craft such as small cruisers, day-boats, dinghies, sailboards and personal watercraft. Recreational vessel tracking data is shown in Figure 17.10 (see Chapter 17: Shipping and Navigation).

20.3.7 A car ferry 'Glenachulish' crosses Kyle Rhea between Easter and mid-October. This ferry transits between Kylerhea and Glenelg. The ferry crosses the strait seven days a week between 10am and 6pm every 20 minutes (www.skyeferry.co.uk). Figures from the ferry company reveal that the ferry carried 30,000 passengers in 10,000 cars in 2008. 85% of this traffic was one way & non local (Hibberd, 2009).

20.3.8 Fishing vessels and fish farm support vessels use Kyle Rhea. The tracks for these vessels are shown in Figure 17.9 (Chapter 17, Shipping and Navigation). Other non-recreational vessels include military and cargo vessels, tankers, and tug boats of which approximately one vessel per day transits the Kyle.

20.3.9 In summary, approximately 5 vessels pass through Kyle Rhea per day during winter and during summer this is increased to 23 per day, where the increase is mainly due to increased recreational use.

Noise Sensitive Premises (NSPs)

20.3.10 Noise sensitive premises are defined in British Standards (BS) 5228 (BSI, 2009) as being 'any occupied place outside a site used as a dwelling (including gardens), place of worship, educational establishments hospital or similar institution, or any other property likely to be adversely affected by an increase in noise level'.

Option 1

20.3.11 Based on the definition of NSPs above, four NSPs (inhabited houses) were identified from aerial photography and 1:10000 Ordnance Survey (OS) mapping within the vicinity of the Project (less than 300m of the substation, drilling area and/or substation). These are shown in Figure 20.1. NSP 1 is a dwelling north of Kylerhea, on the road to the ferry terminal on Skye. NSP 2 is a dwelling near the Kylerhea ferry terminal on Skye. NSP 3 is a dwelling near the Glenelg ferry terminal building (3) on the mainland and NSP 4 is the otter hide, located within the Forestry Commission Scotland land on Skye.

20.3.12 These premises may be affected by noise generated from vehicles transporting materials, equipment and personnel for the onshore construction works due to their position on route to the proposed onshore development site as well as potentially being affected by noise from the HDD and substation construction (see section 12.4).

20.3.13 The distances of these receptors from different elements of the proposed works are given in Table 20.7 below.

Table 20.7. Distances of NSPs from different elements of the Project for Option 1.

NSP		**Distance from array boundary**	**Distance from substation**	**Distance from potential drilling location**
No.	**Name**			
1	Dwelling north of Kylerhea, Skye	462m	443m	274m
2	Dwelling at Kyle Rhea ferry terminal, Skye	199m	232m	236m
3	Dwelling at Glenelg ferry terminal, Glenelg	339m	813m	904m
4	Otter hide, Skye	281m	835m	1058m

Option 2

20.3.14 Three NSPs were identified from aerial photography and 1:10000 Ordnance Survey (OS) mapping within the vicinity of the Project (less than 300m of the substation, drilling area and/or substation). Details are provided in Table 20.8 below.

20.3.15 These premises may be affected by noise generated from the HDD or operation of the substation (see section 12.4).

20.3.16 The distances of these receptors from different elements of the proposed works are given in Table 20.8 below.

Table 20.8. Distances of NSPs from different elements of the Project for Option 2.

NSP		Distance from array boundary	Distance from substation	Distance from potential drilling location
No.	Name			
1	Dwelling north of Kylerhea, Skye	474m	275m	21m
2	Dwelling at Kyle Rhea ferry terminal, Skye	199m	16m	301m
5	Dwellings in Kylerhea	679m	492m	27m

Traffic

20.3.17 No traffic count information was available from Transport Scotland or the Department for Transport for the single track road which runs from Kylerhea ferry slipway to the A87. Therefore the current level of traffic using this road is not known. However some assumptions of the amount of traffic coming through Kylerhea can be made using the following information. There are more than 20 houses in Kylerhea, and it is assumed that of this population all have a car and make one return journey per day. Therefore the amount of traffic using this road is low in comparison to the main route from the mainland onto Skye via the A87 and Skye bridge.

20.3.18 In addition, traffic passes through Kylerhea from the ferry service from Glenelg to Kylerhea, which is operational from Easter to mid-October (www.skyeferry.co.uk). Information obtained from the Glenelg-Skye Ferry service (pers.comms) suggests the average numbers of vehicles using the ferry per day is approximately 100. The maximum numbers of vehicles per day experienced using the ferry is 240. This is a rare occurrence associated with a road traffic accident in which the road to the Skye bridge is closed).

20.3.19 As the majority of the works are proposed to be conducted in the winter, the A87 would be the main route to access Kylerhea.

20.4 Impact assessment

20.4.1 The impact assessment is presented below for the potential onshore noise the Project may have on sensitive receptors.

Do nothing scenario

20.4.2 The do-nothing situation would result in no change to the existing ambient noise situation.

Potential impacts during construction

20.4.3 Estimating the amount of onshore traffic at the time of writing the Environmental Statement (ES) has been difficult, because different contracting methods will yield varying numbers and extent of land based traffic (see Chapter 18, Traffic and Transport). Deliveries of major pieces of plant and equipment will likely be made by sea, and it is planned to use the private slipway at Kylerhea (option 1) or the pebble beach close to Kylerhea village (option 2) to receive materials.

20.4.4 The initial mobilisation phase during installation could see a small increase in the volume of land based traffic. Most personnel are likely to mobilise to the nearest port e.g. Lochalsh.

There may occasionally be approximately two cars at, or going to, Kylerhea or Glenelg during installation and commissioning.

20.4.5 For option 1, equipment and materials will be brought in by sea to the ferry slipway and then transported a short distance by road from the slipway to the FC site using HGVs. These vehicles are likely to cause some noise and vibration. The drilling area would be at the FC car park (Figure 5.1).

20.4.6 Option 2 involves bringing all equipment to the site at Kylerhea directly by sea and so there will be no transfer of materials or equipment by road. The drilling area for option 2 is within an area of flat grassland near Kylerhea village (Figure 5.1).

Impact 1: Noise and vibration impacts associated with the movement of construction-related vehicles along the road from the A87 to Kylerhea village and on the FC access track

20.4.7 Construction related vehicle movements will pass along the road from the slipway to the FC land and along the existing FC access track for option 1. A change in the level of noise from the baseline is expected from the Project, due to an increase in traffic from construction-related vehicles, particularly during mobilisation and demobilisation. All vehicles will be moving very slowly and are unlikely to cause significant vibrations. During the 75 day drilling period there will be a small number of personnel vehicles travelling to and from the site. The magnitude of option 1 is **low**.

20.4.8 There will be minimal construction related vehicles for option 2 with all materials and equipment brought directly to the site by sea. The magnitude of option 2 is **negligible.** Option 2 has been chosen to reduce the need for vehicles coming in to Kylerhea and along the small roads. Instead materials and equipment will be brought onto the beach via the sea. Dwellings in Kylerhea are therefore unlikely to be affected by construction traffic if option 2 is pursued. At worst, a **negligible** significance is predicted for option 2.

20.4.9 The dwellings near the ferry slip way and the Old Croft House may be temporarily affected by construction related traffic movements. The Old Croft House is rented out as tourist accommodation (see Chapter 22, Tourism and Recreation). Sea Generation (Kyle Rhea) Ltd will endeavour to undertake onshore construction works out with the peak tourism season where possible. The sensitivity of these properties is predicted to be **medium**.

20.4.10 It is unlikely that the otter hide will be significantly affected by noise related to construction traffic due to its distance from the road and therefore the sensitivity of this NSP is considered to be **negligible**.

20.4.11 The maximum anticipated noise impact due to construction related-traffic is therefore considered to be **minor**.

Impact 1: Suggested Mitigation
1. No specific mitigation suggested. 2. Ensure construction-related traffic is limited to daytime periods only

Residual impact:

20.4.12 Following the adoption of the mitigation measures outlined above, the impact significance from construction traffic noise and vibration will remain **minor.**

Impact 2: noise and vibration from HDD

20.4.13 Potential noise and vibration impacts on human receptors may arise as a result of the construction activities associated with the HDD and export cable installation. Once the surface is broken noise will be largely produced by a generator, with typical noise levels temporarily increasing at nearby NSPs.

20.4.14 The predicted maximum period of drilling for the onshore works is 75 days, with operation 12 hours a day, for 7 days a week.

20.4.15 For Option 1, the nearest dwelling (dwelling north of Kylerhea) is within 274 metres of the proposed HDD works. This receptor has been assessed to be of **medium** sensitivity, as outlined in impact 1, however, this distance is considered to be sufficiently far away from to be just audible and thus be an impact of **low** magnitude, particularly given the temporary nature of HDD activity.

20.4.16 For Option 2, the nearest NSP (a dwelling within Kylerhea, NSP 5) is approximately 20m away from the proposed HDD works, This is considered to be an impact of **moderate** magnitude.

20.4.17 The impact significance is therefore predicted to be **minor adverse** for option 1 or **moderate adverse** for option 2.

Impact 2: Suggested Mitigation
1. For both options, construction vehicles to not arrive or leave the site between 19:00 and 07:00. 2. For option 2, works to be restricted to the hours of between 07:00 and 19:00, with no works on Saturday from 13:00 h and Sunday 3. For option 2 an appropriate, temporary, physical barrier to attenuate noise from the directional drill used, as recommended in in BS5228-1:2009, to minimise the effects of noise emissions from the drill. 4. 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. 5. Conventional best practical means (BPM) in construction operations. including: a) Education and awareness-raising of construction operatives with regard to the prevention of local community noise disturbance. b) Minimising the idling of vehicles in proximity to the residential properties. c) Avoiding excessive revving of plant equipment engines. d) Extra care taken in handling and placing materials. e) Ensuring that the most modern plant equipment is used and fitted with appropriate noise attenuation. f) Proper maintenance and operation of plant and equipment.

Residual impact:

20.4.18 If noise control measures and best practice are adopted the maximum significance of this impact is reduced to **minor adverse**.

Impact 3: Surface noise from vessels

20.4.19 Vessel options currently being considered for the installation of the devices may include the following types of vessels (although not all of them) (Chapter 5, Project Description):

- Moored barge;
- Jack up vessel;
- Multicat; and
- DP vessel.

20.4.20 During installation, vessels are likely to be within 500m of the NSPs identified in Section 20.3 and within approximately 1 to 1.5km of Kylerhea village.

20.4.21 Underwater drilling operations for the offshore works have slight potential to generate noise above the surface. The drilling operations will be hydraulically driven and will operate for 24hrs a day to reduce the duration of the period that the rig is on site. The main sources of noise will be the drilling head and the two operating generators required to power equipment and lights aboard the drilling area.

20.4.22 This impact will be temporary and its magnitude is predicted to be **low**. With receptors of medium sensitivity this results in an impact of **minor adverse** significance.

Impact 3: Suggested Mitigation
1. Adoption of Best Practicable Means as described in impact 2 mitigation.

Residual impact

20.4.23 Following the implementation of the mitigation measures described above the impact significance will be **minor**.

Potential impacts during operation

Impact 4: Noise associated with movement of vehicles related to substation maintenance

20.4.24 The onshore facility will be visited by personnel to maintain it, resulting in the use of the road between the A87 and Kylerhea village by one to two vehicles of small size and in the context of the existing traffic on this road the noise associated with this impact is likely to be of **negligible** magnitude.

20.4.25 As the NSPs identified above will be of **low** sensitivity to this level of potential noise, which results in an impact of **negligible** significance.

Impact 4: Suggested Mitigation
1. No specific mitigation suggested

Residual impact

20.4.26 No further mitigation is suggested and therefore the impact of maintenance activities will remain of **negligible** significance.

Impact 5: Noise associated with movement of vessels related to maintenance of devices

20.4.27 Scheduled maintenance is likely to be carried out one device at a time, four times per year and the likely maintenance period per device is two days. The devices themselves consist of a tower, which supports a self-contained lifting system for maintenance and repair. This avoids the need for large lifting vessels to be on site when maintenance and repairs are required and reduces disturbance to the local environment during operation and maintenance (O&M), with smaller vessels used to transport technical staff and repair materials.

20.4.28 In addition, inspections of the inter-array cables will be carried out by a Remotely Operated Vehicle (ROV) at 6 months and 12 months after installation, and regular inspections of the support structures will be required. The ROV produces little noise itself, but will be operated from a vessel.

Unscheduled maintenance may also be required during the operation of the devices. Unscheduled maintenance by its nature is unpredictable and thus difficult to assess.

However unscheduled maintenance is likely to occur rarely, and many defects are expected to be identified and addressed during scheduled maintenance.

20.4.29 The majority of scheduled and un-scheduled maintenance will be performed using small personnel craft operated from a local harbour. Therefore the noise associated with this impact is likely to be of **negligible** magnitude in the context of the existing use by marine vessels in Kyle Rhea.

20.4.30 The NSPs are predicted to have **low** sensitivity to this level of noise and therefore the impact significance will be **negligible**.

Impact 5: Suggested Mitigation
1) Mitigation as outlined in impact 2 should be implemented.

Residual impact

20.4.31 The impacts will remain of **negligible** significance.

Impact 6: Noise generated by substation during operation.

20.4.32 For option 1, there are unlikely to be significant operational impacts from the substation. The substation is very small (approximately 6m x 3m) and the separation distance between the substation and nearest NSPs is approximately 500m. The material of the substation will be sufficient to suitably attenuate any noise emissions for the equipment inside. The magnitude of this impact considered **negligible**. The NSPs are deemed to have **low** sensitivity to this level of noise. Therefore the impact significance is considered to be of **negligible** significance.

20.4.33 For option 2, the nearest NSP (dwelling at Kyle Rhea ferry terminal) is within approximately 20m of the small substation. There is some screening of the proposed substation and the dwelling due to a natural bank and stone wall which separates the two. This NSP is considered to be of **medium** sensitivity.

20.4.34 The small substation proposed will not contain any transformers, the main noise generating equipment within most substations, with the transformers being housed within the devices (turbines) themselves, at sea. The substation will house switch gear and control systems and consequently the potential for noise generation is considerably lower than a normal transformer substation. It is assessed that in the absence of transformers, the magnitude of this impact is **low**.

20.4.35 There is also a telephone box next to the proposed substation site. Since the telephone box is enclosed, and the substation will also be enclosed, it is anticipated that the noise level will be just audible, and short-term, as the impact will be felt for the duration of a telephone conversation, therefore the potential impact will be of **low** magnitude. Based on Table 20.4 above, this receptor is deemed to be of **low** sensitivity since it is an outdoor facility, thus the impact significance will be **minor adverse**.

20.4.36 The noise levels within the substation will comply with the Control of Noise at Work Regulations (2005) in order to protect personnel. Therefore the impact significance for options 1 and 2 is considered to be of **negligible to minor adverse** significance.

Impact 6: Suggested Mitigation
1) Insulate substation with a suitable material to attenuate the noise. An acceptable limit within the adjacent dwelling will be agreed at the detailed design stage, once more information is available.

Residual impact

20.4.37 The impacts will remain of **negligible to minor adverse** significance.

Impact 7: Noise generated by SeaGen devices during operation.

20.4.38 There is potential for underwater noise associated with the gearbox and rotation of the blades, to be translated into low level airborne noise during normal operation. Under maximum tidal flow, water flow around the tower may also result in airborne noise.

20.4.39 It is considered unlikely that these sources of airborne noise will be significant when compared to the existing noise levels associated with; tidal flow, local ferry operation, transiting vessels and marine recreational activities and therefore the magnitude will be **negligible.** The nearest NSP is 200m away from the array and therefore it is unlikely that this receptor will be affected. The sensitivity of this receptor is therefore **negligible.** The remaining receptors are greater than 200m away from the array and not anticipated to be affected by operational noise. The significance of this impact is predicted to be **negligible**.

20.4.40 The implications of underwater operational noise for marine life are considered in Chapter 12, Marine Mammals and Basking Sharks and Chapter 14 Fish and Shellfish.

Impact 7: Suggested Mitigation
1) No further mitigation suggested.

Residual impact

20.4.41 The impacts will remain of **negligible** significance.

Potential impacts during the decommissioning phase

20.4.42 After the planned lifetime of the Project, SeaGeneration (Kyle Rhea) Ltd will decommission all of the SeaGen devices and where appropriate, associated infrastructure.

20.4.43 Decommissioning of the Project and associated infrastructure is expected to give rise to similar impacts as those described for the construction, with the exclusion of HDD and foundation drilling and therefore decommissioning is expected to have a lesser impact on onshore noise.

20.4.44 As mentioned in Chapter 5, Project Description, a detailed plan of decommissioning will be submitted for approval by the regulatory authorities prior to construction.

20.5 Summary

20.5.1 The main potential impacts of the Project on human receptors were identified. These have included noise generated by construction and operation-related traffic, from marine vessels during construction and operation, and from the operation of the SeaGen devices themselves.

20.5.2 Potential impacts, without mitigation, were considered to be of **negligible** to **moderate adverse** significance.

20.5.3 Following the adoption of the recommended best practice guidance and mitigation measures, the residual impacts to human receptors from onshore noise associated with the Project will be of **negligible** to **minor adverse** significance.

20.6 References

British Standard Institute (2009). BS 5228-1: 2009 Code of practice for noise and vibration control on construction and open sites. Noise.

British Standard Institute (2009). BS 5288-2: 2009 Code of practice for noise and vibration control on construction and open sites. Vibration.

British Standard Institute (2008). BS 6472-1:2008 Guide to evaluation of human exposure to vibration in buildings. Part 1: vibration sources other than blasting

British Standard Institute (2010). BS 4866:2010 Mechanical vibration and shock — Vibration of fixed structures — Guidelines for the measurement of vibrations and evaluation of their effects on structures

The Highways Agency guidance Design Manual for Roads and Bridges [DMRB], Volume 11, Section 3, Part 7 “Noise and vibration

21 SOCIO ECONOMICS

Page

21.1 Introduction

21.1.1 This chapter provides information on the potential socio-economic impacts of the Project. This includes potential implications of the Project on existing employment, education, health, and community at Kylerhea and Glenelg, and the wider community in surrounding areas, as well as Scotland as a whole. Specific impacts in relation to commercial fisheries, traffic and transport, onshore noise, and tourism and recreation are discussed in Chapters 15, 18, 20 and 22 respectively.

21.1.2 The potential impacts of the Project on the existing activities and conditions are then assessed in terms of their significance. Where required, mitigation measures are proposed to avoid or minimise adverse impacts.

21.1.3 Sea Generation (Kyle Rhea) Ltd recognises the importance of marine industries to local communities in both social and economic terms. Full details of consultation already undertaken, and planned for the future, is discussed in Chapter 6, Consultation. The impacts of the Project on commercial fishing and tourism are considered separately in Chapters 15 and 22, respectively.

Study area

21.1.4 The study area for the socio-economic assessment includes communities along Kyle Rhea both on the Kylerhea village (Skye) and the Glenelg (mainland) sides, which might be affected by the Project. These are considered in the context of the Lochaber, Skye and Wester Ross region as well as for the wider Highlands, Scotland or UK economies.

Overview of potential impacts

21.1.5 Installation, maintenance and decommissioning of the Project will make use of the local supply chain where appropriate. The Project will help support the local economy and play a role in job creation.

21.1.6 Local businesses will benefit from increased local spend (e.g. accommodation, restaurants, shops, transport operators), particularly during the installation phase, but continuing through operation and eventually to decommissioning.

21.1.7 The Project represents a significant stepping stone in the advancement of the tidal energy industry which has significant potential socioeconomic benefits for Scotland and the UK.

21.1.8 There are currently no tidal arrays installed and this Project represents a vital step in the commercialisation of the tidal energy industry. The SeaGen device in Strangford Lough, Northern Ireland is the first commercial scale tidal turbine in the world. Kyle Rhea will be the first location where an array of proven SeaGen technology will be deployed.

Policy, legislation and guidance in relation to socio-economics

21.1.9 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.

21.1.10 Certain elements of the SPP are particularly relevant to potential socio-economic impacts of the Project. 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.

21.1.11 'Going for Green Growth: a Green Jobs Strategy for Scotland' (Scottish Executive, 2005) sets out how this priority should be delivered through sustainable economic development. Further to this vision, the Scottish Government Economic Strategy (Scottish Government, 2011) 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.

21.1.12 The Scottish Government believes 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 plays 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.

21.1.13 The Highland Renewable Energy strategy and planning guidelines 2006 (Highland Council, 2006) state that positive and negative socio-economic onshore impacts should be addressed in the planning application; including the assessment of: additional jobs; especially in fragile remote areas, skills and training, inflation of labour rates, house prices, and shortage of key skills for traditional activities such as farming and fishing.

21.1.14 The Highland-wide Local Development Plan (Highland Council, 2012a) sees marine renewable energy development as contributing to the local and regional economies of the Highlands, and states '*The Council will expect developments to benefit the local community and contribute to the wellbeing of the Highlands, whilst recognising wider national interests"*. The Highland Council Community Benefit Policy (Highland Council, 2011) recognises that the offshore renewable industry is still in an early stage and is unlikely to be in a position to generate community benefit until the industry becomes more commercially viable. As discussed in Chapter 1, Introduction, investment in Sea Generation (Kyle Rhea) Ltd is being sought and the current owners are not in a position to agree or refuse any community benefit deals. The impact assessment assumes the worst case scenario for socioeconomics: that there will be no Community Benefit payment.

21.1.15 Policy 67 (Renewable Energy Developments) of the Local Development Plan, states that the Council will consider 'any positive or negative effects it is likely to have on the local and national economy; and will assess proposals against other policies of the development plan, the Highland Renewable Energy Strategy and Planning Guidelines and have regard to any other material considerations, including proposals able to demonstrate significant benefits including by making effective use of existing and proposed infrastructure or facilities.'

21.1.16 This policy context indicates that socio-economic assessment for the Project should focus on the potential for the development to contribute to sustainable economic development.

21.2 Methodology

21.2.1 The following consultation, data and impact significance definitions were used to assess the potential impacts on socio-economics.

Consultation in relation to socio-economics

21.2.2 Discussions have been undertaken with the Glenelg and Arnisdale Development Trust prior to this assessment.

21.2.3 A Scoping Opinion was sought in March, 2010 and the full response is provided in **Appendix 4.1**.

21.2.4 Sea Generation (Kyle Rhea) Ltd has instigated a public liaison group to provide key public representatives (including Highland and Island Enterprise, Glenelg and Arnisdale Development Trust and Community Council, Isle of Skye Ferry Community Interest Company, and the Forestry Commission) with information on a quarterly basis so that the local communities and other parties can be kept up to date. This also gives the public an opportunity to regularly voice any concerns through their representatives. The first meeting was held in November 2011.

21.2.5 Sea Generation (Kyle Rhea) Ltd provided 50% of the funding required to set up an online community portal[44] to allow the sharing of information on all topics of interest to the local community, including updates on the Project.

21.2.6 It is understood that there is enthusiasm and opposition to the Project on Skye and the mainland. Through holding regular liaison meetings and public exhibitions, Sea Generation (Kyle Rhea) Ltd hope to inform public perception and alleviate concerns where possible.

21.2.7 A summary of the responses from consultees (via Scoping and Liaison Group) with regards to socio-economics is presented in Table 21.1.

Table 21.1: Summary of consultation relating to socio-economics

Key issues raised	Response
The Highland Council advised that the application 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 Project.-	Information is provided where possible, in particular providing examples from the SeaGen project in Strangford Lough
Scottish Government stated '*The developers should also note that the Highland Wide Local Development Plan will set out The Highland Council's policies on planning for renewable energy*.'	Paragraphs 21.1.14 to 21.1.16
The Liaison Group stressed the importance of creating local job opportunities.	See impacts 3 and 4

Data collection

21.2.8 The principal data sources relevant to the socio-economics are shown below in Table 21.2.

44 http://www.glenelg.co.uk/

Table 21.2: Data sources to inform the existing environment

Data Source	Spatial coverage	Author	Year
Community Development Plan	Glenelg and Arnisdale	Glenelg & Arnisdale Development Trust	2012
Highland-wide Local Development Plan	Highland	Highland council	2012
UK Tidal Current Resource & Economics	UK	Carbon Trust	2011
Local Plan	West Highland & Islands	Highland Council	2010
Eilan a'Cheò Ward Community Development Plan	Skye	Highland Council	2009

Impact assessment

21.2.9 The impact assessment is completed using relevant guidance (see Chapter 4, EIA Methodology). The sensitivity of the receptor to potential impacts of the Project can be characterised as one of four levels, high, medium, low and negligible. The definition of each level is given below in Table 21.3.

Table 21.3: Definition of terms relating to the sensitivity to an impact

Value / Sensitivity	Definition
High	No capacity to accommodate the proposed form of change.
Medium	Very low capacity to accommodate the proposed form of change.
Low	Low capacity to accommodate the proposed form of change.
Negligible	Receptor has some tolerance to accommodate the proposed change.

21.2.10 The significance of potential impacts of the Project is based on the intensity or degree of disturbance to baseline conditions and is assessed through a combination of the sensitivity of the receptor (above) and the potential magnitude of the impact of disturbance. Magnitude can be categorised into four levels of magnitude, high, medium, low and negligible. The definitions of each of these are given in Table 21.4.

Table 21.4: Definition of magnitude of an impact upon receptors

Magnitude	Definition
High	Very significant, permanent / irreversible changes, over the whole feature / asset, and / or significant alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact certain or likely to occur.
Medium	Significant, permanent / irreversible changes, over the majority of the feature / asset, and / or noticeable alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness.

Magnitude	Definition
	Impact certain or likely to occur.
Low	Noticeable, temporary (during the Project duration) change, over a minority of the feature / asset, and / or limited but noticeable alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact will possibly occur.
Negligible	Noticeable, temporary (for part of the Project duration) change, or barely discernible change for any length of time, over a small area of the feature or asset, and/or slight alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact unlikely or rarely to occur.

21.2.11 Table 21.5 combines the definitions of magnitude with the level of sensitivity/value/importance of receptor to provide a prediction of overall significance of the impact.

Table 21.5: The level of significance of an impact resulting from each combination of sensitivity and magnitude

Sensitivity	Magnitude			
	High	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

21.3 Existing environment

Local communities

21.3.1 Kyle Rhea is situated in the Highland region of Scotland, in the Skye and Lochalsh area. The Skye and Lochalsh area is sparsely populated with a population estimated to be 12,722 (NRS mid-year estimates, 2010, cited in The Highland Council, 2012b).

21.3.2 In common with the rest of Highlands, the population of Skye and Lochalsh is ageing and this trend is expected to continue. The age profile of the area's population is projected to change significantly over the next 10 years, with a 40% growth in those 65 or older and an 8% decline in children. This is due to declining birth rates, ageing of the current population, the older age profile of immigrants and the continued out-migration of young adults. Parts of the region (Lochaber, Skye and Wester Ross) are attractive for retirement, but many young people leave to seek out Higher Education and employment opportunities elsewhere. (HIE, 2011)

21.3.3 The communities on both sides of Kyle Rhea are sparsely populated with a number of isolated settlements. These include Kylerhea on Skye and the Glenelg and Arnisdale community.

21.3.4 House prices have been rising in recent years. The median house price in the wider region of Lochaber, Skye and Wester Ross in 2008 was £123,250 compared to £117,750 in the Highlands and Islands and £114,500 in Scotland (HIE, 2011).

Skye community

21.3.5 The Isle of Skye (Eilean a' Cheò) is a sparsely populated rural area with a below average population density. The Skye economy is primarily service-based, with consequent lower than average wages and higher seasonal unemployment than the rest of Scotland (The Highland Council, 2009).

21.3.6 In mid 2006 the population of Skye was 9,780. The population grew by 4% between 2001 and 2006, the second highest growth rate outside Inverness, as a result of inward migration, generally moving to the area following retirement. The profile is slightly older than the Highland average, with high proportions in the 50+ age group and one of the highest proportions of people aged over 85. (The Highland Council, 2006).

Glenelg and Arnisdale community

21.3.7 The Glenelg and Arnisdale community is presented as sharing many of the assets and challenges of remote peninsular and island communities on the west coast of Scotland. It is geographically isolated, but has clear boundaries, giving, potentially, a strong sense of identity. The small population , has just over 200 permanent adult residents and around 80 residents below voting age. Although geography may be an advantage for tourism, with remoteness appealing to many visitors, it creates its own problems in accessing non local services , particularly for those without reliable transport (Glenelg and Arnisdale Development Trust, 2012).

21.3.8 The population of Glenelg and Arnisdale was estimated to be 291 in 2009 (General Register Office for Scotland, 2009) with 229 aged 18 or above. This indicates that there has since been a drop in population (see above). Demographically the future presents a major challenge for the community, especially regarding the future of the primary school. The school roll has fallen by 8% between 2006 and 2011, from 42 to 38. Within the next few years several factors will influence retention of the current population; predominantly the availability of work and removal of access to local services.

Industry and employment

21.3.9 Both on Skye and on the mainland, local people are employed by public bodies, are self-employed, or employed by local businesses. The economy of the wider Skye, Lochaber and Wester Ross region is dominated by tourism, which accounts for 35% of employment (see Chapter 22, Tourism and Recreation). The most significant growth areas in recent years has been in the outdoor activity sector and the higher-end market for food and accommodation (HIE, 2011). A large proportion of workers (58%) were employed by companies with less than 25 employees in 2008. HIE (2011) show less than 5% of employment is in agriculture and fishing, however HIE stated that this is likely to be an underestimation due to excluding self-employment in the data collection. Unemployment in Lochaber, Skye and Wester Ross is very seasonal and shows higher fluctuations than in the Highlands and Islands (HIE, 2011).

21.3.10 The Glenelg and Arnisdale Development Trust (GADT) sees the potential for growth likely to result from a combination of harnessing local renewable resources and investment in tourism (Glenelg and Arnisdale Development Trust, 2012).

Community perception

21.3.11 There is already activity in the field of renewable energy in Skye and support for renewable energy schemes which benefit local communities is evident, for example, through the Isle of Skye Renewables Cooperative Ltd[45] and Sleat Renewables Ltd[46]. For the Isle of Skye, renewable energy projects can create local employment opportunities, deliver revenue to the community and generate power for local schemes (LEADER Eilean a' Cheò Steering group, 2009).

21.3.12 The Glenelg and Arnisdale Development Trust support local business opportunities wherever possible focussing on the key industries identified in the area, these being renewable energy, and leisure and tourism. Their objective is "to investigate revenue generating projects in order to make the Glenelg community financially sustainable in a very short period of time and generating a surplus that can be reinvested in the community for projects that the community wants and that will make the community even more prosperous thus attracting more people and businesses to the area" (Glenelg and Arnisdale Development Trust, 2012).

21.4 Impact assessment

Do nothing scenario

21.4.1 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 socio-economics.

21.4.2 The immigration of people over 65 years and emigration of younger people is likely to continue while employment and education opportunities are limited. This will put a strain the local economy.

21.4.3 The key sector will continue to be tourism which provides seasonal fluctuations in employment.

21.4.4 In addition, the 'do nothing' scenario may limit the progress of the tidal industry across Scotland.

Potential impacts during the construction phase

Impact 1: Direct capital expenditure (project development, manufacture and assembly)

21.4.5 A review of the Kyle Rhea Project which analysed the supply chain was undertaken by BVG Associates in 2011, and commissioned by Highlands and Islands Enterprise. The report noted the following: that Scotland is at the forefront of the emerging wave and tidal industry, in terms of installed and planned wave and tidal devices; that 15% of the world's economically accessible tidal resource is located in Scotland (Future Marine Energy 2006 as cited by BVG Associates 2011); and that together, wave and tidal energy could contribute up to 20% of the UK's current electricity demand (Future Marine Energy 2006 as cited by BVG Associates 2011). Therefore, Scotland is in a good position to make to the most of this economic opportunity.

21.4.6 The Project is a major undertaking, with total capital costs of around £40m. The Supply Chain Analysis report identifies the following key stages of the Project. These are development and consenting, device manufacture, balance of plant manufacture (components of the tidal array, other than the device), installation and commissioning and operations and maintenance (O&M).

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[45] http://www.skye.coop/skye_home.asp

[46] http://www.sleat.org.uk/index.asp?pageid=75258

21.4.7 These stages in the Project process require a range of skills and services, including:

- Engineering consultancy;
- Environmental consultancy;
- Local mariner experience;
- Ecologists;
- Marine archaeologists;
- Installation vessels;
- Quayside facilities;
- Port facilities;
- Management services;
- Marine biologists;
- Specialist survey craft;
- Vessel and tooling;
- Heavy engineering;
- Local vessels for O&M; and
- Training provision.

21.4.8 There are significant opportunities for manufacturing capital expenditure to benefit local economy. Where possible, if local expertise are available at a competitive rate, Sea Generation (Kyle Rhea) Ltd will employ local contractors, as it has done thus far during site selection and collection of environmental data (e.g. employment of local bird surveyor, hire of local sea angling vessel and crew for survey). Local and regional opportunities throughout Scotland and the UK include:

- Vessel charter of installation, survey, safety and personnel transfer vessels;
- Fabrication and assembly services;
- Directional drilling and cable laying services;
- Mooring and anchoring services; and
- Installation services.

21.4.9 The Sustainable Development Commission (2007) identified that local economies could benefit from the development of tidal energy schemes and projects. This was based on simple analysis of the local labour market in areas of high tidal resource which showed that there are potential strengths in terms of installation and service industries in these areas. It was also considered that opportunities for wider regeneration may also arise, particularly where the tidal resource exploited is in a rural or deprived area.

21.4.10 There is an opportunity for some of the manufacturing to be carried out in the west Highlands region or wider in Scotland, subject to tendering. The magnitude of this impact is considered to be **low** and the sensitivity considered to be **medium**, with a temporary impact giving a potential **minor beneficial** significance.

Impact 1: Suggested Mitigation
No mitigation suggested

Residual impact:

21.4.11 No mitigation is suggested and the residual impact will remain **minor beneficial** significance.

Impact 2: Indirect capital expenditure (marine services and onshore construction)

21.4.12 Marine contractors operating around Kyle Rhea and Lochalsh will have the opportunity to benefit from contracts during installation with further potential local opportunities for crew on work boats and guard boats. During offshore installation activities there will be use of local vessels and dive teams where available and where appropriate. The number of vessels and crew required will fluctuate based on the stage of the Project.

21.4.13 Other potentially locally sourced services may include suppliers of hardware, chandlery etc. Sea Generation (Kyle Rhea) Ltd intends to locally purchase any items that are easily sourced and of competitive value. Based on continued provision of local logistical support, combined with potential procurement of a portion of project supplies locally, the local economic contribution during the installation phase may be significant, with a resulting temporary change in the socio-economics of the area. This impact is considered to be of **medium** magnitude.

21.4.14 The indirect impacts of capital expenditure are likely to be felt by a number of local businesses. The small number of local businesses indicates a **medium** sensitivity to socio-economic influences. Medium magnitude of impact and medium sensitivity suggests an impact of long term, **moderate beneficial** significance of the Project.

Impact 2: Suggested Mitigation
No mitigation suggested

Residual impact:

21.4.15 No mitigation is suggested and the residual impact significance will remain **moderate beneficial**.

Impact 3: Indirect economic benefits (employment, accommodation and services)

21.4.16 The Project will be one of the first tidal arrays in Scotland and the only one using proven technology. Scottish Government (Marine Energy Group, 2009) figures indicate 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 an important step to achieve this goal. The commercial deployment of wave and tidal energy projects in Scotland represents a huge opportunity for Scotland's potential supply chain companies, with, for example, the industry in Orkney is already employing in excess of 250 people in a range of supply chain activities (Marine Energy Group, 2009) associated with the European Marine Energy Centre (EMEC) test facility and other projects.

21.4.17 A number of specific employment opportunities will be created by the Project, including:

- Local surveyors have been employed for ornithological and marine mammal surveys and further works may be required pre and post installation;
- Local boats and crew are being used wherever possible and this will continue throughout the Project; and
- Local construction firms may be employed in the onshore construction works, including civil engineering works, ground works, building construction, road construction, mechanical services, electrical services, utility providers, painting and decorating, joinery and carpentry.

21.4.18 Construction workers employed by the Project may spend one or two summers on site, depending on the contractors and vessels commissioned for installation. During installation, Sea Generation (Kyle Rhea) Ltd anticipates renting a local house to provide accommodation for key staff. However, up to 36 personnel may be required for different stages of the installation and additional accommodation will also be required at local hotels. Most personnel will stay in the vicinity of the local port, most likely Kyle of Lochalsh, although some staff may stay more locally to the Project site. 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. For the SeaGen project in Northern Ireland, MCT spent around £1.3m in the adjacent towns of Portaferry and Strangford from 2005 to 2011 (including both construction and operation phases) and an additional £2.1m elsewhere in Northern Ireland.

21.4.19 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 tourist board and communities will be important to ensure that opportunities are maximised, without adversely impacting tourism.

21.4.20 The socio-economic benefits arising from the Project are likely to result in temporary detectable change in the socio-economics of the area, therefore this impact can be considered to be of **medium** magnitude.

21.4.21 As existing local employment opportunities are currently limited (see Section 21.3, Existing environment), the socio-economics can be described as being of **medium** sensitivity.

21.4.22 Therefore the increased employment opportunities and the increased local spend overall will be of **moderate beneficial** significance.

Impact 3: Suggested Mitigation
No mitigation suggested

Residual impact:

21.4.23 No mitigation is suggested and the residual impact will remain **moderate beneficial** significance.

Potential impacts during the operation phase

Impact 4: Impact on employment

21.4.24 There will be employment opportunities associated with maintenance of the Project, both on and offshore. In some cases local contractors may be employed to undertake non-specialist works. In Strangford Lough, a local family-run business were commissioned to provide long term operation and maintenance support, including vessel transfer of personnel and carrying out basic maintenance with appropriate training.

21.4.25 This level of change may significantly affect one or two people by providing long term employment, but is not likely to alter the overall economy and employment levels dramatically, and therefore the magnitude of pressure is **low**. However, given that there is limited employment in the area, the extra employment will be quantifiable and so the receptor can be considered to be of **medium** sensitivity.

21.4.26 As such, the impact on employment will be long term and of **minor beneficial** significance.

Impact 4: Suggested Mitigation
No mitigation suggested.

Residual impact:

21.4.27 No mitigation is suggested and the residual impact significance is predicted to be of **minor** beneficial.

Impact 5: Community benefits

21.4.28 Sea Generation (Kyle Rhea) Ltd will seek to involve local businesses when possible to maximise the potential benefits to the local community. However, this engagement is not likely to alter the baseline condition dramatically and therefore the magnitude of impact is predicted to be **low**. Given that the support to the local community will be quantifiable, the receptor can be considered to be of **medium** sensitivity.

21.4.29 Consequently, the impact is predicted to be long term and of **minor beneficial** significance.

Impact 5: Suggested Mitigation
No mitigation suggested.

Residual impact:

21.4.30 No mitigation is suggested and the residual impact significance will be **minor beneficial.**

Potential impacts during the decommissioning phase

21.4.31 During decommissioning there will be similar impacts to those outlined during construction, albeit on a smaller scale (as some infrastructure is likely to be left in situ and therefore less work will be required). The decommissioning work is expected to have a minor positive impact on socio-economics.

Potential cumulative impacts

21.4.32 Other potential renewable energy projects in the region include:

- Ardintoul Wind
- Arnisdale River Hydro
- A'Mhaoile 900KW community-owned wind turbine

21.4.33 These are all currently being assessed for feasibility and there are no project details to assess at this stage.

21.5 Summary

21.5.1 The Project will provide **minor to moderate** 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 and operational phase of the Project. There will also be on-going spend on local services associated with operation and maintenance.

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22 TOURISM AND RECREATION

22.1 Introduction

22.1.1 This chapter of the Environmental Statement (ES) describes the existing tourism and recreational activities within the Project and associated study area.

22.1.2 It presents the findings of an assessment of potential impacts arising from Option 1 and Option 2 for the construction, operation and decommissioning phases of the Project.

22.1.3 This chapter should be read in conjunction with Chapter 21, Socio Economics and Chapter 16, Seascape Landscape and Visual Assessment, Chapter 17, Shipping and Navigation and Chapter 18, Traffic and Transport.

Study area

22.1.4 The study area considers tourism and recreation in the communities located around Kyle Rhea, both on the Kylerhea (Skye) side and on the Glenelg (mainland) side, as well as the wider region of Skye and west Highlands (around Lochaber and Wester Ross) which may be affected by the Project.

Overview of potential impacts

22.1.5 The Project will introduce a new visual aspect to the local area around Kyle Rhea which has the potential to affect visitor's perceptions and enjoyment of the area and therefore may affect some tourism and recreational activities.

22.1.6 Existing marine recreational activities, including sailing, sea kayaking and scuba diving, within the study area, will be displaced during construction of the Project. Marine recreational activities particularly sailing may also be displaced during operation (Chapter 17 Shipping and Navigation).

22.1.7 The tidal array may be viewed as an interest feature which has the potential to attract tourists. The Portaferry tourist information centre has a SeaGen display which is used to educate members of the public on tidal stream technology and Strangford Lough project. SeaGen is also listed as a tourist attraction for local boat trips (Sea Safari47).

[47] http://www.clearsky-adventure.com/Sea_Safari/195

Policy, legislation and guidance in relation to tourism and recreation

22.1.8 Under the EIA Regulations, an EIA should include a 'description of the likely significant effect… of the Project on human beings, the landscape and the interaction of these with each other and wildlife, the air, soils and climate'

22.1.9 The Countryside (Scotland) Act 1967 along with the 1991 Natural Heritage (Scotland) Act, establishes SNH with responsibilities for facilitating the enjoyment of natural heritage (SNH, 2009). The Marine (Scotland) Act (2010), Part Three, makes provision for the development of marine planning at a regional and national level, which may see relevant changes introduced in respect of the use of sea areas.

22.1.10 Consenting, EIA and Habitats Regulation Appraisal (HRA) guidance for marine renewable energy developments in Scotland (EMEC and Xodus, 2010) addresses tourism and recreation within a section entitled "Other Sea and Land users".

22.1.11 Statements of Scottish Government policy in the National Planning Framework (NPF), the consolidated Scottish Planning Policy (SPP) (including 'Open space and recreation') and Scottish Government Circulars, provide material considerations to be taken into account in development of plans and development management decisions. Scottish Government policy 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.

22.2 Methodology

22.1.1 This assessment follows the latest guidance on EIA (Including EMEC and Xodus Group in press and IEMA, 2006), and draws on experience from recent examples of similar renewable energy projects in the UK and Europe, as well as professional judgement. A baseline for tourism and recreation has been established through a desk based review, with an impact assessment then conducted to predict the potential impacts of the Project on the baseline environment.

Consultation in relation to tourism and recreation

22.1.2 A Scoping Opinion was sought from both statutory and non-statutory consultees (MCT, 2010) in March 2010. Responses are detailed in Appendix 4.1 and a summary of the main points pertinent to tourism and recreation, along with an explanation of how they were addressed, is provided below (Table 22.1).

Table 22.1: Summary of consultation relating to tourism and recreation

Key issues raised	Response
SNH advises that recreational stakeholders should also be contacted including the Scottish Canoe Association and Inverness Diving Club.	These groups have been made aware of the project and invited to public exhibition

Key issues raised	Response
RYA: in section 5.3.1, the scoping report states that MCT has recently commissioned vessel surveys for the study area and that *'During a 14 day period in March 2010, 94 vessel tracks were recorded'*. The RYA feels that this survey period provides an inadequate representation of recreational vessel movements in the area as March is very early in the season when many recreational vessels will still be laid up after the winter. The RYA would therefore expect another survey to be carried out during the high season, May to September, to gauge the full extent of vessel numbers in Kyle Rhea.	Updated shipping surveys are discussed in Chapter 17, Shipping and Navigation
The RYA would like to make the developers aware that the majority of summer recreational traffic in the area is on a passage north or south for safety reasons and to save time rounding Skye.	Recreational yachting is considered in Chapter 17, Shipping and Navigation.
The RYA believes that the threat to recreational yachts by underwater turbine blades can be minimised by specifying a minimum underwater clearance of 3.5 meters (m) below mean low water springs (MLWS).	The clearance depth will be greater than 3.8m MLWS. Navigation safety is discussed in Chapter 17, Shipping and Navigation
The RYA has put together a position statement regarding the development of offshore renewable energy developments. The RYA's concerns regarding recreational boating and offshore energy developments are included in this statement and we would expect these to be addressed in an ES for a project such as this.	The RYAs position statement is considered in Appendix 17.1 NRA, and Chapter 17, Shipping and Navigation
RYA, In addition to the position statement, the RYA has also produced the UK Coastal Atlas of Recreational Boating. The Atlas contains maps of recreational cruising routes, racing and sailing areas as well as locations of RYA affiliated clubs, training centres and also marinas (independent) around the UK. I see that the data from the Atlas has been referred to within the Shipping and Navigation section of the Scoping report. The RYA is encouraged that the GIS data is being considered at this early stage and as with the position statement, would expect this information to also be taken into account and represented within the ES.	This document has been used to inform Section 22.3, Existing environment

Data collection

22.1.3 A desk-based assessment has been carried out to establish a baseline for tourism and recreation within the study area using information drawn from publicly available literature and data.

22.1.4 The principal data sources relevant to tourism and recreation are shown below in Table 22.2.

Table 22.2: Data sources to inform the existing environment

Data Source	Spatial coverage	Website
Office for National Statistics	UK	www.statistics.gov.uk
Visit Scotland Research Statistics	Scotland	www.visitscotland.org
Visit Highlands website	Highlands	www.visit highlands.com
Explore Scotland Website	Scotland	www.explorescotland.net
Skye the Island and Lochalsh	Skye and Lochalsh	www.skye.co.uk

Data Source	Spatial coverage	Website
UK Atlas of Recreational Boating	UK	Provided on request by RYA

Impact assessment

22.1.5 The significance of an impact related to the Project is based on a combination of; the receptor sensitivity to that impact and the intensity or degree of disturbance (magnitude) to baseline conditions caused by that impact.

22.1.6 The magnitude of an impact is categorised as high, medium, low or negligible. The definitions of each of which are given in Table 22.3.

Table 22.3: Definition of magnitude of an impact upon receptors

Magnitude	Definition
High	A fundamental change to the baseline condition of tourism and/or recreation.
Medium	A clear change resulting in the non-fundamental, temporary or permanent condition of tourism and/or recreation
Low	A minor change to the baseline condition of tourism and/or recreation (or a change that is temporary in nature).
Negligible	An imperceptible and/or no change to the baseline condition of tourism and/or recreation.

22.1.7 The sensitivity, value or importance of the receptor for each impact is characterised as high, medium, low or negligible. The definition of each level is given below in Table 22.4.

Table 22.4: Definition of the receptor sensitivity/value/importance

Sensitivity/Value	Definition
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 impacts on the tourist industry and recreation. This would imply a substantial reduction in the number of people participating in an activity and have resultant impacts on local business.
Medium	Environment clearly responds to impact(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 impact on the tourist industry and recreation. This would imply a reduction in the number of people participating in an activity and resultant impacts on local business.
Low	Environment responds in minimal way to impacts so 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). These impacts are normally temporary or reversible and are unlikely to have impacts on local businesses.
Negligible	Environment responds in minimal way to impact such that only negligible change(s) occur which may or may not be detectable, or no changes result at all.

22.1.8 Table 22.5 combines the definitions of magnitude with the level of sensitivity/value/importance of receptor, to predict the overall significance of the impact. The red and amber coloured squares correspond to impacts, considered to be significant within the EIA.

Table 22.5: The level of significance of an impact resulting from each combination of sensitivity and magnitude

Sensitivity	Magnitude			
	High	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

22.3 Existing environment

22.3.1 In the Highlands and Islands region, tourism is a significant part of the local economy. The sector includes around 3,000 businesses, supports 25,000 jobs and generates £1.2 billion annually. (HIE, 2010) It is estimated that in 2010, UK residents took 1.67 million trips to the Highlands and Islands, staying 7.16 million nights and spending £384 million. Visitors from overseas made around 0.44 million trips to the Highlands, staying 2.03 million nights and spending £153 million. Overseas visitors to the Islands of Scotland made around 0.20 million trips, staying for 0.68 million nights and spending £44 million (Visit Scotland 2011).

22.3.2 Tourism accounts for 35% of employment in the Skye, Lochaber and Wester Ross region (HIE, 2010).

22.3.3 Visitors are drawn to Skye and Lochalsh by its dramatic landscape with its mountain profiles and rich history. Among the most visited attraction of the region Eilean Donan Castle and Visitor Centre attracted 314,199 visitors in 2011. (Visit Scotland, 2011)

22.3.4 Skye and Lochalsh have a wide range of castles and folk museums as well as wildlife watching, walking, cycling, golf, angling, pony trekking and boat trips. (Visit Highland website).

Heritage

22.3.5 The heritage of Skye & Lochalsh is diverse, including: dinosaur footprints at Staffin Bay in North Skye, Neolithic chambered cairns, stone circles, and peat banks, still utilised by the community to the present day.

22.3.6 SNH (2012) has undertaken a project that attempts to assess the wildness of certain areas of Scotland. This is based on research by the University of Leeds for the Cairngorms National Park. The assessment is based on four physical attributes. One of these attributes is the visible lack of buildings, roads, pylons and other modern artefacts. In regard this attribute the immediate area around Kyle Rhea has a medium to high presence of modern artefacts.

Walking and wildlife watching

22.3.7 Skye and Lochalsh support a vast rural landscape with a high level of wildness (SNH, 2012). Skye boasts the Cuillin mountain range and a relatively large coastal area with several peninsulas and sheltered bays, including Elgol and Sleat. These varied habitats support diverse wildlife including otters, mountain flowers, bluebell, sea eagles and corncrakes. The mainland provides mountain walks with interesting wildlife, including red deer. Further information is provided in Chapters 10, Terrestrial Ecology and 11, Ornithology.

22.3.8 The 'walk highlands' website48 lists four walks presented in Table 22.6.

Table 22.6 Walks along Kyle Rhea (walkhighlands website)

Walk name	Description
Kylerhea Otter Haven	Easy walk with lovely views over the Kyle strait to the mainland. The otter hide at the midway point gives a good opportunity to spot otters, seals and other wildlife. Picnic tables and toilets near start.
Kylerhea hills – Beinn na Caillich, Sgurr na Coinnich, Ben Aslak	A challenging circuit with a mountainous feel, rewarded by great views all round. A tough day walk but without the scrambling required in the Cuillin and in a very quiet part of the island.
Ardintoul circuit, near Glenelg	A very varied circuit taking in wild moorland, forest tracks and a beautiful walk along the shores of Loch Alsh.
The Lochalsh Dirty 30 Challenge	The Dirty 30 circuit can be completed as a tough long day or 2 day circuit over varied ground with great views.

22.3.9 The Kylerhea otter haven opened in the late 1980s and is well promoted, and well used, with the following facilities:

- directional road signage;
- gravel car park;
- picnic area below car park;
- gravel track to hide;
- toilets;
- small shelter;
- information boards at car park and along track;
- viewing hide;
- interpretation panels in hide; and
- binoculars

22.3.10 Hibberd (2011) suggests the otter hide is largely used by tourists (UK and foreign). The main wildlife tourism season is May and June (Blake *et al* , 2010 cited in Hibberd, 2011). A study by Hibberd (2011) recorded 219 people attending the otter hide over 5 days during summer 2010. However the study involved providing regular presentations free of charge and is likely to be an over-estimation of visitor numbers. Annual visitor figures for Kylerhea are estimated at 20,000 per annum (Taylor 2010 pers. comm, cited in Hibberd, 2011). It is anticipated that the majority of visitors to Kylerhea village will visit the otter

[48] http://www.walkhighlands.co.uk/

hide.

Water sports

22.3.11 Kyle Rhea is listed in the Visit Scotland (undated) Best Sea Kayaking in Europe website. The web site states that this is an advanced route with the tide reaching up to 7 knots creating waves and whirlpools.

22.3.12 Recreational drift diving occurs through Kyle Rhea which is famous for the sensation created by the tide current speed more than for the view on the rocky bottom (deesidedivers website). There are also other dive sites within lochs Duich, Long and Alsh, as well as around Skye.

Recreational sailing

22.3.13 Recreational passage through Kyle Rhea is heavy (RYA, 2008). Kyle Rhea is encompassed by an RYA UK sailing area. This area is extensively used for general day-sailing by all types of recreational craft, particularly smaller craft such as small cruisers, day-boats, dinghies, sailboards and personal watercraft. DECC suggests that such craft will not normally be undertaking point-to-point passages but will be on out and return activities and may appear to be sailing in random directions as they take advantage of wind and tide to make progress (DECC, 2009). However, during consultation the RYA specified that the majority of summer recreational traffic in the area is on a passage north or south for safety reasons and to save time rounding Skye (Table 22.1, and Scoping Opinion, Appendix 4.1).

22.3.14 The Broadford marina is located in the study area, as well as RYA training centres in Broadford and Kilbed (DECC *et al* . 2009).

Ferries

22.3.15 A car ferry ‘Glenachulish’ crosses Kyle Rhea between Easter and mid-October. This ferry transits between Kylerhea and Glenelg and is the last manually operated turntable ferry in Scotland. The ferry crosses the strait seven days a week between 10am and 6pm every 20 minutes (Skyferry, 2012).

22.3.16 Figures from the ferry company reveal that the ferry carried 30,000 passengers in 10,000 cars in 2008. 85% of this traffic was one way & non local (Hibberd, 2009).

Existing businesses

22.3.17 There is limited accommodation for tourism in Kylerhea, with one self catering cottage, the Old Crofthouse.

22.4 Impact assessment

Do nothing scenario

If the Project is not realised, it is likely that the existing environment with regard to tourism and recreation would continue, see section 22.3 Existing environment.

Potential impacts during the construction phase

Impact 1: Disturbance to tourism and recreational activity – onshore and offshore

22.4.1 Tourism and recreational activity within the study area will be temporarily disturbed by the construction activities which will affect the landscape, the ambient noise and potentially some wildlife.

22.4.2 Construction activities will temporarily modify views within the study area – especially between the Kyle of Lochalsh port, from where daily runs of materials, plant, equipment and personnel are planned (a full landscape assessment is presented in Chapter 16, Seascape Landscape and Visual Assessment).

22.4.3 Noise generated during the array installation may have direct or indirect impacts on recreation and tourism, although the impacts will be short term (see Chapter 20, Onshore Noise for more details). The main sources of construction noise include:

- Vessels;
- Movement of machinery/device components;
- Installation of machinery/device components;
- Directional drilling; and
- Installation of onshore substation.

22.4.4 The main direct impacts of installation noise will be disturbance experienced by visitors to the coast within the immediate vicinity of the Project site caused by HDD drilling and construction of the substation. The installation noise may also have limited adverse impacts on marine wildlife and seabirds, with an indirect impact on those wishing to observe marine wildlife and birds. For an in-depth assessment of this topic, see Chapter 11 Ornithology, and Chapter 12 Marine mammals and basking shark. Potential impacts on otters are considered in Chapter 10, Terrestrial and intertidal ecology.

22.4.5 Disturbance will be temporary, with offshore work undertaken during one or two summers and onshore work taking 75 days (see Chapter 5, Project description). It is anticipated that noise disturbance will be confined to small areas around works site. For Option 1 this will include the access track to the otter hide and for Option 2 this will include the area to the south of the ferry access road (See Chapter 5, Project Description (Figure 5.1) and Chapter 20, Onshore Noise). As these areas are relatively small the magnitude of the noise impact is therefore considered to be low.

22.4.6 The existing environment in this area is attractive for tourism and recreational activities due to the landscape specificities and its wildlife, although the same statement can be made about much of the wider area around Skye and Lochalsh. The sensitivity of the tourism and recreational activities to disturbance by construction works is considered to be low based on the temporary nature of the impact (see Table 22.4). In addition there are a number of tourist attractions in the study area (Skye, Lochaber and Wester Ross region) which will be unaffected by the Project.

22.4.7 In accordance with Table 22.5 the impact of disturbance to tourism and recreational activity is considered to be of minor significance.

Impact 1: Suggested Mitigation
39. This impact has been mitigated by the project design as far as possible, reducing the overall timescale for construction by overlapping the directional drilling works and substation construction.

Residual impact:

22.4.8 The residual impact of disturbance to tourism and recreational activity will remain of minor significance.

Impact 2: Displacement of tourism and recreational activity – onshore

22.4.9 In the interests of efficiency and safety, installation activities may involve restriction of a small area during construction/drilling however this is not anticipated to result in restricted access to the otter hide either in Option 1 or Option 2 (see Chapter 2, Project description for more detail).

22.4.10 Any disruption to traffic may inconvenience tourists. This is assessed in Chapter 18, Traffic and Transport and is deemed to be of minor significance.

22.4.11 Noise from the construction works is considered in Chapter 20, Onshore Noise and is deemed to be of minor significance with limited impact on the otter hide due to its distance from the construction works (the otter hide is 815m from the substation and 990m from the potential drilling area for Option 1 and is 975m from the substation and 1260m from the potential drilling area for Option 2. Disturbance at the start of track to the otter hide may deter some visitors under Option 1. Limited economic impact is anticipated as there is no fee to visit the otter hide and limited local business associated with the visitors attracted to the area by the otter hide and therefore the sensitivity of the onshore tourism is predicted to be low.

22.4.12 Should Option 2 be taken forward disruption to traffic is expected to be of a lower magnitude, since there will be no need for construction vehicles to travel inland along the Kyle Rhea road to access the Forestry Commission Scotland (FCS) picnic site, car park and track to the otter hide. As a result, the potential impacts of noise for Option 2 are also expected to be of a lower magnitude. Thus, in both instances a negligible magnitude is predicted.

22.4.13 Disruption to tourism and recreation onshore is therefore likely to be marginally greater should Option 1 be taken forward. Onshore construction will last for a maximum of 75 days weeks and, as previously discussed, access to the otter hide will be maintained, therefore the magnitude is deemed to be low. The impact of displacement of tourism and recreation is therefore considered to be of negligible or minor adverse significance.

Impact 2: Suggested Mitigation
1. Locate construction works off the track access to the otter hides. The hide and FC land will maintain access to tourists and Forestry Commission. 2. Onshore construction work will be scheduled for winter if possible, when visitor numbers to the otter hide are lowest.

Residual impact:

22.4.14 If the above mitigation is implemented it is likely that residual impact of displaced tourism and recreational activities onshore will be of negligible significance.

Impact 3: Displacement of tourism and recreational activity – offshore

22.4.15 Chapter 17, Shipping and Navigation states that the sea room in Kyle Rhea would reduce from the present 440m (between 5m contours) to 250m during installation. The increased risk of collision due to the reduced sea room is deemed to be a tolerable (moderate) risk (see Chapter 17 and **Appendix 17.1**).

22.4.16 Installation is planned during the summer months which will coincide with peak recreational activity. The installation works are temporary and at worst will be carried out over two summers, giving an impact of medium magnitude based on the definitions outlined in Table 22.3 (i.e. short-term, temporary and reversible).

22.4.17 As discussed in Section 22.3, Existing environment, the use of Kyle Rhea for recreational sailing is high and based on the definition provided in Table 22.4 recreational vessels are deemed to have **medium** sensitivity due to the importance of the site. SCUBA divers and kayakers may choose not to use Kyle Rhea during installation works, although it is anticipated that a route through Kyle Rhea will be maintained. As a result the impact of offshore displacement of tourism and recreational activity will be of **moderate adverse** significance.

Impact 3: Suggested Mitigation
1. Consult with RYA to develop a strategy which allows minimal interference with recreational vessels, and maintains a passage through the Kyle Rhea; 2. Support vessels escort traffic through the Kyle to ensure safe passage during construction and avoid closure of Kyle Rhea. 3. Guard vessels will be on standby to help keep unpowered or limited manoeuvrability vessels clear of the works.

Residual impact:

22.4.18 If the above mitigation is implemented it is likely that residual impact of displaced tourism and recreational activities offshore will be of **minor** significance.

Potential impacts during the operation phase

Impact 1: Creation of a point of interest for visitors

22.4.19 With increased awareness of climate change, marine renewable energy devices could result in additional visitors (both renewable energy professionals and tourists). Therefore the array could have a positive impact on tourism and recreation by becoming a visitor attraction in its own right. This has been observed at Strangford Lough (Northern Ireland), where the SeaGen device installed in 2008 is now part of the tourist itinerary for a number of wildlife and heritage trip vessels (see Section 22.3, Existing environment). Information and a model of the device was provided to the Tourist Information centre in Portaferry, Northern Ireland close to the SeaGen installation to encourage tourist interest in the project. Sea Generation (Kyle Rhea) Ltd is committed to providing similar tourist information close to Kyle Rhea.

22.4.20 The impact of the devices on tourism and recreation as a point of interest is anticipated to be of as a **low** magnitude. Tourism and recreation is considered to be of a **low** sensitivity and thus the impact is assessed as being of **minor beneficial** significance.

Impact 2: Disturbance of tourism and recreational activity

22.4.21 The operational array is not expected to impede tourists travelling within Skye and Lochalsh, or activities in the immediate vicinity of the Project site. Offshore operation and maintenance activity will be carried out using small local vessels.

22.4.22 Recreational sailing will continue in Kyle Rhea during operation. A minimum clearance of 3.8m below MLWS will allow passage of recreational vessels. The towers of the devices will be painted and lit in accordance with MCA standards to ensure they are visible to all marine users.

22.4.23 The devices can provide an interest feature to kayakers as shown in a video by a kayaker in Strangford Lough[49]. As discussed in Section 22.3, Existing environment, Kyle Rhea is only suitable for advanced kayakers. The minimum 3m clearance of the rotors and slow tip speed of up to 11.94m/s (26.7mph) ensures a very low risk to a capsized kayaker.

22.4.24 As discussed in Section 22.3, Existing environment, there are a number of sites for SCUBA diving in the surrounding area. Kyle Rhea is used as a drift dive for experienced divers. Divers are trained to consider a safe dive plan prior to diving and so it is anticipated that they will be able to plan a drift dive within Kyle Rhea which avoids the devices e.g. following a contour of around 20m or less will keep divers away from the location of the devices and/ or starting their dive downstream of the devices (paying attention to the tide times). As a result, collision with moving rotors is highly unlikely and displacement of divers from Kyle Rhea is not expected. Therefore the magnitude of impact of the operational array on recreation is considered to be low. The sensitivity of the receptor will also be low as only minimal changes are expected (see Table 22.4). Therefore in accordance with Table 22.5 the impact of tourism and recreational activity during operation will be of **minor adverse** significance.

Impact 3: Suggested Mitigation
1. During maintenance, when the cross beam is out of the water a notice to mariners will be released each day.

Residual impact:

22.4.25 The residual impact on the disturbance to tourism and recreational activities once the tidal array is operational will be of **negligible** significance.

Potential impacts during the decommissioning phase

22.4.26 During decommissioning there will be similar impacts to those outlined during the construction phase, with the exception of directional drilling and foundation drilling. A full decommissioning strategy will be developed nearer the time but it is likely that vessel requirements and safety zones will be, at worst, similar to construction.

22.4.27 Minimal onshore decommissioning works are anticipated (see Chapter 5, Project

[49] http://www.youtube.com/watch?v=1v06y_fIkeE

Description).

22.4.28 The sensitivity of tourism and recreational receptors to decommissioning works is predicted to be **low**. The magnitude of decommissioning impacts will be low based on the temporary nature and therefore the impacts will be of **minor adverse** significance.

Impact 4: Suggested Mitigation
A detailed mitigation strategy will identify appropriate mitigation measures taking into account the existing environment at the time.

Residual impact:

22.4.29 The residual impact of decommissioning activities on tourism and recreation will remain of **minor adverse** significance.

Potential cumulative impacts

22.4.30 There are no foreseeable developments which have potential to act cumulatively with the project on tourism in the study area.

22.5 Summary

22.5.1 Tourism and recreation represent a major sector in the economy of the study area. It is the aim of Sea Generation (Kyle Rhea) Ltd that the Project can add to the local economy with minimal impact on existing sectors. With appropriate mitigation minor to negligible adverse significant impacts are anticipated for local tourism with potential for the Project to create beneficial impacts.

22.6 References

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Hibberd (2009). The Kyleakin and Kinloch Hills Visitor Experience Plan

Hibberd (2011). Watching wildlife; the role of interpretation in delivering visitor satisfaction

HIE (2010). Sectorial Strategy: Tourism. Available at www.hie.co.uk

IEMA (2006) Guidelines for Environmental Impact Assessment

Marine Current Turbines (MCT) (2010) Installation of tidal turbine array at Kyle rhea, Scotland. Scoping Study

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Skye Ferry website http://www.skyeferry.co.uk/index.html

SNH (2009) A handbook on environmental impact assessment: Guidance for Competent Authorities, Consultees and others involved in the Environmental Impact Assessment Process in Scotland

SNH (2012). Mapping Scotland's wildness and wild land. Available at: http://www.snh.gov.uk/protecting-scotlands-nature/looking-after-landscapes/landscape-policy-and-guidance/wild-land/mapping/

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Walkhighlands website http://www.walkhighlands.co.uk/

23 MILITARY ACTIVITY

Page

23 CONTENTS

23.1 Introduction

23.1.1 This chapter describes current military activity within the proposed Kyle Rhea Tidal Stream Array ('the Project') and associated study area. The impact of the potential interaction between the Project and military activity is assessed for the construction, operation (and maintenance) and decommissioning phases of the Project. Where appropriate, mitigation measures are proposed to ensure the identified impacts are avoided, removed or minimised, where possible. Potential cumulative impacts are also considered.

23.1.2 This chapter has links with Chapter 17, Shipping and Navigation.

Study area

23.1.3 The study area considered for the military assessment includes Kyle Rhea and the military Practice and Exercise Areas (PEXA) surrounding the Isle of Skye (see Figure 23.1).

Overview of potential impacts

23.1.4 Acoustic output associated with the tidal devices could potentially have impacts upon military sonar (Faber Maunsell and Metoc Plc, 2007). However there is no evidence currently available to suggest such an impact will arise.

23.1.5 There is a potential for temporary disruption to military exercises and activities during the installation, and longer term disruption during operation . For example, any military vessels wishing to pass through Kyle Rhea may need to modify their route to avoid the turbines and vessel traffic within nearby military practice and exercise areas (PEXA) may increase.

Policy, legislation and guidance in relation to military activity

Military practice and exercise areas

23.1.6 PEXA charts produced by the UK Hydrographic Office show the marine 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. Any marine operational activities, whether at the surface or at the seabed, must be aware of military PEXA and vice versa. Although PEXAs impose certain constraints and difficulties, development of the seabed can often be accommodated. No legislation or general guideline on development in and around PEXAs currently exists, the MoD must be consulted on a case-by-case basis.

23.2 Methodology

Consultation in relation to military activity

23.2.1 No concerns have been raised by any statutory or other consultees in relation to military activity. The likelihood of any significant impacts arising is considered to be very small. As a result this impact has been 'scoped out' of the EIA, and no original data collection or detailed assessment activities were deemed necessary. However the potential impacts on this receptor are broadly discussed here to ensure impacts are comprehensively considered should any changes have occurred since a scoping opinion was sought in 2010.

23.2.2 On the 8th August 2012 a meeting was held with Lt Cdr RN DSOO FOSNNI[50] to discuss the potential interactions of the Project with military activity. Two key points were raised and these are highlighted in Table 23.1, below.

Table 23.1: Summary of consultation relating to military activity

Key issues raised	Response
The only PEXA in the area with potential to be affected by the project is considered to be the noise range at North and South Rona.	Paragraph 23.3.2
The MOD should be kept informed of activities during construction	'Suggested mitigation'' boxes in Section 23.4

Data collection

23.2.3 A desk-based review of available information has been used to describe activities and interest features within and around the Project. The key sources of information used are presented in Table 23.2.

Table 23.2: Data sources to inform the existing environment

Data Source	Spatial coverage
PEXA Charts	UK
Admiralty Charts	UK

Impact assessment

23.2.4 The significance of potential impacts is discussed qualitatively in the context of existing activities. In assessing impacts, reference has been made to the impact assessment criteria outlined in Chapter 4, EIA Methodology.

23.2.5 The significance of the impact 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.

[50] Full title: Lieutenant Commander Royal Navy, Deputy Staff Operations Officer Flag Officer Scotland, Northern England and Northern Ireland,

23.2.6 The sensitivity of the receptor/value/importance 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 23.3.

Table 23.3: Definition of terms relating to the sensitivity to an impact

Value / Sensitivity	Definition
High	Long term (for the life time of the Project) disruption to military activities which cannot be adapted or relocated.
Medium	Long term (for the life time of the Project) 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 installation) disruption to military activities causing activities to be adapted or relocated.
Negligible	Military activities will be able to take place un-hindered.

23.2.7 The magnitude of impact is identified and predicted as a deviation from the established baseline conditions in accordance with Table 23.4 for the construction, operation and decommissioning phases of the Project, and is based on criteria identified by the Faber Maunsell (2007).

Table 23.4: Definition of magnitude of an impact upon receptors

Magnitude	Definition
High	Very significant, permanent / irreversible changes, over the whole feature / asset, and / or significant alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact certain or likely to occur.
Medium	Significant, permanent / irreversible changes, over the majority of the feature / asset, and / or noticeable alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact certain or likely to occur.
Low	Noticeable, temporary (during the Project duration) change, over a minority of the feature / asset, and / or limited but noticeable alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact will possibly occur.
Negligible	Noticeable, temporary (for part of the Project duration) change, or barely discernible change for any length of time, over a small area of the feature or asset, and/or slight alteration to key characteristics or features of the particular environmental aspect's character or distinctiveness. Impact unlikely or rarely to occur.

23.2.8 Table 23.5 shows a matrix of the significance criteria relevant to impacts on military activities that are used throughout this chapter. The significance of each impact is characterised as either 'major', 'moderate', 'minor' or 'negligible' according to criteria laid out by the Faber Maunsell (2007). An impact can be either adverse or positive, or neutral in the case of negligible. It should be noted that any residual impact (the impact after the implementation of mitigation) which remains at the level of 'moderate' or 'major' is regarded by the EIA Regulations as being significant. Further detailed within in Chapter 4, EIA Methodology.

Table 23.5: The level of significance of an impact resulting from each combination of sensitivity and magnitude

Sensitivity	Magnitude			
	High	**Medium**	**Low**	**Negligible**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible

23.3 Existing environment

23.3.1 Western Scotland has large areas designated as military practice and exercise areas (PEXA). Kyle Rhea is not located within a PEXA, the nearest (D710) is located 20km away at the Inner Sound, between Raasay and mainland Scotland (Figure 23.1).

23.3.2 The South Rona PEXA (X5718) is used as a noise range and is approximately 35 km from the Project. Other local PEXAs are rarely used (pers comm Lt Cdr RN DSOO FOSNNI[50]).

23.3.3 The Royal Navy's British Underwater Testing and Evaluation Centre (BUTEC) is located in the Inner Sound between Raasay and the Scottish mainland. The test centre is operated on behalf of the Royal Navy by QinetiQ[51]. The facility is used to provide acoustic signature services and target echo strength, munitions and weapon system performance assessment and underwater weapons and sonobuoy testing[2]. The range is protected by by-laws and is approximately 10km long and 6km wide, 175m and 200m deep, and an air danger area can cover the whole range when activated[2]. Military activities, including military diving are carried out in the area (EMU Ltd, 2006). Military vessels rarely pass through the shallow and narrow strait of Kyle Rhea . No submarines are taken through Kyle Rhea (pers comm Lt Cdr RN DSOO FOSNNI[50]).

23.3.4 Marico Marine (2007) shows naval vessel movements to the north west of Kyle Rhea, in the Inner Sound and to the south of Kyle Rhea, in the Sound of Sleat. No naval routes are shown through Kyle Rhea.

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51 http://www.ltpa.co.uk/site_range/butec/index.asp

23.3.5 Large scale Joint Warrior exercises in May and October have potential to increase the level of military vessel movements around the study area although the exercises are unlikely to involve Kyle Rhea specifically (pers. comm. Lt Cdr RN DSOO FOSNNI[50])

23.3.6 Kyle Rhea is close to a Low Flying Tactical Training Area[52] within which aircraft may be flown as low as 100ft (30.5m). Low flying within Kyle Rhea is not expected given the steep sides of Kyle Rhea which ascend sharply to 50m on the Skye side and 30m on the mainland side, as well as the electricity pylons crossing the Kyle.

23.4 Impact assessment

Do nothing scenario

23.4.1 Under a 'do nothing scenario', it is not anticipated that any there would be any significant changes to current military activities in and around Kyle Rhea.

Potential impacts during the construction phase

Impact 1: Disruption of military activity

23.4.2 There is potential for temporary disruption to military navigation through Kyle Rhea during the installation period however given the low use of the site, described in Section 23.3 the magnitude of this impact will be low.

23.4.3 The Scottish Marine Renewables SEA (Faber Maunsell and Metoc Plc., 2007) reports that acoustic output associated with tidal devices has potential to affect military sonar. Noise from installation activities and increased vessel traffic has potential to disrupt the noise range at Rona. However **Appendix 12.6** shows that underwater noise from percussive drilling during installation will reach ambient noise levels between 300m to 3km. The North Rona PEXA is approximately 35km away and will not be affected by installation activities, other than possible increased vessel traffic moving through the PEXA.

23.4.4 The BUTEC in the Inner Sound is more than 5km north-west of Kyle Rhea, and as mentioned before, vessels associated with BUTEC rarely pass through the Kyle. As above, percussive drilling during installation will reach ambient noise levels between 300m to 3km. Since the range is located more than 5km away from installation activities, the centre is not anticipated to be impacted by the installation. Thus these activities are of a sufficient distance away and will not be impacted by the installation.

23.4.5 Any disruption is expected to be of low magnitude, limited to the region within or immediately adjacent to Kyle Rhea, and will be temporary during the period of installation. Given the low use of nearby PEXAs and of Kyle Rhea the receptor is deemed to have low sensitivity. On this basis the significance of impact is predicted to be **negligible**.

Impact 1: Suggested Mitigation
• The Defence Estates will be informed in advance of intended works and any

52 http://www.mod.uk/DefenceInternet/AboutDefence/WhatWeDo/AirSafetyandAviation/LowFlying/LFAs/

Impact 1: Suggested Mitigation
potentially conflicting activities will be coordinated to minimise disturbance. • The Project will adhere to the safety measures identified in the Navigational Safety Risk Assessment (Appendix 17.1), with particular reference to the following points: • Notice of the works would be promulgated through the UKHO Maritime Safety Information system (e.g. Notices to Mariners (NMs)) and will occur just prior to and during the installation works; • Installation vessels will display the appropriate lights and marks(to be agreed with Northern Lighhouse Board (NLB) and Maritime Coastguard Agency (MCA); • Support vessel(s) on site. • 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:

23.4.6 Any disturbance of military activity will be local and short term, and following successful implementation of mitigation the significance of impact any potential impacts will continue to be **negligible**.

Potential impacts during the operation phase

Impact 1: Disruption of the military activity

23.4.7 It is not expected that the operational phase of the Project will have any impact on military activities. Submarines are not expected to use the Kyle in a submerged state. Military surface vessels travel through Kyle Rhea very occasionally and have no special requirements compared to other large vessels (pers. Comm. Lt Cdr RN DSOO FOSNNI[50]). Therefore the safety management measures proposed in Chapter 17, Shipping and Navigation and Appendix 17.1, Navigational Risk Assessment will encompass military surface vessels.

23.4.8 The maximum height of the devices when the rotor arms are raised out of the water is approximately 40m above Chart Datum (CD) (Figure 5.3) to the top of the lift legs. This does not exceed the height of the cliff on the Skye side of the Kyle or the Pylons crossing the Kyle and so it is not expected that there will be any low flying aircraft in the vicinity. The normal operating height of the tower above CD will be up to 18m (worst case scenario, see Chapter 5, Project Description).

23.4.9 It is possible that 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. Given the low level of maintenance that will be required on site the magnitude of impact is assessed as being **low** with the receptor being of **low** sensitivity. The significance of the impact is assessed to be **negligible**.

Impact 1: Suggested Mitigation
1. Navigational safety mitigation is provided in Chapter 17, Shipping and Navigation and this applies to military surface vessels. 2. The Defence Estates will be informed in advance of intended works and any potentially conflicting activities will be coordinated to minimise disturbance.

Residual impact:

23.4.10 As no further mitigation is required, the residual impact will remain **negligible**.

Potential impacts during the decommissioning phase

Impact 2: Disruption of the military activity

23.4.11 As per the installation phase of the Project, decommissioning will involve the movement of a number of vessels to and from the array site. Any disruption will be temporary and the magnitude of this impact will be **low** in a **low** sensitivity environment. On this basis an impact of **negligible** significance is predicted.

Impact 2: Suggested Mitigation
1. Navigational safety mitigation is provided in Chapter 17, Shipping and Navigation and applies to military surface vessels. 2. Safety procedures similar to the temporary installation phase will be implemented. 3. The Defence Estates will be informed in advance of intended works and any potentially conflicting activities will be coordinated to minimise disturbance.

Residual impact:

23.4.12 As with construction and operation, the residual significance of impact following mitigation is expected to be **negligible**

Potential cumulative impacts

23.4.13 It is unlikely that the Project will act in combination with any other existing or proposed activities or projects to result in cumulative impacts on military activities.

23.5 Summary

23.5.1 Through consultation with the Defence Estates it was identified that there are no concerns with regard to military activities and the Project. The Project site is located outside of any designated military areas. Submarines are not expected to use the site; however during installation there may be minor disruption to other military vessels operating near Kyle Rhea in adjacent PEXAs.

23.5.2 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 17.1**) will reduce the significance of impacts to **negligible**.

23.6 References

Emu Ltd. (2006). Site Condition Monitoring: Surveys of biogenic and rocky reefs in the Lochs Duich, Long and Alsh cSAC. Scottish Natural Heritage Commissioned Report No.240 (ROAME No. F02AC409).

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24 SUMMARY OF IMPACTS, MITIGATION, GOOD PRACTICE AND MONITORING

Page

24 CONTENTS

24.1 Introduction

24.1.1 The purpose of this chapter is to provide a summary of impacts, mitigation, good practice, monitoring and management measures proposed within this Environmental Statement (ES).

24.1.2 Section 24.2 identifies the key good practice and mitigation that will be undertaken to limit the significance of the impacts across multiple receptors assessed within the ES. Section 24.3 summarises the specific impacts and mitigation measures recommended for each receptor group in turn. Possible environmental monitoring requirements prior to installation and post installation are discussed in more detail in Section 24.4 but will be determined in detail in consultation with Scottish Natural Heritage (SNH) and Marine Scotland. Management procedures are identified in Section 24.5. Concluding comments are made in Section 24.6.

24.2 Summary of key high level mitigation and best practice measures

24.2.1 A number of key mitigation and best practice measures have been proposed throughout the ES spanning a number of receptors and/ or a number of different impacts. These are as follows:

- Development of an Environmental Management Plan (EMP) to be agreed with the Highland Council, SEPA, SNH and Marine Scotland, following submission of this ES. The EMP will be a working document detailing the environmental actions highlighted in the ES, all activities to be carried out on site, responsibilities for those activities, environmental risks and the management protocols to be put in place to control these, as well as identification of personnel responsible for each element of the EMP;
- An Environmental Monitoring and Adaptive Management Plan (EMAMP), to be agreed with Marine Scotland (MS) and Scottish Natural Heritage (SNH);
- A detailed Construction Method Statement (CMS) and a Pollution Control and Spillage Response Plan to be prepared and agreed with SEPA, SNH and MS-LOT prior to commencement of construction;
- All work will be undertaken to an overarching Health, Safety and Environmental Management System (HSEMS), which will include the CMS, the PIRP and the Environmental Management Plan. The project will be supervised in accordance with the Construction Design and Management Regulations (2007);
- Pollution Control and Spillage Response Plans to be developed and included in the EMP;

- A Construction Traffic Management Plan (CTMP) will be developed in consultation with the Highland Council which will include details of the construction vehicles proposed (size; weight; number of axles); construction programme; swept path analysis, preferred route to access the Project site; details of any deflectograph surveys required pre and post-construction, temporary signal control during construction, and protocols for Abnormal Indivisible Loads (AILs);
- Site Waste Management Plan to be developed and agreed with SEPA and Marine Scotland
- Horizontal Directional Drilling (HDD) utilised to reduce or remove the pathway for impacts to many receptors.
- Area of disturbance associated with all works will be kept to a minimum.
- Substation and drilling rig footprints will be sited outside of the SAC and SSSI boundary to reduce impacts on sensitive features; and
- An environmental clerk of works (ECoW) will be appointed, to be present on site and oversee the construction phase. The clerk of works will have responsibility for overseeing the implementation of ecological mitigation measures agreed with the key regulators, SEPA, SNH and Marine Scotland.

24.3 Summary of impact assessments by ES receptor chapter

24.3.1 This section tabulates the impacts, mitigation and best practice for each of the receptor chapters covered within the ES chapters 7 to 13.

Marine Physical Environment and Coastal Processes

24.3.2 Table 24.1 below summarises the impacts identified within the marine physical environment and coastal processes chapter and Table 24.2 summarises the key best practice and mitigation measures which Sea Generation Ltd propose to limit or reduce the significance of those impacts.

Table 24.1 Summary of impacts Marine Physical Environment and Coastal Processes

Phase	Potential Impact	Magnitude	Sensitivity	Significance	Residual Significance
Construction	Effects on hydrodynamic regime	low	low	negligible	negligible
	Effects on sediments and sediment structures	low	low	negligible	negligible
	Effects on geological and geomorphological formations	negligible	negligible	negligible	negligible
Operation	Effects on hydrodynamic regime	low	low	negligible	negligible
	Effects on sediments and sediment structures	medium	low	minor adverse	minor
	Effects on geological and geomorphological formations	low	low	negligible	negligible
Decommissioning	Similar impacts to construction				

Table 24.2 Recommended mitigation for potential impacts to marine physical environment and coastal processes. if no mitigation measures are recommended the impact is not included in the table.

	Impacts	
Mitigation and best Practice	Effects on sediments and sediment structures (constriction)	Effects on geological and geomorphological formations (constriction)
Non-intrusive surface cable laying techniques	✓	✓
Scour protection (if necessary)	✓	

Hydrogeology, geology and non-marine surface water

24.3.3 Table 24.3 below summarises the impacts identified within the hydrogeology, geology and non-marine surface water chapter and Table 24.4 summarises the key best practice and mitigation measures which Sea Generation Ltd propose to limit or reduce the significance of those impacts.

Table 24.3 Summary of impacts for hydrogeology, geology and non-marine surface water

Phase	Potential Impact	Magnitude	Sensitivity	Significance	Residual Significance
Construction	Impact of drilling pad substation and cable tunnels/trench on geology	negligible	low	negligible	negligible
	Impact of drilling pad and substation construction on soils	negligible	low	negligible	negligible
	Change in surface run-off patterns	negligible	low	negligible	negligible
	Mobilisation of sediment in surface water runoff	low	low	minor adverse	negligible
	Drilling fluids causing contamination of watercourses	negligible	low	negligible	negligible
	Spills and leaks of oil, fuel or any other potentially polluting substance	negligible	low	negligible	negligible
	Impact of Directional Drilling on Groundwater Flow Patterns	negligible	low	negligible	negligible
Operation	Spills and leaks of oil, fuel or any other potentially polluting substance	negligible	low	negligible	negligible
	Flooding of the site or increased risk of flooding on downstream land	negligible	negligible	negligible	negligible

Table 24.4 Recommended key best practices and mitigation for potential impacts to Hydrogeology and Geology. if no mitigation measures are recommended the impact is not included in the table.

		Impacts					
		Impact of drilling pad and substation construction on soils **(construction)**	Change in surface run-off patterns **(construction)**	Mobilisation of sediment in surface water runoff **(construction)**	Drilling fluids causing contamination of watercourses **(construction)**	Spills and leaks of oil, fuel or any other potentially polluting substance **(construction and operation)**	Flooding of the site or increased risk of flooding on downstream land **(operation)**
Mitigation and best practice	Removed soil to be stored separately away from the main areas of construction traffic	✓		✓	✓		
	Soil to be stored at an appropriate height and width to minimise erosion	✓		✓			
	Adherence to the DEFRA guidance (for the Sustainable Use of Soils on Construction Sites)	✓		✓			
	Method statements to be provided setting out how any waste materials will be dealt with	✓		✓	✓		
	A Site Waste Management Plan (SWMP) will be produced	✓			✓		
	Where possible, the stockpiles will be protected by covering with the excavated turf	✓					
	Onshore works to be undertaken in accordance with C650 Environmental good practice on site		✓				
	Silt traps will be used to capture suspended solids where necessary.			✓			
	SEPA Guidance (PPG) to be followed, Specifically PPG 1,2, 5, 6,7 and 21				✓	✓	
	Construction Industry Research and Information Association (CIRIA) C532 to be followed.				✓	✓	
	Potentially polluting substances to be stored in a designated storage area within impervious bunds with 110% capacity to ensure complete spill / leak retention.					✓	

	Potentially polluting substances to be stored >10m from all watercourses					✓	
	Machinery and equipment to be routinely inspected to ensure they are in good working order					✓	
	Spill kits to be available on site at all times.					✓	
	Where appropriate wheel washing to be used to prevent excess soil being transferred to public roads.					✓	
	Drainage to be restored to its current standard or better (in consultation with the Forestry Commission).						✓

Marine water quality

24.3.4 Table 24.5 below summarises the impacts identified within the marine water quality chapter and Table 24.6 summarises the key best practice and mitigation measures which Sea Generation Ltd propose to limit or reduce the significance of those impacts.

Table 24.5 Summary of impacts for Marine Water Quality

Phase	Potential Impact	Magnitude	Sensitivity	Significance	Residual Significance
Construction	Marine pollution from construction	low	medium	minor adverse	negligible
	Introduction of marine non-native species	medium	medium	moderate	negligible
	Introduction of non-native species	negligible	high	minor	minor adverse
Operation	Marine pollution due to accidental spillage	negligible	medium	negligible	negligible
	Introduction of marine non-native species	negligible	high	minor	negligible
Decommissioning	Similar impacts to construction				

Table 24.6 Recommended key best practices and mitigation for potential impacts to Marine Water Quality. if no mitigation measures are recommended the impact is not included in the table.

		Impacts		
		Marine pollution from **construction and operation**	Introduction of marine non-native species **(construction)**	Introduction of marine non-native species **(operation)**
Mitigation and best practice	All vessels associated with the Project to comply with IMO/MCA codes for prevention of oil pollution and, where appropriate, will have onboard SOPEPs	✔		
	Pollution Prevention Guidelines (PPG) issued by SEPA (e.g. PPG 5: Works and maintenance in or near water) to be followed.	✔		
	All contracted vessels to carry oil and chemical spill mop up kits.	✔		
	Vessels with an established track record of operating in waters where the conditions can become severe over a short period of time to be used where possible.	✔		
	Vessels to be made aware of local operating conditions and will adhere to the appropriate navigational standards and practices	✔		
	Installation and routine maintenance activities to only occur when Sea Generation (Kyle Rhea) Ltd is confident there is limited risk associated with bad weather.	✔		
	A marine non-native species risk assessment will consider; vessel activities, previous locations, and planned routes that could introduce marine non-native species.		✔	✔
	Guidance on the introduction of marine non-natives to be taken from other industries within the marine environment, such as those produced by the Oil & Gas industry.		✔	✔
	Vessels to adhere to Marine Guidance Note 363: The Control and Management of Ships' Ballast Water and Sediments, where applicable		✔	
	Antifouling on the pile and rotor blades to prevent colonisation of the device and prevent the structure forming a stepping stone for non-native species			✔

Terrestrial and Intertidal Ecology

24.3.5 Table 24.7 below summarises the impacts identified within the terrestrial and intertidal ecology chapter and Table 24.8 summarises the key best practice and mitigation measures which Sea Generation Ltd propose to limit or reduce the significance of those impacts.

Table 24.7 Summary of impacts for Terrestrial and Intertidal Ecology

Phase	Potential Impact	Magnitude	Sensitivity	Significance	Residual Significance
Construction	Destruction or damage to sensitive terrestrial habitats	low	medium	minor adverse	minor adverse
	Impacts to wild plants	low	medium	minor adverse	negligible
	Potential spread of invasive, non-native species	low	medium	minor adverse - not significant	negligible
	Otter - destruction, obstruction or damage to breeding sites, places of rest or shelter and disturbance and intentional or reckless injury and killing	medium - low	high - low	moderate - minor adverse	minor adverse
	Pine marten – destruction, obstruction or damage to resting sites, disturbance and intentional or reckless injury and killing	low	high	minor adverse	negligible
	Bats - destruction, obstruction or damage to resting sites, disturbance and intentional or reckless injury and killing	low	high	minor adverse	negligible
	Intentional or reckless killing and injury of reptiles	low	medium	minor adverse	negligible
	Invertebrates: destruction, obstruction or damage to resting sites, disturbance and intentional or reckless injury and killing	low	high	minor	negligible
Operation	Disturbance to sensitive terrestrial habitats	Not applicable			
	Disturbance to intertidal habitat	negligible	low	negligible	negligible
	Collision of otter with devices	low	high	minor adverse	minor adverse
	Impacts to protected species due to onshore maintenance	low	medium - low	minor adverse	minor adverse
Decommissioning	Similar impacts to construction				

Table 24.8 Recommended key best practices and mitigation for potential impacts to Terrestrial and Intertidal Ecology. if no mitigation measures are recommended the impact is not included in the table.

		Impacts								
		Destruction or damage to sensitive terrestrial habitats	Impacts to wild plants	Potential spread of invasive, non-native species	Otter - destruction, obstruction or damage to breeding sites, places of rest or shelter and disturbance and intentional or reckless injury and killing	Pine marten – destruction, obstruction or damage to resting sites, disturbance and intentional or reckless injury and killing	Bats - destruction, obstruction or damage to resting sites, disturbance and intentional or reckless injury and killing	Intentional or reckless killing and injury of reptiles	Invertebrates: destruction, obstruction or damage to resting sites, disturbance and intentional or reckless injury and killing	Impacts to protected species due to onshore maintenance
Mitigation and best practice	Construction activities, materials, machinery and vehicles to be limited to defined routes and construction areas minimising the footprint and preventing disturbance of adjacent habitat	✓	✓		✓				✓	✓
	Felling of trees and shrubs to take place outside of the nesting bird season (mid-February to August inclusive).	✓								✓
	A secure tight boundary to be made around the construction footprint, with exclusion zones clearly marked by weather proof signs at regular intervals.	✓								
	Good working practices and SEPA protocols to be adhered to during construction, eliminating risk of exposure to oil, chemicals and other harmful materials.	✓								
	Soils and materials that may be a source of dust to be stored away from the SAC boundary and consideration given to wind direction and shelter	✓								
	Best practice guidance to be followed including The coastal and marine environmental site guide (C584) and Guidance note C692 Environmental Good Practice on Site Guide.	✓								✓
	Piles of peat/heath turves to be bladed and kept moist to avoid drying out	✓								
	Peat turves to be stored within the construction footprint, a minimum 200m from the watercourses and sensitive (heathland) habitats.	✓								

		Impacts								
		Destruction or damage to sensitive terrestrial habitats	Impacts to wild plants	Potential spread of invasive, non-native species	Otter - destruction, obstruction or damage to breeding sites, places of rest or shelter and disturbance and intentional or reckless injury and killing	Pine marten – destruction, obstruction or damage to resting sites, disturbance and intentional or reckless injury and killing	Bats - destruction, obstruction or damage to resting sites, disturbance and intentional or reckless injury and killing	Intentional or reckless killing and injury of reptiles	Invertebrates: destruction, obstruction or damage to resting sites, disturbance and intentional or reckless injury and killing	Impacts to protected species due to onshore maintenance
	Excavated peat/heath turf to be removed as intact as possible, and disturbance and movement of the turves will be minimised	✓								
	Best practice measures to encourage rapid stabilisation and re-vegetation of exposed peat to be implemented where required.	✓								
	Terrestrial invasive species survey to carried out prior to construction, to assess the extent invasive species.			✓						
	Management of non-native invasive species to follow guidance as laid out in the Environment Agency's Managing Invasive Non-native Plants (2010).			✓						✓
	Invasive plants within the construction footprint will be removed and disposed of appropriately in accordance with relevant waste regulations, following current best practice.			✓						✓
	Native species of local provenance will be replanted where possible		✓	✓						✓
	Otter and pine martin survey to take place 8 weeks before construction commences to re-assess otter activity.				✓	✓				
	A 'no build' buffer of 50m to be placed either side of the two small burns and the drain, to the north and south of the Project				✓					
	Otter fencing around the construction area (if necessary, this will be dependent on the final location of the works).				✓					
	SEPA Guidance (PPG) to be followed, Specifically PPG 5 and 6				✓					✓
	Guidance including SNH Scottish Wildlife Series: Otters and				✓					✓

		Impacts								
		Destruction or damage to sensitive terrestrial habitats	Impacts to wild plants	Potential spread of invasive, non-native species	Otter - destruction, obstruction or damage to breeding sites, places of rest or shelter and disturbance and intentional or reckless injury and killing	Pine marten – destruction, obstruction or damage to resting sites, disturbance and intentional or reckless injury and killing	Bats - destruction, obstruction or damage to resting sites, disturbance and intentional or reckless injury and killing	Intentional or reckless killing and injury of reptiles	Invertebrates: destruction, obstruction or damage to resting sites, disturbance and intentional or reckless injury and killing	Impacts to protected species due to onshore maintenance
	Development, as well as guidance produced by Design Manual for Roads and Bridges (DMRB Volume 10 section 4) to be followed.									
	Any otter or pine martin carcases found around the sites to be retained and SNH notified, if non-fatal injuries occur as a result of construction then SNH to be notified immediately.				✓	✓				✓
	Artificial light to be directed away from the coastal area and watercourses to allow otters to migrate through the area undisturbed.				✓	✓				✓
	Provision of artificial otters holts on coast line south of the ferry slip and around the village of Kylerhea (if considered appropriate by SNH)				✓					✓
	Branches with splits, cracks, loose bark or holes to be inspected prior to felling or pruning, to ascertain of bats are present.						✓			
	Section felling to be implemented with soft fall techniques. Any larger sections to be left on the ground overnight to allow any bats to leave.						✓			
	If bats or any evidence of bats are detected, all works in the area to cease and advice sought from an Ecologist.						✓			
	A pre-construction reptile survey immediately preceding construction works to be undertaken by a suitably qualified ecologist if any suitable habitat is to be removed (i.e. heathland, woodland).							✓		

Ornithology

24.3.6 Table 24.9 below summarises the impacts identified within the terrestrial and intertidal ecology chapter and Table 24.10 summarises the key best practice and mitigation measures which Sea Generation Ltd propose to limit or reduce the significance of those impacts.

Table 24.9 Summary of impacts for Ornithology

Phase	Potential Impact	Magnitude	Sensitivity	Significance	Residual Significance
Construction	Disturbance of breeding birds	negligible	low to medium	minor adverse	minor adverse
	disturbance of access to marine habitats	negligible	low	negligible	negligible
	Habitat loss	negligible	negligible	negligible	negligible
Operation	vessel disturbance of seabirds	negligible	low	negligible	negligible
	displacement of seabirds from marine habitats	negligible	low	negligible	negligible
	displacement of foraging white-tailed eagle	low	low	minor	negligible
	collision risk to diving seabirds	low - negligible	low	minor - negligible	minor - negligible
	marine pollution and contamination	negligible	low	negligible	negligible
	Indirect effects on prey	low	low	negligible	negligible
Decommissioning	Vessel disturbance	negligible	negligible - low	negligible -	negligible
	habitat reinstatement	negligible	negligible	negligible	Negligible

Table 24.10 Recommended key best practices and mitigation for potential impacts to Ornithology. if no mitigation measures are recommended the impact is not included in the table.

		Impacts									
		Disturbance of breeding birds **(construction)**	disturbance from marine habitats **(construction)**	vessel disturbance of seabirds **(Operation)**	displacement of seabirds from marine habitats **(Operation)**	displacement of foraging white-tailed eagle **(Operation)**	collision risk to diving seabirds **(Operation)**	marine pollution and contamination **(Operation)**	Indirect effects on prey **(Operation)**	Vessel disturbance **(Decommissioning)**	habitat reinstatement **(Decommissioning)**
Mitigation and best practice	Development of a Breeding Bird Protection Plan which will prevent the disturbance of breeding birds listed on Schedule 1 of the Wildlife and Countryside Act;	✓									
	No-stopping rule for vehicles within 250m of the heronry	✓									
	Avoid disturbance of possible preferred feeding and resting areas		✓	✓						✓	
	Adopting voluntary speed restrictions. A maximum vessel speed of 15km/h is likely to give most seabird species time to move away from an approaching vessel without resorting to flight.		✓	✓						✓	
	Measures to be taken to ensure that all suitable perching locations on the devices are safe for birds.				✓						
	Supplementary feeding of white tailed sea eagle if monitoring of the eagles showed that displacement had occurred and was causing a shortage of food.					✓			✓		
	Results of research and monitoring on the subject of collision to be followed and, should there be evidence of mortality, measures considered that aim to prevent it occurring.						✓				
	Pollution Prevention Guidelines to be followed including PPG 5: Works and maintenance in or near water).							✓			
	The most recent good practice guidance on habitat reinstatement to be followed.										✓

Marine Mammals and Basking Sharks

24.3.7 Table 24.11 below summarises the impacts identified within the marine mammals and basking sharks chapter and Table 24.12 summarises the key best practice and mitigation measures which Sea Generation Ltd propose to limit or reduce the significance of those impacts.

Table 24.11 Summary of impacts for Marine Mammals and Basking Sharks

Phase	Potential Impact	Magnitude	Sensitivity	Significance	Residual Significance
Construction	Collision risk	negligible	high - medium	minor adverse	minor adverse
	Noise and vibration	negligible	low - negligible	negligible	negligible
	Disturbance	low	low	minor adverse	minor adverse
Operation	Collision risk	low - negligible	high	moderate - minor adverse	moderate - minor adverse
	Noise and vibration	low	low	minor adverse	minor adverse
	Barrier effects	negligible	low	minor adverse	minor adverse
	EMF	low - negligible	negligible	negligible	negligible
	Indirect impacts from changes to prey resource	negligible	negligible	negligible	negligible
Decommissioning	Similar impacts to construction				

Table 24.12 Recommended key best practices and mitigation for potential impacts to marine mammals and basking sharks. if no mitigation measures are recommended the impact is not included in the table.

		Impacts		
		Collision risk **(construction)**	Collision risk **(operation)**	Noise and vibration **(operation)**
Mitigation and best prbactice	SeaGeneration (Kyle Rhea) Ltd will seek to engage fully and comply with recommendations and good practise regarding seal cork screw fatalities as they develop.	✓		
	An adaptive management approach to this potential impact will be agreed post consent, informed by anticipated near field behaviour data for seals from Strangfrod Lough, where imminent removal of shutdown protocols is expected.		✓	
	The EMAMP (see section 24.2) will be established to monitor for collisions and will reassess the need for a mitigation strategy if collisions are identified.		✓	✓

Benthic Ecology

24.3.8 Table 24.13 below summarises the impacts identified within the benthic ecology chapter and Table 24.14 summarises the key best practice and mitigation measures which Sea Generation Ltd propose to limit or reduce the significance of those impacts.

Table 24.13 Summary of impacts for benthic ecology

Phase	Potential Impact	Magnitude	Sensitivity	Significance	Residual Significance
Construction	Habitat loss and physical damage	low	high	minor adverse	minor adverse
	Habitat disturbance	low	high	minor adverse	minor adverse
	Increased suspended sediments/ smothering	negligible	high	minor adverse	no comment
	Release of contaminated sediment	low	high	minor adverse	negligible
	Pollution from routine and accidental discharges	medium - negligible	high	minor adverse	negligible
	Noise and vibration	low	low	negligible	negligible
	Introduction of Non Natives	low	high	minor adverse	minor adverse
Operation	Pollution from routine and accidental discharges	negligible	high	minor adverse	negligible
	EMF	negligible	low	negligible	negligible
	Introduction of new habitat	negligible	low	negligible	negligible
	Hydrodynamic change and changes in sediment	low	high	minor adverse	minor adverse
Decommisioning	Similar impacts to construction with the exception of impacts from drilling				

Table 24.14 Recommended key best practices and mitigation for potential impacts to benthic ecology. if no mitigation measures are recommended the impact is not included in the table.

		Impacts						
		Habitat loss and physical damage **(construction)**	Habitat disturbance **(construction)**	Increased suspended sediments/ smothering **(construction)**	Release of contaminated sediment **(construction)**	Pollution from routine and accidental discharges **(construction and operation)**	Introduction of Non Natives **(construction)**	EMF **(operation)**
Mitigation and best practice	Ensure that potential habitat loss is minimised where possible throughout the proposed works.	✓						
	Sensitive reef biotopes to be avoided during siting of anchors (where practicable and safe to do so)		✓					
	Allow sufficient time for any increases in turbidity to clear between drilling operations			✓	✓			
	Allow sufficient time for any increases in turbidity to clear between positioning of anchors for securing of installation barge if used			✓	✓			
	All vessels associated with Project operations to comply with IMO/MCA codes for prevention of oil pollution and any vessels over 400 GT will have onboard Ship Oil Prevention Emergency Plans (SOPEPs)					✓		
	All vessels associated with Project operations to carry on-board oil and chemical spill mop up kits.					✓		
	Vessels with a proven track record for operating in tidal races to be used (where possible).					✓		
	Vessel activities during installation, operation, and decommissioning will occur in suitable conditions to reduce the chance of an oil spill resulting from the influence of unfavourable weather conditions.					✓		
	A risk assessment will be completed in compliance with the Water Framework Directive and Marine Strategy Framework Directive objectives to assess the risk of introducing non-native species.						✓	
	When a decision is made on the BPEO for antifouling for the devices, the sensitivity of the benthic					✓		

Table 24.14 Recommended key best practices and mitigation for potential impacts to benthic ecology. if no mitigation measures are recommended the impact is not included in the table.

		Impacts						
		Habitat loss and physical damage **(construction)**	Habitat disturbance **(construction)**	Increased suspended sediments/ smothering **(construction)**	Release of contaminated sediment **(construction)**	Pollution from routine and accidental discharges **(construction and operation)**	Introduction of Non Natives **(construction)**	EMF **(operation)**
	species in the area will be taken into account.							
	Inter-array cables will be aligned approximately north to south. It is assumed that this will reduce the cross sectional area of Kyle Rhea affected by EMF.							✓

Fish and Shellfish Ecology

24.3.9 Table 24.15 below summarises the impacts identified within the fish and shellfish ecology chapter and Table 24.16 summarises the key best practice and mitigation measures which Sea Generation Ltd propose to limit or reduce the significance of those impacts.

Table 24.15 Summary of impacts for fish and shellfish ecology

Phase	Potential Impact	Magnitude	Sensitivity	Significance	Residual Significance
Construction	Loss of spawning grounds	negligible	negligible	negligible	negligible
	Loss of nursery grounds	low	low	negligible	negligible
	Noise- either causing damage to fish or affecting migration	medium - low	low	minor adverse	negligible
	Increase in turbidity	low - negligible	medium	minor adverse	negligible
	Smothering	low	low	negligible	negligible
	Release of sediment bound contaminants	negligible	low	negligible	negligible
	Changes to prey species	low	low	negligible	negligible
	Pollution from routine and accidental discharges	medium - negligible	medium	moderate adverse	minor adverse
Operation	Habitat loss	low	low	negligible	negligible
	EMF	low	medium	minor adverse	minor adverse
	Noise	low	low	negligible	negligible
	Collision with turbines	medium	low	minor adverse	minor adverse
	Changes in water flow	low	negligible	negligible	negligible
	Changes to prey species	low	high	negligible	negligible
	Pollution from routine and accidental discharges	medium - negligible	medium	moderate adverse	minor adverse
Decommissioning	Similar impacts to construction with the exception of impacts from drilling				

Table 24.16 Recommended key best practices and mitigation for potential impacts to fish and shellfish ecology. if no mitigation measures are recommended the impact is not included in the table.

		Impacts					
		Increase in turbidity **(construction)**	Smothering **(construction)**	Release of sediment bound contaminants **(construction)**	Pollution from routine and accidental discharges **(construction and operation)**	EMF **(operation)**	Collision with devices **(operation)**
Mitigation and best practice	Allow sufficient time for any increases in turbidity to clear between drilling operations .	✓	✓	✓			
	Allow sufficient time for any increases in turbidity to clear between anchor laying operations.	✓	✓	✓			
	Environmental Management Plan to be produced to ensure that all risks of pollution are minimised (See Section 24.2)				✓		
	The results of research into EMF and its effect on marine organisms to be monitored to inform mitigation strategies.					✓	
	Inter-array cables will be aligned approximately north to south which is likely to reduce the cross sectional area of Kyle Rhea affected by EMF					✓	
	Appropriate monitoring and reporting programme to be implemented during the construction and operational phases to monitor the reaction of key sensitive receptors. The receptors to be included within the monitoring plan will be agreed with Marine Scotland and SNH.						✓

Commercial Fisheries

24.3.10 Table 24.17below summarises the impacts identified within the commercial fisheries chapter and Table 24.18 summarises the key best practice and mitigation measures which Sea Generation Ltd propose to limit or reduce the significance of those impacts.

Table 24.17 Summary of impacts for commercial fisheries

Phase	Potential Impact	Magnitude	Sensitivity	Significance	Residual Significance
Construction	Exclusion from fishing grounds	medium	medium	minor adverse	minor adverse
	Displacement of fishing effort	medium	medium	minor adverse	minor adverse
	Physical interactions between fishing gear and installation works	medium	medium	minor adverse	negligible
	Biological changes – abundance, range behaviour of target species	medium	low	negligible	negligible
	Restricted access to fishing grounds on either side of the installation site	high	high	moderate	negligible
Operation	Exclusion from fishing grounds during operation	high	medium	minor adverse	minor adverse
	Displacement of fishing effort during operation	high	medium	minor adverse	minor adverse
	Physical interactions between fishing gear and tidal turbine array	high	medium	minor adverse	negligible
	Biological changes caused by operation – abundance, range behaviour of target species	high	low	minor adverse	minor adverse
	Restricted access to fishing grounds on either side of the tidal turbine array	very high	medium	moderate adverse	minor adverse
Decommisioning	Similar impacts to construction				

Table 24.18 Recommended key best practices and mitigation for potential impacts to fish and commercial fisheries. if no mitigation measures are recommended the impact is not included in the table. It should also be noted that many of the mitigation measures provided in Table 24.21 shipping and navigation apply to commercial fishing vessels and activities.

		Impact		
		Physical interactions between fishing gear and construction works **(construction and Operation)**	Biological changes – abundance, range behaviour of target species **(construction)**	Restricted access to fishing grounds on either side of the construction site **(construction)**
Mitigation and best practice	Clear announcement in the form of notice to mariners or contact via the FLO should reduce the risk further by discouraging fishing within the immediate tidal influence of Kyle Rhea during installation. A precautionary no fishing area could be established in consultation with the industry during the main installation phases	✓		
	Mitigation measures relating to the fish and shellfish populations presented in Table 24.16 above		✓	
	If temporary closure of passage is required, consideration to be given to commercial fisheries and attempts made to plan closure for when when fishing vessel movements likely to be less – for example weekends			✓
	Register of any fishing gear lost in the development site to be maintained. In event of loss, opportunity to be provided for affected fishers to grapple for lost gear during routine maintenance operations.	✓		

Seascape/Landscape Character

24.3.11 Table 24.19 below summarises the impacts identified within the seascape/landscape character chapter, Table 24.20 summarises the viewpoint assessments and Table 24.21 summarises the key best practice and mitigation measures which Sea Generation Ltd propose to limit or reduce the significance of those impacts.

Table 24.19 Summary of potential impacts on seascape/landscape character

Seascape/landscape character area	Seascape / Landscape Sensitivity to the proposed development	Magnitude of change	Potential impact	Significance
Kyle Rhea (coastal character area and local coastal character area)	Medium	Generally, moderate, locally major	Major/moderate to Moderate	Locally Significant generally not significant
Sound of Sleat (Coastal Character Area and local costal character areas)	High to Medium	Slight	Moderate to Moderate/minor	Not significant
Loch Alsh (coastal character area and local coastal character area)	Medium	Negligible	Minor	Not significant
Rugged Massif (landscape character type)	Low	Slight	Minor	Not significant
Forest Slopes with Moorland Mosaic (landscape character type)	Low	Slight	Minor	Not significant
Coastal Strath (landscape character type)	Low	Slight	Minor	Not significant
Rocky Undulating Plateau (landscape character type)	Low	Slight	Minor	Not significant
Rural Estate Settlement (landscape character type)	Low	Slight	Minor	Not significant

Table 24. 20 Summary of viewpoint assessment

Ref. No.	Viewpoint	Receptor Sensitivity	Magnitude of change	Potential impact	Significance
1	Ferry West	High (residents, roads users)	Substantial	Major	Significant
2	Ferry East	High (residents, roads users)	Substantial	Major	Significant
3	Otter hide	High (visitors to hide)	Substantial	Major	Significant
4	Beinn Bhuidhe	High (walkers)	Moderate	Major/Moderate	Significant
5	Ben Aslak (higher)	High (walkers)	Moderate	Major/moderate	Significant
6	Glenelg – War Memorial	High (residents, visitors, roads users)	Slight	Moderate	Not significant
7	Road to Corran / Arnisdale	High (road users)	Negligible	Moderate/minor	Not significant
8	Reraig	High (residents, visitors) Medium (road users)	Negligible	Moderate/minor Minor	Not significant
9	Meall Buidhe	High (walkers)	Negligible	Moderate/minor	Not significant

Table 24. 21 Recommended key best practices and mitigation for potential impacts to seascape/ landscape.

		Impact	
		Changes to coastal character area	Impacts on landscape character type
Mitigation and best practice	If possible use of darker colouring and minimal lighting (subject to maritime navigation requirements)	✓	✓
	Appropriate design of new substation (option 1) e.g. landscaping or cladding	✓	✓
	Reinstatement of HDD area	✓	✓
	Education about the project to inform perception	✓	✓

Shipping and Navigation

24.3.12 Table 24.22 below summarises the impacts identified within the shipping and navigation chapter and Table 24.23 summarises the key best practice and mitigation measures which Sea Generation Ltd propose to limit or reduce the significance of those impacts.

Table 24.22 Summary of impacts for Shipping and Navigation

Phase	Potential Impact	Frequency	Consequence	Risk	Residual risk
Construction	Collision with work vessel	reasonably probable	Serious	unacceptable (high)	tolerable (moderate)
	Increased risk to re-routed vessels	reasonably probable	moderate	tolerable (moderate)	tolerable (moderate).
	Working vessel in difficulty	reasonably probable	moderate	tolerable (moderate)	tolerable (moderate)
Operation	Transiting vessel collision with device (Sailing)	reasonably probable	major	unacceptable (high)	tolerable (moderate).
	Transiting vessel collision with device (low powered vessel)	reasonably probable	major	unacceptable (high)	tolerable (moderate)
	Transiting vessel collision with device (powerful vessel)	reasonably probable	serious	unacceptable (high)	tolerable (moderate).
	Drifting vessel collision with device	remote	serious	tolerable (moderate)	tolerable (moderate)
	Increase in vessel-to-vessel encounters / collisions	reasonably probable	serious	unacceptable (high)	tolerable (moderate)
	Increased risk to re-routed vessels	reasonably probable	moderate	tolerable (moderate)	tolerable (moderate)
	Loss of station of device or component	remote	minor	broadly acceptable (low)	broadly acceptable (low)
	Vessel collision with device when crossbeam raised for maintenance	remote	serious	tolerable (moderate)	tolerable (moderate)
	Fishing gear or anchor interaction with subsea cables and rotors	extremely unlikely	minor	broadly acceptable (low)	broadly acceptable (low)
Decommissioning	equal or less than installation impacts				

Table 24.23 Recommended key best practices and mitigation for potential impacts to shipping and navigation. if no mitigation measures are recommended the impact is not included in the table.

		Impact									
		Collision with work vessel **(Construction)**	Increased risk to re-routed vessels **(Construction)**	Working vessel in difficulty **(Construction)**	Transiting vessel collision with device **(Operation)**	Drifting vessel collision with device **(Operation)**	Increase in vessel-to-vessel encounters / collisions **(Operation)**	Increased risk to re-routed vessels **(Operation)**	Loss of station of device or component **(Operation)**	Vessel collision with device when crossbeam raised for maintenance **(Operation)**	Fishing gear or anchor interaction with subsea cables and rotors **(Operation)**
Mitigation and best practice	Duration of installation activity to be minimised where possible.	✓	✓								
	Timing of installation activity to be off-season, with work in early Spring, prior to the Skye ferry resuming operations in Easter.	✓	✓								
	Pilot vessel / escort boat system to guide vessels past mooring lines.	✓	✓		✓					✓	
	Appropriate marking and lighting to ensure visibility of working vessels.	✓	✓		✓						
	Regular broadcasts on VHF Channel 16 from Stornoway Coastguard and intermediate broadcasts from working site.	✓	✓				✓				
	Liaison with local RNLI stations.	✓	✓	✓	✓	✓					
	Emergency Response Cooperation Plan (ERCoP) to be developed and agreed with the MCA prior to installation	✓		✓	✓	✓			✓		
	Distribution of information about devices, e.g. depiction on charts and note on underwater clearance, to allow vessels to pre-plan voyage.		✓		✓			✓			✓

		Impact									
		Collision with work vessel **(Construction)**	Increased risk to re-routed vessels **(Construction)**	Working vessel in difficulty **(Construction)**	Transiting vessel collision with device **(Operation)**	Drifting vessel collision with device **(Operation)**	Increase in vessel-to-vessel encounters / collisions **(Operation)**	Increased risk to re-routed vessels **(Operation)**	Loss of station of device or component **(Operation)**	Vessel collision with device when crossbeam raised for maintenance **(Operation)**	Fishing gear or anchor interaction with subsea cables and rotors **(Operation)**
	Marker buoys off eastern shore to indicate safe inshore passage.		✓		✓		✓	✓		✓	
	Hydrographic data collected by project to be shared with MCA / UKHO to allow update of charts (currently based on lead-line surveys).		✓					✓			
	Improved VHF reception in the area.		✓		✓		✓	✓			
	Suitable guidance in Sailing Directions in the area.		✓								
	Contractors vetted and audited prior to appointment			✓							
	Industry standard operating and safety procedures / safety management systems, such specified within MGN 371.			✓							
	Site personnel trained in first aid and offshore survival.			✓							
	Personal protective equipment to be worn all on site.			✓							
	Timing of activities in suitable tides.			✓			✓	✓		✓	
	Weather forecasts and adverse weather working policy to be in place.			✓							

		Impact									
		Collision with work vessel **(Construction)**	Increased risk to re-routed vessels (**Construction**)	Working vessel in difficulty **(Construction)**	Transiting vessel collision with device **(Operation)**	Drifting vessel collision with device **(Operation)**	Increase in vessel-to-vessel encounters / collisions **(Operation)**	Increased risk to re-routed vessels **(Operation)**	Loss of station of device or component **(Operation)**	Vessel collision with device when crossbeam raised for maintenance **(Operation)**	Fishing gear or anchor interaction with subsea cables and rotors **(Operation)**
	Installation works to be temporarily suspended in poor weather conditions.			✓							
	Information about the devices distributed appropriately				✓						
	Traffic management / reporting system				✓		✓				
	Advice given to transiting vessels to time of passage near slack water during daylight hours.				✓						
	AIS on devices as aid to navigation.				✓						
	Broaden functionality of maintenance RIB to act as an emergency response vessel.				✓	✓					
	Devices designed to be accessible, e.g. with ladders for people and moorings for vessels.					✓					
	Devices to provide first aid equipment onboard and means of raising alarm.					✓					
	Supervisory Control and Data Acquisition (SCADA) should provide a prompt alert if part of a device loses station.								✓		
	Component parts made negatively buoyant where possible.								✓		

		Impact									
		Collision with work vessel **(Construction)**	Increased risk to re-routed vessels **(Construction)**	Working vessel in difficulty **(Construction)**	Transiting vessel collision with device **(Operation)**	Drifting vessel collision with device **(Operation)**	Increase in vessel-to-vessel encounters / collisions **(Operation)**	Increased risk to re-routed vessels **(Operation)**	Loss of station of device or component **(Operation)**	Vessel collision with device when crossbeam raised for maintenance **(Operation)**	Fishing gear or anchor interaction with subsea cables and rotors **(Operation)**
	Regular maintenance visits carried out.								✓		
	Marking and lighting of device, e.g. floodlights on top of tower to light up crossbeam and blades during maintenance activities.									✓	
	Regular broadcasts of warnings that the crossbeam is raised.									✓	
	Advance notifications to local users, harbours, clubs and associations if works are to be of significant duration and / or overnight.									✓	
	Appropriate cable protection installed.										✓
	Post-installation survey of cable to ensure that cable has not moved.										✓

Traffic and Transport

24.3.13 Table 24.24 below summarises the impacts identified within the traffic and transport chapter and Table 24.25 summarises the key best practice and mitigation measures which Sea Generation Ltd propose to limit or reduce the significance of those impacts.

Table 24.23 Summary of impacts for traffic and transport

Phase	Potential Impact	Magnitude	Sensitivity	Significance	Residual Significance
Construction	Temporary disruption and congestion	negligible	low	minor adverse	minor adverse
	Increased risk of road traffic accidents	low	medium	minor adverse	minor adverse
Operation	Temporary disruption and congestion	negligible	low	negligible	negligible
Decommisioning	Similar impacts to construction				

Table 24.24 Recommended key best practices and mitigation for potential impacts to traffic and transport. if no mitigation measures are recommended the impact is not included in the table.

		Impacts		
		Temporary disruption and congestion **(construction)**	Increased risk of road accidents **(construction)**	Temporary disruption and congestion **(operation)**
Mitigation and best practice	Movement of Abnormal Indivisible Loads (AILs) to conform to relevant legislation as outlined and where required the appropriate number of days' notice to be given to the Northern Constabulary.	✓		
	A deflectograph survey (a survey to assess the condition of a road) to be carried out pre and post-construction where necessary and temporary signal control during construction if required.	✓		
	Notifications and procedures that road hauliers must adhere to when delivering to the site to conform to legislation; including Abnormal Indivisible Loads (AILs) to be included in the Construction Traffic Management Plan.	✓		
	Traffic control and the use of a banksman at the site access to mitigate the potential for accidents occurring in the area used by the construction vehicles		✓	

Archaeology

24.3.14 Table 24.26 below summarises the impacts identified within the archaeology chapter and Table 24.27 summarises the key best practice and mitigation measures which Sea Generation Ltd propose to limit or reduce the significance of those impacts.

Table 24.25 Summary of impacts for archaeology and cultural heritage

Phase	Potential Impact	Magnitude	Sensitivity	Significance	Residual Significance
Construction	Impacts to Archaeology and Cultural Heritage – offshore	medium to high	medium to high	moderate to major adverse	negligible
	Impacts to Archaeology and Cultural Heritage – onshore	medium to high	medium to high	moderate to major adverse	negligible
Operation	Impacts to Archaeology and Cultural Heritage	Medium to high	negligible to high	negligible to major adverse	negligible
Decommissioning	Impacts to Archaeology and Cultural Heritage	Similar impacts to construction			

Table 24.26 Recommended key best practices and mitigation for potential impacts to archaeology and cultural heritage. if no mitigation measures are recommended the impact is not included in the table.

		Impacts to Archaeology and Cultural Heritage –offshore **(construction)**	Impacts to Archaeology and Cultural Heritage-onshore **(construction)**	Impacts to Archaeology and Cultural Heritage –offshore **(operation)**
Mitigation and best practice	Where potential cultural heritage assets may be subject to direct impacts, infrastructure to be micro-sited and temporary exclusion zones will be implemented.	✓		✓
	Written Scheme of Investigation (WSI) and Protocol for Archaeological Discoveries (PAD) to be prepared for the approval of Historic Scotland/ Highland Council Archaeological Service.	✓		✓
	To carry out works on a listed building a listed buildings consent will be required, this process will seek to minimise impacts		✓	
	Programme of appropriate archaeological works to be undertaken in compliance with a Written Scheme of Investigation (WSI) and agreed with the Highland Council Archaeological Service, if required.		✓	

Onshore Noise

24.3.15 Table 24.28 below summarises the impacts identified within the onshore noise chapter and Table 24.29 summarises the key best practice and mitigation measures which Sea Generation Ltd propose to limit or reduce the significance of those impacts.

Table 24.27 Summary of impacts for onshore noise

Phase	Potential Impact	Magnitude	Sensitivity	Significance	Residual Significance
Construction	Noise and vibration impacts associated with the movement of construction-related vehicles along the Kylerhea road and access track	low	medium – negligible	minor adverse	minor adverse
	Noise and vibration from HDD	low	low (option 1 and moderate option 2)	minor adverse (option 1) or moderate adverse (option 2)	minor adverse
	Surface noise from construction vessels	low	medium	minor adverse	minor adverse
Operation	Noise associated with movement of vehicles related to switch-house maintenance	negligible	low	negligible	negligible
	Noise associated with movement of vessels related to SeaGen devices maintenance	negligible	low	negligible	negligible
	Noise generated by substation during operation	low	low	negligible	negligible
	Noise generated by SeaGen devices during operation	negligible	negligible	negligible	negligible
Decommisioning	Similar impacts to construction				

Table 24.28 Recommended key best practices and mitigation for potential impacts to onshore noise. if no mitigation measures are recommended the impact is not included in the table.

		Impacts			
		Noise and vibration impacts associated with the movement of construction-related vehicles along the Kylerhea road and access track **(construction and operation)**	Noise and vibration from HDD **(construction)**	Surface noise from construction vessels **(construction)**	Noise associated with movement of vessels related to SeaGen devices maintenance **(operation)**
Mitigation and best practice	Construction-related traffic to be limited to daytime periods and arrival at site between 7:00 and 19:00	✓	✓		
	Works shall be restricted to the hours of between 07:00 and 19:00. No works shall take place on Saturday from 13:00 h and Sunday during construction.		✓		
	An appropriate physical barrier to attenuate noise from the directional drill to be used, as recommended in in BS5228-1:2009, to minimise the effects of noise emissions from the drill. .		✓		
	The control of noise from 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.		✓	✓	✓

Socio-economics

24.3.16 Table 24.30 below summarises the impacts identified within the socio-economics chapter and Table 24.31 summarises the key best practice and mitigation measures which Sea Generation Ltd propose to limit or reduce the significance of those impacts.

Table 24.29 Summary of impacts for socio-economics

Phase	Potential Impact	Magnitude	Sensitivity	Significance	Residual Significance
Construction	Direct capital expenditure (project development, manufacture and assembly)	low	medium	minor beneficial	minor beneficial
	Indirect capital expenditure (marine services and onshore construction)	medium	medium	moderate beneficial	moderate beneficial
	Indirect economic benefits (employment, accommodation and services)	medium	medium	moderate beneficial	moderate beneficial
Operation	Effect on employment	low	medium	minor beneficial	minor beneficial
	Community benefits	low	medium	minor beneficial	minor beneficial
Decommissioning	Similar impacts to construction albeit on a smaller scale				minor beneficial

24.3.17 No mitigation measures are recommended for socio economic impacts

Tourism and Recreation

24.3.18 Table 24.31 below summarises the impacts identified within the tourism and recreation chapter and Table 24.32 summarises the key best practice and mitigation measures which Sea Generation Ltd propose to limit or reduce the significance of those impacts.

Table 24.30 Summary of impacts for tourism and recreation

Phase	Potential Impact	Magnitude	Sensitivity	Significance	Residual Significance
Construction	Disturbance to tourism and recreational activity – onshore and offshore	low	low	minor adverse	minor adverse
	Displacement of tourism and recreational activity – onshore	low	low	minor adverse	negligible
	Displacement of tourism and recreational activity – offshore	medium	medium	moderate adverse	minor adverse
Operation	Creation of a point of interest for visitors	low	low	minor beneficial	minor beneficial
	Disturbance of tourism and recreational activity	low	low	minor adverse	negligible
Decommissioning	Similar impacts to construction with the exception of directional drilling and foundation drilling	low	low	minor adverse	minor adverse

Table 24.31 Recommended key best practices and mitigation for potential impacts to tourism and recreation. if no mitigation measures are recommended the impact is not included in the table.

		Impacts			
		Disturbance to tourism and recreational activity – onshore and offshore **(construction)**	Displacement of tourism and recreational activity – onshore **(construction)**	Displacement of tourism and recreational activity – offshore **(construction)**	Disturbance of tourism and recreational activity **(operation)**
Mitigation and best practice	Reduction of the overall timescale for construction by overlapping the directional drilling works and substation construction (where possible).	✓			
	Access to the otter hide and FC land to be maintained during construction works		✓		
	Onshore construction work to be scheduled for winter if possible, when visitor numbers are lowest.		✓		
	Consultation with the RYA to develop a strategy which allows minimal interference with recreational vessels, and maintains a passage through the Kyle Rhea			✓	
	Appropriate measures to reduce impacts on vessels (see Table 24.22) will also apply to recreational craft			✓	✓

Military Activity

24.3.19 Table 24.33 below summarises the impacts identified within the military activity chapter and Table 24.34 summarises the key best practice and mitigation measures which Sea Generation Ltd propose to limit or reduce the significance of those impacts.

Table 24.32 Summary of impacts for military activity

Phase	Potential Impact	Magnitude	Sensitivity	Significance	Residual Significance
Construction	Disruption of military activity	low	low	negligible	negligible
Operation	Disruption of the military activity	low	low	negligible	negligible
Decommissioning	Disruption of the military activity	low	low	negligible	negligible

Table 24.33 Recommended key best practices and mitigation for potential impacts to military activity. if no mitigation measures are recommended the impact is not included in the table.

		Impacts		
		Disruption of military activity **(construction)**	Disruption of military activity **(operation)**	Disruption of military activity **(decommissioning)**
Mitigation and best practice	The Defence Estates to be informed in advance of intended works and any potentially conflicting activities coordinated to minimise disturbance	✓	✓	✓
	All of the mitigation measures for shipping and navigation which are designed to minimise the significance of impacts to vessels also apply to military vessels which may use the site please refer to Table 24.22 for further details	✓	✓	✓
	The Principal Contractor will liaise with the Defence Estates to ensure that suitable communication channels are selected to avoid compromising authorised communications	✓		✓

24.4 Post consent environmental monitoring

24.4.1 Tidal energy devices are an emerging technology, with limited operational developments upon which to base aspects of assessment. Where devices have been operating and potential environmental interactions have been monitored, the results to date indicate no significant adverse environmental impacts (Strangford Lough for example). However, it is appreciated that the potential interactions of an array of devices is to some extent unknown, and 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.

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

24.4.3 The knowledge gained from environmental monitoring at tidal array sites will have some elements which are specific to individual sites, elements which are specific to individual technologies, however, much of the data collected will be widely applicable to, and of benefit to, developers in the wider tidal energy sector. It would be perverse, therefore, for the burden of such monitoring to fall solely on the handful of developers who have well developed technology and sites, while benefits from that monitoring are available to other, less pioneering developers. For this reason, national government support for aspects of environmental monitoring at early tidal sites is essential if the burden of knowledge collection is to be fairly shared.

24.4.4 SeaGeneration (Kyle Rhea) Ltd is committed to working with Marine Scotland and SNH to develop an appropriate Environmental Monitoring and Adaptive Management Plan (EMAMP) to monitor potential effects of the devices following installation.

24.4.5 The Environmental Monitoring and Adaptive Management Plan may include monitoring of the following key receptors::

- Marine mammals and basking sharks;
- Diving birds;
- Benthic ecology; and
- Terrestrial ecology.

24.4.6 An outline of potential monitoring works which may be appropriate as part of an EMAMP is provided in **Appendix 24.1**.