

Billia Croo Test Site: Environmental Statement

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Document History

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Non-Technical Summary

Introduction

This document is a Non-Technical Summary (NTS) of the Environmental Statement supporting the European Marine Energy Centre's application for consent under Section 36 of the Electricity Act 1989 for the European Marine Energy Centre's Billia Croo wave test site, Mainland Orkney.

Billia Croo Wave Test Site

Established in 2003, the European Marine Energy Centre (EMEC) is the first and only centre of its kind in the world, providing clients of both wave and tidal energy systems with purpose-built, United Kingdom Accreditation Service (UKAS) accredited open-sea testing facilities.

EMEC's grid-connected wave test site is located at Billia Croo (Figure 1), off the west coast of Mainland, Orkney. The site sits to the north of Hoy Mouth, the western entrance to Scapa Flow, and is subjected to the powerful forces of the North Atlantic Ocean.



Figure 1. Aerial image of the Billia Croo wave test site (Credit: Colin Keldie)

The site provides five cabled test berths in the offshore area and two inshore test berths for clients, as shown in Figure 2, along with electrical and communication assets. This application includes an agreed extension to the lease area, to the north and west of the site, which will provide greater sea space around current developments as well as offering prospective clients deeper water testing opportunities.

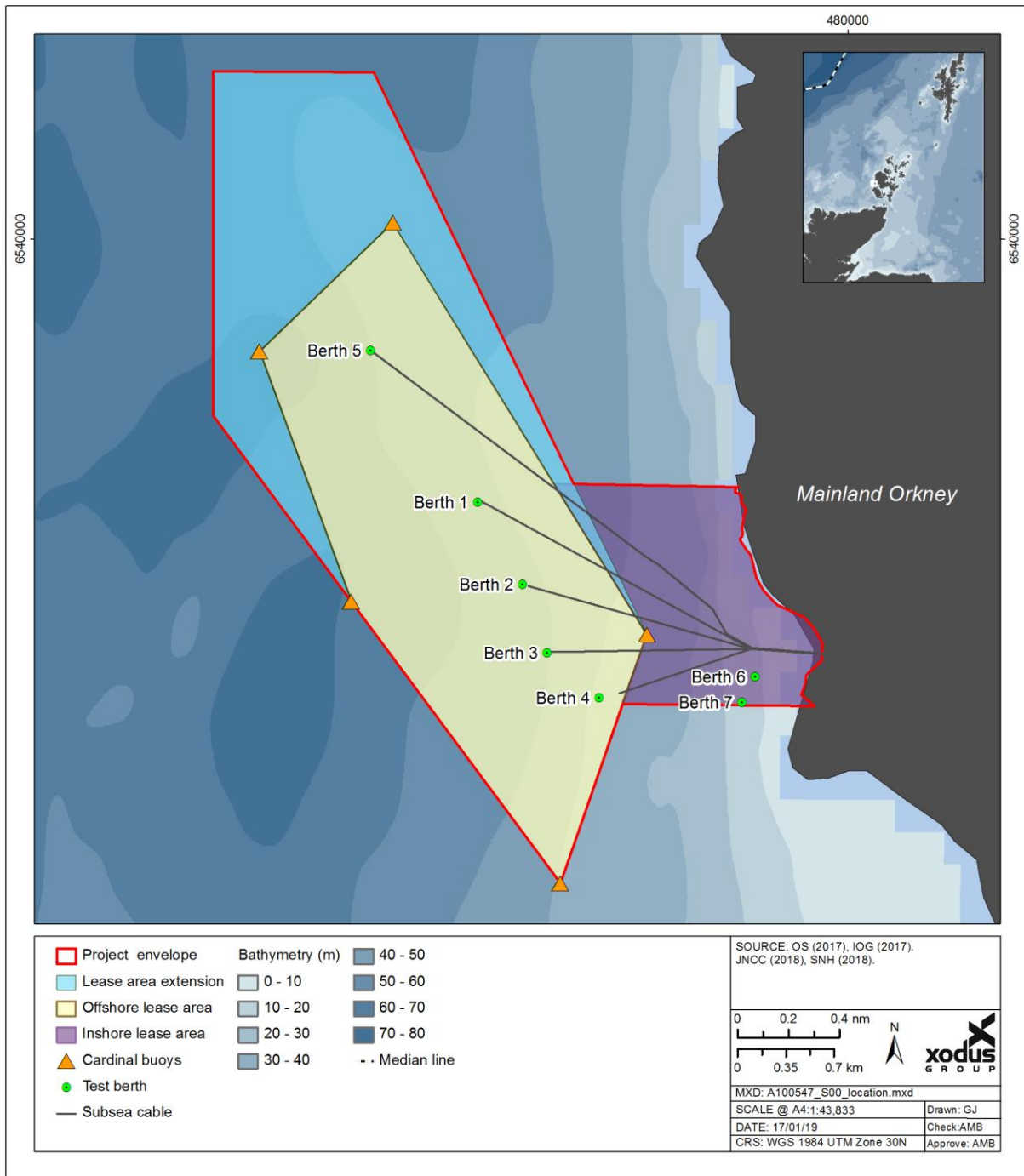


Figure 2. Chart of Billia Croo test site, identifying lease areas

Purpose

The Section 36 consent application does not relate to a new project, but rather is a proposed change to the existing licensing arrangement for clients wishing to test their devices and components at EMEC’s existing Billia Croo test site. The test site was established in 2003 and operational in 2004.

In order to streamline licensing process and support the testing programme for clients at the Billia Croo test site, a site-wide Section 36 consent under the Electricity Act 1989 is being sought by EMEC based on an envelope of deployments, testing, and decommissioning

activities. This is driven by a wish to reduce the potential for multiple consent applications being submitted concurrently (or in close succession) for the same area. As the wave energy sector progresses and with the increasing number of clients wishing to test devices with a generating capacity of greater than 1MW, EMEC recognises a need to implement a proportional consenting process for clients accessing its test site.

Regulatory Consent

Various legislation and regulatory consents drive and shape the processes that allow developers to access and operate their devices at the Billia Croo wave test site. The Marine Scotland Act 2010 gives Scottish Ministers authority for marine planning and conservation powers between 0 to 12 nm. Developers accessing the test site will continue to apply for marine licences to install, operate and decommission their device / component at the site. The EIA Directive (85/337/EEC) defines the requirements for an EIA and has been implemented to ensure any potential environmental effects of a project are taken into consideration during a consent determination, and the Habitats Directive (92/43/EEC) and Birds Directive (79/409/EEC) has been implemented for the protection of designated European sites. Figure 3 shows the designated protected sites, relative to the Billia Croo test site.

There are no planned changes to the onshore infrastructure with respect to this application, therefore any such proposals between the low and high water marks may need additional assessment and will require consideration under the Town and Country Planning (Scotland) Act 1997.

Project Details

Site Selection and Alternatives

EMEC was created in response to the recommendation in April 2001 of the Science & Technology Committee of the House of Commons that the UK should position itself to capture the benefit arising from the emergence of marine renewables technologies through establishing a national offshore wave and tidal test centre. HIE examined four other sites within Scotland and concluded that Billia Croo was most appropriate due to the presence of available resource, facilities and local supply chain. EMEC's Billia Croo wave test site has been established and operating for over 15 years.

Scoping and Consultation

As the Billia Croo test site is an established site, no screening or scoping exercise has been conducted to support this consent application. Outputs that would usually be acquired through scoping exercises have been informed by regular consultation with stakeholders and previous consent applications for the test site. Consultations with Marine Scotland and Scottish Natural Heritage were held to agree on the appraisal methodology and applicable receptors.

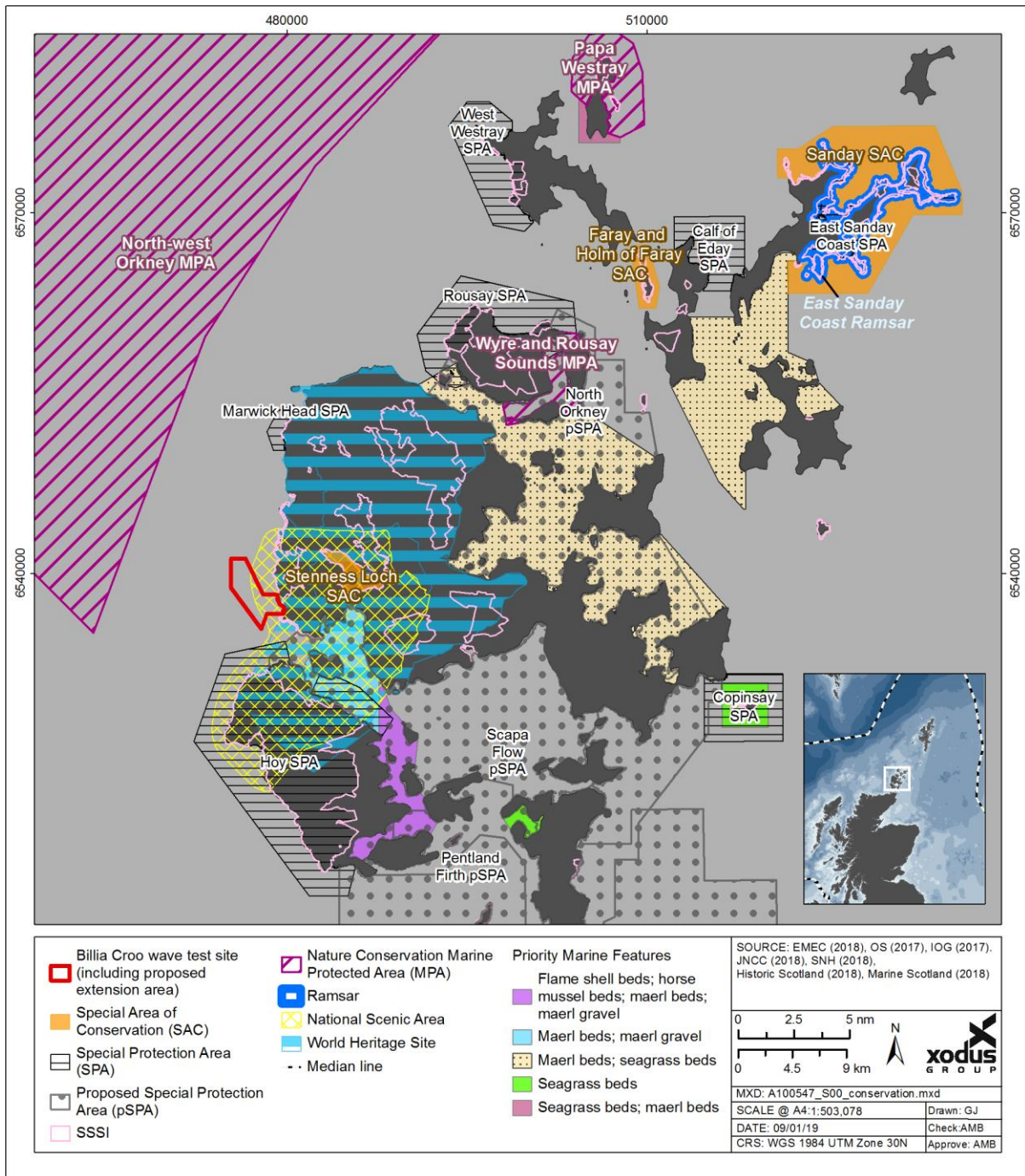


Figure 3. Designated protected sites relative to the Billia Croo test site

Environmental Impact Assessment

An Environmental Appraisal (EA) was conducted to support the consent application, which has been undertaken using a methodology previously conducted to support a similar consent application for EMEC’s full-scale tidal test site, Fall of Warness (EMEC, 2014). The assessment is based on a defined Project Envelope (REP646) describing the various types and associated characteristics of devices and components likely to be tested at the grid-connected test site. The methodology included:

1. Identification of activities/effect requiring detailed appraisal.

2. Identification of potential effect-pathways and assign level of importance.
3. Detailed appraisal of 'important' or 'potentially important' effects.

A summary of the receptor-specific appraisals has been presented to consider the maximum-case scenarios based on the Project Envelope. If there are key deviations in the device design or in any activity (installation, operation, maintenance and decommissioning), further appraisal work may be required. Any additional appraisal required to support project-specific application will be undertaken by the individual client and agreed with EMEC and Marine Scotland on a case-by-case basis.

Benthic Environment

The west coast of Orkney is a high energy coastal environment, consisting of various types of benthic communities and seabed characteristics. Figure 4 shows examples of the seabed and associated communities at the test site.



Figure 4. ROV images taken during the recent cable survey at Billia Croo (EMEC, 2017)

The potential effect-pathways assessed include:

- habitat loss/damage;
- smothering by resettlement of disturbed sediments and drill cuttings;
- introduction of marine non-native species;
- changes to hydrodynamic and sediment regime; and
- electromagnetic field effects.

The predicted potential impacts on benthic habitats and species are considered as not of importance to the ecological functioning of the area. The appraisal concludes that while the development footprint includes some rocky habitat - with a likelihood of protected stony/rocky reefs present - any potential impacts on the physical integrity of sedimentary substrates and of rock, boulder and cobble substrates are not regarded as important. This is due to the scale of the test site in the context of the wider environment. Good-practice mitigation measures should be applied by developers and marine contractors to minimise the risk of introducing marine non-native species to the area.

Hydrodynamic and Physical Processes

The Billia Croo test site located on the south-west coast of the Orkney mainland is comprised of a predominantly rocky coastline (see Figure 5), with few beaches and harsh wave conditions from the North Atlantic.



Figure 5. Low shore at Billia Croo (EMEC, 2009)

The potential effect-pathways assessed include changes to sedimentary processes and changes to erosive forces and patterns.

The predicted potential impacts on hydrodynamic and physical processes are not considered to be important at the scale presented in the Project Envelope. However, some device-specific monitoring by clients may have merit in informing impact assessments at future commercial sites.

Fish and Shellfish

A variety of marine fish will be encountered at Billia Croo, some of which are recognised Priority Marine Features and some of which have commercial value for fisheries. Orkney is located within spawning and nursery areas for a number of fish species; the Billia Croo test site overlaps with areas recognised as having the potential for spawning and nursery.

The potential effect-pathways assessed include:

- installation vessel transits and manoeuvring leading to disturbance;
- underwater noise from foundation/mooring installation methods and vessels;
- increased suspended sediment/turbidity;
- smothering because of drill cuttings or resettlement of sediments;
- benthic habitat loss/damage;
- introduction of marine non-native species; and
- underwater noise from active acoustic equipment.

The predicted potential impacts on diadromous (fish that split their life cycle between fresh and salt water such as, salmon), gadoid (bony fish such as, cod), clupeid (ray-finned fish such as, herring) and elasmobranch (cartilaginous fishes including shark, ray and skate) species are not regarded as important at a Scottish population level. The appraisal concludes that

there is no likely significant effect on salmon as qualifying features of any Special Area of Conservation in Scotland, so no further consideration was required. Potential impacts on any other marine fin-fish were not regarded as important at a population level.



Figure 6. Sandeel (The Wildlife Trust, 2019a)

The proximity to the NW Orkney Nature Conservation Marine Protected Area is noted, as sandeel is a qualifying feature (pictured in Figure 6). Any potential impacts on sandeels are not regarded as important at a population level, or of a degree that could have any measurable effect on key predators (such as, seabirds). The appraisal also considers any potential impacts on shellfish to be unimportant at a population level.

Basking Sharks

Around Orkney, basking sharks form casual visitors along the coastline, usually identified as feeding and maintaining a greater distribution further offshore.

The potential effect-pathways assessed include:

- installation vessel(s) presence, transiting and manoeuvring leading to disturbance;
- underwater noise from foundation/mooring installation methods, active acoustic equipment or geophysical/geotechnical surveys leading to disturbance;
- entanglement in mooring lines or cabling;
- entrapment in devices, multiple mooring lines or cabling;
- presence of WEC(s) leading to barrier effects; and
- increased suspended sediment/turbidity leading to disturbance.

The predicted potential impacts will not have any negative implications for the conservation status of basking sharks. None of the activities which have been identified for further assessment are anticipated to generate instances of mortality or injury to basking sharks. Uncertainties relating to basking shark hearing sensitivities place particular emphasis on the importance of monitoring at the test site. Regarding barrier effects, the appraisal considers the potential for any effect on basking shark distribution or movement to be negligible. There is no connectivity and no impact pathway to negatively impact basking shark features of the Sea of Hebrides proposed Marine Protected Area or at any other protected sites with this species listed as a qualifying feature.

The appraisal recommends that a licence to disturb basking sharks will be required to address potential disturbance impacts resulting from noise emissions from foundation and mooring installation and vessels and may also be required to cover the potential for injury or death from entanglement in mooring systems in the water column.

Cetaceans

Several cetacean species (which include whales, dolphins and porpoises) regularly occur within the test site. They are protected in the Scottish territorial seas as Priority Marine Features; and those sighted at the test site include: harbour porpoise; killer whale; minke whale; Risso's dolphin; and, white-beaked dolphin. There are UK Biodiversity Action Plans (BAPs) in place to protect cetacean species across the UK. The most commonly occurring cetacean species at the Billia Croo test site is harbour porpoise.

The potential effect-pathways, specific to cetacean species, assessed include:

- underwater noise and presence of installation vessel(s), including transiting and manoeuvring leading to disturbance;
- underwater noise from foundation/mooring installation methods leading to disturbance;
- underwater noise from active acoustic equipment leading to disturbance;
- underwater noise from geophysical/geotechnical surveys leading to disturbance;
- entanglement in mooring lines or cabling;
- entrapment in devices, multiple mooring lines or cabling; and
- increased suspended sediment/turbidity leading to disturbance.

The predicted potential disturbance impacts from installation noise will not be detrimental to the maintenance of populations of any cetacean species or their Favourable Conservation Status. However, a licence to disturb European Protected Species (all cetacean species) may be required to address potential injury and disturbance impacts from the installation of foundation structures and moorings for devices. It is predicted that the potential impacts from entanglement risk will not be detrimental to the maintenance of the population. The appraisal considers the potential for barrier effects on cetaceans to be negligible and not to generate any significant population-level or management unit-scale impacts.

There is likely no significant effect to bottlenose dolphins as a qualifying feature of the Moray Firth Special Area of Conservation, nor to harbour porpoise as a qualifying feature of the Inner Hebrides and the Minches Site of Community Importance or Skerries and Causeway Special Area of Conservation and, therefore further assessment is not required.

Pinniped

Two species of pinniped (seals) inhabit UK coastlines: the harbour seal (also known as the common seal) and the grey seal. The distribution of seals observed around Billia Croo varied between species, as shown in Figure 7.

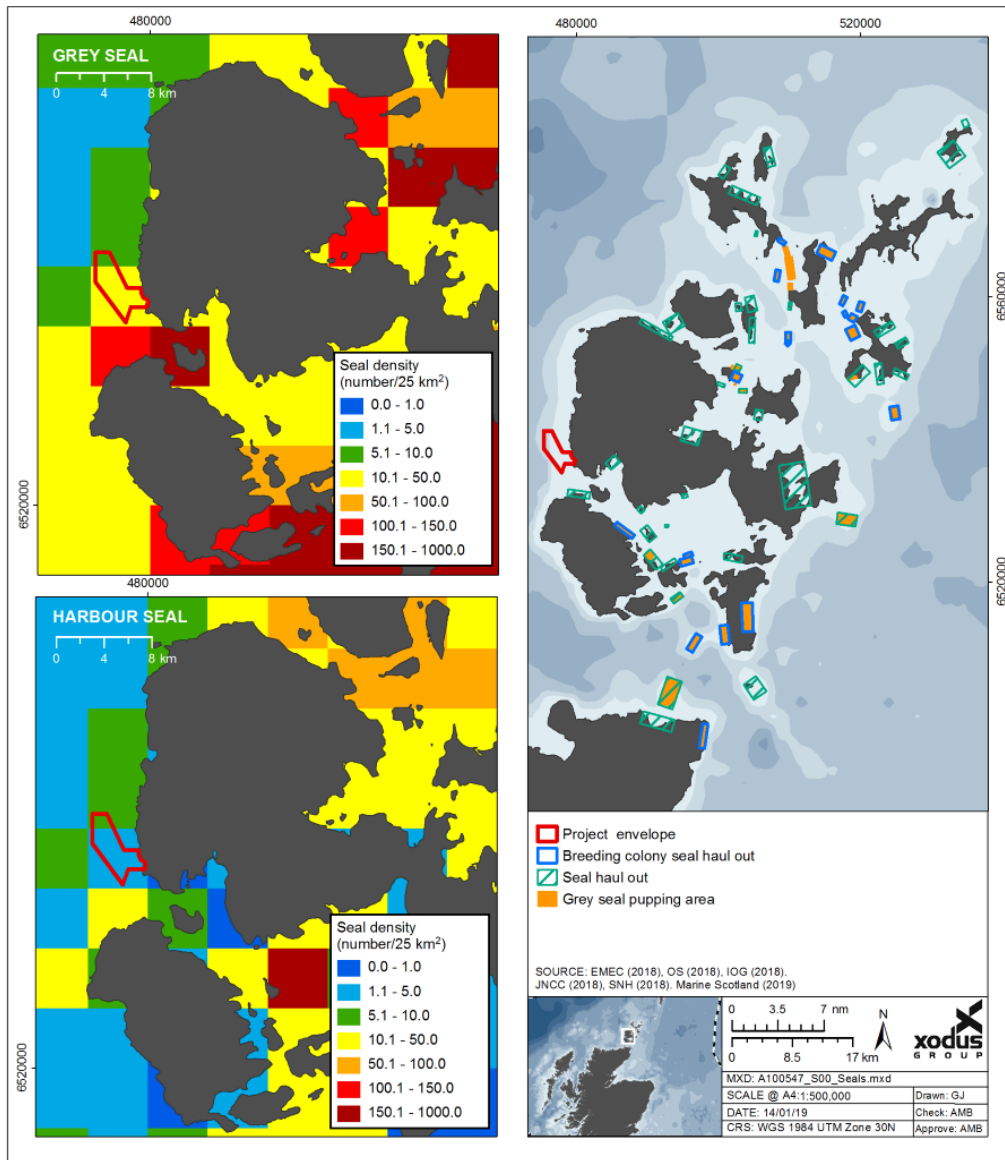


Figure 7. Grey and harbour seal densities and designated haul-outs around the Billia Croo test site

The potential effect-pathways assessed for seal species include:

- underwater noise and presence of installation vessel(s), including transiting and manoeuvring leading to disturbance;
- underwater noise from foundation/mooring installation methods leading to disturbance;
- underwater noise from active acoustic equipment leading to disturbance;
- entanglement in mooring lines or cabling;
- entrapment in devices, multiple mooring lines or cabling; and
- increased suspended sediment/turbidity leading to disturbance;

The predicted potential disturbances are not anticipated to generate any mortality or injury to seals. Seal injury events resulting from project activities are limited to injuries from mooring installation noise and entanglement. Given the available information on habitat use by both grey and harbour seals, such events are considered unlikely and impacts to the conservation-status of seal populations or fitness of individuals are anticipated to be negligible. The appraisal considers the potential for barrier effects on grey and harbour seals to be negligible and not to generate any significant population-level impacts.

The Billia Croo test site is not directly connected with any designated seal haul-outs sites (where seals come out of the water to pup or rest) or Special Areas of Conservation. However, there is potential for connectivity with the Sanday Special Area of Conservation or Faray and Holm of Faray Special Area of Conservation. Injury and disturbance impacts are not anticipated to occur on a scale as to adversely impact the seal qualifying features of these designated sites. As such, there will be no Likely Significant Effect on grey seals or harbour seals as a qualifying feature of either site and therefore, further assessment was not required.

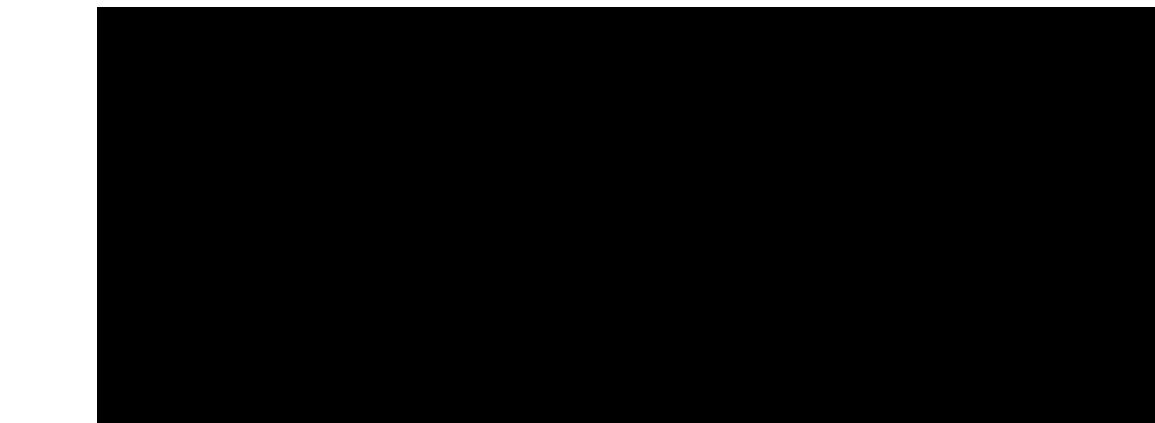
Ornithology

The generally high energy, nutrient rich status of the seas around Orkney supports a rich and abundant marine life including high numbers of marine birds year-round. Numerous sites have been designated under international legislation to protect breeding sites, foraging grounds and wintering areas. The Billia Croo test site is used by 22 species of birds as well as a few migratory species which were recorded irregularly at the site. The test site is not considered to have any particular importance to sustaining the populations of these migratory species and therefore such species are not considered further in the appraisal. The test site is used by birds primarily for foraging, but also for resting and common transiting.

The potential effect-pathways assessed include:

- installation vessel(s) presence, transiting and manoeuvring;
- high intensity work lights on project vessels to facilitate night work leading to disorientation and collision;
- seabed habitat loss, change and creation of artificial reef; and
- accidental release of contaminants.

A Habitats Regulations Appraisal screening concluded that the Hoy Special Protect Area and Scapa Flow proposed Special Protect Area [REDACTED]. Please see the Billia Croo Environmental Appraisal for further information regarding the appraisal. [REDACTED]



Otters

European otters have the widest geographical range of any otter species and constitute the only native otter in the UK. The Orkney Islands constitute important habitat to UK otters, though the distribution of this species varies across the islands.

The potential effect-pathways assessed for otters include:

- installation vessel(s) presence, transiting and manoeuvring leading to disturbance;

- underwater noise from foundation/mooring installation methods and vessels leading to disturbance;
- underwater noise from active acoustic equipment leading to disturbance; and
- habitat loss/damage.

The European otter is a European Protected Species which occurs relatively infrequently at Billia Croo. Potential disturbance impacts from project activities are limited to those from vessel presence. Isbister Loch Special Area of Conservation is located approximately 12 km from Billia Croo, but it is considered that there is no connectivity with this site. The installation or maintenance of cabling within the shoreline will require a project-specific appraisal and appropriate consultation to determine the need for a licence to disturb European Protected Species. Disturbance, injury or death is considered unlikely from vessel usage and therefore a licence to disturb EPS is not considered necessary for offshore activities.

Commercial Fisheries

The Billia Croo test site is marked by cardinal buoys (Figure 9), recorded as a chartered area, and marked in accordance with IMO and IALA standards. Given the established nature of the site, local commercial fisheries interests are well aware of the existence of the site and have adapted practices accordingly.

Inshore fishing takes place in the vicinity of Billia Croo targeting lobster, edible crab, green crab and velvet crabs. These species are fished in water depths of approximately 33 - 38 m all year round depending on the weather.

The potential effect-pathways assessed include:

- impact on static and mobile fishing gear; and
- damage to vessels and fishing gear.

The commercial fisheries appraisal concludes that the potentially important impacts on commercial fisheries as a result of activities in the test site were exclusion from fishing grounds, risk of snagging, and increased transit time as a result of the extension area. It was concluded that none of these impacts would have an important impact on any fishing industries operating in the vicinity of the Billia Croo test site.



Figure 9. Cardinal buoy present at the Billia Croo test site

Archaeology

Orkney waters have the potential for shipwreck and aircraft discoveries due to the islands' history. However, there are no known historic environment assets in the Billia Croo test site area.

The loss of or damage to marine historic environment assets was the only potential effect-pathway assessed on known assets, unknown assets, and submerged prehistoric landscapes.

The likelihood of important impacts on historic environment assets are predicted to be negligible-low as a result of the proposed activities at Billia Croo described in the Project Envelope. In order to manage the potential for impacting unknown heritage, EMEC have an Archaeological Discoveries Standard Operating Procedure (SOP). Should any cultural heritage sites be reported during marine works, it is recommended that they are investigated by a qualified marine archaeologist as the potential for retaining cultural heritage information could be high. It should be noted that impact upon planes lost on military service automatically contravenes the Protection of Military Remains Act 1986, even if they were unknown prior to the impact.

Navigational Risk Assessment

The Navigational Risk Assessment undertaken provided a comprehensive review of how other sea users interact with the site and provided a general overview of vessel traffic in the area. It was determined that there is very little commercial shipping activity near the site but many fishing vessels operate out of Stromness with the majority transiting past the Billia Croo test site.

It was concluded that most vessels currently avoid passing within the test site and the orientation of traffic flow with the extension means that there will be little impact on future vessel traffic. Mooring failure was identified as a possible hazard, particularly given the significant metocean conditions at the site. However, a number of risk controls are already in place to prevent such an event. From the hazards identified at the site, they were all determined to be low risk. A great number of risk controls are already in place at Billia Croo, and a number of additional risk controls were identified to enhance the safety of each additional device. The extension will require the relocation of the five cardinal marks currently in place at Billia Croo test site.

Seascape, Landscape and Visual Impact Assessment

The Seascape, Landscape and Visual Impact Assessment examines the effects of activities and installations within the Project Envelope on:

- landscape as a resource in its own right (including coastal, landscape and seascape), caused by changes to its constituents' elements, its specific aesthetic or perceptual qualities, and/or its character; and
- views and visual amenity as experienced by people, resulting from changes in the appearance of the landscape.

The assessment has considered the potential effects on landscape and visual receptors of the future operational activities associated with the Billia Croo test site, under the parameters of the Project Envelope. All operational impacts at the test site are judged to be long term and are fully reversible. Effects on landscape character across other parts of the study area will be minor or negligible. Effects on receptors travelling through the area by ferry will be minor, as the devices and operations within the test site will be passing features in the view and are

unlikely to detract from the passenger's overall experience. Lastly, the test site will not have any unduly adverse effect on the integrity of the National Scenic Area or the qualities for which it has been designated.



Figure 10. View of Hoy Sound and the Orkney Mainland from Hoy – the Billia Croo test site is on the left of the view

Social and Economic Benefits

An economic impact assessment contracted by HIE assessed the social and economic impacts of EMEC on the local, regional, UK and international perspective, including:

- population and demographic benefits to Orkney;
- other benefits that have been generated through enhanced infrastructure that was provided primarily to meet current or anticipated wave and tidal related developments and for supply chain maximisation;
- the acceleration of international wave and tidal R&D and development facilitated by EMEC, with work generated for Orkney's supply chain;
- applied and academic research generated; and
- EMEC's role in hydrogen development projects.

The report concluded that EMEC has prompted considerable impact in Orkney and throughout the UK in terms of investment and job creation. The overall employment impact in Orkney (as of 2017) of 1,653 FTE job years equates to an average of 110 FTEs annually over the 15-year period (2003-2017); in the Highlands and Islands as a whole 131 FTEs annually; in Scotland 216 FTEs per year; and in the UK 282 FTEs per year.

Mitigation, Monitoring and Research

In order to reduce the potential impact that a deployment or activity may have on the environment, it is possible to apply mitigation measures to reduce the severity of the potential impact or remove the respective impact. Monitoring measures can similarly be applied to check the status of an impact and/or to increase understanding of the potential impact for the

benefit of the client, regulators and industry. As a consequence of monitoring, it may be necessary to remove, introduce or modify mitigation measures applied.

Throughout the Environmental Appraisal, Seascape, Landscape and Visual Impact Assessment and Navigation Risk Assessment mitigation and monitoring measures have been identified relating to particular areas of environmental concern. Certain measures will be implemented by EMEC whereas others are expected to be implemented by clients accessing the site. As part of project-specific licence applications, clients are required to submit a Project-specific Environmental Monitoring Programme which provides detail on the mitigation, monitoring and research measures being executed during project.

EMEC has conducted extensive research to advance the industry's understanding of environmental impacts to date, however, further research activities have been identified through the Environmental Appraisal process. Such activities will be discussed further and agreed with the EMEC Monitoring Advisory Group before progressing.

Abbreviations, Acronyms and Glossary

ADCP	Acoustic Doppler Current Profiler
AEP	Auditory Evoked Potentials
ALARP	As Low as Reasonably Practicable
ASCOBANS	Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas
ATBA	Area to be Avoided
BAP	Biodiversity Action Plan
CCA	Coastal Character Assessment
CCTV	Closed-circuit television
CGOC	Coastguard Operations Centre
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPA	Coastal Protection Act
CTD	Conductivity, temperature, and depth
EA	Environmental Appraisal
EC	European Commission
EEZ	European Economic Zone
EIA	Environmental Impact Assessment
EMEC	European Marine Energy Centre
EMF	Electromagnetic Field
EPS	European Protected Species
ERCoP	Emergency Response Co-operation Plans
ES	Environmental Statement
FCS	Favourable Conservation Status
FEPA	Food and Environmental Protection Act
FTE	Full Time Equivalent
GCR	Geological Conservation Review
GVA	Gross Value Added
HIE	Highlands and Islands Enterprise
HMCG	Her Majesty's Coastguard
HRA	Habitats Regulation Appraisal
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
ICES	International Council for the Exploration of the Seas
IMO	International Maritime Organisation
IROPI	Imperative Reason of Overriding Public Interest
LAT	Lowest Astronomical Tide
LCCA	Local Coastal Character Assessment
LCT	Landscape Character Type
LSE	Likely Significant Effects
LUC	Land Use Consultants
M	Metres
MGN	Marine Guidance Note
MLWS	Mean Low Water Spring
MNNS	Marine non-native species
MPA	Marine Protected Area
MPS	Marine Policy Statement
MS-LOT	Marine Scotland's Licensing Operations Team
NCMPA	Nature Conservation Marine Protected Area
nm	Nautical mile
NMOC	National Maritime Operations Centre

NRA	Navigational Risk Assessment
NSA	National Scenic Area
NTS	Non-Technical Summary
OIC	Orkney Islands Council
OREI	Offshore Renewable Energy Installation
PMF	Priority Marine Feature
pMPA	proposed Marine Protected Area
pSPA	proposed Special Protection Area
PPE	Personal protective equipment
RCCA	Regional Coastal Character Assessment
REZ	Renewable Energy Zone
RNLI	Royal National Lifeboat Institution
ROV	Remotely operated underwater vehicle
S36	Section 36 consent under the Electricity Act 1989
SAC	Special Area of Conservation
SAM	Scheduled Ancient Monument
SAR	Search and Rescue
SCI	Sites of Community Importance
SHA	Statutory Harbour Authority
SLVIA	Seascape, Landscape and Visual Impact Assessment
SNH	Scottish Natural Heritage
SOP	Standard Operating Procedure
SPA	Special Protection Area
SSSI	Sites of Special Scientific Interest
UKAS	United Kingdom Accreditation Service
UXO	Unexploded Ordnance
VTS	Vessel Traffic Services
WFD	Water Framework Directive
ZTV	Zone of theoretical visibility

1 Introduction

1.1 Purpose

This Environmental Statement (ES), together with the accompanying Environmental Appraisal, Seascape, Landscape and Visual Impact Assessment, and Navigational Risk Assessment, constitutes the formal report of the Environmental Impact Assessment (EIA) and Habitats Regulation Appraisal (HRA) requirements. This has been executed in support of an application for consent under Section 36 of the Electricity Act 1989 submitted by the European Marine Energy Centre (EMEC) for the wave test site at Billia Croo, Orkney.

The ES summarises the findings of the Environmental Appraisal (REP666) that considers potential impacts of test site activities based on the Project Envelope (REP646). This ES references and should be read in conjunction with the following key documents:

- Environmental Appraisal, produced by Xodus Group (REP666);
- Seascape, Landscape and Visual Impact Assessment, developed by Land Use Consultants (LUC) (REP663);
- Navigational Risk Assessment, updated by Marine and Risk Consultants (Marico Marine) (REP522); and
- Socio-economic Assessment, summarised report based on assessment commissioned by Highlands and Islands Enterprise (HIE) (REP659).

1.2 Scope

The Section 36 consent application, supported by this ES and associated appraisals/assessments, does not relate to a new project, but rather is a proposed change to the existing licensing arrangement for clients wishing to test their devices and components at EMEC's existing Billia Croo test site. The test site was established in 2003 and became operational in 2004.

Previous site-wide consents have supported the existence of the site rather than individual device deployments. Consequently, to date, all clients have been required to apply for their own Marine Licence (under the Marine Scotland Act 2010, following the replacement of FEPA and CPA licences in 2010) and those clients with deployments with a generating capacity greater than 1 MW, also require Section 36 consent (S36). Developers have been required to provide appropriate supporting information to assess the potential impacts associated with their project.

In order to streamline the licensing process and support clients' testing programmes at the Billia Croo test site, a site-wide S36 under the Electricity Act 1989 is being sought by EMEC based on an envelope of deployments, testing, and decommissioning activities. This is driven by a wish to reduce the potential for multiple S36 applications being submitted concurrently (or in close succession) for the same area. As the wave energy sector progresses and with the increasing number of clients wishing to deploy devices with a generating capacity of greater than 1MW, EMEC recognises a need to implement a proportional consenting process for clients accessing its test site.

Please note, as the Billia Croo test site is an established site, no screening or scoping exercise has been conducted to support this S36 application. Previous consent applications for the test site and regular consultations have informed and enhanced outputs that would typically be informed by scoping exercises.

1.3 Relevant Legislation and Policy

1.3.1 Energy and Climate Change Policy

The need for secure, versatile energy supplies and the challenge of climate change are driving various policies and strategies to shift energy production to low carbon sources and thus, aid in the development of renewable energy in the UK, and Scotland.

Through the Climate Change Act 2008, the Climate Change (Scotland) Act 2009, and the Directive on Renewable Energy (2009/28/EC), the UK and Scottish Governments have committed to tackling climate change through the sourcing of energy needs (including electricity, heat and transport) from low carbon sources, including renewable sources.

EMEC was established to support wave and tidal energy clients bring their device concepts from tank testing into real-sea testing environments building towards commercial scale arrays. In addition, the lessons learned in developing projects at EMEC can be applied to the development of large-scale arrays around Scotland and internationally, in line with international, UK and Scottish policy. The Billia Croo test site has an embedded generation capacity of 7MW and the installed capacity will make a contribution towards achieving the targets set out in key legislation, particularly, the UK Climate Change Act 2008 and the Climate Change (Scotland) Act 2009.

1.3.2 Marine Planning Framework

1. Marine Scotland Act 2010 and the Marine and Coastal Access Act 2009

The Marine and Coastal Access Act 2009 gave authority for marine planning and conservation powers for 12 to 200 nm offshore. The Marine (Scotland) Act 2010 followed with legislation and management framework for the marine environment within 0 to 12 nm of Scottish territorial waters.

The Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 established a management framework for the marine environment allowing competing demands on the sea to be managed in a sustainable way. In 2015, the National Marine Plan was adopted which provides an overarching framework for all marine activity in Scottish waters, enabling sustainable development in a manner which will protect and enhance the marine environment. A three-year review of the plan's implementation commenced in 2018 which will ultimately allow Ministers to decide if the plan requires to be replaced or amended. Due to the current uncertainties around the UK leaving the EU, Ministers agreed that it is not possible to complete an effective assessment of the impact of the plan at this stage and determine any necessary changes. The National Marine Plan set the context for planning within Scotland and the need for regional marine plans. Orkney Islands Council is currently in the process of developing the Orkney Islands Marine Planning Partnership with the aim of establishing the partnership in 2019.

2. Marine Policy Statement – UK

The UK Government, the Scottish Government, the Welsh Assembly Government and the Northern Ireland Executive have all adopted the UK Marine Policy Statement (MPS) as the framework for preparing Marine Plans and executing decisions affecting the marine environment.

The MPS aims to promote sustainable economic development, ensure a sustainable marine environment, and contribute to the social and economic benefits of the marine

area. The MPS recognises the importance of marine renewable projects in marine planning for the contribution of securing the UK's energy objectives.

3. Marine and Terrestrial Interface

There are no planned changes to the established onshore infrastructure proposed within this application and this application relates to infrastructure and assets below the MHWS. However, as the jurisdiction of marine and terrestrial authorities overlap between the low and high water marks the local authority, Orkney Islands Council, for this project should be adequately consulted as part of the application process.

This ES does not include onshore works, and any such proposals will require consideration under the Town and Country Planning (Scotland) Act 1997. Specific works between the low and high water marks that may need additional assessment have specifically been excluded from this application and will need further consideration if such works become proposed.

1.3.3 Environmental Impact Assessment

The EIA Directive (85/337/EEC) defines the requirements for an EIA and has been implemented to ensure any potential environmental effects of a project are taken into consideration during a consent determination. This has been transposed into Scottish legislation, in the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017.

1.3.4 Nature Conservation

European sites for the protection of flora and fauna of European importance are designated under the Habitats Directive (92/43/EEC) and Birds Directive (79/409/EEC) as Special Areas of Conservation (SACs) and Special Protected Areas (SPA) (also referred to as Natura 2000 sites or European sites). The Habitats Directive is transposed in Scotland by both the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended), known as the Habitats Regulations and Conservation of Habitats and Species Regulations 2010. These regulations cover European sites occurring in onshore areas and territorial waters (out to 12 nm). In accordance with the Habitats Regulations, the effects of a project on the integrity of a European site are assessed and evaluated as part of the HRA process. An HRA screening process has been developed as part of the Environmental Appraisal (EA), and has been submitted as supporting documentation to the Section 36 consent application.

Projects which are not directly connected with, or necessary to the management of, a European site which have the potential to significantly impact a site, either individually or in combination with other projects, will be subject to an Appropriate Assessment per Article 6(3) of the Habitats Directive. The Appropriate Assessment will appraise the potential impacts of the project activities on the European site's conservation objectives.

An Appropriate Assessment must include: (1) a scientific appraisal of the Likely Significant Effects (LSEs) to a European site's qualifying features and conservation objections from the project; and (2) a conclusion about the integrity of the site, in the context of the Natura 2000 site network, based on this appraisal.

1.3.5 Section 36, Electricity Act 1989

Section 36 of the Electricity Act 1989 requires consent from Scottish Ministers to construct, extend or operate an offshore generating station over 50 MW in the Scottish Renewable Energy Zone (REZ) and over 1 MW within Scottish territorial waters. Marine Scotland's

Licensing Operations Team (MS-LOT) is responsible for issuing consent for renewable energy projects under Section 36 of the Electricity Act 1989, on behalf of Scottish Ministers.

EMEC proposes to apply for a site-wide Section 36 consent, for a range of wave energy devices (generating stations) with a generating capacity of over 1MW. Although the current embedded generation capacity for the site is 7MW, EMEC will be applying for a generating capacity of 20MW. As EMEC's Billia Croo test site is within 12 nautical miles (nm) of land, a Section 36 consent under the Electricity Act 1989 will be necessary.

2 Site Selection and Alternatives

EMEC was created in response to the recommendation in April 2001 of the Science & Technology Committee of the House of Commons that the UK should position itself to capture the benefit arising from the emergence of marine renewables technologies through establishing a National Offshore Wave & Tidal Test Centre.

A study completed by HIE (see REP653 for detail) had examined four other sites within Scotland as potential test centres for marine energy. The other sites considered included Lewis, South Uist, Caithness, and Islay. The decision to site the test centre, now known as EMEC, in Orkney was announced by the Scottish Government in July 2001 with the intention that "Scotland would become a world leader in energy production from wave and tidal power as a result".

The report concluded that the location was best in terms of the available resources, such as:

- close proximity of both wave power and tidal currents;
- a shorter distance offshore to exploit these resources;
- the availability of onshore facilities such as offices,
- storage and berthing; and
- suitable connection to power lines.

In addition, the presence of Europe's largest natural harbour, Scapa Flow, offers immediate proximity to shelter for both marine vessels and devices associated with activities at EMEC's test sites. The range of businesses and organisations based in Orkney that are geared to supporting EMEC and marine renewables development has also been a locational advantage.

EMEC's Billia Croo wave energy test site has been established and operating for over 15 years.

3 Description of the Project

The Section 36 consent application, supported by this ES and associated appraisals/assessments, does not relate to a new project, but rather is a proposed change to the existing licensing arrangement for EMEC's existing Billia Croo test site.

3.1 European Marine Energy Centre

Established in 2003, EMEC is the first and only centre of its kind in the world providing clients of both wave and tidal energy systems with purpose-built, United Kingdom Accreditation Service (UKAS) accredited open-sea testing facilities.

With 14 full-scale test berths (8 tidal energy and 7 wave energy) across two sites, there have been more grid-connected marine energy devices deployed at EMEC than at any other test

site in the world. Clients are attracted from around the world to use EMEC's test facilities enabling them to demonstrate their innovative technologies in some of the harshest marine environments. EMEC also operates two non-grid-connected test sites where clients can test smaller scale devices, or those at an earlier stage in their development, to gain real sea experience in less challenging conditions than those experienced at the grid-connected wave and tidal energy test sites.

Beyond device testing, EMEC provides independently-verified performance assessments and a wide range of consultancy and research services, as well as providing consenting support to clients.

3.2 Billia Croo Wave Test Site

EMEC's grid-connected wave test site is located at Billia Croo, off the west coast of Mainland, Orkney. The site sits to the north of Hoy Mouth, the western entrance to Scapa Flow, and is subjected to the powerful forces of the North Atlantic Ocean. The test site area has one of the highest wave energy regimes in Europe, with an average significant wave height of 2-3 metres (m), reaching extremes of up to 17m. The location of the EMEC wave energy test site is shown in Figure 11 below.

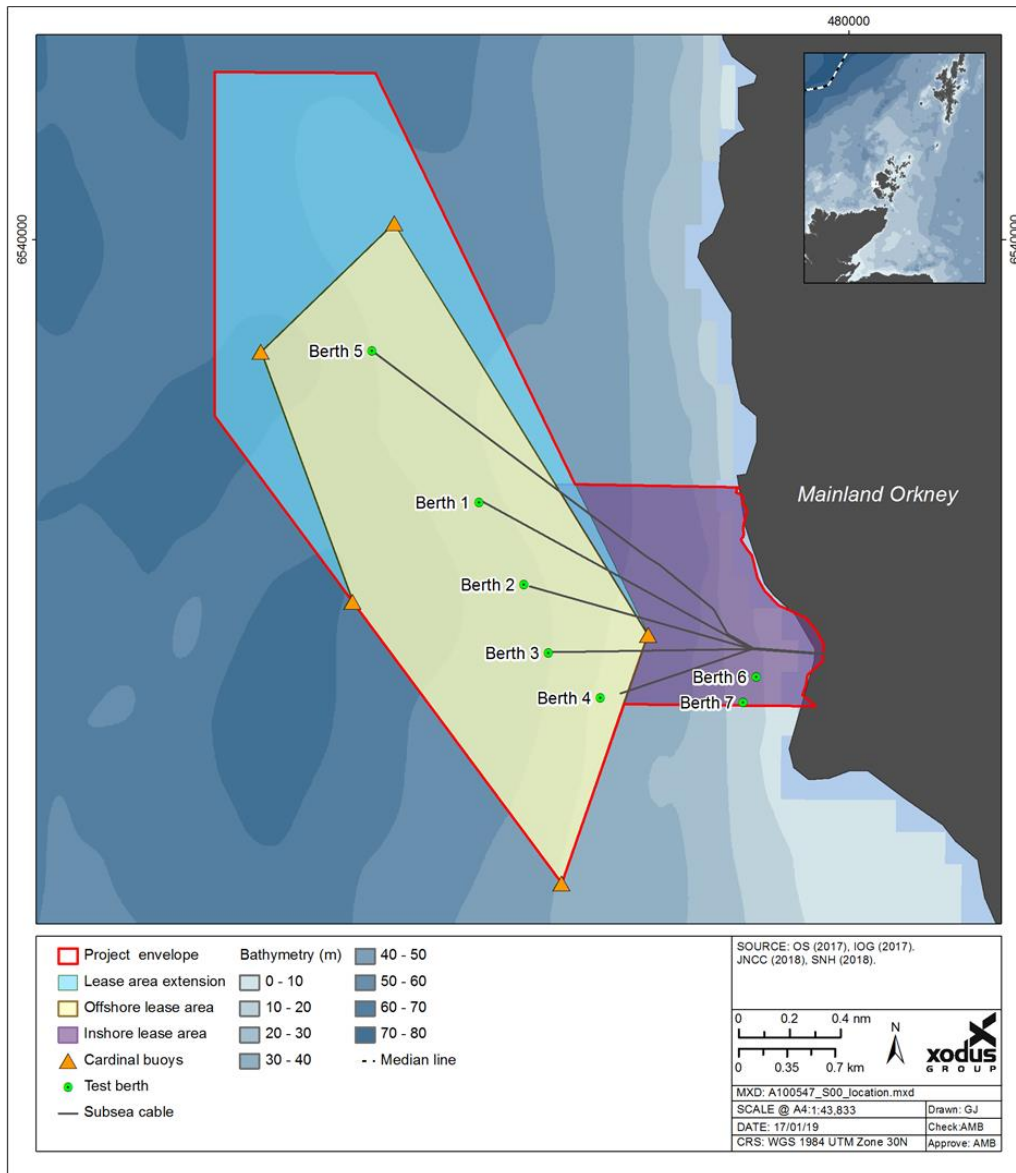


Figure 11. Location of the EMEC wave test site at Billia Croo, Orkney

EMEC has recently agreed an extension to the lease area, to the north and west of the site, which will provide greater sea space around current developments as well as offering prospective clients deeper water testing opportunities.

The site currently provides five cabled test berths in up to 70m water depth (four at 50m, one deeper), located approximately 2km offshore and 0.5km apart. In addition to this, the site includes a nearshore area situated closer to the substation to accommodate shallow water projects, totalling to seven berths. Five 11kV subsea cables extend to each berth from an onshore electricity substation which houses the main switchgear, backup generator and communications room. The substation controls the supply from each wave device and includes connection to the National Grid. An adjacent laydown area provides clients with space to place their power conditioning equipment required to convert electricity from the level at which it is generated to grid-compliant electricity. EMEC sells generated electricity on behalf of the clients, who receive the return. In addition to transporting electricity, the subsea cables also contain a fibre-optic core which allows clients to communicate with their devices and transmit data back to the EMEC data centre and office facilities in Stromness, Orkney.

3.3 Social and Economic Benefits

3.3.1 EMEC Social and Economic Impact Assessment

In February 2016, the economist Steve Westbrook (see REP653) produced an economic impact assessment on behalf of HIE to assess the impact of EMEC since its establishment in 2015, and the report was later updated to include impacts arising from 2016 to 2017. A Socio-economic Report (REP659) has been developed which summarises Westbrook’s findings and provides a perspective on the socio-economic impact of establishing EMEC, which has been provided in support of this application for S36 for the Billia Croo test site.

3.3.2 Summary

Due to EMEC being the first test centre of its kind to be established, and now having over a decade of evidence to draw from, the social and economic impacts of the site can be used to accurately forecast the potential impacts that may be experienced when introducing marine renewable technologies to other areas.

EMEC has prompted considerable impact in Orkney and throughout the UK in terms of investment and job creation. EMEC’s total local spend in Orkney has been over £16 million (50% of all EMEC spend 2005 - 2017). According to the Steve Westbrook study (REP653), in 2017 approximately 200 people were employed in Orkney in the marine renewables sector. As of 2017, £23 million had been invested by Orkney Islands Council (OIC) and HIE in supporting infrastructure for the sector in Orkney. The HIE commissioned economic impact assessment¹ estimates that EMEC has generated a gross value added (GVA) to the wider UK economy of £84.7 million, with 4,227 full time equivalent (FTE) job years so far.

The table below summaries the total quantifiable impact (between 2003-2017) attributable to EMEC, combining impacts associated with marine renewable energy-related infrastructural developments in Orkney; EMEC’s operations; marine energy device developments; and other academic-related and public sector-related employment impacts in Orkney.

Table 1. Quantifiable employment impact of EMEC (between 2003-2017) per area

	Cumulative FTE years	Cumulative Earnings (£m)	Cumulative GVA (£m)
Orkney	1,653	55.9	98.3
Highlands & Islands	1,969	65.0	116.3
Scotland	3,244	113.9	213.6
UK	4,227	149.8	284.7

The overall employment impact in Orkney (as of 2017) of 1,653 FTE job years equates to an average of 110 FTEs annually over the 15 year period (2003-2017); in the Highlands and Islands as a whole 131 FTEs annually; in Scotland 216 FTEs per year; and in the UK 282 FTEs per year.

3.4 Current Licences and Consents

As the Billia Croo test site has been established since 2003, there are numerous consents and licences that have previously been granted for the site, associated with both site

¹ From “European Marine Energy Centre Economic Impact Assessment”, Steve Westbrook. 18 February 2016. Highlands and Islands Enterprise.

development and client specific activities. Table 2 highlights the current licences and consents applicable to the Billia Croo test site.

Table 2. Current licences and consents applicable to the Billia Croo test site

Type of Consent/ Licence/ Appraisal	EMEC	Developers
Previous and existing consents	<p>3 CPA licences for cables.</p> <p>4 FEPA licences for cable protectors.</p> <p>Planning permission for onshore facilities.</p> <p>Marine licence for the deployment of scientific instrumentation.</p>	<p>Various CPA/FEPA/marine licences held by individual clients for device deployments.</p> <p>Various Section 36 consents for projects with greater than 1 MW generating capacity.</p>
Crown Estate (Scotland) lease	<p>Current lease to 2025.</p> <p>Variation process underway for a 21-year lease extension from 2019 to 2040.</p>	N/A
Embedded Generation Connection Agreement	<p>Agreement commenced in 2004 and currently limits total export capacity to 7 MW.</p>	N/A
Hazard Identification and Risk Assessment	<p>Undertaken in 2002 to support the presence of the test site.</p>	N/A
Navigational Risk Assessment	<p>An NRA was undertaken in 2008 to inform device specific NRAs (Abbott Risk Consulting Ltd, 2009).</p> <p>Updated NRA (REP522) carried out by Marine and Risk Consultants Ltd in 2018, to support site-wide S36 application.</p>	<p>Various project-specific NRAs in support of device specific deployments.</p>
Appraisals and assessments	<p>EIA undertaken with associated ES undertaken in 2002 to support FEPA and CPA applications. An updated environmental description was then prepared in 2005 (Aurora Environmental, 2005) and subsequently updated by EMEC in 2009 (REP107).</p>	<p>Individual developers have produced appraisals in support of their respective deployments. Each focussing on the specifics of individual deployments.</p>
Seascape, Landscape and Visual Impact Assessment	<p>Conducted in 2019 by Land Use Consultants Ltd, to support site-wide S36 application (REP663).</p>	Various

4 Project Envelope

As EMEC are applying for a site-wide Section 36 consent, it is necessary to develop an envelope of possible device types and components including associated operations that may be conducted at the Billia Croo test site. In forming the Billia Croo Project Envelope (REP646), EMEC has utilised the established Design Envelope approach, comprising of worst-case scenarios to provide scope for the assessment and in turn scope for any consent awarded.

The Project Envelope (REP646) describes the various types and associated characteristics of devices and components likely to be tested at the grid-connected test site and associated marine operations, and scientific equipment. The Project Envelope is based on detailed knowledge of parameters relating to devices that have been deployed at EMEC to date, together with emerging designs. The Project Envelope therefore reflects the anticipated range of devices, and features thereof, and is an expression of the maximum anticipated likely usage of the site.

Following agreement with the regulator, through the process of the EA and other assessments, it is considered that any application for a marine licence or Section 36 consent for testing activities or operations, within the parameters of the Project Envelope, at the Billia Croo test site may be regarded as pre-appraised in terms of an environmental impact assessment and HRA. Where projects are deemed to not fit within the Project Envelope, an additional appraisal will be required by the applicant (this will be determined by Marine Scotland after initial discussions).

Table 3 outlines the typical categories and activities under the Project Envelope.

Table 3. Activities included within the Project Envelope

Infrastructure not including foundation/mooring	Foundation and mooring methods	Likely marine works	Typical vessels	Typical scientific instruments/testing
<p>WECs:</p> <ul style="list-style-type: none"> - Single Device Arrays and Components - Over-topping Device - Oscillating Wave Surge Converter - Submerged Pressure Differential - Oscillating Water Column - Attenuator - Point Absorber - Bulge Wave - Rotating Mass <p>Electrical Hubs</p> <p>Floating Platforms</p>	<ul style="list-style-type: none"> - Foundation structure fixed into the seabed via piles/pins (non-percussive drilling only) - Foundation structure held on to the seabed by gravity - Gravity-based anchor(s) with mooring line(s) attached - Rock anchor(s) with mooring line(s) attached - Suction anchor(s) with mooring lines attached - Embedment anchor(s) with mooring line(s) attached - Pin(s) (e.g. rock bolts) with mooring line(s) attached - Other mooring structure pinned (non-percussive drilling), or held on, to the seabed by gravity 	<p>Pre-installation:</p> <ul style="list-style-type: none"> - ROV/diver surveys - ADCP and waverider deployment/retrieval - Bathymetry surveys - Sub-bottom profiling - Acoustic surveys <p>Installation:</p> <ul style="list-style-type: none"> - Drilling and grouting - Lowering infrastructure - Cable works and connection to device <p>Testing and maintenance of devices:</p> <ul style="list-style-type: none"> - ROV inspection - Diver activities - Repairs below and above sea surface - Biofouling removal - Acoustic surveys <p>Decommissioning:</p> <ul style="list-style-type: none"> - ROV inspection - Cable works and disconnection - Diver activities - Cutting and drilling - Grappling operation - Lifting infrastructure - Forensic/failure analysis 	<ul style="list-style-type: none"> - Tug - Workboat with and without dive support capability - Multicat workboat - Dive support vessel - Survey vessel (ROV compatible) - Gantry barge - Crane barge - DP Class II Anchor Handler Tug - Cable laying vessel 	<ul style="list-style-type: none"> - Wave Measurement Buoys - Acoustic Doppler Current Profilers (ADCP) - Acoustic measurement devices - Active acoustic devices - Acoustic communication devices - Marine robotics - Datacentres - Testing of anti-fouling systems, biofouling and corrosion tests - Underwater cameras - Conductivity Temperature Depth (CTD) measurement instruments - Integrated monitoring pod housing an array of the above instrumentation

5 Environmental Appraisal Methodology

This Environmental Statement summarises the findings from the Environmental Appraisal, the Seascape, Landscape and Visual Impact Assessment (SLVIA) and the Navigational Risk Assessment. This section focuses on the assessment methodology employment in the EA, with specific details regarding the method employed in the SLVIA and NRA provided in the respective sections.

Please refer to the EA (REP666) for a detailed discussion of the methodology employed, along with key data sources used throughout the appraisals. The appraisals have been carried out based on the detailed Project Envelope.

5.1 Consultation and Scoping

Two separate meetings were held to agree on the methodology and approach to be adopted for the EA and scope the work prior to commencement:

- 7th of November – Marine Scotland, Xodus Group, EMEC
- 16th of November – Scottish Natural Heritage (SNH), Xodus Group, EMEC

As discussed previously, no screening or scoping exercise has been conducted to support this S36 application. The scope and key data sources utilised in the EA, SLVIA and NRA have been informed by regular consultation with stakeholders and previous consent applications for the test site.

5.2 Methodology

In 2014, EMEC undertook an EA for the Fall of Warness tidal test site (EMEC, 2014). The aim of the EA was to pre-appraise potential deployments within the context of the wider test site. The four-step process used for the Fall of Warness is the chosen methodology for the appraisals for the Billia Croo test site. This allows for:

- continuity of appraisal methodology between different EMEC test sites;
- use of a methodology that has previously been accepted by the regulator and their advisors; and
- clearly distinguishes between the assessment requirements under different legislative regimes.

Figure 12 briefly summarises the agreed upon methodology. The following is an overview of the actions carried out in each step presented in the figure:

Step 1 - Identification of activities/effects requiring detailed appraisal

- Step 1 sets out the definitions and categories of potential effects (see Table 4) to be considered in subsequent steps. These categories are to be applied to all receptor types and be used to identify which activities/effects require detailed appraisal.
- Where impact mechanisms are poorly understood, there is a preference at this stage for precautionary categorisation of 'potentially important'.

Step 2 - Identify potential effect-pathways and assign level of 'importance'

- Step 2 identifies development activities and potential effect-pathways and assigns a level of importance (as per definitions developed/agreed in Step 1) for each receptor under consideration. Potential effects are considered in broad-principles. Construction,

installation and decommissioning effects are considered separately from those during operational and maintenance phases.

- This step of the evaluation also addresses potential effects prior to the consideration of mitigation and monitoring options.
- Following identification of the potential effects and their importance, a description of the relevant natural heritage features that could be impacted by, and the impact assessment for activities at the Billia Croo test site is provided.

Step 3 - Detailed appraisal of 'important' or 'potentially important' effects

- Step 3 undertakes a full detailed appraisal of potential activities/effect-pathways regarded to be 'important' or 'potentially important'. The detailed appraisal reports on the following outcomes:
 - Appraisal conclusion for each receptor/receptor group or impact type, including outcomes for protected sites and species;
 - Any species licensing needs; and
 - Potential mitigation and monitoring measures.

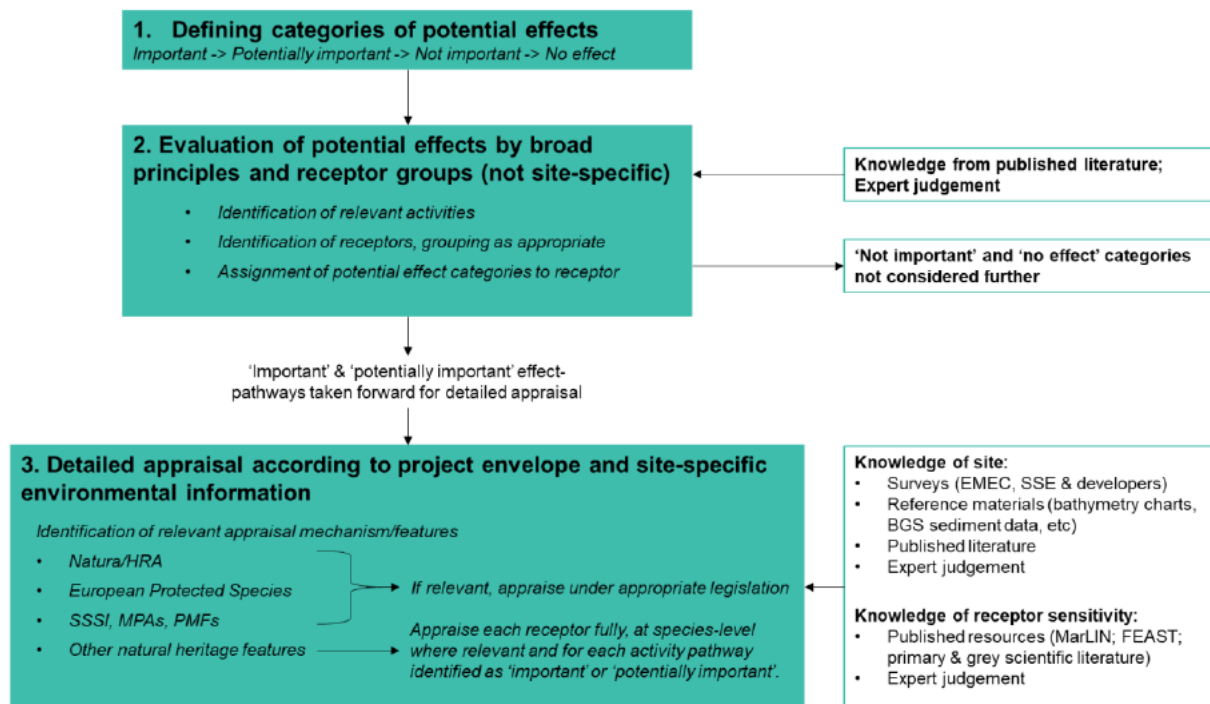


Figure 12. Assessment methodology applied throughout the Environmental Appraisal process

Table 4. Definition and importance categories for potential effect-pathways

Potential importance of effect	Effects (positive and/or negative)	Further assessment required?
Important	<ul style="list-style-type: none"> • Likely Significant Effect on European site(s); • Impact on European Protected Species; • Impact on the integrity of a Site of Special Scientific Interest (SSSI) or damage to natural features of a SSSI; • Impact on the protected features of a Marine Protected Area (MPA); • Impact on a Priority Marine Feature (PMF); • Impact on other sensitive natural heritage features at a population/habitat scale of concern; and 	Yes

Potential importance of effect	Effects (positive and/or negative)	Further assessment required?
	<ul style="list-style-type: none"> Impact on Scheduled Ancient Monument (SAM) or ships and aircraft lost on military service. 	
Potentially important	<ul style="list-style-type: none"> Potential Likely Significant Effect on European site(s); Potential impact on European Protected Species; Potential impact on the integrity of a SSSI or damage to natural features of a SSSI; Potential impact on the protected features of a MPA; Potential impact on a PMF; Potential impact on other sensitive natural heritage features at a population/habitat scale of concern; and Potential impact on SAM or ships and aircraft lost on military service. 	Yes (further information will assist determination of importance, including consideration of uncertainties)
Not important	Negligible effect on natural heritage interests.	No
No effect	No effect on natural heritage interests.	No

5.2.1 HRA Approach

Within each receptor an appraisal consideration of the protected sites is undertaken. Where it is determined that there is no connectivity to the protected site and the test site, it is determined that there is no LSE to the qualifying features and no further HRA is provided. Where connectivity is determined, an assessment of the potential importance of the test site to the particular receptor (qualifying feature with connectivity) is given alongside the importance of the potential impact pathways and judgement used to ascertain whether LSE is considered likely.

5.2.2 Exclusions

It should be noted that the following elements are excluded from the EA process:

- onshore (including intertidal) ancillary developments and infrastructure are not addressed in these appraisals (including the landfall of cables). Any such proposals require consideration under the Town and Country Planning (Scotland) Act 1997; and
- all activities out with the Project Envelope.

As discussed previously, the NRA and SLVIA has been completed using a different assessment methodology which are discussed in greater detail under the relevant sections, Section 7 and 8 respectively.

5.2.2.1 Cumulative impacts

Cumulative impacts act together with other impacts (including those from any concurrent or planned future third-party activities) to potentially affect the same receptors as the activities and area as per the Project Envelope. Please refer to the EA for a list of projects considered in the cumulative impact assessment. Only projects that share a relevant pathway of effect with the Project are considered in the cumulative assessment.

6 Environmental Appraisal

The following is a summary of the Environmental Appraisal (REP666), it is recommended that consultees refer to EA rather than ES when reviewing the outcomes of the appraisal process.

The following section provides a summary of the receptor-specific appraisals, these have been presented to consider the maximum-case scenarios based on the Project Envelope. However,

it should be noted that, if there are key deviations in the device design or in any activity (deployment, installation, decommissioning, operations and maintenance), further appraisal work may be required. Any additional appraisal work required will be undertaken by the individual client and agreed with EMEC and Marine Scotland on a case-by-case basis.

Please refer to the Environmental Appraisal for detailed appraisals of individual receptors. Within the EA, key data sources that have been used to inform the appraisal have been identified in the individual appraisal sections.

6.1 Benthic Environment

6.1.1 Baseline Description

6.1.1.1 Natural Heritage Context Intertidal Area

The west coast of Orkney is a high energy coastal environment. The inshore lease area encompasses the intertidal area at Billia Croo, the infralittoral zone, and part of the circalittoral zone further offshore, as shown in Figure 13. The Billia Croo shoreline, where the cables make landfall, is composed of bedrock and boulders (EMEC, 2009). The boulder beach is flanked to the south by a rocky promontory, and to the north by shelving bedrock leading to a cliff coastline.

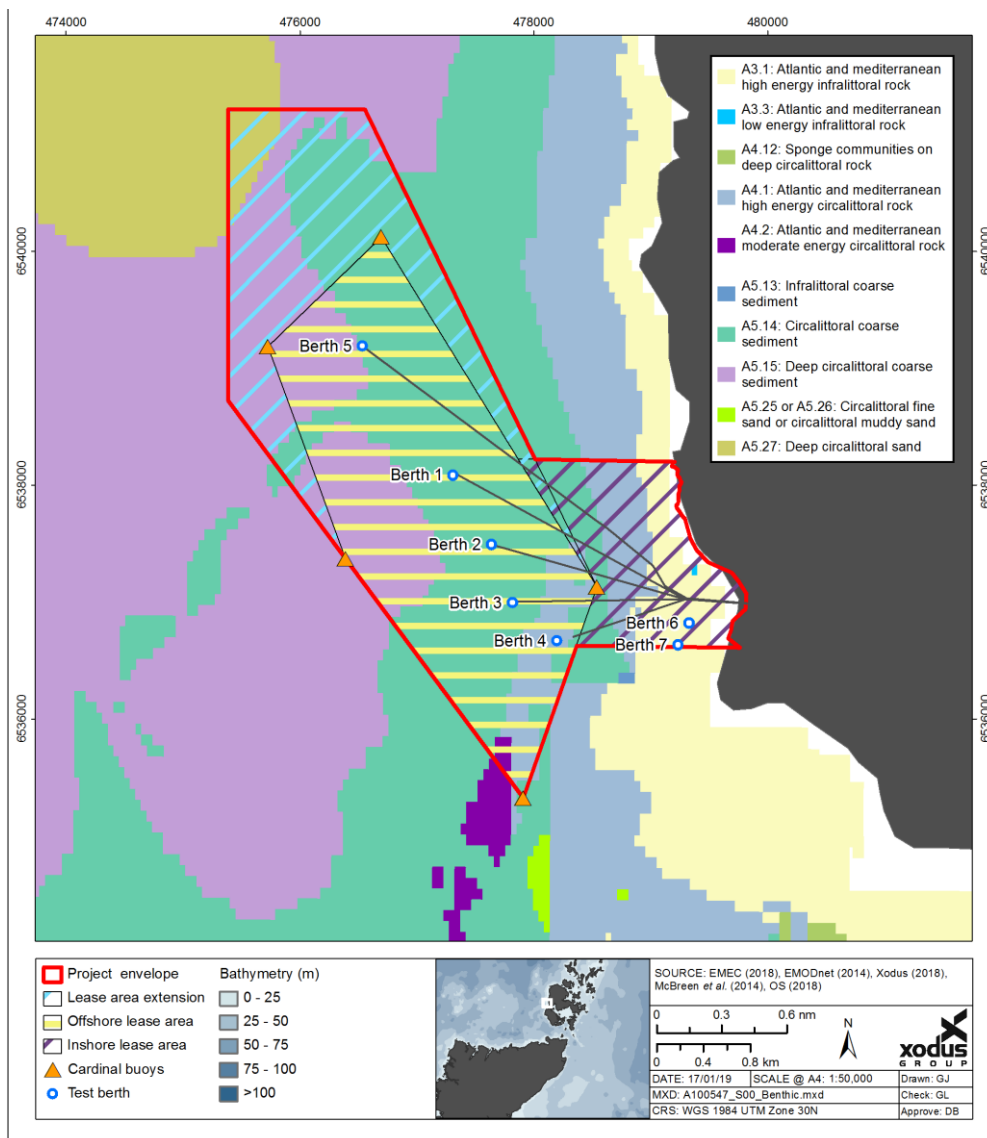


Figure 13. EUNIS broad-scale seabed habitats in the vicinity of the Billia Croo test site (JNCC, 2018)

Subtidal Area

The inshore lease area encompasses the intertidal area and extends to the infralittoral zone and part of the circalittoral zone. The seabed within infralittoral zone at Billia Croo, from the mean low water spring (MLWS) mark down to 20 m water depth, is dominated by exposed bedrock. From 20 – 25 m water depth, where the circalittoral zone starts, the seabed is characterised by bedrock with an overlying sediment veneer in many places.

ROV surveys and previous samples undertaken by students support the broad-scale seabed habitat map for UK waters (JNCC, 2018) which show that the rocky seabed identified by EMEC in the subtidal area of the Billia Croo test site is classified as high energy infralittoral rock and high energy circalittoral rock. The infralittoral and circalittoral rock in this area is also classified as potential bedrock/stony reef habitat, listed in the Annex I of the European Commission (EC) Habitats Directive (Ellwood, 2013). The area of coarse to fine sand identified further offshore in the offshore lease area is classified as coarse sediments on the broad-scale seabed habitat map (JNCC, 2018).

Benthic Species

By definition, the intertidal area is part of the littoral zone, which extends beyond the intertidal area, whilst the subtidal area comprises the infralittoral, circalittoral and sublittoral zones. There is a succession of benthic communities at Billia Croo in the intertidal area and subtidal area, this is detailed further in Table 5 and Table 6 below.

Table 5. Benthic species identified in the intertidal zones at Billia Croo (EMEC, 2009)

Shore/ seabed area	Zone classification	Character of zone	Species present
Top of the shore	Supralittoral	Bedrock promontory and boulder beach	Dominated by the lichen <i>Verrucaria maura</i> . Barnacles present.
	Upper littoral	Bedrock promontory and shelf	Rock pools present with dense coralline algal crusts, fucoids and kelp in deeper pools. Green algae in pools higher up the shore including <i>Enteromorpha</i> spp.
Middle of shore	Mid littoral	Boulder beach and bedrock promontory	Dominated by barnacles and fucoid algae. <i>Fucus vesiculosus</i> and <i>Fucus serratus</i> . Mussels (<i>Mytilus edulis</i>) form a band mid-way down the shore.
	Eulittoral	Exposed bedrock shelf	Dominated by mussels with barnacles and barnacles with limpets (<i>Patella</i> spp.) and <i>Fucus vesiculosus</i> f. <i>linearis</i> .
	Lower littoral	Boulder beach	Stands of dulse (<i>Palmaria palmata</i>) and other red seaweeds where <i>Osmundea</i> (<i>Laurencia</i>) and/or <i>Gelidium</i> always dominate.

Table 6. Benthic species identified in the subtidal zones at Billia Croo (EMEC 2009)

Shore/ seabed area	Zone classification	Character of zone	Species present
Below low water	Infralittoral	Bedrock	Dominated by dense <i>L. hyperborea</i> forest. Thins to kelp park with depth, with sparse understorey of red seaweeds. Sparse fauna and algal crusts. <i>E. esculentus</i> with sparse dead man's fingers (<i>A. digitatum</i>) and some grazing tolerant fauna.
	Infralittoral/ circalittoral	Rock faces, steep exposed rock features and gullies. High energy, tide and wave swept rock faces.	Dominated by dead man's fingers (<i>A. digitatum</i>) and the bryozoan <i>Securiflustra securifrons</i> .
Begins 20 – 25m deep	Circalittoral	Soured rock and rock surfaces	Dominated by the bryozoan <i>F. foliacea</i> . Other bryozoans and hydroids present.
	Circalittoral/ sublittoral	Mixed sediments of the overlying veneer and at the boundary of sublittoral sediment.	Brittlestar beds dominated by <i>Ophiothrix fragilis</i> and <i>Ophiocomina nigra</i> . Associated with the starfish <i>Luidia ciliaris</i> . <i>Urticina felina</i> present.
From 45m	Sublittoral	Sand cover of the offshore zone.	Dominated primarily by infaunal polychaete species. Nematodes, amphipods, bivalves and echinoderms also present.

6.1.1.2 Protected Sites

The Stromness Heaths and Coast Site of Special Scientific Interest (SSSI) forms an extensive protected area on the west coast of Orkney, crossing the Billia Croo test site. However, the protected features of this site are on the land and therefore do not include any benthic features. The North-West Orkney Nature Conservation Marine Protected Area (NCMPA) is designated for sand banks, sand wave fields and sediment wave fields representative of the Fair Isle Strait Marine Process Bedforms Key Geodiversity Area and sand eels. The site is located over 9 km from Billia Croo. The closest SAC with benthic features as a qualifying feature is the Sanday SAC, designated for the presence of bedrock reefs listed on Annex I of the EC Habitats Directive, and located 50 km north-east. Due to the distance to these conservation sites, there is no connectivity with the proposed activities at the Billia Croo wave test site.

6.1.2 Effect Pathways

The potential effect-pathways assessed on the baseline environment include:

- habitat loss/damage;
- smothering by resettlement of disturbed sediments or drill cuttings;
- introduction of marine non-native species (MNNS);
- changes to hydrodynamic and sediment regime; and,
- electromagnetic field (EMF) effects.

6.1.3 Appraisal Mechanism

Table 7 presents the relevant legislation and any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features.

Table 7. Appraisal mechanism for benthic and intertidal species and habitats

Feature type	Appraisal mechanism/ relevant legislation	Applicable	Reasoning
Qualifying features of European sites	The Conservation of Habitats and Species Regulations 2017 Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)	No	No connectivity with SACs with benthic qualifying features.
European Protected Species (EPS)	The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)	No	No benthic species are listed as EPS.
Notified features of SSSIs	Nature Conservation (Scotland) Act 2004 (as amended)	No	No SSSIs with benthic features will be impacted.
Protected features of MPAs	Marine (Scotland) Act 2010 Marine and Coastal Access Act 2009 (if relevant)	No	No MPAs with benthic features will be impacted.
PMFs	Marine (Scotland) Act 2010	Yes	The PMF 'kelp beds' may be present in the nearshore area at Billia Croo, due to the presence of <i>L. hyperborea</i> forests.
Other sensitive	Appraisal of other features under:	Yes	Captures assessment of all other sensitive natural heritage

Feature type	Appraisal mechanism/ relevant legislation	Applicable	Reasoning
natural heritage features	<ul style="list-style-type: none"> The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore) The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 Marine (Scotland) Act 2010 Wildlife and Countryside Act 1981 		features at a population/habitat scale of concern.

6.1.4 Assessment of Potentially Significant Impacts

6.1.4.1 Appraisal of PMFs and other natural heritage features

An overview of the seabed habitats that may be impacted by the activities described in the Project Envelope, and their associated footprint, is presented in Table 8.

Table 8. Overview of habitat types that may be impacted by the Project Envelope activities and potential worst-case footprint

Project envelope installations or activities	Worst case seabed area	Likely habitats to be impacted		
		Inshore lease area	Offshore lease area	Proposed extension
Cable laying	<300mm diameter	Infralittoral rock with kelp (<i>L. hyperborea</i>) forests	Mixed sediments of the overlying veneer, dominated by brittle stars and starfish.	Mixed sediments of the overlying veneer, dominated by brittle stars and starfish.
Vessel anchoring system	0.01km ² for a single anchor and anchor chain	Circalittoral rock with soft coral <i>A. digitatum</i>	Fine to coarse sand dominated primarily by infaunal polychaete species.	Fine to coarse sand dominated primarily by infaunal polychaete species.
WEC moorings	750m ² per WEC 0.015km ² for 20 WECs	Circalittoral rock dominated by the bryozoan <i>F. foliacea</i>		
Electrical hubs moorings	400m ² per hub 0.004km ² for 10 hubs			

6.1.4.2 Appraisal of Cumulative Impacts

The nearest activity to the Billia Croo test site which interacts with the seabed is, the Stromness A dredge spoil disposal site, and the nearest subsea cable being planned is the SSE Stromness to Dounreay cable route which will pass the Billia Croo test site approximately 1 km to the south-east. Due to the relatively low water depths in the test site, the anchor chains that may be used by installation or decommissioning vessels for projects are not expected to overlap with the footprint of anchors and anchor chains that may be deployed at these sites, therefore no cumulative impacts on the seabed are anticipated.

The main commercial fishing gear deployed in the test site and surrounding area are pots, all inshore Scottish waters are subject to a restriction for cockle harvesting, and there is a restriction on fishing for sandeel using towed gear with mesh of less than 32 mm all year-round in ICES area IVa. Due to the limited use of bottom fishing gear, no cumulative benthic impacts with fisheries are anticipated.

Appraisal conclusion for cumulative impacts on benthic species and habitats: No cumulative impacts are determined to be important to benthic and intertidal species and habitats.

6.1.4.3 Summary

The appraisal concludes that while the development footprint includes some rocky habitat, with potential Annex I stony/rocky reefs, any potential impacts on the physical integrity of sedimentary substrates and of rock, boulder and cobble substrates are not regarded as important at the scale of the development and in the context of the wider environment.

Any potential impacts on benthic habitats and species are considered as not of importance to the ecological functioning of the area. Good-practice mitigation should be applied to minimise the risk of introducing marine non-native species (MNNS). In this regard, monitoring of the colonisation of devices and infrastructure by benthic flora and fauna could also form part of a MNNS management protocol.

6.2 Hydrodynamic and Physical Processes

6.2.1 Baseline Description

6.2.1.1 Natural Heritage Context

The Billia Croo test site is located on the south-west coast of the Orkney mainland. The coastline is predominantly rocky, with few beaches, and its westerly location leaves it exposed to harsh wave conditions from the North Atlantic. Littoral transport is dominated by wave processes, with much of this coastline being exposed to the high energy wave conditions. Long-term coastal edge retreat is occurring at many beaches and cliffs in the area, most notably at the Bay of Skail (approximately 8.6 km north from the Billia Croo test site) (JNCC, 1997). The geology of the offshore EMEC test site is undifferentiated sandy gravels underlain by mudstones and siltstones (BGS, 2018). The littoral zone (shore or seabed area) within the Billia Croo area consists of a boulder beach and is characterised by exposed littoral rock (ICIT, 2006).

Wind from the west and south-east is one of the most significant features of the Orkney climate, and gales are frequent in occurrence, typically around 30 days in an average year with the winter months being the windiest (JNCC, 1997). The average significant wave height at the Billia Croo test site is around 1.7 m, with corresponding average wave periods of around 14 seconds (EMEC, 2008). Extreme 100-year return period waves from the dominant wave direction are predicted at the site with significant wave heights of around 14 m (EMEC, 2008).

The tides around Orkney produce a net flow of water from west to east within Scapa Flow and between the islands, but tidal currents are relatively weak in the north-south direction on the west coast of Orkney, with current speeds rarely exceeding 0.5 m/s on a site-specific survey (EMEC, 2008). The mean spring tidal range at nearby port of Stromness is 2.9 m, while the mean neaps range is 1.3 m, and the 1 in 50-year return period tidal surge can be between 1.25 m and 1.5 m around the Orkney Isles (SNH, 2000).

The western coast of Orkney, within the vicinity of the EMEC site, is used for leisure and recreational craft at a moderate to high level (Marine Scotland, 2018). There are no listed scuba-diving areas within the vicinity of the EMEC test site; the closest scuba diving site is Tarbarka wreck and is approximately 5.6 km south (Marine Scotland, 2019). There are no stated surfing locations within the vicinity of the EMEC site; the closest being the Bay of Skail (Marine Scotland, 2019); and Skara Brae and Skail Bay Right which are located approximately 9 km north (Magicseaweed, 2019). There are no stated windsurfing locations within the Orkney Islands (Marine Scotland, 2019). There are no designated bathing waters on the Orkney Islands (SEPA, 2019). There are no general boating areas within the vicinity of the EMEC site; the closest general boating area is located approximately 23 km east. Therefore, the main recreational receptor in which changes to the hydrodynamic regime could impact is leisure and recreational craft.

6.2.1.2 Protected Sites

The North-West Orkney NCMPA is located 9.8 km from the site. The NCMPA is a shallow area situated to the north and west of the Orkney Islands on the Scottish continental shelf. This site is designated for the following geomorphological feature; sand banks, sand wave fields and sediment wave fields repetitive of the Fair Isle Strait Marine Process Bedforms Key Geodiversity. The Stromness Heaths and Coast SSSI which runs along the west coast of Mainland Orkney, overlaps the test site towards the eastern nearshore extent of the site boundary. This site is designated for two geological features; coastal geomorphology of Scotland, and the non-marine Devonian stratigraphy.

Geological Conservation Review (GCR) sites have been identified as sites of national and international importance regarding British geology, including the West Coast of Orkney GCR site. Billia Croo is located within the Breck Ness to Noup Head coastal water body. The condition of this surface water body has been historically high (from 2014), with future predictions of it remaining so (from 2027 onwards) (NMPI, 2019). There are no designated bathing waters on the Orkney Islands (SEPA, 2019). The installation and presence of devices or other infrastructure is considered unlikely to adversely impact upon the water quality of the Breck Ness to Noup Head coastal water body.

6.2.2 Effect Pathways

The potential effect-pathways assessed on the baseline environment include:

- changes to sedimentary processes; and
- changes to erosive forces and patterns

6.2.3 Appraisal Mechanism

Table 9 presents the relevant legislation and any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features.

Table 9. Appraisal mechanism for hydrodynamic and physical processes

Feature type	Appraisal mechanism/ relevant legislation	Applicable	Reasoning
Qualifying features of European sites	The Conservation of Habitats and Species Regulations 2017 Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)	Yes	WFD River Basin Management Plan Coastal Water Bodies

Feature type	Appraisal mechanism/ relevant legislation	Applicable	Reasoning
	Water Framework Directive (WFD) 2000/60/EC		
Notified features of SSSIs	Nature Conservation (Scotland) Act 2004 (as amended)	Yes	Potential connectivity with the Stromness Heaths and Coast SSSI designated for coastal geomorphological features.
Protected features of MPAs	Marine (Scotland) Act 2010	No	Potential connectivity with the North-West Orkney NCMPA designated for marine geomorphology of the Scottish Seabed, however due to intervening distance connectivity is unlikely.
PMFs	Marine (Scotland) Act 2010	Yes	PMFs known to be present.
Other sensitive natural heritage features	Appraisal of other features under: <ul style="list-style-type: none"> The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore) The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 Marine (Scotland) Act 2010 	Yes	Captures assessment of all other sensitive natural heritage features at a population/habitat scale of concern

6.2.4 Assessment of Potentially Significant Impacts

6.2.4.1 Appraisal of Protected Sites

It is anticipated that during the installation phase, the installation of seabed mounted infrastructure, seabed piercing infrastructure, mooring lines and anchors will result in localised seabed disturbance and sediment suspension around the infrastructure at Billia Croo. Sediment suspension will be limited to the device vicinity whilst seabed change will be small in scale and recover to its original state in the medium-term of months to years. There may be temporary, highly localised change in seabed character due to buried sediment layers being disrupted through the installation of infrastructure, however this disturbance will also recover over the medium-term of months to years.

The geomorphological nature of the NCMPA site is sensitive to changes in the sediment regime within the marine environment and as such, this receptor is deemed to have high sensitivity to the activities at the test site. However, increased volumes of suspended sediment within the water column due to the installation of the wave devices is unlikely to be transported to the NCMPA. The NCMPA is situated a significant distance away, 9.8 km north of the Billia Croo test site, and there is very little sediment transport in a north-south direction as a result of low current speeds, incident wave angle and lack of mobile sediments.

The SSSI site is sensitive to changes in the sediment regime and as such this receptor is deemed to have high sensitivity to the test site. However, the potential disturbance to sediment

during the installation and operation phases is unlikely to have an adverse impact on the sediment regime within the marine environment and as such, will not adversely impact the SSSI.

Billia Croo is located across both the Breck Ness to Noup Head (ID 200237) and Tor Ness to Breck Ness coastal water bodies (ID 200231). The condition of these surface water bodies has been historically high (from 2014), with future predictions of it remaining so (from 2027 onwards) (Marine Scotland, 2019). Although cumulative wave height reduction downstream of an array has been previously modelled and shown as significant (Venugopal *et al.* 2017), the number of WECs proposed at Billia Croo deems this potential impact as not important. The installation and presence of devices is considered unlikely to adversely impact upon the water quality of these coastal water bodies, due to the temporary nature of installation works, the low volumes of increased suspended sediment, and the high natural variability of the site.

Appraisal conclusion for protected sites: Any potential impacts are not regarded as important at the scale of the development.

6.2.4.2 Appraisal of other Natural Heritage Features

The sand dune systems located along the coast of Orkney are sensitive to changes in sources of sediment. However, the dune system located to the south of the site is unlikely to be impacted by the installation of wave devices at the Billia Croo test site due to being situated downstream; any potential impacts to the sediment regime within the marine environment will not impact the dune systems situated upstream.

The West Coast of Orkney Geological Conservation Review (GCR) site (May & Hansom, 2003) has the potential to be impacted by the test site, as the wave array could alter the wave field incident on the coastline. However, this GCR is characterised by hard rock and high cliffs, so a slightly altered wave field will have an imperceptible difference to them and will be within the natural variability of the site. Therefore, as discussed for the Stromness Heaths and Coast SSSI, the GCR will not be adversely impacted.

The protruding topography of the coastline to the south of Billia Croo will provide shelter for Warebeth Beach during both the installation, operation and decommissioning phases. As such, it is considered that any activities as presented in the Project Envelope are unlikely to impact upon beach sediments at Warebeth Beach.

Appraisal conclusion for other natural heritage aspects of hydrodynamic and physical processes: In summary, any changes to the hydrodynamic regime and coastal environment, are regarded as negligible to the extent that they will mostly be immeasurable. Consequently, within the specifications of the Project Envelope, no further assessment is required in relation to hydrodynamic and coastal processes. Any changes during the operational phase will also be temporary, given the status of the site as a test site. Furthermore, given the number of devices, the spacing of test berths and the intermittent nature of their operation, any measurable alterations to hydrodynamics and physical processes are predicted to be so small as to be of no importance to the local physical environment.

6.2.4.3 Appraisal of Cumulative Impacts

Sediment concentrations are a key concern of cumulative impacts, likely caused through construction and installation activities for any marine and coastal projects near Billia Croo.

The MeyGen Pentland Firth project is considered to be too far away to act in a cumulative manner in terms of increased suspended sediment in the water column. Due to the proposed N1 ScotWind wind lease area's distance from the Billia Croo test site, cumulative impacts are

not predicted. The proposed SSE cable from Orkney to mainland Scotland is located less than 1 km from the Billia Croo test site and has the potential of elevated suspended sediment during installation phases, which has the potential to act cumulatively with any suspended sediment generated at Billia Croo. However, given the limited nature of any suspended sediment from Billia Croo, it is considered the potential for cumulative impacts is low.

Several aquaculture developments around Orkney raise likelihood of increased sediment in the water column, but due to mitigation and operational procedures in place at fish farms to minimise this, any increase should be negligible. The possibility for cumulative effects with the Billia Croo test site is therefore considered low.

Appraisal conclusion for cumulative impacts on hydrodynamic and physical processes: Any potential impacts are not regarded as important at the scale of the development.

6.2.4.4 Summary

Any potential impacts on hydrodynamic and physical processes are not considered to be important at the scale presented in the Project Envelope. However, some device-specific monitoring by clients may have merit in informing impact assessments at commercial sites.

6.3 Fish and Shellfish

6.3.1 Baseline Description

6.3.1.1 Marine fish

A variety of marine fish will be encountered at Billia Croo, some of which are included in the PMF list and some of which have commercial value. Orkney is located within spawning and nursery areas for a number of fish species, the Billia Croo test site overlaps with areas recognised as having the potential for spawning and nursery. An indication of relevant species is provided in Table 10. The potential impacts identified as important for marine fish were underwater noise from WEC operation; changes to the sedimentary regime, smothering, benthic habitat loss, introduction of MNNS, EMF and habitat creation.

Table 10. Summary of nursery and spawning in the vicinity of the Billia Croo test site (Coull *et al.*, 1998; Ellis *et al.*, 2014)

Species	Spawning	Intensity	Nursery	Intensity
Herring (<i>Clupea harengus</i>)	Y	Undetermined	Y	Low
Lemon sole (<i>Microstomus kitt</i>)	Y	Undetermined	Y	Undetermined
Sandeel (<i>Ammodytes marinus</i>)	Y	Low	Y	Undetermined
Sprat (<i>Sprattus sprattus</i>)	Y	Undetermined	N	-
Angler fish (<i>Lophius piscatorius</i>)	N	-	Y	High
Blue whiting (<i>Micromesistius potassou</i>)	N	-	Y	High
Cod (<i>Gadus morhua</i>)	N	-	Y	Low
Hake (<i>Merluccius angustimanus</i>)	N	-	Y	Low
Mackerel (<i>Scomber scombrus</i>)	N	-	Y	High
Whiting (<i>Merlangius merlangus</i>)	N	-	Y	Low
Spurdog (<i>Squalus Acanthiai</i>)	N	-	Y	Low
Common skate (<i>Dipturus batis</i>)	N	-	Y	Low
Ling (<i>Molva molva</i>)	N	-	Y	Low
Saithe (<i>Pollachius virens</i>)	N	-	Y	Undetermined
Spotted ray (<i>Aetobatus narinari</i>)	N	-	Y	Low
Tope shark (<i>Galeorhinus galeus</i>)	N	-	Y	High

Gadoids

Gadoid species are known for both their commercial and conservation interests. Species such as cod (*Gadus morhua*) and whiting (*Merlangius merlangius*) are known to have an important economic value and several gadoid species are included on the PMF list including cod, ling (*Molva molva*), saithe (*Pollachius virens*) and Norway pout (*Trisopterus esmarkii*). Billia Croo is a known nursery ground for a number of gadoid species including anglerfish (*Lophius piscatorius*), blue whiting (*Micromesistius potassou*), cod, hake (*Merluccius angustimanus*), ling, saithe, lemon sole (*Microstomus kitt*) and whiting. The area does not support spawning for any gadoid species (Coull *et al.*, 1999, Ellis *et al.*, 2012). It is expected that these species will be encountered at Billia Croo, but that the site does not represent a high-density nursery area or spawning area.

Gadoids are classed as having intermediate hearing ability, with some species being sensitive to loud noises. Cod in particular has been identified as having high sensitivity to marine noise and has been identified as using vocalisations for communication (Faber Maunsell, 2007). Given the lack of percussive piling and the intermittent nature of deployments at Billia Croo, it is considered unlikely that any impacts would have an impact on any gadoid species including cod at a population level.

Clupeids

Clupeid species which may be encountered at Billia Croo include herring (*Clupea harrangus*) and sprat (*Sprattus sprattus*). Out-with spawning time, herring are thought to stay away from the immediate coastal area (Barnes, 2008) so may not be seen with great regularity. Both herring and sprat have some commercial value and Billia Croo is recorded as overlapping with the spawning area for both species. Herring is also recorded as a PMF and both species are recognised as having ecological value as a food source for other fish, bird and mammal species.

Clupeid species are considered sensitive to sound, yet the localised nature of underwater noise described as included within the Project Envelope means that no impact because of noisy activities is predicted. Additionally, clupeid species are not known to make vocalisations (Popper, 1993). Substrates from Billia Croo identified were mainly medium to coarse sand and therefore considered potentially suitable for herring spawning.

Sandeels

Sandeels provide an important food source for a variety of bird and fish species, with many bird species feeding chicks exclusively on the species, causing its inclusion on the PMF list. The Billia Croo site overlaps with areas determined to be sandeel nursery and spawning (low intensity) grounds. Therefore, it is possible that the species would be encountered at the site and indeed utilise the site to some extent for nursery and spawning. However, sandeel are known to have a strong preference for sandy substrates (Marine Scotland, 2017). Particle size analysis of substrates from Billia Croo identified they were mainly medium to coarse sand with an estimated < 5% classed as fine sands.

Elasmobranchs

Please note potential impacts on basking sharks are covered separately in Section 6.4.

Elasmobranch species with the potential to be encountered at Billia Croo include common skate (*Dipturus batis complex*), and spurdog (*Squalus acanthias*), both included on the PMF list. Billia Croo overlaps with the nursery grounds of numerous elasmobranch species – spurdog, common skate, spotted ray (*Raja montagui*), tope (*Galeorhinus galeus*) and thornback ray (*Raja clavata*).

Understanding of elasmobranch hearing is limited, but the general understanding is that they have low sensitivity with a narrow range of hearing (Casper, 2010). Elasmobranch species are also not considered to be particularly sensitive to changes in sedimentary and hydrodynamic regime given their mobile and wide-ranging nature. Of all fish species elasmobranchs are potentially the most sensitive to EMF, but the effects are poorly understood (Faber Maunsell, 2007). Certain species of elasmobranch lay eggs in cases on the seabed, changes in sedimentary regime and smothering during installation would be of potential concern to these species. However, Billia Croo is not known to overlap with key spawning habitat of any elasmobranch species.

Other marine fin fish

Other species which may be encountered at Billia Croo and may have ecological or commercial value include anglerfish, Norway pout, whiting, ling, saithe and mackerel, which all occur on the PMF list.

6.3.1.2 Diadromous fish

Atlantic salmon, sea trout and European eel (*Anguilla anguilla*) are all encountered in Orkney waters, these species are all included on the PMF list.

There are few salmon rivers recorded in Orkney and none on the west coast of Orkney near Billia Croo (NMPi, 2018). Given the lack of clarity on the migratory routes and behaviour of Atlantic salmon it is considered possible they could be encountered in the Billia Croo area. Sea trout also have a relatively poorly understood distribution and migratory behaviour; however, they are considered widespread in Scottish waters and are infrequently reported out-with the coastal zone (Tylers-Walters, 2016). They are therefore likely to be encountered at Billia Croo, but not with great frequency.

The European eel has a complex life history that is poorly understood, involving migration of mature adults from European rivers and estuaries to the Sargasso Sea in the west Atlantic for spawning, and the subsequent return of juveniles (Avant, 2007). It is therefore considered the presence of European eels at Billia Croo is possible, but it is not considered they will be encountered with any significant frequency or that Billia Croo is a particularly important site for the species.

The potential impacts identified as important for diadromous fish were underwater noise; EMF and barrier effects.

6.3.1.3 Marine shellfish

The nature of the seabed in the vicinity of Billia Croo is ideal habitat for a number of shellfish species including lobster (*Homarus gammarus*), brown crab (*Cancer pagurus*), velvet crab (*Necora puber*), shrimp (*Nephrops norvegicus*), and possibly the PMF classified European spiny lobster (*Palinurus elephas*). The potential impacts identified as important for marine shellfish were changes to the sedimentary regime, smothering, benthic habitat loss, introduction of MNNS and habitat creation.

Crustaceans

Several commercially important species such as brown crab (*Cancer pagurus*), velvet crab (*Necora puber*) and lobster (*Homarus gammarus*) can be found at Billia Croo, including the European spiny lobster (*Palinurus elephas*) featured on the PMF list. In 2012, a fisheries study was undertaken at Billia Croo which concluded that the site provides suitable feeding and refuge habitat for lobster and has the potential to act as a nursery area to both the local fishery and Orkney as a whole (EMEC, 2012).

Crustacean species likely to be encountered at Billia Croo are considered to have relatively low sensitivity to increases in suspended sediment and smothering (Neal and Wilson, 2008). There is the potential for non-native species to be introduced because of introduction of WECs and other infrastructure to Billia Croo. By following good practice in relation to biosecurity this risk will be kept to a minimum and given the small scale of development is not considered important.

Molluscs

A range of mollusc species is expected at Billia Croo, including PMF species such as heart cockle (*Glossus humanus*) and fan mussel (*Atrina fragilis*). By virtue of their mobility, molluscs are generally considered of low tolerance to suspended sediment and smothering. EMF impacts are poorly understood in molluscs, it is generally considered species are of low sensitivity.

6.3.1.4 Protected sites

Protected sites which feature fish and shellfish as a qualifying feature and occur in the vicinity of Billia Croo are the Thurso SAC and the NW Orkney NCPMA. Atlantic salmon (*salmo salar*) is the primary qualifying feature of the Thurso SAC located approximately 41 km away. The NW Orkney NCPMA is located approximately 10 km from Billia Croo and has sandeel as a protected feature.

6.3.2 Effect Pathways

The potential effect-pathways assessed on the baseline environment include:

- Installation vessel transits and manoeuvring leading to disturbance;
- underwater noise from foundation/mooring installation methods and vessels;
- increased suspended sediment/turbidity;
- smothering because of drill cuttings or resettlement of sediments;
- benthic habitat loss/damage;
- introduction of MNNS; and
- underwater noise from active acoustic equipment.

6.3.3 Appraisal Mechanism

Table 11 presents the relevant legislation and any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features.

Table 11. Appraisal mechanism for fish and shellfish

Feature type	Appraisal mechanism/ relevant legislation	Applicable	Reasoning
Qualifying features of European sites	The Conservation of Habitats and Species Regulations 2017 Conservation (Natural Habitats, &c.) Regulations 1994 (as amended).	Yes	Potential connectivity with Thurso SAC which has Atlantic salmon as a qualifying feature.
European Protected Species	The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended).	No	The only fish species listed as EPS is sturgeon (<i>Acipenser sturio</i>). Billia Croo is outwith the distribution range of this species.

Feature type	Appraisal mechanism/ relevant legislation	Applicable	Reasoning
Notified features of SSSIs	Nature Conservation (Scotland) Act 2004 (as amended).	No	No marine fish are notified features of SSSIs.
Protected features of MPAs	Marine (Scotland) Act 2010.	Yes	Sandeels are a protected feature of the NW Orkney NCMPA.
PMFs	Marine (Scotland) Act 2010.	Yes	Fish PMFs are likely to be present at Billia Croo.
Other sensitive natural heritage features	<ul style="list-style-type: none"> The Wildlife and Countryside Act 1981 The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore) The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 Marine (Scotland) Act 2010 	Yes	Captures assessment of all other sensitive natural heritage features at a population/ habitat scale of concern.

6.3.4 Assessment of Potentially Significant Impacts

6.3.4.1 Appraisal of qualifying features of European sites

Several rivers along the north coast of Scotland are known to be important for Atlantic salmon, this importance has led to the designation of several rivers as SACs including the Thurso SAC, which is located approximately 41.3 km from the Project Envelope. The River Thurso drains a moderately large catchment in Caithness and flows north before entering the Pentland Firth at the town of Thurso. The river supports a higher proportion of multi sea-winter salmon than is found in many rivers further south in the species' range and the river is known to support the full range of salmon life-history types (JNCC, 2017).

Appraisal conclusion for Atlantic salmon as qualifying species of European sites: There will be no LSE on Atlantic salmon as a qualifying feature of any SAC. Therefore, no further assessment under HRA is required.

6.3.4.2 Appraisal of protected features of MPAs

The NW Orkney NCMPA is located approximately 9.8 km from Billia Croo. One of the protected features of the NW Orkney NCMPA is sandeel. The MPA plays an important role in supporting wider populations of sandeel, specifically newly hatched sandeel larvae from this region are exported by currents to sandeel grounds around Shetland and the Moray Firth (JNCC, 2018). Billia Croo is recorded as a nursery and spawning ground for the species. However, this is true of the wider environment in general and the Billia Croo site is not recognised to be any more significant for sandeel than the surrounding area.

Appraisal conclusion for sandeels as a protected feature of an NCMPA: Given the localised nature and small scale of predicted seabed disturbance the potential for significant impacts to sandeel from the NCMPA is unlikely. Therefore, it is concluded there is no significant risk of hindering the achievement of the conservation objectives of the NCMPA and no further assessment is required.

6.3.4.3 Appraisal of cumulative impacts

There are no cumulative impacts predicted as a result of any projects on the benthic or hydrodynamic characteristics at Billia Croo; therefore, it can be considered that there will be no cumulative impacts to fish and shellfish as a result of benthic or hydrodynamic changes. Other cumulative impacts may arise as a result of disturbance and noise as a result of simultaneous installation operations. Although activities at the Billia Croo test site may take place concurring with adjacent projects, any simultaneous activities will only take place over a limited period of time and therefore it is considered that the potential for activities within Billia Croo to act cumulatively with disturbance and noise from other projects is limited.

6.3.4.4 Summary

The appraisal concludes that there is no LSE on salmon as qualifying features of any SAC, so no further consideration under HRA is required. Any potential impacts on diadromous species, gadoid species, clupeid species and elasmobranch species are not regarded as important at a Scottish population level. However, some monitoring and research in the context of the test site could have merit. Potential impacts on any other marine fin-fish are not regarded as important at a population level.

The proximity of the Billia Croo test site to the NW Orkney NCMPA is noted, as sandeel is a qualifying feature. The Billia Croo area is considered a nursery area for sandeel and is also recorded as overlapping with a spawning area, however the sediment at the Billia Croo site is not considered favourable for sandeel spawning. Any potential impacts on sandeels are not regarded as important at a population level, or of a degree that could have any measurable effect on key predators.

The appraisal also considers any potential impacts on shellfish to be unimportant at a population level. And suggests that some monitoring and research in the context of the test facility would have merit, and good practice should be adopted to reduce any risk of introducing MNNS.

6.4 Basking Sharks

6.4.1 Baseline Description

6.4.1.1 Natural heritage context

Basking sharks are known to utilise different regions for life-history events, such as feeding and breeding, at different times of the year (Gore *et al.*, 2008). Oceanic and tidal fronts are targeted by basking sharks as they may provide foraging opportunities for this planktivore¹¹ (Priede and Miller, 2009) and, as a result, lend themselves as sites of social activity, including breeding events (Sims *et al.*, 2000; Speedie *et al.*, 2009). Recent tagging data indicates high inter-individual variability in basking shark movement patterns, with several different broad-scale migratory pathways existing for sharks originating in the northeast Atlantic (Doherty *et al.*, 2017).

Around Orkney, basking sharks form casual visitors along the coastline, maintaining a greater distribution offshore (Evans *et al.*, 2011). Eighteen basking sharks were recorded during the EMEC wildlife observations collected between 2009 and 2015, of which six occurred within the existing lease area. Two-thirds of the animals described in these observations were identified as feeding (EMEC wildlife observation data 2009 - 2015).

The majority of basking sharks recorded near Billia Croo during the 2009 – 2015 wildlife surveys showed the animals as being stationary (e.g. resting) or moving very slowly. Only two individuals were recorded as feeding at the surface in late July 2014 and early August 2015,

a likely indication of feeding on a temporary prey patch during a summer peak in plankton biomass (Sims *et al.*, 2005). Basking sharks may be sensitive to vessel presence and associated activities, including the transiting and manoeuvring of vessels. Due to the limitations of studying basking sharks in captivity, the hearing physiology and auditory abilities of this species are, as yet, uncharacterised.

Basking sharks (*Cetorhinus maximus*) are the largest fish to occur in UK waters. Having been hunted until the mid-1990s, this species is now protected by a suite of national and international legislation. This species is listed in Appendix II of the Berne Convention, Appendix I/II of the Convention on Migratory Species (Bonn Convention), Annex V of the OSPAR Convention, and are protected in the UK by the Wildlife and Countryside Act 1981 (as amended). The last of these pieces of legislation provides protection against harm to this species through defined offences, whilst the Wildlife and Natural Environment (Scotland) Act 2011 provides a mechanism for licensing anticipated offences in Scottish waters. Basking sharks are also listed in several conservation policy documents for their importance as a UK species, including their designation as: a UK Biodiversity Action Plan (UK BAP) Priority species; a Scottish Priority Marine Feature (PMF) (Tyler-Walters *et al.*, 2016); and their inclusion in the Scottish Biodiversity List.

Strictly migratory species reliant on utilisation of specific routes or habitats are especially vulnerable to barrier effects. Whilst basking sharks may be impacted by obstructions in coastal seas from large-scale engineering projects, such as wind or wave energy arrays, evidence of inter-population variability in site fidelity may enable individuals to utilise alternate migration routes and avoid such obstructions.

6.4.1.2 Protected sites

The only site designated for the protection of basking sharks in Scotland is the Sea of Hebrides proposed Marine Protected Area (pMPA) located over 250 km south west of Billia Croo (SNH, 2014).

6.4.2 Effect Pathways

The potential effect-pathways assessed on the baseline environment include:

- Installation vessel(s) presence, transiting and manoeuvring leading to disturbance;
- underwater noise from foundation/mooring installation methods leading to disturbance;
- underwater noise from active acoustic equipment leading to disturbance;
- underwater noise from geophysical/geotechnical surveys leading to disturbance;
- entanglement in mooring lines or cabling;
- entrapment in devices, multiple mooring lines or cabling;
- presence of WEC(s) leading to barrier effects; and
- increased suspended sediment/turbidity leading to disturbance.

6.4.3 Appraisal Mechanism

Table 12 presents the relevant legislation and any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features.

Table 12. Appraisal mechanism for basking shark species and habitat

Feature type	Appraisal mechanism/relevant legislation	Applicable	Reasoning
Qualifying features of European sites	The Conservation of Habitats and Species Regulations 2017 Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)	No	There is no potential connectivity with any SAC or any other European sites.
European Protected Species	The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)	No	Basking sharks are not listed as EPS. However, they are subject to licensing requirements under the Wildlife and Natural Environment (Scotland) Act 2011, which are similar to those for EPS.
Notified features of SSSIs	Nature Conservation (Scotland) Act 2004 (as amended)	No	No SSSIs within the region have basking shark features.
Protected features of MPAs	Marine (Scotland) Act 2010	Yes	Basking sharks are qualifying features of the Sea of Hebrides pMPA.
PMFs	Marine (Scotland) Act 2010	Yes	Basking sharks are PMFs.
Other sensitive natural heritage features	Appraisal of other features under: <ul style="list-style-type: none"> The Wildlife and Countryside Act 1981 The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore) The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 Marine (Scotland) Act 2010 	Yes	Captures assessment of all other sensitive natural heritage features at a population/habitat scale of concern.

6.4.4 Assessment of Potentially Significant Impacts

6.4.4.1 Appraisal of qualifying features of protected sites

Whilst some basking sharks from this site may travel to the Orkney Islands as casual visitors, the predominant movements of basking sharks within the UK appear to be: (1) movement between the shelf waters and deeper slope waters of Hebridean and Irish Seas; and (2) some individual movement between the Celtic Seas and Faroe Islands (Doherty *et al.*, 2017).

Appraisal conclusion for qualifying features of protected sites: It is concluded that there is no connectivity and no impact pathway to negatively impact basking shark features of the Sea of Hebrides pMPA or at any other protected sites with this species listed as a qualifying feature.

6.4.4.2 Appraisal under The Wildlife and Countryside Act 1981

A basking shark licence will be required from the Scottish Government for any activities which will disturb, injure or kill basking sharks. None of the activities which have been identified for further assessment are anticipated to generate instances of mortality or injury to basking sharks. Standard Operating Procedures (SOPs) will limit the number of vessel users and the flow of marine traffic within and to/from the test site area, and effectively mitigate against collision risk to basking sharks. This mitigation effort should also reduce the potential impact of cumulative noise from vessel activity onsite.

Appraisal conclusion for disturbance and/or harassment impacts to basking sharks: EMEC's SOPs will work to minimise the potential to cause a disturbance from vessel presence. However, as a precautionary measure, clients are recommended to apply for a basking shark licence for activities within the Billia Croo test site. Installation activities, particularly drilling noise, has been identified to emit low frequency sounds which have the potential to disturb basking sharks. In such cases, a basking shark licence will be required.

6.4.4.3 Appraisal of other natural heritage features

Given knowledge of basking shark distribution across their wider geographic range (Witt *et al.*, 2012), and the fact that the Billia Croo test site does not appear to form critical foraging habitat for this species (EMEC wildlife observations data 2009 - 2015; Evans *et al.*, 2011), it is considered that any obstruction or restriction to free movement due to the presence of wave devices and other infrastructure in the Project Envelope area is likely to be negligible.

Appraisal conclusion for basking sharks impacts on other natural heritage features:

The appraisal considers the potential for barrier effects on basking sharks to be negligible.

6.4.4.4 Appraisal of cumulative impacts

Basking sharks relevant cumulative impact pathways include other sea users' potential to increase vessel presence or introduce entanglement risks. Relevant impact mechanisms may include recreational or commercial vessels, fishing and aquaculture sites. The region is not targeted by recreational sea users. Some commercial activity such as ferry vessels and vessels used aquaculture sites could introduce cumulative impacts. Neither the test site nor transiting ferry vessels will generate barrier effects, so individuals can avoid any temporary disturbance by utilising the surrounding habitat.

There is potential for entanglement with gillnet fisheries and local fish pens; however, there have been no published reports of basking shark entanglement in fish pens in Orkney. The low density of individuals occurring in the nearshore environment drastically reduce the likelihood of entanglement from either fishing gears, aquaculture or the installation, operation or decommissioning of WECs, and mitigation measures will further reduce the risk of entanglement to basking sharks.

SOPs including implementation of a Vessel Management Plan (VMP) and training shipboard personnel in the Scottish Marine Wildlife Watching Code (SMWWC), will limit the number of vessel users and the flow of marine traffic and enable identification of basking sharks to effectively mitigate against collision risks to this species.

Appraisal conclusion for cumulative impacts on basking sharks: In review of activities undertaken by other sea users, it is considered that cumulative disturbance impacts from commercial or recreational vessel presence in the test site and surrounding waters are minimal and will not be detrimental to the maintenance of the population of the species concerned at Favourable Conservation Status across their natural range. Mitigation measures to monitor the occurrence of basking sharks throughout the test site will help minimise the potential for

entanglement impacts to individual animals from test site activities and their potential overlap with the activities of aquaculture sites nearby.

6.4.4.5 Summary

The appraisal concludes that within the bounds of the Project Envelope description, potential disturbance and barrier impacts will not have any negative implications for the conservation status of basking sharks. None of the activities which have been identified for further assessment are anticipated to generate instances of mortality or injury to basking sharks.

It is considered that any potential disturbance impacts would not have negative implications for the conservation status of the species, nevertheless uncertainties relating to basking shark hearing sensitivities place particular emphasis on the importance of monitoring at the test site.

The appraisal indicates that a licence to disturb basking shark will be required, to address potential disturbance impacts resulting from noise emissions from foundation and mooring installation and vessels. Furthermore, a licence to disturb basking sharks will be required to cover the potential for injury or death from entanglement in mooring systems for any system that requires mooring lines and/or cables in the water column.

Regarding barrier effects, the appraisal considers the potential for any effect on basking shark distribution or movement to be negligible and no significant population-level impacts are predicted from project activities.

There is no connectivity and no impact pathway to negatively impact basking shark features of the Sea of Hebrides pMPA or at any other protected sites with this species listed as a qualifying feature.

No important impacts are predicted as a result of the proposed activities at Billia Croo. Potential disturbance impacts from vessel presence are not anticipated to be detrimental to the maintenance of basking shark populations or their use of this area. Given uncertainties regarding some potential impacts and the opportunity to learn from test deployments, potential mitigation and monitoring measures are presented in Section 9 below. These measures can be seen as appropriate as conditions on a basking shark licence.

6.5 Cetaceans

6.5.1 Baseline Description

6.5.1.1 Natural heritage context

Details on species distribution and abundance in the vicinity of Billia Croo and across the UK Exclusive Economic Zone (EEZ) are provided in Table 13. EMEC wildlife observations collected between 2009 and 2015 show 14 species of cetacean occur within the existing lease areas.

Several cetacean species regularly occurring within the test site are protected in the Scottish territorial seas as Priority Marine Features (PMFs) under a list developed jointly by SNH and the JNCC (Tyler-Walters *et al.*, 2016); these include: harbour porpoise; killer whale (*Orcinus orca*); minke whale (*Balaenoptera acutostrata*); Risso's dolphin (*Grampus griseus*); and white-beaked dolphin (*Lagenorhynchus albirostris*). Additionally, there are UK Biodiversity Action Plans (BAPs) in place to protect cetacean species across the UK, including species found in

the vicinity of Billia Croo, such as: minke whale; Risso's dolphin; white-beaked dolphin; killer whale; white-sided dolphin (*Lagenorhynchus acutus*); and pilot whale (*Globicephala melas*).

Table 13. Demographics of cetaceans most likely to occur in the region comprising Billia Croo (Hammond *et al.*, 2017; IAMMWG, 2015)

Species	Density (animals/km ²)	Abundance	Management Unit	Abundance in UK EEZ
Harbour porpoise	0.152	6,147	227,298	110,433
Risso's dolphin	0.014 ¹⁶	440 ¹³	No data (UK & Irish waters)	No data
Minke whale	0.010	383	23,528 (UK & Irish waters)	12,295
Atlantic white-sided dolphin	0.021 ¹³	1,366 ¹³	69,293 (UK & Irish waters)	46,249
Killer whale	No data	No data	No data (suggested association with Iceland and Faroe Islands)	No data
White-beaked dolphin	0.021	868	15,895 (UK & Irish waters)	11,694
Long-finned pilot whale	No data	No data	No data	No data
Bottlenose dolphin	0.004	151	195	195

All species of cetaceans are listed as species of European Community interest in:

- Appendix II of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES),
- Appendix II of the Bern Convention, and
- Annex IV of the European Commission (EC) Habitats Directive.

Cetacean species are also listed within the Bonn Convention as ratified through the Wildlife and Countryside Act 1981, and therefore requiring strict protection in UK territorial waters. Those species which are listed in Annex IV are termed 'European Protected Species' (EPS). The harbour porpoise (*Phocoena phocoena*) is additionally protected under the terms outlined in the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS). The Nature Conservation (Scotland) Act 2004 extends the protection afforded by the Wildlife and Countryside Act 1981, by making reckless disturbance of marine mammals an offence in Scottish waters.

6.5.1.2 Protected sites

There are three pMPAs and three SACs (NMPi, 2018) with proximity to the Billia Croo area.

NCMPAs in Scottish waters with cetacean features include: the Southern Trench pMPA (straight-line distance: 125 km south-southeast) and Sea of Hebrides pMPA, both proposed for the protection of minke whales (158 km southwest); and the North East Lewis pMPA (254 km southwest), proposed for the protection of Risso's dolphins (SNH, 2014a-c). Scottish SACs with cetacean features include: the Moray Firth SAC (straight-line distance: 95 km south-southwest), designated to protect the inshore bottlenose dolphins of the area; and the Inner Hebrides and the Minches SCI (140 km west-southwest) and the Skerries and Causeway SAC (450 km south-southwest), both designated for the protection of harbour porpoise.

6.5.2 Effect Pathways

The potential effect-pathways assessed on the baseline environment include:

- Underwater noise and presence of installation vessel(s), including transiting and manoeuvring leading to disturbance;
- underwater noise from foundation/mooring installation methods leading to disturbance;
- underwater noise from active acoustic equipment leading to disturbance;
- underwater noise from geophysical/geotechnical surveys leading to disturbance;
- entanglement in mooring lines or cabling;
- entrapment in devices, multiple mooring lines or cabling; and
- increased suspended sediment/turbidity leading to disturbance.

6.5.3 Appraisal Methodology

Table 14 presents the relevant legislation and any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features.

Table 14. Appraisal mechanism for cetacean species and habitats

Feature type	Appraisal mechanism/ relevant legislation	Applicable	Reasoning
Qualifying features of European sites	The Conservation of Habitats and Species Regulations 2017 Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)	Yes	Potential connectivity with SACs with cetacean qualifying features, including: Moray Firth SAC (designated for bottlenose dolphin); the Inner Hebrides and the Minches SCI and the Skerries and Causeway SAC (both designated for harbour porpoise).
European Protected Species	The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)	Yes	All cetacean species are listed as EPS. Harbour porpoise and bottlenose dolphin are additionally listed at the species-level.
Notified features of SSSIs	Nature Conservation (Scotland) Act 2004 (as amended)	No	No SSSIs within the region have cetacean features.
Protected features of MPAs	Marine (Scotland) Act 2010	Yes	Potential connectivity with the Southern Trench pMPA (designated for minke whales).
PMFs	Marine (Scotland) Act 2010	Yes	Cetacean PMFs are known to be present.
Other sensitive natural heritage features	Appraisal of other features under: <ul style="list-style-type: none"> • Wildlife and Countryside Act 1981 • The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 NM from shore) • The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 	Yes	Captures assessment of all other sensitive natural heritage features at a population/habitat scale of concern

Feature type	Appraisal mechanism/ relevant legislation	Applicable	Reasoning
	<ul style="list-style-type: none"> Marine (Scotland) Act 2010 		

6.5.4 Assessment of Potentially Significant Impacts

6.5.4.1 Appraisal of qualifying features of protected sites

Appraisal conclusion for qualifying features of protected sites: Whilst there is some potential for connectivity with the Southern Trench, North East Lewis and Sea of Hebrides pMPAs, this is considered very limited in magnitude and activities at Billia Croo are not anticipated to impact upon the conservation objectives of this site or its cetacean protected features. There is no connectivity with any of the SACs sites with cetacean features. For this reason, there is no likely significant effect to bottlenose dolphin as a qualifying feature of the Moray Firth SAC, nor to harbour porpoise as a qualifying feature of the Inner Hebrides and the Minches SCI or Skerries and Causeway SAC. An Appropriate Assessment (under HRA) is therefore not required.

6.5.4.2 Appraisal of cumulative impacts

Relevant cumulative impact pathways include other sea users' potential to generate noise emissions, which may compound the installation and vessel noise emissions at the test site. Relevant impact mechanisms may include recreational or commercial vessels and construction activities. MOD activities are considered out with the range.

The region is not targeted by recreational sea users. Neither the test site nor transiting ferry vessels will generate barrier effects, so individuals can avoid any temporary noise elevation by utilising the surrounding habitat. For this reason, potential disturbance impacts from temporal overlap between noise-generating activities at the test site and transiting ferry vessels will be highly constrained and are not anticipated to generate cumulative disturbance impacts. Maintenance and operations vessels are expected to generate lower-pressure, high frequency sounds which will attenuate rapidly within the marine environment. Vessels of these sizes are not considered to constitute sources of significant disturbance to marine pinnipeds, therefore not introducing cumulative impacts.

As a worst-case scenario, percussive piling may generate underwater noise which can be heard up to 50 km away in an open water environment (Bailey *et al.*, 2010); however, noise emissions at the harbour works sites or potential forthcoming windfarms will be dampened through repeated refraction off the shallow seabed, and surrounding coastline and nearby islands. Noise emissions generated by piling activities at nearshore and offshore construction sites in the wider area are unlikely to travel to the Billia Croo test site

Appraisal conclusion for cumulative impacts on cetaceans: In review of activities undertaken by other sea users, it is considered that cumulative disturbance impacts from commercial or recreational vessel presence or construction activities near the test site and surrounding waters are minimal and will not be detrimental to the maintenance of the population of the species concerned at Favourable Conservation Status across their natural range. Mitigation measures to monitor the occurrence of cetaceans throughout the test site, particularly during installation and decommissioning activities, will help minimise the potential for disturbance impacts to individual animals from test site activities and their potential overlap with the activities of other sea users.

6.5.4.3 Summary

Within the bounds of the Project Envelope description, the appraisal concludes that the potential disturbance impacts from installation noise will not be detrimental to the maintenance of populations of any cetacean species or their Favourable Conservation Status across their natural range. However, a licence to disturb EPS may be required to address potential injury and disturbance impacts from the installation of foundation structures and moorings for devices.

Any system that utilises mooring lines and/or cables in the water column has the potential to cause injury or death from entanglement in mooring systems. It is considered that the potential impacts from such entanglement risk will not be detrimental to the maintenance of the population of the species concerned at Favourable Conservation Status in their natural range. Nevertheless, review of mitigation measures on a project-specific basis is recommended to increase awareness and response time, should an entanglement event occur.

The appraisal considers the potential for barrier effects on cetaceans to be negligible and not to generate any significant population-level or management unit-scale impacts.

There is no connectivity with any SACs sites with cetacean features in the UK. For this reason, there is no likely significant effect to bottlenose dolphin as a qualifying feature of the Moray Firth SAC, nor to harbour porpoise as a qualifying feature of the Inner Hebrides and the Minches SCI or Skerries and Causeway SAC and further assessment under HRA is not required. Whilst there is some potential for connectivity with the Southern Trench, North East Lewis and Sea of Hebrides pMPAs, this is considered very limited in magnitude and activities at Billia Croo are not anticipated to impact upon the conservation objectives of this site or its cetacean protected features.

The use of active acoustic devices and the potential for entrapment in WECs will require project-specific appraisal and appropriate consultation to determine the need for a licence to disturb EPS and any additional mitigation and/or monitoring. Increased projects could lead to cumulative effects, especially in noise-related disturbances, due to the potential for vessel overlap and mooring/foundation installation. Please refer to the Environmental Appraisal for detailed noise threshold values for cumulative sound exposure to aid in the determination of a licence.

No important impacts are predicted as a result of the proposed activities at Billia Croo. Where the possibility of disturbance to cetaceans remains, EPS licensing needs have been identified. These, along with other recommendations have been captured in the mitigation and monitoring strategies outlined in Section 9 below. However, the conclusion reached in all cases is that such potential disturbance impacts will not be detrimental to the maintenance of any cetacean populations or the Favourable Conservation Status across their natural range.

Project-specific assessments are required for aspects of the following impact pathways and, thus, each client will need to identify any appropriate mitigation and/or monitoring in response to:

- use of active acoustic equipment;
- employment of percussive piling methods; and
- the potential for injury from entrapment in devices.

Overall, injury impacts to cetacean receptors are anticipated to be negligible, particularly with the implementation of the mitigation measures outlined in Section 9. Moreover, the mitigation measures will reduce the likelihood of the occurrence of a disturbance event. However, as the potential to disturb cetaceans is still a possibility for vessel and installation-related activities,

and from WEC operation, an EPS licence for disturbance is recommended for these impact pathways.

6.6 Pinniped

6.6.1 Baseline Description

6.6.1.1 Natural heritage context

Two species of pinniped inhabit UK coastlines, both of which are phocid (i.e. true) seals: the harbour seal (*Phoca vitulina*) and the grey seal (*Halichoerus grypus*) (Pollock *et al.*, 2000). In Scottish waters, harbour seals and grey seals are protected through their inclusion in the following legislation:

- Conservation of Seals Act 1970 as amended through the Seals (Scotland) Order 2002;
- Annex II of the Habitats Directive as adopted through the Conservation of Habitats and Species Regulations 2010;
- the Wildlife and Countryside Act 1981;
- The Conservation (Natural Habitats, &c.) Regulations 1994; and,
- the Marine (Scotland) Act 2010.

Harbour seals are additionally protected as a UK Biodiversity Action Plan (BAP) species and both seal species are protected in the Scottish territorial seas as PMFs under a list developed jointly by SNH and the JNCC (Tyler-Walters *et al.*, 2016).

As species listed in Annex II of the Habitats Directive, both species are considered species of 'Community Interest', who require the designation of Special Areas of Conservation (SACs) for their protection. Additionally, The Protection of Seals (Designation of Haul-Out Sites) (Scotland) Order 2014 designates 194 known seal haul-outs as protected sites, making it an offence to harass, injure or kill a seal at those sites. Beyond these protected sites, the Marine (Scotland) Act 2010 makes it an offence to kill, injure or take a seal at any time except to alleviate suffering under the relevant licence.

Observations data from the Billia Croo test site were dominated by grey seal sightings (68%; n=1378), with only 4% (n=83) of sightings containing harbour seals (EMEC, 2015). Observations peaked in August and September, likely a reflection of increased foraging activity in the nearshore environment prior to the onset of the grey seal pupping season (EMEC, 2015). Demographic information for harbour and grey seals at Billia Croo are described in Table 15.

Table 15. Pinniped demographics in the region comprising Billia Croo (SMRU, 2017; EMEC, 2015; SCOS, 2017)

Species	Density (animals/km ²)	Sightings abundance (EMEC observations data 2009 – 2015)	UK Abundance
Harbour seal (<i>Phoca vitulina</i>)	0.2	86	31,300
Grey seal (<i>Haliochorus gripus</i>)	0.6	1,821	141,000

The distribution of seals observed around Billia Croo varied between species, and evidence of seal density from tagging data and surveys is depicted in Figure 14 below. The density estimates have been extrapolated from tagging data which consists of a series of spatial locations (fixes) for tagged animals, with overlapping fixes increasing the likelihood of estimated habitat use.

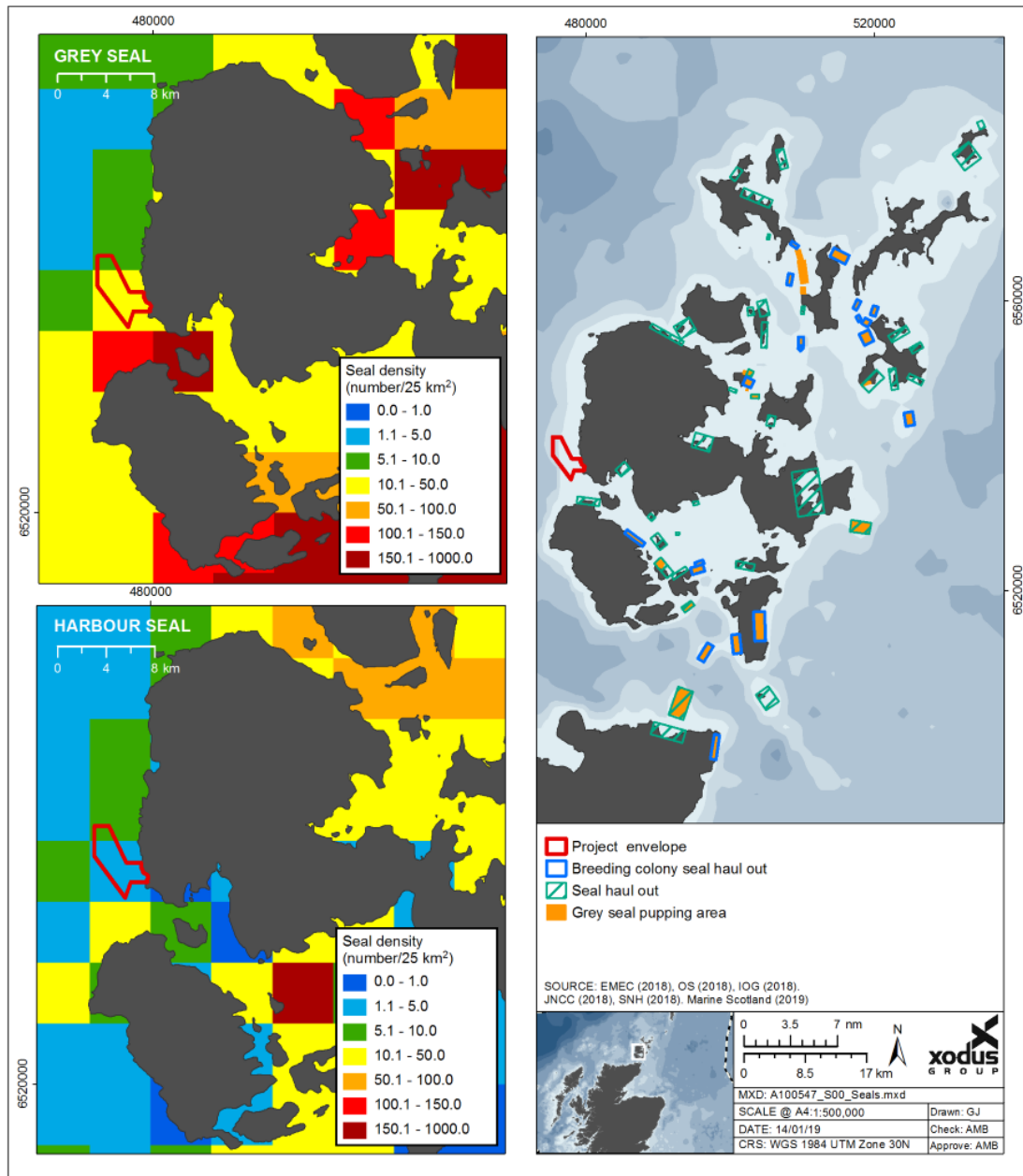


Figure 14. Grey and harbour seal densities and designated haul-outs around the Billia Croo test site

6.6.1.2 Protected sites

A variety of protected sites are designated to protect seals in Scottish and UK waters. These include designated seal haul-outs, SSSIs and SACs. There are 194 designated seal haul-outs and 45 breeding colonies located in Scottish waters, the majority of which occur in the Northern Isles and Outer Hebrides (NMPi, 2018). Some of the more significant haul-outs are also designated as SSSIs, including the following protected sites in Orkney: Eynhallow, Switha, Ward Hill Cliffs, and Muckle and Little Green Holms. All four of these protected sites are located more than 20 km from Billia Croo. There are three SACs with seal features in Scottish waters: the Sanday SAC (49.3 km east-northeast), designated for harbour seals; Faray and Holm of Faray SAC (38.5 km east-northeast), designated for grey seals; and the Dornoch Firth and Morrich More SAC (126.2 km south-southwest), designated for harbour seals.

6.6.2 Effect Pathways

The potential effect-pathways assessed on the baseline environment include:

- underwater noise and presence of installation vessel(s), including transiting and manoeuvring leading to disturbance;
- underwater noise from foundation/mooring installation methods leading to disturbance;
- underwater noise from active acoustic equipment leading to disturbance;
- entanglement in mooring lines or cabling;
- entrapment in devices, multiple mooring lines or cabling; and,
- increased suspended sediment/turbidity leading to disturbance.

6.6.3 Appraisal Mechanism

Table 16 presents the relevant legislation and any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features.

Table 16. Appraisal mechanism for pinniped species and habitats

Feature type	Appraisal mechanism/relevant legislation	Applicable	Reasoning
Qualifying features of European sites	The Conservation of Habitats and Species Regulations 2017 Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)	Yes	Potential connectivity with Special Areas of Conservation (SAC) with seal qualifying features, including: Sanday SAC (designated for harbour seals), Faray and Holm of Faray SAC (designated for grey seals), and the Dornoch Firth and Morrich More SAC (designated for harbour seals).
European Protected Species	The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)	No	Grey and harbour seals are not listed as EPS.
Notified features of SSSIs	Nature Conservation (Scotland) Act 2004 (as amended)	Yes	Potential connectivity with the following SSSIs with pinniped features: East Sanday Coast, Eynhallow, Faray and Holm of Faray, Muckle and Little Green Holms, Switha, and Ward Hill Cliffs.
Protected features of MPAs	Marine (Scotland) Act 2010	No	No connectivity with any NCMPAs with seals as qualifying features. Therefore, not capable of affecting protected pinniped features of any MPAs.
Protected features of Seal Haul-Outs	Marine (Scotland) Act 2010	Yes	Both grey and harbour seals have designated seal haul outs in the region which may have potential connectivity.
PMFs	Marine (Scotland) Act 2010	Yes	Both grey and harbour seals are PMFs.
Other sensitive natural heritage features	Appraisal of other features under: <ul style="list-style-type: none"> • Wildlife and Countryside Act 1981 • The Marine Works (Environmental Impact Assessment) (Scotland) 	Yes	Captures assessment of all other sensitive natural heritage features at a population/habitat scale of concern.

Feature type	Appraisal mechanism/relevant legislation	Applicable	Reasoning
	Regulations 2017 (relevant to projects located 0-12 nm from shore) <ul style="list-style-type: none"> • The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 • Marine (Scotland) Act 2010 • Conservation of Seals Act 1970 as amended through the Seals (Scotland) Order 2002 		

6.6.4 Assessment of Potentially Significant Impacts

6.6.4.1 Appraisal of qualifying features of protected sites

Designated Seal Haul-Outs and SSSIs

There are 61 designated haul-outs located within 100 km of the Billia Croo test site. Those within the 20km are listed in Table 17 below. Those haul-outs within 100 km distance have been selected as appropriate, as 1000 km is the most likely distance from haul-outs in which both seal species are likely to forage. Whilst there is no direct overlap between Billia Croo and any seal haul-outs, there may be connectivity with seals associated with nearby haul-outs who utilise the Billia Croo area for foraging.

Table 17. Designated seal haul-outs located within 100 km of the Billia Croo test site (Marine Scotland, 2018)

Haul-out	Distance and bearing
Northeast Hoy	10.2 km south-southeast
Holm of Houton	10.9 km east-southeast
Cava	13.2 km south-southeast
Damsay & Holm of Grimbister	14.8 km east-northeast
Barrel of Butter	15.3 km east-southeast
Ve Ness	15.5 km east-southeast
North and East Fara	16.1 km south-southeast
Flotta Oil Terminal	19 km south-southeast
Selwick	2.5 km south-southeast
North Flotta and Calf of Flotta	20 km east-southeast

The majority of disturbance responses in seals have been measured on-land and focus on animals reacting to a disturbance by fleeing haul-out sites and moving into the water (Kelly *et al.*, 1987; Andersen *et al.*, 2011). Breeding and pupping seals at terrestrial haul-outs are particularly sensitive to disturbances from close approach by humans or nearby human activities, and they may stampede into the water in response (Marine Scotland, 2014). This can have significant impacts on the health of seal pups, as they can be left without maternal care for an extended period and may be trampled during such a disturbance event.

Special Areas of Conservation (SACs)

There are several SACs with seal qualifying features which have potential connectivity with Billia Croo due to the presence of seals which may have emanated from those sites; they include: Sanday SAC (designated for harbour seals), Faray and Holm of Faray SAC

(designated for grey seals), and the Dornoch Firth and Morrich More SAC (designated for harbour seals). Whilst there is also evidence of grey seal movement to and from Orkney waters which may enable connectivity with SACs beyond Orkney (i.e. North Rona, Isle of May, and Berwickshire and North Northumberland SACs), this connectivity is anticipated to be highly limited and no connectivity with these sites is anticipated during the vulnerable breeding season (SMRU Ltd, 2011). As such, there are not likely to be any LSE to grey seal qualifying features from these more distant European sites, thus they have been excluded from the appraisal below.

Appraisal conclusion for qualifying features of protected sites: The Project Envelope area is not directly overlapping any designated seal haul-outs. This reduces the likelihood of any activities, described within the Project Envelope, committing a seal harassment offence under the Marine (Scotland) Act 2010 to negligible. However, further appraisal of potential injury or mortality of seals is required under Part 6 of the Marine (Scotland) Act 2010 on 'Conservation of Seals.'

Billia Croo is not directly connected with, or necessary to site or conservation management of, any SAC in the UK. However, there is potential connectivity with the Sanday and Faray and Holm of Faray SACs. As such, activities occurring at Billia Croo have the potential to impact the seal qualifying features of these sites, and thus it is necessary to undertake an appraisal against their conservation objectives to identify the potential for LSEs to these sites. This appraisal is provided in greater detail within the EA.

6.6.4.2 Appraisal under Marine (Scotland) Act 2010

The following Section outlines the appraisal undertaken in relation to the Marine (Scotland) Act 2010.

Appraisal conclusion for injury or mortality to grey or harbour seals in Scottish waters: The Billia Croo test site is not directly overlapping with any seal haul-outs, and therefore the potential for committing a harassment offence under Section 117 – 'Protection at Seal Haul-Outs' is considered negligible.

The distance from haul-outs also reduces the likelihood of activities within the Project Envelope generating an injury offence under Part 6 of the Marine (Scotland) Act 2010. Seal injury events resulting from project activities are limited to injuries from mooring installation noise and entanglement. Given the available information on habitat use by both grey and harbour seals, such events are considered unlikely and impacts to the conservation-status of seal populations or fitness of individuals are anticipated to be negligible.

Provided EMEC's Standard Operating Procedures (SOPs), are followed at Billia Croo, including the management of vessel numbers, activities and mooring use throughout the site, there are anticipated to be no harassment offences against seals at designated haul-outs from use of this site.

6.6.4.3 Habitats Regulation Appraisal

The following Section outlines the information necessary for the Competent Authority to undertake an Appropriate Assessment against SACs with seal qualifying features, as prescribed under the Habitats Directive. This includes appraisal of:

- The connectivity to a site, either due to proximity to the site or the importance of the test site as a migratory route for the qualifying features of the site;
- The importance of the test site to the biological functions of the qualifying features of the protected site, for example as foraging or breeding habitat; and

- The potential impact pathways of project activities and the relative sensitivities of the qualifying features against those pathways.

The sites identified as relevant for this appraisal, are the Sanday SAC (49.3 km east-northeast); and Faray and Holm of Faray SAC (38.5 km east-northeast). Given that grey and harbour seals are non-migratory species, the following appraisal will focus on the proximity of the Project Envelope area to these SACs to determine the potential connectivity of project activities to the sites.

Appraisal conclusion for grey and harbour seals as qualifying species of European sites: The Billia Croo test site is not directly connected with, or necessary to site or conservation management of, any SAC in the UK.

The activities within the Project Envelope are not anticipated to generate any mortality or injury events. Disturbance from underwater noise generated by vessels, installation methods and WECs are not anticipated to occur on a scale as to adversely impact the seal qualifying features of the Sanday SAC or Faray and Holm of Faray SAC. Please refer to the Environmental Appraisal for detailed noise threshold values for cumulative sound exposure.

There will be no LSE on grey seals or harbour seals as a qualifying feature of any SAC. For this reason, it is concluded that there will be no adverse effects to either European site or the Natura 2000 network of sites from project activities and further assessment under HRA is not required.

6.6.4.4 Appraisal of cumulative impacts

Relevant cumulative impact pathways include other sea users' potential to generate noise emissions which may compound the installation and vessel noise emissions at the test site. Relevant impact mechanisms may include recreational or commercial vessels and construction activities. MOD activities are considered out with the range. Please refer to the EA for further detail on impact pathways and mechanisms.

Appraisal conclusion for cumulative impacts on grey and harbour seals: In review of activities undertaken by other sea users, it is considered that cumulative disturbance impacts from commercial or recreational vessel presence or construction activities near the test site and surrounding waters are minimal and will not be detrimental to the maintenance of the population of the species concerned at Favourable Conservation Status across their natural range. Mitigation measures to monitor the occurrence of pinnipeds throughout the test site, particularly during installation activities, will help minimise the potential for disturbance impacts to individual animals from test site activities and their potential overlap with the activities of other sea users.

6.6.4.5 Summary

Disturbance impacts to seals may be generated by several noise-emissions sources at Billia Croo, including vessels; active acoustic monitoring equipment; WECs; and the installation of foundations or moorings at the test site.

The activities within the Project Envelope are not anticipated to generate any mortality or injury to seals. Seal injury events resulting from project activities are limited to injuries from mooring installation noise and entanglement. Given the available information on habitat use by both grey and harbour seals, such events are considered unlikely and impacts to the conservation-status of seal populations or fitness of individuals are anticipated to be negligible.



Great-northern diver (Gavia immer)

Small numbers of great-northern diver regularly forage in the test site area during the non-breeding period of the year, with most records within 1.5 km of the coast in waters of <40m depth. The maximum count seen was four birds. Great-northern diver do not breed in the UK. The species are a qualifying interest of the Scapa Flow pSPA and North Orkney pSPA.

Common eider (Somateria mollissima)

Common eiders use the test site year-round, with small numbers occurring during the breeding season. The counts of the test area show fewer than 10 individuals and maximum of 25 individuals. Wintering common eider is a qualifying feature for both Scapa Flow pSPA and North Orkney pSPA.

Long-tailed duck (Clangula hyemalis)

Long-tailed duck are a winter visitor from Artic and sub-Artic breeding grounds, with only 1-8 individuals occasionally seen in the test site area, concluding negligible importance for this species. The records of long-tailed duck are confined to the shallow water areas (approximately <10 m depth) within 1 km of the coast. The species are a qualifying feature of Scapa Flow pSPA and North Orkney pSPA.

Eurasian wigeon (Mareca Penelope)

Very small numbers (1 to 9 individuals) have been occasionally seen within 300 m of the coast in winter months, with seven records only spread over eight years of survey. Several thousand wigeon inhabit Orkney over winter.

Northern fulmar (Fulmarus glacialis)

Northern fulmar is the most abundant species recorded in the test site, with a peak count of 5,000 individuals. The species use the test site for foraging, resting, and common transit. Breeding northern fulmar is a qualifying interest for several SPAs in Scotland, with particular importance being Hoy SPA.

Manx shearwater (Puffinus puffinus)

Manx shearwater occur occasionally in the test site, with a common count of <10 individuals, and a maximum count of 19 individuals. Manx shearwaters are mainly surface feeders, but they will also surface dive to depths of up to 50 m to catch prey at depth (Shoji *et al.*, 2015). The closest colonies are in western Scotland, most notably the large colonies on Rum and St Kilda, both approximately 300 km to the south-west of Billia Croo. Both these colonies are SPAs where this species is a qualifying feature.

European storm petrel (Hydrobates pelagicus)

Very small numbers were occasionally recorded, with the peak count seen as two individuals. The closest SPAs where European storm petrel is a qualifying species at Sule Skerry and Sule Stack SPA (approximately 59 km west of Billia Croo) and Auskerry SPA (approximately 60 km by sea east of Billia Croo).

European shag (Phalacrocorax aristotelis)

European shag was the second most abundant species recorded in the surveys, with counts of up to several hundred individuals, and exceptionally over 1,000 individuals, occur many times a year, but typically the numbers are well below 100 individuals. European shags



primarily use the site for foraging (shags roost on land). European shags typically feed on benthic/demersal fish prey and normally choose areas where the depth to the seabed is generally less than 40 m (Wanless *et al.*, 1997). Breeding European shag is a qualifying species for Sule Skerry and Sule Stack SPA (approximately 59 km west of Billia Croo). Overwintering European shags are a qualifying species for Scapa Flow pSPA and North Orkney pSPA.

Northern gannet (Morus bassanus)

Northern gannets occur at the test site in low to moderate numbers through the summer and autumn, with typically <10 individuals present, but occasionally as many as 100 individuals are present and exceptionally over 300. Northern gannets primarily use the site for foraging, searching in flight for pelagic fish prey which is caught by plunge diving from height. The closest colonies to Billia Croo are relatively small colonies in Westray and Sule Stack.

Black-legged kittiwake (Rissa tridactyla)

Black-legged kittiwake occurs at the test site in low to moderate numbers through summer and autumn, with typically <10 individuals present, but with occasional feeding groups of as many as 150 individuals present and exceptionally up to 300. Kittiwakes primarily use the site for foraging, searching in flight for fish prey which is generally caught by dip-feeding or plunge diving. Kittiwakes are a qualifying interest for several SPAs in Orkney, closest of which is the Marwick Head SPA and Hoy SPA.

Common gull (Larus canus)

Common gull occur in the test site at around <10 birds outside the breeding season; very occasionally there are flocks of up to 300 present. Almost all records were estimated to be within 750 m of the coast. Like other gulls, common gull is a surface feeder and searches for food on the wing. Common gull is not a qualifying species for any of the SPAs in northern Scotland.

Herring gull (Larus argentatus)

Herring gulls were commonly seen in the Billia Croo area throughout the year, typically <10 birds were present, very occasionally flocks totalling up to approximately 100 were present and on one occasion a flock totalling 175. Herring gulls feed from the sea surface, searching for food on the wing; they also feed along the coast and inland. Herring gull is not a qualifying species for any of the SPAs in Orkney.

Great black-backed gull (Larus marinus)

Great black-backed gull were commonly seen in the test site, typically <5 birds were present, occasionally flocks totalling up to approximately 40 were present and on two occasions a flock of approximately 90 individuals was seen. Great black-backed gulls are a surface feeding species and search for food on the wing; they also feed along the coast. Breeding great black-backed gull is a qualifying species at three SPAs in Orkney including Hoy SPA.

Arctic tern (Sterna paradisaea)

The arctic tern occurs in low to moderate numbers through the summer months, with typically <10 individuals present, but occasionally as many as 100 individuals are present and exceptionally up to approximately 500. Arctic tern use the site for foraging (this species prefers to rest on land), searching in flight for small fish prey, such as sandeels, which are caught by dip-feeding or plunge diving. Arctic tern is a qualifying species at five SPAs in Orkney including Rousay SPA.

Great skua (Stercorarius skua)

The great skua occurs in low to moderate numbers through the summer months, with typically <5 individuals present, but occasionally as many as 25 individuals present and exceptionally

a flock of 50. Great skuas use the site for foraging and resting. The only SPA in Orkney where breeding great skua is a qualifying species is Hoy SPA.

Arctic skua (*Stercorarius parasiticus*)

The arctic skua occurs in very low numbers through the summer months, with typically <3 individuals present, but occasionally as many as 10 individuals present and exceptionally a flock of 15. Arctic skuas use the site for foraging and resting. Arctic skua is a qualifying species at four SPAs in Orkney including Hoy SPA and Rousay SPA.

Common guillemot (*Uria aalge*)

Common guillemot was the third most abundant species recorded in the surveys, with extremely variable numbers between breeding and non-breeding seasons. Breeding seasons counted typically <25 individuals, but up to 100 individuals were recorded on many occasions and exceptionally 380 individuals. Common guillemots use the test site for foraging and resting, and typically feed on fish prey such as sandeels in water depths of up to around 60m. Breeding common guillemots is a qualifying species at five SPAs in Orkney, of which the Hoy SPA and Marwick Head SPA are closest.

Razorbill (*Alca torda*)

Razorbills commonly occur in low numbers in the test site and its immediate vicinity during the breeding season months (April to August) with counts of typically <5 individuals but up to 20 recorded occasionally, and 40 exceptionally. Razorbills use the test site for foraging and resting. Razorbills typically feed on fish prey such as sandeels, which are caught by pursuit diving to depths of up to around 30m. The only SPA in Orkney where breeding razorbill is a qualifying species is West Westray SPA (approximately 39 km north-east of the site).

Atlantic puffin (*Fratercula arctica*)

Atlantic puffins commonly occur in low numbers in the test site and its immediate vicinity during the breeding season months (April to August) with counts of typically <5 individuals, but occasionally up to 30 are recorded, and exceptionally 60 individuals. Atlantic puffins use the test site for foraging and resting. Atlantic puffins typically feed on small fish prey such as sand eels, which are caught by pursuit diving to depths of up to around 20m. Breeding Atlantic puffin is a qualifying species at four SPAs in Orkney, north Sutherland and Caithness, by far the closest of these is Hoy SPA (approximately 6 km south of Billia Croo).

Black guillemot (*Cephus grille*)

Black guillemots (also known as tysties) are very commonly present in low numbers in the test site during the breeding season months (April to August), with typical counts of <10 individuals, but occasionally approximately 20 individuals, and exceptionally 29 individuals were present. Black guillemots use the test site for foraging and resting. Black guillemots feed on benthic and demersal fish prey such as butterfish, which are caught by diving to the seabed. Black guillemot is not a qualifying species for any SPA, however this species is a feature of interest for Papa Westray MPA which is located approximately 53 km north-east of the project.

Little auk (*Alle alle*)

Small numbers of little auk are occasionally present in the test site most winters (late October to March) with small counts of just one or two individuals, and the largest count being eight. Little auk is not a qualifying interest for any SPA or MPA.

6.7.2 Effect Pathways

The potential effect-pathways assessed on the baseline environment include:

- installation vessel(s) presence, transiting and manoeuvring;

- high intensity work lights on project vessels to facilitate night work leading to disorientation and collision;
- seabed habitat loss, change and creation of artificial reef; and,
- accidental release of contaminants.

6.7.3 Appraisal Mechanism

Table 18 presents the relevant legislation and any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features.

Table 18. Appraisal mechanism for ornithology species and habitats

Feature type	Appraisal mechanism/relevant legislation	Applicable	Reasoning
Qualifying interests of European sites	The Conservation of Habitats and Species Regulations 2017 Habitats Regulations Appraisal (HRA) Habitats Regulations 1994 (as amended).	Yes	Various qualifying species from a variety of SPAs may have connectivity with the site.
European Protected Species	EPS legislation - Habitats Regulations 1994 (as amended in Scotland).	No	No bird species are listed as EPS.
Notified features of SSSIs	SSSI legislation - Nature Conservation (Scotland) Act 2004.	Yes	Captures assessment of SSSIs with birds as notified features.
Protected features of MPAs	Marine (Scotland) Act 2010	No	No connectivity with any MPAs with protected bird features.
PMFs	Marine (Scotland) Act 2010	No	No bird species are listed as PMFs.
Other sensitive natural heritage features	Appraisal of other features under: Electricity Works (EIA) (Scotland) Regulations (Amendment) 2008; Marine Works (EIA) (amendment) Regulations 2011; Marine (Scotland) Act 2010.	Yes	Captures assessment of all other sensitive natural heritage features at a population/habitat scale of concern.

6.7.4 Assessment of Potentially Significant Impacts

6.7.4.1 Habitat Regulations Appraisal of qualifying bird interests of European sites

An HRA screening exercise was undertaken in relation to the bird SPA qualifying interests. The process was designed to identify those SPAs considered to have connectivity and for which a Likely Significant Effect (LSE) is considered possible. Metrics on mean foraging range, mean of the maximum foraging range (MMFR) and maximum foraging range (review by Thaxter *et al.*, 2012) are used to categorise the potential strength of connectivity between a SPA breeding site and the Billia Croo test site for qualifying species. Further information on the determination of connectivity is provided within the Environmental Appraisal. Based on the method applied, it is assumed that there is potential for up to high connectivity for qualifying species of the Scapa Flow pSPA which at closest is only 2 km from the test site, and potential for low connectivity for qualifying species of the North Orkney pSPA which at closest lies 28 km (sea route) from the Billia Croo test site.

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Environmental Appraisal for details of the Natura Appraisal undertaken.

For all qualifying species, other than ██████████ it is determined that there is no potential for the SPA conservation objectives to be undermined. This conclusion is reached on the basis that all, except one of these species, are rated as having either very low and low vulnerability to wave energy development activities.

The one exception noted above is great northern diver, a species which is rated as having moderate vulnerability to wave energy developments (Furness *et al.*, 2012). For great northern diver (non-breeding), there is potential for connectivity if birds that form part of the wintering population within Scapa Flow pSPA also make use of adjacent waters, such that impacts on these birds could ultimately impact the population using the SPA. However, surveys completed by the JNCC found low densities of great northern divers in the vicinity of Billia Croo, contiguous with the higher densities observed within Scapa Flow. While great northern divers are noted as making relatively short distance swimming movements within wintering locations, we have no information on specific movements within and in vicinity of Scapa Flow. Given absence of site-specific or more general behavioural evidence of connectivity between Billia Croo and Scapa Flow pSPA for (non-breeding) great northern diver, and the very low numbers at Billia Croo relative to the pSPA population, it was concluded no LSE for this feature.

6.7.4.2 Appraisal of notified ornithology features of SSSI

SSSIs are designated under the Nature Conservation (Scotland) Act 2004 (as amended) and it is an offence for any person to intentionally or recklessly damage the protected natural features of an SSSI. The 14 km coastline from Point of Ness near Stromness to Skail Bay and adjacent to the test site area is designated as the Stromness Heaths and Coasts SSSI. However, no notified ornithology features are associated with this SSSI. The landward extents of the breeding seabird SPAs are also designated as SSSIs, with breeding seabirds as notified features. The closest of these to the test site are Hoy SSSI and Marwick Head SSSI. The conclusions regarding the potential for the test site to affect the integrity of these SPAs equally applies to the notified ornithology features of the SSSI designations.

6.7.4.3 Appraisal of other features

Bird species that commonly use the Billia Croo test site in at least moderate numbers and that are either not qualifying interests or features of the above mentioned SPAs or SSSIs, respectively, or also have substantial regional (Orkney) populations outside of these sites that are relevant for appraisal of potential impacts from the project are black guillemot and European shag.

European shag (breeding)

Parts of Billia Croo and its immediate vicinity has high importance for the regional (Orkney) population of shags in the breeding season. European shags' preference for feeding on the seabed in relatively shallow water (<30 m deep) means that the immediate vicinity of the five offshore berths (Berths 1 to 5) is likely to be have low importance as foraging habitat for this species compared to the shallower parts of the test site closer to the coast and including the vicinity of the two inner test berths (Berths 6 and 7). The project would potentially expose European shag to vessel disturbance, localised changes to seabed foraging habitat and the accidental contamination; however, European shag is rated as having low vulnerability to effects of wave energy devices, other infrastructure and associated vessel activity and the risks of accidental contamination are low due to the project's embedded mitigation.

Appraisal conclusion for European shag (breeding): Any potential impacts are not regarded as important at an Orkney regional level. **Black guillemot**

Black guillemots' preference for feeding on the seabed in relatively shallow water (<40 m deep) means that the immediate vicinity of five offshore berths (Berths 1 to 5) is likely to have low importance as foraging habitat for this species compared to the shallower parts of the test site closer to the coast and including the vicinity of the two inner device berths (Berths 6 and 7). The project would potentially expose black guillemot to vessel disturbance, localised changes to seabed foraging habitat and the accidental contamination; however, black guillemot is rated as having low vulnerability to wave energy devices and associated vessel activity and the risks of accidental contamination are low due to the project's embedded mitigation. Black guillemot is the sole biodiversity feature of interest for Papa Westray MPA. This MPA is located approximately 53 km north-east of the test site. However, it is unlikely that there is more than negligible connectivity between this site and the test site as black guillemots travel up to only a few kilometres from colonies to forage.

Appraisal conclusion for black guillemots: Any potential impacts are not regarded as important at an Orkney regional level.

6.7.4.4 Appraisal of Cumulative Impacts

With the exception of the breeding red-throated species, it is concluded that the Billia Croo test site activities would have either no or negligible cumulative impacts on seabird species. Developments or activities that involve operating vessels within the Scapa Flow pSPA will potentially contribute to a cumulative disturbance effect on the breeding [REDACTED] qualifying interests of Scapa Flow pSPA and Hoy SPA.

6.7.4.5 Summary

Although the test site and its immediate vicinity are used by a wide variety of birds, in an Orkney-wide context the site generally has low or very low importance for these species, mainly as a foraging site. Exceptions are European shag, black-legged kittiwake and northern fulmar, all of which the site is considered to have low to moderate importance. HRA screening in the appraisal shows that many of the birds using the site are likely to be from SPA breeding populations, in particular Hoy SPA and Marwick Head SPA, for example black-legged kittiwake, guillemot, great skua and [REDACTED]

The appraisal identifies the potential for disturbance from project vessels and displacement from fixed marine infrastructure as the most important potential impacts on birds, though for most species any effects would be highly localised. Accidental release of contaminants and disturbance by lighting are also identified as potential issues for birds but project mitigation measures mean that neither of these are likely to materially impact on bird receptors. Surface-piercing infrastructure and their wakes are likely to attract some bird species (e.g. gulls, terns, black guillemot and European shag) through providing perches for roosting and enhanced feeding opportunities; such attraction could lead to localised and small beneficial effects to these species. Particular attention is drawn to the potential for the project vessel activity to cause disturbance to breeding [REDACTED] oraging in the test site and its immediate vicinity. There is some uncertainty concerning this species' response to vessel activity during the breeding season and whether the breeding sites of individuals using the test site are within Hoy SPA; monitoring to address these knowledge gaps is suggested.

6.8 Otters

6.8.1 Baseline Description

6.8.1.1 Natural heritage context

European otters have the widest geographical range of any otter species and constitute the only native otter in the UK. Following historic population lows from decades of population loss, otter populations have shown strong recovery of population estimates in recent years (SNH, 2015; Strachan, 2007). Population trend data indicates a population increase with projections of long-term stability of this species and maintenance of its 'favourable' conservation status, pending continued conservation of its natural habitats (SNH, 2015; JNCC, 2007). Threats to otters include but are not limited to pesticide use; hunting; pollution; static gear fishing; drainage management, modification of hydrographic function, inland water courses, and water levels; and infilling of freshwater sources, such as ponds, pools, marshes or potential freshwater sources, such as pits, dykes, and ditches (JNCC, 2007).

The Orkney Islands constitute important habitat to UK otters, though the distribution of this species varies across the islands (DECC, 2016). The uninhabited island of Switha and the area comprising Northwall have been identified as coastal areas which regularly support otters (Orkney Islands Council, 2019); which are also SSSIs, are more than 20 km and 60 km from Billia Croo, respectively. EMEC wildlife observations collected between 2009 and 2015 only include two otter recordings within the marine environment, indicating that the coastline near Billia Croo does not constitute important habitat to this species. This conclusion was additionally supported by a dedicated otter survey which determined the Billia Croo area was not regularly used by otters, though evidence of occasional use was collected (Booth, 2010).

European otters (*Lutra lutra*) are listed as species of European Community interest in Appendix I of Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Appendix II of the Bern Convention, and in Annex II and IV of the European Commission (EC) Habitats Directive, as ratified through the Wildlife and Countryside Act 1981 (as amended), and therefore requiring strict protection in UK territorial waters. Those species which are listed in Annex IV of the Habitats Directive are termed EPS. European otters are additionally protected within the UK through their inclusion as a priority species in the Biodiversity Action Plan (BAP) 1995 and as Scottish Priority Marine Features (PMFs) (Tyler-Walters et al., 2016).

6.8.1.2 Protected sites

There are several sites with otter features located in Orkney, including the Loch of Isbister SAC (straight-line distance: 11.8 km north-northeast), Switha SSSI (23.5 km southeast), and Northwall SSSI (60 km northeast). Otters form a qualifying feature, but not primary feature of the Loch of Isbister SAC, which offers freshwater habitat for this species. The Switha and Northwall SSSIs protect coastal otters in Orkney, which occur with less regularity than in Shetland (Kruuk *et al.*, 1989). However, unlike the Loch of Isbister SAC, these sites are located on separate islands from the Orkney Mainland, with vast marine waterways to traverse. Given relevant knowledge of habitat use by coastal otters being particularly spatially constrained (SNH, 2015; Carrs, 1995), it is unlikely that the otter features at either the Switha or Northwall SSSI would travel to the Billia Croo area, and as such the otter features protected at these sites are considered beyond the range of connectivity with Billia Croo.

6.8.2 Effect Pathways

The potential effect-pathways assessed on the baseline environment include:

- installation vessel(s) presence, transiting and manoeuvring leading to disturbance;
- underwater noise from foundation/mooring installation methods and vessels leading to disturbance;
- underwater noise from active acoustic equipment leading to disturbance; and,
- habitat loss/damage.

6.8.3 Appraisal Mechanism

Table 19 presents the relevant legislation and any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features.

Table 19. Appraisal mechanism for otter species and habitats

Feature type	Appraisal mechanism/relevant legislation	Applicable	Reasoning
Qualifying features of European sites	The Conservation of Habitats and Species Regulations 2017 Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)	Yes	Connectivity with the Loch of Isbister SAC is considered in Section 11.4
European Protected Species	The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)	Yes	Otters are listed as EPS.
Notified features of SSSIs	Nature Conservation (Scotland) Act 2004 (as amended)	No	SSSIs with otter features in Orkney are located on other islands beyond mainland Orkney and therefore considered beyond the range for connectivity with Billia Croo.
Protected features of MPAs	Marine (Scotland) Act 2010 Marine and Coastal Access Act 2009 (if relevant)	No	Not capable of affecting protected otter features of any MPAs.
PMFs	Marine (Scotland) Act 2010	Yes	Otters are PMFs.
Other sensitive natural heritage features	Appraisal of other features under: <ul style="list-style-type: none"> • The Wildlife and Countryside Act 1981 • The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore) • The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 • Marine (Scotland) Act 2010 	No	There are no other identified sensitive natural heritage features at a population/habitat scale of concern.

6.8.4 Assessment of Potentially Significant Impacts

6.8.4.1 Qualifying features of protected sites

Whilst many SACs have been designated for the protection of otters in the UK, the vast majority of these sites encompass terrestrial or freshwater habitats. The only SAC designated for the protection of otters in Orkney is the Loch of Isbister SAC, located approximately 11.8

km NNE from the Billia Croo test site (JNCC, 2018). The Loch of Isbister SAC protects a shallow eutrophic lake which supports a variety of native flora. Otters constitute a qualifying feature of this site, but not a primary reason for its selection (JNCC, 2015a).

Appraisal conclusion for qualifying features of protected sites: It is concluded that there is no connectivity and no impact pathway to generate LSEs to the otter qualifying features at the Loch of Isbister SAC or any other European sites.

6.8.4.2 Appraisal of EPS

Articles 12 and 16 of the Habitats Directive outline the protective measures required under this international policy. EPS in the UK are defined as those species listed on Annex IV of the Habitats Directive whose natural range includes any area within the UK and UKCS.

Appraisal Conclusion for disturbance impacts to otters as EPS: Within the bounds of the Project Envelope, it is considered that disturbance impacts from maintenance and installation vessel presence are unlikely and will not be detrimental to the maintenance of otter populations or the Favourable Conservation Status (FCS) of this species across its natural range.

6.8.4.3 Appraisal of Cumulative Impacts

Relevant cumulative impact pathways include other sea users which have the potential to interact with otters in the nearshore marine environment, such as recreational vessels, as well as transiting vessels passing nearby. The potential for vessel-related disturbance to otters are considered unlikely, because the nearshore region of Billia Croo does not constitute key habitat to the species.

Appraisal Conclusion for cumulative impacts to otters: In review of activities undertaken by other sea users, it is considered that cumulative disturbance impacts from commercial or recreational vessel presence in the test site and surrounding waters is unlikely and will not be detrimental to the maintenance of otter populations or the FCS of this species across its natural range.

6.8.4.4 Summary

The European otter is an EPS which occurs relatively infrequently at Billia Croo. Potential disturbance impacts from project activities are limited to those from vessel presence. Isbister Loch SAC is located approximately 12 km from Billia Croo, and it is considered that there is no connectivity with this site. The installation or maintenance of cabling will require a project-specific appraisal and appropriate consultation to determine the need for a licence to disturb EPS. Disturbance, injury or death is considered unlikely from vessel usage and therefore a licence to disturb EPS is not considered necessary for offshore activities.

No important impacts are predicted as a result of the Project Envelope. Potential disturbance impacts from vessel presence are considered unlikely and will not be detrimental to the maintenance of any otter populations or the FCS of this species across its natural range.

Recommendations to ensure that this impact pathway remains negligible have been captured in the mitigation and monitoring strategies outlined in Section 9.

6.9 Commercial Fisheries

6.9.1 Baseline Description

The Billia Croo test site is clearly marked by cardinal buoys, recorded as a chartered area, and marked in accordance with IMO and IALA standards. The offshore lease area, within the cardinal buoys is not an exclusion zone, but is an area to be avoided by vessels not actively involved in works onsite. Chart 2249 states that “*Mariners should avoid passing within the test area marked by cardinal buoys. Experimental devices usually marked by yellow buoys and lights with daymarks, are temporarily established in the area. Devices marked by buoys may also be deployed between this area and the coast.*” All significant work undertaken is and will be displayed by Notices to Mariners. Given the established nature of the site, local commercial fisheries interests are well aware of the existence of the site and have adapted practices accordingly.

The sea area adjacent to Billia Croo is mainly used by trawlers passing through on the way to their preferred fishing grounds that tend to be further north and west of the test site, although in bad weather there maybe trawling closer inshore (Carl Bro, 2002). Fishing along the west coast of the Orkney mainland takes place in water depths of approximately 58 m (Carl Bro, 2002). Inshore fishing takes place in the vicinity of Billia Croo targeting lobster, edible crab, green crab and velvet crabs. These species are fished in water depths of approximately 33 - 38 m all year round depending on the weather (Carl Bro, 2002; EMEC, 2009). Inshore fishing vessels also utilise a passage through the inshore area of the test site to more productive fishing grounds further north.

Billia Croo is located within International Council for the Exploration of the Seas (ICES) rectangle 46E6. From the years 2013 to 2017, over 30 species were recorded in the landings data for this rectangle from vessels under 10 m (see Figure 15). Brown crab is the dominant species in terms of landings value for vessels under and over 10 m in length in the years 2013 to 2017, shellfish dominate landings with other key species including lobster and velvet crab.

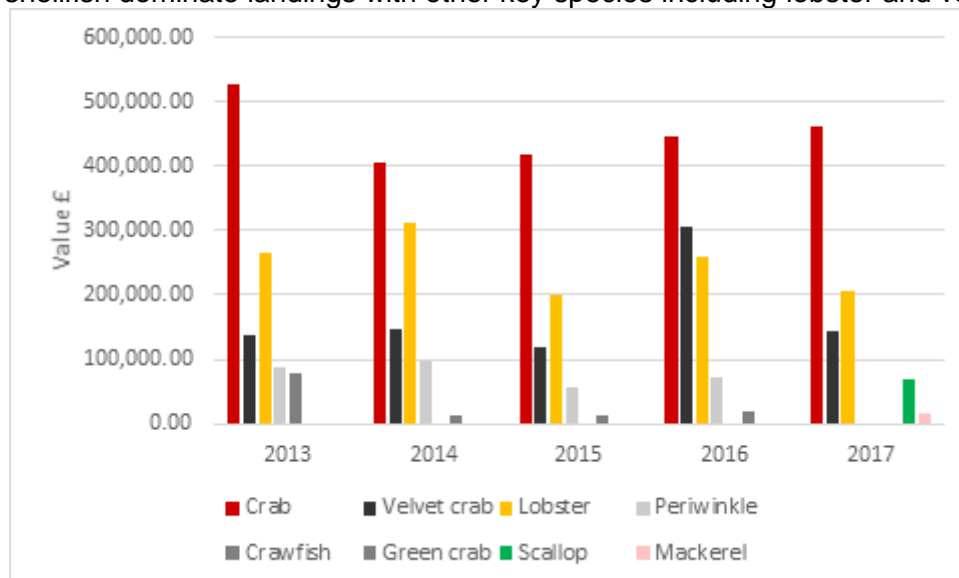


Figure 15. Top species by value landed by vessels under 10 m in ICES rectangle 46E6 (Scottish Government, 2018c)

Fishing effort is consistent throughout the year, with a slight increase during summer months, fishing effort is lowest in January. There are several aquaculture sites in Orkney waters, however none occur in the vicinity of the Billia Croo test site. The closest sites are a shellfish

site located approximately 7 km away and a fin fish site at Bring Head located approximately 9 km south.

Studies recording fishing vessel tracks from 2017 to 2018 for the Billia Croo NRA showed Stromness is an active fishing harbour, and a significant number of transits are recorded passing through Hoy Mouth and on to the east or west of the Billia Croo test site. An offshore route of vessels passing to the west of Orkney mainland passes clear of the Billia Croo test site boundary. Some fishing vessel tracks can however be seen transiting the north-east corner of the lease extension area. A proximity analysis reported that a significant number of fishing vessels pass within 2 nm of the test site boundary (Marine and Risk Consultants, 2019).

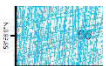


Figure 16. Fishing vessel transits in the vicinity of Billia Croo (Marine and Risk Consultants, 2019)

Numerous restrictions are applicable to Billia Croo, including:

- Council Regulation (EC) No 850/98 and Commission Regulation (EC) 494_2002, a restriction on fishing for sandeel using towed gear with mesh of less than 32 mm;
- Inshore Fishing (Prohibition of Fishing for Cockles) (Scotland) (No. 3) Order 2006, all inshore Scottish waters are subject to a restriction for cockle harvesting;
- Specified Crustaceans (Prohibition on Landing, Sale and Carriage) (Scotland) Order 2017, applying landing controls for Scottish crab and lobster fisheries;
- Common Fisheries Policy, fishing by non-UK vessels between 6 and 12 nm is restricted to countries with historic rights relating to specific fisheries; and,
- Orkney Fish Producers' Organisation.

Please note, a 2018 SNH study considering additional management of bottom contacting mobile fishing gears, particularly in PMF areas, could lead to increased management for fisheries.

Mobile and static gear fisheries

The most utilised gear type in ICES rectangle 46E6 was recorded as pots in the years from 2013 to 2017, correlating with the most valuable species in the area, crab (Scottish Government, 2018c). Otter trawls and dredges are also utilised but to a much lesser extent, and hand lines and hand fishing make a contribution to the under 10 m vessel types. However, it is considered the use of mobile gear at Billia Croo is negligible. Other gear types are utilised in ICES rectangle 46E6 but at very low level of effort. The number of vessels utilising creels in the inshore area of the test site is 10 – 15, further offshore this varies from 5 - 10 to 3 – 10 in the furthest offshore area of the test site area. Most of brown crab in Scotland is landed from June to December and velvet crabs between July and November.

Of potential importance to all fishing vessels is the increased transit time to other fishing areas which will occur as a result of the extension to the test site area to the north. Table 20 details the transit distances using various routes on a journey from Stromness harbour to a site 5 nm north of the test site. The increase in distance between the current offshore route and the modified route to take account of the site extension, is considered minimal at 0.21 nm.

Table 20. Transit times from Stromness to 5nm north of Billia Croo (Marine and Risk Consultants, 2019)

Transit route	Distance in nm
Inshore route to the east of the test site	9.7
Current offshore route to the west and north of the test site	11.2
Modified offshore route (to account for the proposed extension area) to the west and north of the test site	11.41

6.9.2 Appraisal Mechanism

Table 21 presents the relevant legislation and any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features.

Table 21. Appraisal mechanism for commercial fisheries

Feature type	Appraisal mechanism	Applicable	Reasoning
Aquaculture	Presence of active aquaculture sites in the vicinity of the Billia Croo test site.	No	It is not considered that any aquaculture developments will be impacted as a result of any activities within the Project Envelope, therefore no further assessment is deemed necessary.
Static gear fish	Presence of active static fishing in the area and/or use of the area to transit to other fishing grounds.	Yes	Billia Croo inshore area is known to be utilised for static gear fisheries and for transiting of vessels to other fishing grounds further north. The inshore area is also used for storage of static gear (moved offshore in periods of bad weather to avoid damage from rocks).
Mobile gear fisheries	Presence of active mobile fishing in the area and/or use of the area to transit to other fishing grounds.	No	Billia Croo area is known to be used to a certain extent for mobile fisheries but is also known as an area of transit for mobile fishing gear vessels to fishing grounds further north.

6.9.3 Assessment of Potentially Significant Impacts

6.9.3.1 Mobile and static gear fisheries

The site is considered to represent a relatively small area of suitable creeling areas in the wider environment and therefore if fishermen choose to avoid the site it is not considered to

represent a significant impact. The test site is not recorded as an exclusion zone, however consultation undertaken with OFA as part of the NRA (Marine and Risk Consultants, 2019) highlighted that due to the presence of cables, devices, mooring systems and hazards as a result of decommissioned infrastructure, fishermen tend to avoid the site to avoid damage to vessels and gear.

To conclude, the Billia Croo test site is not considered to be an important fishing area for static or mobile gears. The inshore area is known to be utilised for storage of static gear and the test site is also on a transit route for static and mobile gear vessels transiting to fishing areas further north. The potential impacts which were considered of importance were exclusion from fishing grounds, snagging of gear and increased transit times as a result of the extension area.

Appraisal conclusion for mobile and static gear operators: No potentially important impacts on commercial fisheries are predicted as a result of the Billia Croo Project Envelope.

6.9.3.2 Appraisal of cumulative impacts

The key consideration would be projects with the potential to exclude fisheries operators from the same area as the Billia Croo test site especially where this may occur simultaneously. The SSE proposed cable between Orkney and mainland Scotland is located approximately 1 km from the test site at the closest point. During cable installation it is anticipated there will be an exclusion zone for both fishing and vessel transit around the area of cable lay. If this occurs simultaneously with an installation at Billia Croo, this may lead to two areas of exclusion for fishing vessels in close proximity to each other. Any exclusion however will be temporary in nature and fishing operators will be made aware of planned operations well in advance through Notice to Mariners. No impacts are predicted to fish and shellfish species including cumulatively with other projects as a result of activities presented in the Project Envelope, it is therefore considered no cumulative impacts to commercial species will occur.

Appraisal conclusion for cumulative impacts to commercial fisheries: Although it is possible that installation works at Billia Croo and other projects may occur in a similar area simultaneously this will be for a short duration and not considered to be important at an industry level. No other cumulative impacts are predicted.

6.9.3.3 Summary

The commercial fisheries appraisal concludes that the potentially important impacts on commercial fisheries as a result of activities in the Project Envelope were exclusion from fishing grounds, risk of snagging and increased transit time as a result of the proposed extension area. It was concluded that none of these impacts would have an important impact on any fishing industries operating in the vicinity of the Billia Croo test site.

6.10 Archaeology

6.10.1 Baseline Description

6.10.1.1 Submerged landscapes and prehistoric sites

Submerged landscapes are where human beings and early hominids previously lived or hunted on terrain which was at that time dry land, or where they exploited fish and shellfish on the coast which is now submerged.

The survival of submerged landscapes and in particular submerged peat deposits and woodland remains that contain organic microfossils (e.g. pollen, diatoms, foraminifera) and macrofossils (e.g. seeds, wood, buds, insects) are important resources in reconstructing former landscapes, the activities of past human communities and sea level change, shown most recently in Orkney Waters and the Pentland Firth by the ongoing research by the Rising Tide Project and Dr Scott Timpany (Bates *et al.*, 2013; Timpany *et al.*, 2017).

Recent research and modelling indicates that the relative sea level was perhaps 20 m lower 10,000 years ago, before rising comparatively quickly up to 7,000 years ago, slowing after that until by roughly 5,000 years ago the coastlines of Orkney are, with some later localised transgressions and variation, roughly as we see them now (Bates *et al.* 2013; Dawson & Wickham-Jones, 2007; Wickham-Jones & Bates, 2016). Relative sea level has continued to rise since prehistory. In summary, in the lease area, the potential for the survival of prehistoric deposits is negligible-low, especially because most of the site is exposed bedrock, or mobile sediments comprising sandy gravels and gravelly sands.

6.10.1.2 Shipwrecks, aircraft and obstructions

Shipwreck inventories and documentary sources are usually biased towards the 18th century and later when more systematic reporting began (Pollard *et al.*, 2014). Therefore, there are few known historical records of medieval and earlier wrecks. The coastal archaeological evidence suggests exploitation of the marine environment within the area for fishing and transport purposes from prehistoric times.

As a maritime nation with a reliance on marine based trade and exchange, there have been countless shipwrecks around UK waters from all periods, many of which remain unreported. Especially with the strong seas in the area, there is a high probability for unknown, unrecorded vessels to have sunk here over the centuries. If these have not been destroyed by the marine environment, the remains of such vessels and their associated artefacts may not always be visible in geophysical data due to being constructed from materials that do not provide strong geophysical or magnetic returns or buried beneath the surface of the seabed. However, based on results from the surveys conducted, the nature of the seabed, as shown by the surveys, demonstrate that the risk of impacting unknown remains is likely to be low, although the potential risk rises slightly in areas of less mobile sand where preservation by burial is more likely. Table 22 presents a summary of the wreck sites within or close to the Billia Croo test site.

6.10.1.3 Historic minefields and unexploded ordnance (UXO)

During both World Wars a large amount of ordnance, both offensive and defensive, was used in the seas around the Orkney Islands and the Pentland Firth. Some of these munitions still exist and are regularly found by divers or fishermen. These finds are taken very seriously by the MoD who immediately deploy a bomb disposal team to assess and deal with the items located. They are usually detonated where they are found as it is considered too dangerous to move them.

One of the largest German minefields was laid to the north of mainland Scotland by surface raider SMS Möwe in January 1916. This was known to the British as the Whitten Head Field and had over 250 mines. By the end of April 1916, the Royal Navy had accounted for 70 of these mines and considered the field cleared. However, there is the possibility that live mines from the Whitten Head minefield could have drifted into the area either as a result of minesweeping operations or mines having broken free of their moorings. Mines associated with the Whitten Head Field have been found ashore on Orkney and in the Pentland Firth.

However, there are no reports of mines being laid in the Billia Croo area or of bombs being dropped, there are no reports for finds in this area in the Bi - Monthly Minesweeping Reports, and no reports from U Boats operating in the area in both World Wars. Therefore, the indications are that there is negligible-low potential for unexploded historic ordnance in the Billia Croo test site.

Table 22. List of possible wreck sites within or close to the Billia Croo test site

Name	UKHO wreck number	Canmore	Description	Circumstance of loss	Date Lost	Proximity to Project Envelope	Source	Importance
Margery	-	327410	Wooden Sloop. Cargo of Easdale slates	'Lost' between Breckness and Black Craig, Outertown, Stromness	15/01/1777	Unknown	1, 6	Medium
Mellona	-	287335	Wooden Brig	Wrecked near Breckness	26/10/1806	Unknown	1, 6	Medium
British Queen	-	224111	Timber laden for N Shields Master Jeffreys, from Pictou	Ashore at Breckness. Cargo and materials saved. Possibly salvaged	30/11/1811	Unknown	1,2,6	Medium
William	-	259701	Vessel, Sligo to London	Wrecked a few miles north of Stromness in violent gale. Part of stern and small articles washed ashore	15/12/1832	Unknown	1, 6	Uncertain
George	-	270207	Wooden Smack of Aberdeen. Cargo of butter. Captain Simpson	Wrecked to the North of Breckness	15/12/1832	Unknown	1, 6	Medium
Duke of Sussex	-	225587	Wooden rigged ship, from Sunderland to Cape of Good Hope. Cargo of coal and glass	Wrecked in gale at Breck Ness. The master, his wife, 1st and 2nd Mate plus five crew drowned. Their grave is in Stromness Kirk Yard	25/01/1840	Unknown	1, 6	High
Bromby	-	270251	Wooden Schooner. Liverpool to Aberdeen. General cargo	Wrecked in Hoy Sound, off Breckness. Some of cargo recovered to Stromness	09/11/1842	Unknown	1, 6, 9	Medium
Star of Dundee	-	225584	Wooden Schooner. 78 tons. Capt. Lawson. Wick to Bristol. Cargo of herring	Driven ashore at Black Craig. Sole survivor supposed to have sheltered in cave and climbed cliff following day	05/03/1843	Unknown	1, 2, 6	Medium
Isabella	-	-	Vessel of Kirkwall. Liverpool to Stettin	Ashore Black Craig. Possibly salvaged	21/03/1843	Unknown	10	Uncertain

Name	UKHO wreck number	Canmore	Description	Circumstance of loss	Date Lost	Proximity to Project Envelope	Source	Importance
Betsy	-	277247	Sloop of Wick. From Wick to Liverpool. Cargo of herring	Onshore at Breckness. Crew and part of cargo saved	00/11/1847	Unknown	1, 6	Medium
Robert & Alice	-	226763	Wooden Sloop of Inverness. Lossiemouth. Capt. Gillanders. Cargo of herring	Lost on Braga Skerry. Ship and crew lost	07/10/1854	Unknown	1, 2, 6	Medium
Lord Mulgrave	-	226771	Wooden Barque. 417 tons, built Whitby. Capt Atkinson. From Shields to New York/Quebec. Cargo including coal	Driven ashore, in gale SW/11, at Point of Tanga, Black Crag, Outertown, Stromness. 5 crew lost	09/03/1859	Unknown	1, 2, 6	High
Clifton Hall	-	226836	Wooden Barque of Sunderland. 354 tons. Liverpool to Shields. Cargo of salt	Abandoned in sinking condition off Hoy, gale WNW/9, crew landed in Walls, Longhope. Drifted ashore near Black Craig	27/02/1869	Unknown	1, 2, 6	High
Arcturus	-	256174	Wooden Barque of Rugenwalde, Germany. 530 tons. Capt Brandhoff. From Onega, Russia to Liverpool. Cargo of deals and boards	Stranded on Braga Skerry, Breckness in gale NW9 while running for shelter. Crew reached shore in small boat, which capsized in surf	13/10/1881	Unknown	1, 6	High
Shakespeare	-	229392	Steel Steam Trawler of Hull. 182 tons. Capt Patch	Lost on Point of Spaal near Braga Skerry, to N of Breck Ness with loss of 4 men. Survivors taken off by L/B and LSA	12/11/1907	Unknown	6	Low
Unknown (Dead)	1116	102302	Object reported. Not found in subsequent survey in 2009	MFV ILENE damaged when struck submerged object. Object not sighted	19/04/1982	Unknown	4, 6, 9	Negligible

Name	UKHO wreck number	Canmore	Description	Circumstance of loss	Date Lost	Proximity to Project Envelope	Source	Importance
Unknown	88867	-	Unknown contact reported from survey	In area of disused Oyster renewable energy device	20/03/2018	Within	4, 9	Negligible
Unknown	88868	-	Unknown contact reported from survey	In area of disused Oyster renewable energy device	20/03/2018	Within	4, 9	Negligible
Unknown	88869	-	Unknown contact reported from survey	In area of disused Oyster renewable energy device	20/03/2018	Within	4, 9	Negligible
A/C Skua L2951	-	287560	Blackburn Skua Type II. L2951 771 Sqn	Crash landed in the sea 6 miles west of Stromness killing both the crew	26/04/1944	Unknown	1, 6, 8, 9	Very High
A/C Sea Otter JM761	-	287564	Vickers Supermarine Sea Otter. JM761 771 Sqn. Flying from Abbotsinch (Glasgow) to the airfield at Twatt, Orkney (HMS Tern) with two crew and a gunnery officer as passenger	Engine failure near Hoy, so the pilot made a successful forced landing in Hoy Sound. However, the hull must have been damaged and the Sea Otter began to sink. Rescued by Navy launch	25/04/1944	Unknown	1,8,9	Very High

1 = Whittaker (1998); 2 = Lam & Lam (1998); 3 = Ferguson (1987); 4 = UKHO; 5 = Ferguson (1988); 6 = Canmore; 7 = Wrecksite.eu; 8 = A.R.G.O.S; 9 = Lamb (2007); 10 = John o' Groat Journal.

6.10.2 Appraisal Mechanism

Table 23 presents the relevant legislation and any applicable reasons for undertaking an appraisal based on features present in the site or nearby qualifying features.

Table 23. Appraisal mechanism for archaeological features

Feature type	Appraisal mechanism/relevant legislation	Applicable	Reasoning
Scheduled Ancient Monuments	The Ancient Monuments and Archaeological Areas Act 1979	No	None present
Ships and aircraft lost on military service	The Protection of Military Remains Act 1986	Yes	Potential for two unlocated military aircraft to be in the Project Envelope area
Protected features of Historic MPAs	Marine (Scotland) Act 2010	No	No Historic MPAs in the Project Envelope area
Other sensitive archaeological / cultural heritage features	Appraisal of other features under: <ul style="list-style-type: none"> The Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (relevant to projects located 0-12 nm from shore) The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2017 Marine (Scotland) Act 2010 	Yes	Captures assessment of all other potentially sensitive historic environment features that may be present in the Project Envelope area

6.10.3 Assessment of Potentially Significant Impacts

6.10.3.1 Military remains

There are two aircraft that were lost on military service during World War II somewhere west of Stromness. While records from the time indicate that it is unlikely the aircraft are located within the test site area, the locations of these wrecks have never been found. The likelihood of survival in this highly dynamic environment means that the risk of impacting remains from these aircraft is negligible-low. However, it should be noted that any aircraft remains found are automatically protected under the Protection of Military Remains Act 1986, since they were lost on active service, and impact would automatically contravene the Protection of Military Remains Act 1986, even if they were unknown prior to the impact.

Appraisal Conclusion for military remains: While there is negligible-low risk of impacting aircraft remains, good practice mitigation (especially due to the automatic nature of their legal protection) should be applied to eliminate the risk. This would comprise ROV or diver inspection of where the seabed is to be disturbed prior to installation.

6.10.3.2 Appraisal of other (non-designated) archaeological features

There are no known historic environment assets in the test site. However, there is potential for wreckage to survive in gullies and be buried in any less mobile sediments from wrecks that would be considered important if they survived. However, the likelihood of survival is considered negligible-low due to the highly dynamic environment and salvage activities conducted at the time a vessel was lost.

Appraisal Conclusion for (non-designated) archaeological and cultural heritage features: While there is negligible-low risk of impacting historic environment assets, good practice mitigation should be applied due to the potentially important nature of any remains. This would comprise instigation of The Crown Estate's *Protocol for Archaeological Discoveries: Offshore Renewables Projects* (2014). EMEC operates an Archaeological Discoveries SOP (SOP128) to guide EMEC personnel, clients and marine contractors on the method of preserving and recording discoveries.

6.10.3.3 Appraisal of Cumulative Impacts

There are a number of offshore renewables and marine cable projects in the Pentland Firth and Orkney Waters, which are all designed to avoid significant impacts on the historic environment. The likelihood of impacts on historic environment assets as a result of the proposed activities at Billia Croo described in the Project Envelope are not considered to be important.

Appraisal conclusion for cumulative impacts on marine archaeology: No cumulative impacts are predicted to marine archaeological features.

6.10.3.4 Summary

The likelihood of important impacts on historic environment assets are predicted to be negligible-low as a result of the proposed activities at Billia Croo described in the Project Envelope. In order to manage the potential for impacting unknown heritage, EMEC have an Archaeological Discoveries SOP. The Archaeological Discoveries SOP which is a reporting protocol which should be instigated in the event of a discovery of previously unknown marine cultural material within the test site. Should any cultural heritage sites be reported during marine works, it is recommended that they are investigated by a qualified marine archaeologist as their potential for retaining cultural heritage information could be high.

A pre-installation seabed survey or diver survey prior to or during work on the seabed could identify if any aircraft wreckage is present, to inform any micro-siting to avoid any potential impact. It should be noted that impact upon planes lost on military service automatically contravenes the Protection of Military Remains Act 1986, even if they were unknown prior to the impact.

Given the possibility of some potential impacts and the opportunity to learn from test deployments, potential mitigation and monitoring measures are presented in Section 9. The likelihood of important impacts on historic environment assets are predicted to be negligible-low as a result of the proposed activities at Billia Croo described in the Project Envelope.

7 Navigational Risk Assessment

7.1 Purpose

The following section summarises the Billia Croo Navigational Risk Assessment (REP522) and should be read in conjunction with the full assessment. The Navigational Risk Assessment (NRA) updates the previous NRA and reviews the potential impact of the site extension on navigational safety, identifying any recommendations as required. This NRA is device neutral, not assessing any particular device or type of device, but instead assumes a range of possible devices as described in the Project Envelope. This assessment was conducted to the Maritime and Coastguard Agency's MGN 543 standard for assessing Offshore Renewable Energy Installations (OREIs).

7.2 Scope and Approach

The assessment reviews the test site and provides a baseline vessel traffic analysis, including the existing vessel traffic patterns and risk profile for navigational incidents. The assessment includes an analysis of how the operation of the test site impacts shipping and navigation which includes, traffic routing; collision risk; contact risk; communications, radar and positioning systems; search and rescue; and, cumulative and in-combination effects. As part of the assessment, consultation was conducted with key stakeholders to gain local knowledge and insight on navigation. Stakeholders consulted included:

- Maritime and Coastguard Agency;
- Northern Lighthouse Board;
- Orkney Islands Council Marine Services – Statutory Harbour Authority;
- Orkney Fisheries Association;
- Orkney Ferries;
- Orkney Marinas;
- Royal Yachting Association; and
- NorthLink Ferries (Note: no response received).

The NRA identifies navigational hazards during the general operation of the test site and the changing phases of clients' testing campaigns at the test site. These hazards are then assessed, and risk controls identified to reduce the risk to As Low as Reasonably Practicable (ALARP). Finally, the NRA makes recommendations as to the safety of the test site and identify any additional measures that should be implemented to further improve safety at the site.

7.2.1 Impact Assessment Methodology

The NRA was commissioned to assess the impact on navigation potentially caused by continued operation of the test site and associated activities, including the installation, testing and decommissioning of device. The NRA is limited to identifying and quantifying any additional or increased navigational risk resulting from the project. It subsequently identifies possible mitigation measures where appropriate and makes recommendations.

The process starts with the identification of all potential hazards. It then assesses the likelihood (frequency) of a hazard causing an incident, and considers the possible consequences of that incident. It does so in respect of two scenarios, namely the “most likely” and the “worst credible”. The quantified values of frequency and consequence are then combined using a risk algorithm to produce a risk score for each hazard. These are collated into a “Ranked Hazard List” from which the need for possible additional mitigation may be reviewed.

The hazards were scored using the collective experience of Marine Risk Consultants, EMEC and consultees, with traffic analysis, incident analysis and other available information to support the assessment.

7.3 Baseline Conditions

7.3.1 Test Site Marking

The Billia Croo test site is marked by five cardinal marks; one for each cardinal direction and a second westerly cardinal. Each cardinal flashes with yellow lights and is painted using the correct yellow-black colour scheme. The site is marked on charts and includes a note requesting mariners to avoid passing within the test area marked by cardinal buoys. The

marking of the devices themselves varies, but in general any surface piercing device is marked with one or more yellow lights and is painted yellow above the surface, as per IALA requirements. An advisory 500m “Area to be Avoided” is in place around each device.

7.3.2 Existing Vessel Traffic Management

The Billia Croo test site is not within port limits, however, is adjacent to the harbour limits of the Orkney Islands Council Marine Services. Orkney Islands Council Marine Services have Vessel Traffic Services (VTS) with full radar coverage of the Billia Croo test site, but they do not actively monitor or direct traffic outside the Statutory Harbour Authority (SHA) limits.

The site is within an IMO-adopted Area to be Avoided (ATBA), which was established following the Braer oil spill. All vessels over 5,000 GT carrying oil or other hazardous cargoes should avoid this area.

7.3.3 Search and Rescue

Royal National Lifeboat Institution (RNLI) lifeboats are stationed in the Orkney Islands at Longhope (Hoy), Stromness and Kirkwall (both Orkney Mainland). Her Majesty’s Coastguard (HMCG) helicopter assets are based at Sumburgh, Stornoway and Inverness. Shetland Coastguard Operations Centre (CGOC) are the local coastguard base for the Orkney Islands, however following the implementation of the Future Coastguard Programme, incidents are now managed from the National Maritime Operations Centre (NMOC) and distributed depending on resourcing.

7.3.4 Other Offshore Activities

There are no chartered aquaculture sites near to the Billia Croo test site, nor were any proposed developments mentioned by stakeholders. There are a number of existing and proposed lease areas for renewable energy (including wind and wave) existing on the west coast of the Orkney Islands. With the exception of the EMEC subsea cables to the test berths, there are no other cables in the study area. There are no anchorages near to the test site. There are no military practice areas near to the test site. A spoil ground exists approximately two nautical miles to the west of the test site however this is marked as disused.

7.3.5 Existing Vessel Traffic

Figure 17 shows the main routes used by vessel traffic passing the Billia Croo test site. The greatest density of traffic is to the south of the test site, vessels inbound to Stromness, particularly the Stromness - Scrabster ferry. An inshore (easterly) and offshore (westerly) route directly adjacent to the test site is also discernible. The activities of vessels engaged in the renewables industry and working on the devices within Billia Croo can be seen. The density of traffic further offshore is not significant. The site is surrounded by cardinal marks and this has a clear effect on the traffic flows with vessel traffic staying immediately adjacent to the site.



Figure 17. Vessel traffic density at the Billia Croo test site

Cargo transits are infrequent, occasionally transiting into Stromness and a single tanker transit was recorded offshore, but both vessel types are well clear of the test site. Stromness is a major ferry port, with the NorthLink Hamnavoe (112m) ferry operating a daily service to and from Scrabster. There is a one nautical mile passing distance of this route to the southern boundary of the Billia Croo test site.

Stromness is an active fishing harbour and a great number of the vessels recorded are passing through Hoy Mouth and then passing to the east or west of the test site. An offshore route of vessels passing to the west of Orkney Mainland also passes clear of the existing Billia Croo test site boundary.

Greatest concentration of recreational traffic is in Stromness Harbour and vessels leaving the harbour would do so to the south, towards the Scottish Mainland, or a lesser number would transit north passed the west coast of the Orkney Islands. Stromness sailing club is located inside Stromness Harbour however the majority of sailing and racing takes place within the harbour.

Finally, in terms of site usage by tugs and service craft, which include pilot boats, tugs, maintenance vessels and other workboats, the key activity within the test site is that of construction, maintenance and decommissioning vessels working at devices positioned within Billia Croo. There is also an inshore route passing the Billia Croo test site which is used by maintenance vessels associated on transit between Kirkwall and Stromness.

An analysis of MAIB incidents between 1997 and 2015 was conducted. Very few incidents were recorded near to the Billia Croo test site. Four mechanical failures of fishing vessels are

shown offshore and a single accident to a person. Many of the incidents are further inshore on the approaches to Stromness.

7.4 Assessment

7.4.1 Hazard Identification

The following table provides an overview of the key impacts to navigation that were identified and a summary of findings. A detailed overview of each potential impact pathway is provided in the NRA.

Table 24. Impacts to navigation identified during the NRA

Impacts to navigation	Key findings
Impact on vessel traffic routing	<ul style="list-style-type: none"> • There are two clear routes used by vessels transiting past the site; an inshore and offshore route. • The inshore route is used more frequently than the offshore route, this is due to the reduced transit distance required as opposed to using the offshore route. The extension would not impact the feasibility of this inshore passage. • Regarding the offshore route, analysis of vessel traffic data suggests that passing traffic leave less than 500m spacing from the cardinals marking the boundary of the site. Due to the extension, vessels would necessarily have to divert further offshore to clear the new boundary. This additional distance is minimal and would not require any additional change of course than is currently required.
Impact on contact / allision risk	<ul style="list-style-type: none"> • The presence of a devices in the test site will not increase the relative likelihood of a hazard of contact due to navigating reasons, through for example human error or mechanical failure occurring. The relative risk is increased if vessel traffic must necessarily transit closer, providing less room to correct an error should it occur. • Powered contact - few vessels not working on the test site pass close to Billia Croo and therefore there are a low number of vessels which could potentially come into contact with the device. This likelihood is further reduced due to the presence of cardinal marks and local knowledge of the site. • Drift contact - conditions around Billia Croo can be significant with prevailing westerly waves and wind which could cause a vessel to drift towards the site, potentially contacting a device. Such an incident is however unlikely to occur given the relatively sparse traffic density around the site and close proximity of the site to the lee-shore. • Contact by maintenance vessel - Contact between a vessel and a device is much more likely to occur than with another passing vessel. The maintenance operators are well trained and used to operating in close proximity to these devices.
Impact on collision risk, visual navigation and collision avoidance	<ul style="list-style-type: none"> • OREIs have the potential to disrupt traffic flows and obscure other navigating vessels which has the potential to result in a collision. • Given the small size of the devices and the low traffic density at Billia Croo, this is not considered to be significant.
Effect of tides, tidal streams and weather	<ul style="list-style-type: none"> • The tidal stream is north-westerly and south-easterly in orientation, which is parallel to the direction of travel of vessels passing the test site. • The prevailing south-westerly wind has the potential to push vessels transiting offshore towards the devices. Given the low density of traffic and proximity to the lee-shore, this would not be a significant hazard.

Impacts to navigation	Key findings
	<ul style="list-style-type: none"> Poor visibility is relatively common in the Orkney Islands, however as the site is well marked, charted and has existed for several years, mariners would pass around the cardinals.
Impact on under keel clearance	<ul style="list-style-type: none"> Certain devices which may be deployed at the test site may be bottom mounted or mid-water level, which would impact the available depth of water for transiting vessels. Under Keel Clearance Analysis was completed. For the offshore berths, the analysis suggests that when using average significant wave heights and the types of vessels which transit near the test site, any device with an LAT depth of 40 metres or less (10 metres below LAT) would not pose a navigational risk to passing vessels. The UKC for inshore berths were not calculated using this method as they could potentially be in less than 10 metres of water. Therefore, no UKC value would be acceptable and devices which are mid-water column would pose a hazard to navigating vessels if there is no surface marking, or other additional risk controls such as an isolated danger mark.
Impact of failure of moorings	<ul style="list-style-type: none"> Moorings failure could occur for a variety of reasons, including incorrect moorings, equipment fatigue and extreme metocean conditions. Each client has a requirement to provide a Third-Party Verification on the structural integrity of the device and mooring/foundation system. A breakout would likely result in a device swept from the test site through the actions of wind and waves. This could pose a navigational hazard to passing traffic, however given the density of traffic recorded during the vessel traffic analysis, this is relatively low.
Impact on fishing activity	<ul style="list-style-type: none"> Whilst fishermen could fish in the test site, generally they would avoid the area due to the potential for surface and bottom hazards which could damage fishing gear through entanglement with devices such as creel strings or directly through trawling. Once in location the devices have been well marked and their location well promulgated reducing the chance of incidents of fishing gear being damaged.
Impact on recreational activity	<ul style="list-style-type: none"> The Orkney Islands have a higher proficiency level of yachtsman as the area is isolated from the UK and yachts must cross either the North Sea or Pentland Firth to reach the area.
Impact on subsea cables	<ul style="list-style-type: none"> Analysis has identified no anchoring in the area by third-party vessels, and given the depth of water and metocean conditions, this would not be expected to change. Furthermore, most fishing in the area is using static gear which are less likely to snag on cables.
Impact on search and rescue and emergency response	<ul style="list-style-type: none"> Given the scale of the site, the continued operation of the test site is not anticipated to cause any significant impact on SAR operations.
Impact on communications, radar and positioning systems	<ul style="list-style-type: none"> The profile of the devices and the relative size compared to other OREIs does not suggest that there would be any significant impacts upon communications, radar or positioning systems.
Cumulative and in-combination effects	<ul style="list-style-type: none"> No significant developments are known to be planned in close proximity to Billia Croo however a number of lease sites exist and are proposed on the west coast of the Orkney Islands. Increased vessel traffic associated with other developments would increase the traffic density in the area and therefore could result in additional collision risks or contact with devices stationed at Billia Croo. Billia Croo site, in combination with other sites, could result in significant impacts on traffic flow.

Impacts to navigation	Key findings
	<ul style="list-style-type: none"> To mitigate these impacts, navigational corridors between licensed areas may be required, although the determination of these would need to be considered on a case by case basis.

7.4.2 Embedded Risk Controls

A number of risk controls are embedded at Billia Croo and have been included in the risk assessment. The embedded risk controls are summarised below:

- PPE requirement;
- training of staff;
- ERCoP;
- layout plan;
- notice to mariners and promulgation;
- incident monitoring and reporting;
- EMEC procedures;
- hydrography;
- charting;
- site monitoring;
- CCTV;
- site marking;
- liaison with local stakeholders; and,
- 500m advisory Area to be Avoided.

Further additional risk controls were identified during the assessment which can be implemented on a project-specific basis.

7.4.3 Risk Assessment

Table 25 shows a summary risk assessment for Billia Croo. All hazards were assessed to be Low Risk with embedded mitigation in place.

Table 25. Billia Croo Summary Risk Assessment

ID	Hazard Title	Hazard Detail	Risk Score
5	Maintenance Vessel Contacts a Device	Maintenance vessel contacts with a device	3.47
9	Third Party Grounding Due to Avoidance of Site	A navigating vessel (all types) grounds due to the presence of the site	3.32
12	Breakout of a Device from Moorings	A device's moorings fail, device becomes a hazard to navigation	3.19
10	Collision with Site Maintenance Vessel	A navigating vessel collides with a tug or maintenance vessel or construction/decommissioning vessel.	3.06
3	Fishing Vessel Contacts a Device	A fishing vessel contacts with a device	2.98
4	Recreational Vessel Contacts a Device	A recreational vessel contacts with a device	2.98
11	Grounding of Maintenance Vessel	A maintenance vessel grounds whilst on passage to/from the site	2.86

ID	Hazard Title	Hazard Detail	Risk Score
2	Passenger Vessel Contacts a Device	A passenger vessel contacts with a device	2.72
8	Third Party Collision Due to Avoidance of Site	Two navigating vessels collide due to the presence of the site.	2.70
1	Commercial Ship Contacts a Device	A commercial vessel such as a cargo vessel or tanker contacts with a device	2.39
7	Fishing Gear Interaction with a Device	A fishing vessel's gear interacts with a device or its moorings or subsea cables.	1.95

7.4.4 Summary

In summary, the vessel traffic analysis that was conducted determined there is very little commercial shipping activity near to the Billia Croo test site. Many fishing vessels operate out of Stromness, the majority of which are on transit past the Billia Croo test site, albeit some may fish using static gear in the inshore vicinity. Whilst 4,000 vessels transited within two nautical miles of the site, only 600 passed within 500m and less than 400 passed within the footprint of the site.

The impact to vessel routing was considered. It was concluded that most vessels currently avoid passing within the test site and the orientation of traffic flow with the extension means that there will be little impact on future vessel traffic. The inshore route will be unaffected by the extension. Analysis of contact risk with the devices showed a very low likelihood of a passing or disabled vessel contacting a device. The risks of the site were not considered to be increased due to the wind, wave and tides. A detailed analysis of under keel clearance requirements was conducted, it was concluded that for most operating conditions, a 10m UKC should be maintained for devices to avoid a contact between a submerged device and the types of vessels operating in the area. Mooring failure was identified as a possible hazard, particularly given the significant metocean conditions at the site, however a number of risk controls are already in place to prevent such an event.

An NRA was conducted which identified 11 hazards; by scoring the likelihood and consequence of each, it was determined that all hazards were low risk. A great number of risk controls are already in place at Billia Croo, and a number of additional risk controls were identified to enhance the safety of each additional device.

The extension will require the relocation of the five cardinal marks currently in place at Billia Croo test site. A layout was proposed which would reduce this to four cardinal marks and should be discussed with the Northern Lighthouse Board.

As the NRA has been conducted as a site-wide generic assessment based on a range of possible device types, clients accessing the Billia Croo test site will be expected to produce an NRA Addendum which addresses specific navigational implications of their particular project and associated device. A template to support this is available on request from EMEC.

8 Seascape, Landscape, Visual Impact Assessment

8.1 Purpose

The following section summarises and should be read in conjunction with the assessment undertaken by Land Use Consultants, *Billia Croo Wave Test Site: Seascape, Landscape and Visual Impact Assessment* (REP663). The SLVIA examines the effects of activities and installations within the Project Envelope on:

- landscape as a resource in its own right (including coastal and landscape and seascape), caused by changes to its constituent elements, its specific aesthetic or perceptual qualities, and/or its character; and
- views and visual amenity as experienced by people, resulting from changes in the appearance of the landscape.

8.2 Scope and Approach

Please refer to the SLVIA for all relevant policy and guidance used, as well as detailed consultations.

8.2.1 Effects Assessed in Full

This assessment is focused on changes that will occur in the marine environment. It therefore focuses on the changes that may occur to the character of the marine and coastal landscape (sometimes referred to as 'seascape'). The assessment also examines the effects of the test site on views, as perceived by people, as a result of changes in the marine outlook. The assessment goes on to consider changes in the special qualities of the National Scenic Area in which the test site is located.

The test site covers a range of activities and installations, with the deployed devices changing over the lifespan of the consent (20 years). Effects are not therefore assessed for separate construction, operation and decommissioning phases, as it is assumed that installation and removal works may be being carried out at any time during the 20-year consent. The study area was defined as a 5 km radius around the outer edge of the extended wave test site area.

All potentially significant landscape and visual effects have been examined.

8.2.2 Effects Scoped Out

On the basis of the desk based and field survey work undertaken, the professional judgement of Land Use Consultants, experience from other relevant projects, and feedback received from consultees, the following topic areas have been 'scoped out' of the detailed assessment:

- effects on receptors outside the visual envelope of the test site and/or beyond 5km from the test site boundary, where it is judged that significant effects are unlikely to occur;
- effects on 'residential visual amenity', i.e. the visual component of 'living conditions', since the devices deployed within the test site will not be so overbearing or dominating as experienced from any individual property as to result in unacceptable living conditions;

- physical effects on coastal/onshore landscape, since there are no onshore elements within the Project Envelope;
- effects arising from vessel movements outside the test site, since vessels will be moving through areas where shipping is already a feature; and
- cumulative effects, since no other consented or planned developments have been identified that would interact with the test site to give rise to potentially significant cumulative effects.

8.2.3 Methodological Overview

The key steps for assessing landscape and visual effects are as follows:

- the landscape (including ‘seascape’) of the study area was analysed and landscape receptors identified;
- the area over which the test site will be visible was established through creation of a zone of theoretical visibility (ZTV);
- the visual baseline was recorded in terms of the different groups of people who may experience views of the development and the nature of their existing views and visual amenity;
- viewpoints were selected (including representative viewpoints, specific viewpoints and illustrative viewpoints), and agreed with consultees (see Section 10);
- likely significant effects on landscape and visual resources were identified; and
- the level (and significance) of landscape and visual effects was judged with reference to the sensitivity of the resource/receptor (its susceptibility and value) and magnitude of effect (a combination of the scale of effect, geographical extent and duration/reversibility).

8.2.4 Judging the Levels of Effect

The separate judgements of susceptibility, value, scale, geographical extent, duration and reversibility, are considered together to provide an overall profile of each identified effect. An overview is then taken of the distribution of judgements to make an informed professional assessment of the overall level of each effect, drawing on guidance provided in the third edition of the Guidelines for Landscape and Visual Impact Assessment (GLVIA3). A numerical or formal weighting system is not applied. Instead, consideration of the relative importance of each aspect feeds into the overall decision.

The levels of effect used in this SLVIA are defined as shown in Table 26 for landscape effects and Table 27 for visual effects. The descriptions are provided as examples, and each effect is judged individually.

Table 26. Levels of Landscape Effect

Level	Effect Description
Major	The Project will result in an obvious and widespread change in landscape/seascape characteristics and character, such as permanent loss of key characteristics, likely affecting a highly-valued landscape with a medium or high susceptibility to that type of change.
Moderate	The Project will result in a noticeable change in landscape/seascape characteristics and character, such as a large-scale but temporary change in landscape features, likely affecting a landscape with a medium susceptibility to that type of change. This level of effect may also occur when a smaller scale of change acts on a more highly valued landscape.

Level	Effect Description
Minor	The Project will result in a small change in landscape/seascape characteristics and character, such as a localised effect occurring over a long duration, or a larger-scale effect on an area of lower susceptibility and/or value.
Negligible	The Project will not result in a noticeable change in landscape/seascape characteristics or character.

Table 27. Levels of Visual Effect

Level	Effect Description
Major	The Project will result in an obvious and widespread change in the visual amenity experienced by the receptor(s), who are likely to have medium or high susceptibility to that type of change. For example, this level of effect may arise from the permanent obstruction or interruption of a highly valued view.
Moderate	The Project will result in a noticeable change in the visual amenity experienced by the receptor(s), who are likely to be of medium susceptibility to that type of change. For example, this level of effect may arise from a large-scale but temporary change in a view, or a smaller change affecting a highly valued view.
Minor	The Project will result in a small change in the visual amenity experienced by the receptor(s), who may be of lower susceptibility to that type of change. For example, this level of effect may arise from a larger-scale but temporary change in a view that is not highly valued, or a very small change experienced by higher-susceptibility receptors.
Negligible	The Project will not result in a noticeable change in the visual amenity experienced by the receptor(s).

8.2.5 Direction of Effects

The direction of effect (positive, negative or neutral) is determined in relation to the degree to which the proposal fits with landscape character and the contribution to the landscape or visual amenity that the development makes. For the purposes of this assessment, the precautionary principle indicates that the presence of the test site should be considered a negative change in the context of this highly scenic and nationally designated landscape.

8.3 Baseline Conditions

8.3.1 The Study Area

The inland study area comprises two distinct areas: the Orkney Mainland; and the north of the island of Hoy. Within the study area, notable features on the Mainland include the town of Stromness, with its dispersed outlying settlements, and the intricate western coastline. Hoy provides dramatic contrast, with towering hills and cliffs. Overall the landscapes are remote and rural, with small scattered settlements. There are generally wide-ranging views towards the open sea. Figure 18 provides an indication of the type of landscapes, using a photo taken from Hoy.

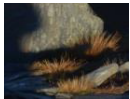


Figure 18. View of Hoy Sound and the Orkney Mainland from Hoy – the Billia Croo test site is on the left of the view

The coast of Orkney Mainland is edged by rugged sandstone cliffs which meet gently sloping farmland consisting largely of windswept rough grasses and moorland. Stromness town sits in the south west of the Mainland. Other settlement is dispersed, as individual farms or small clusters of houses, surrounding Stromness or following the A-road to the north. There is little else in the way of built environment, other than farm buildings, basic infrastructure and individual wind turbines, see Figure 19. Core path WM26 runs north along the clifftop, and there is a small network of core paths in the area around Stromness including a very short section of National Cycle Network Route 1 that can be found within the study area.

The northernmost part of Hoy, including the impressive St John's Head, also sits within the study area. The coastal landscape is characterised by its towering cliffs, over 150m tall. Again, a small network of minor roads radiates from the ferry pier at Moaness, connecting very few scattered dwellings. A core path, H1, follows the valley between Cuilags and Ward Hill. The study area also includes a small portion of the island of Graemsay. This is similar in topography to the Mainland, being low lying with limited relief.



Figure 19. Settled farmland at the edge of Stromness

Being off the north coast of Scotland, Orkney experiences a temperate, wet climate, with temperatures mild in winter and low in summer. It also experiences limited daylight hours in winter, but long days in summer. Orkney is well renowned for its almost constant winds, with gales common in winter.

Orkney is also well known for its evidence of Neolithic settlement and has a rich cultural history, still evident as standing stones and brochs throughout much of its landscape. Visible remains along the coast of the study area include the ruins of Breckness House, and the coastal defences at Ness Battery and Point of Oxan. The Heart of Neolithic Orkney World Heritage Site includes several sites, the closest of which is Skara Brae, 5.7 km from the test site.

8.3.2 Landscape and Coastal Character

This coastal character assessment (CCA) (LUC, 2016) was undertaken at both regional and local scales, in line with SNH methodology on coastal character assessment (Carol Anderson Landscape Associates, 2018). Regional coastal character areas (RCCA) and local coastal character areas (LCCA) are defined as lengths of coast, with the descriptions for each area broadly indicating its offshore and onshore extent. Since all coastal character areas, by definition, have a marine element and key characteristics that relate to the sea, all the below LCCAs have been considered in the assessment.

Table 28. Local Coastal Character Areas

LCCA	Key characteristics
25a Point of Ness to Billia Croo	<ul style="list-style-type: none"> • South-west facing onto the Hoy Sound as it opens out to the turbulent Atlantic. • Sinuous coastline of shallow bays and headlands, with a small sandy beach backed by coarser cobbles at Warebeth.

LCCA	Key characteristics
	<ul style="list-style-type: none"> • Pasture slopes gently away from the coastal edge to a series of low hills which contain the coastal edge to the north, with settlement on the hill slopes orientated towards the coast. • Coastal defences include Ness Battery, a relic of Orkney's wartime heritage in defending Scapa Flow. • At Breckness there are the remains of Breckness House and broch on the shore line. • The dramatic Hoy hills are ever present in views across the Hoy Sound to the south, and the rising landform of Black Craig contains views to the north-east.
25b Billia Croo to Neban Point	<ul style="list-style-type: none"> • Fronts onto the Atlantic, and the wide, open, expansive sea dominates the character of the coast. • Relatively straight, and comprising high, rugged sandstone cliffs, indented with caves along the base of Black Craig. • Undeveloped and accessible only on foot, the coast has a strong sense of remoteness. • Open and undeveloped moorland rises away from the cliff edge to low hills at Black Craig to the south-east and the larger North Hill to the north-east. • The open Atlantic is ever present in views, and views into the settled and farmed lowland to the south-east are also available.
25c Neban Point to Bay of Skail	<ul style="list-style-type: none"> • Open and exposed to the Atlantic, with strong elemental qualities. • Rugged sandstone cliffs of up to 50 m in height, with an intricately weathered shoreline displaying a distinctive layered geology. • Spectacular coastal cliff scenery at Yesnaby, with caves, blowholes, geos and sea stacks including "Yesnaby Castle". • Unsettled, but built structures include Yesnaby Gun Battery, a promontory fort at Brough of Bigging and the Broch of Borwick. • Backed by rolling, semi-natural coastal heath and grassland rising to hills to the south and falling into the Skail basin to the north. • There are open, unimpeded sea views to the west, and ever-changing views from the coastal path along a succession of headlands to the north and south.
29a and 29b Graemsay ²	<ul style="list-style-type: none"> • Semi-enclosed flows of tidal water, seldom very calm. • Boat traffic, lighthouse at Pont of Oxan, ferries approaching Stromness and views out to open sea create a strong maritime influence. • Low-lying island character has a strong relationship with north east Hoy, with views to high hills and the open sea. • Consistent coastal edge of low cliffs, skerries, shingle and sandy bays • Scattered settlement on sloping farmland rising to whaleback ridgeline of the island. • Views of Stromness to the north and the open sea to the west.
30d Middle Skerry to Out Taings ²	<ul style="list-style-type: none"> • Large, semi enclosed, flow of strong tidal water, a sense of visual containment to the east. • Passage of boat traffic and associated navigational aids. • Dynamic coastal edge comprises areas of rugged cliff, sloping rock platforms, skerries and small sandy bays. • Pasture and arable hinterland; steep convex slopes; sparse settlement and largely isolated.
37b St John's Head	<ul style="list-style-type: none"> • Dramatic stretch of coast exposed to the vast, open expanse of the Atlantic Ocean. • Large scale, rugged, red sandstone cliffs, all over 150 m in height and deeply indented with geos that extend up to 450 m inland. • The Old Man of Hoy, a dramatic and distinctive sea stack.

² Key characteristics for these LCCAs are not defined in the CCA document, and have therefore been developed from the CCA text.

LCCA	Key characteristics
	<ul style="list-style-type: none"> • Smooth undeveloped moorland hinterland rises away from the cliff tops to rounded inland peaks. • Views from the cliff top walk are available, north and south along the colourful and rugged coastal cliffs, east to dramatic inland hills and west across the sometimes turbulent seas of the Atlantic.
37c Braebuster	<ul style="list-style-type: none"> • Open and exposed to the Atlantic, particularly in the west, with some shelter provided by Mainland and Graemsay in the east. • Relatively straight and low-lying coast, in contrast with the rugged cliffs south of Kame of Hoy and the rounded summits in the Hoy interior. • Broad, rocky foreshore, with shallow bays and caves, and small cliffs west of Bay of the Tongue. • Hinterland rises gradually away from the coast across open moorland towards Cuilags, with some farmland around the small scattered settlement on the minor road from Hoy. • Dramatic enclosing landform and lack of inter-visibility with nearby settlement at Hoy enhances the sense of isolation. • Elevated and open views to open seas to the west and Mainland to the north.

8.3.3 Visual Character

A ZTV was generated to an assumed height of 12 m above high water, across the whole of the site area. 12 m is stipulated as the maximum device height in the Project Envelope, and any taller device would need further assessment. The ZTV is illustrated within the SLIVA and indicates the maximum extent of theoretical visibility of device(s)/component(s) across the study area.

8.3.3.1 Key Visual Receptors

Key visual receptors have been identified by examining the ZTV as described above, and by determining the locations where susceptible receptors may be located, drawing on desk-based and field-based observations. Key receptors with potential visibility are:

- Communities in any of the settlements or individual residences across the area which lie within the ZTV, in particular people in the Outertown area, and the adjacent dispersed settlement extending east towards Stromness;
- Recreational users of the landscape (residents or visitors) within the ZTV, including those using footpaths and cycle routes, in particular:
 - Walkers on the West Coast Path (core path WM26) between Stromness and the Bay of Skail, as well as people walking on other core paths around Outertown and Ness;
 - Walkers climbing to the summits of Sui Fea and Cuilags on Hoy;
 - Walkers using core paths on Graemsay;
 - People visiting the cliffs at Yesnaby; and,
 - People accessing the coast at Warebeth Beach.
- Users of the marine environment, including:
 - People involved in recreational sailing or boat trips;
 - People arriving or departing from the islands on the Scrabster to Stromness ferry; and,
 - People using the passenger ferry between Stromness, Graemsay and Moaness.

A total of six viewpoints were selected and agreed in consultation with SNH and the OIC. Details of the viewpoints are provided in Table 29.

Table 29. Viewpoint selection

Viewpoint, grid reference and figure no.	Receptor and activity of receptor being represented	Reason for Selection
Viewpoint 1 Yesnaby 321823, 1015675	Recreational visitors walking on West Coast Path (core path WM26) or viewing the coast from Yesnaby car park.	Popular clifftop location with nearby car park, offering elevated views south-west across the test site.
Viewpoint 2 Black Craig 322009, 1010994	Recreational visitors walking on West Coast Path (core path WM26), including those making the ascent of Black Craig from Outertown to the observation post.	Hill top viewpoint close to the test site and overlooking the whole area. The observation post at the summit is associated with the wave test site.
Viewpoint 3 Outertown 323344, 1010055	Residents of Outertown and surrounding dispersed settlement. People working in the nearby area. People using core path WM29.	Elevated view from Outertown, representing the only settled part of the study area within the ZTV, including a number of dwellings that have views of the sea.
Viewpoint 4 Warbeth Beach 323569, 1008526	Recreational visitors to the beach. Walkers along the coast nearby (core path WM31). People visiting Stromness Cemetery.	Sea level viewpoint on popular signposted beach with car park, well used by local people as well as visitors.
Viewpoint 5 Cuilags 321013, 1003368	Walkers climbing the hills in the north of Hoy.	Elevated summit representing the surrounding hills in the north of Hoy, offering elevated and wide-ranging views, including northward across the site.

8.4 Assessment

8.4.1 Effects on Coastal and Landscape Character

Effects on coastal character were judged to be moderate along the coastline between Yesnaby in the north and Breckness in the south, as represented by LCCAs 25b and 25c. This level of effect is largely due to the highly sensitive nature of these coastal character areas, as a result of their remoteness and elevated views over the sea. The magnitude of effect in this area was also judged to be higher, due to the close proximity to the test site. A minor level of effect is anticipated on coastal character across the rest of the study area.

Table 30. Summary of effects on landscape receptors

Receptor	Sensitivity	Magnitude	Level of effect
LCCAs			
25a Point of Ness to Billia Croo	Medium	Low	Minor
25b Billia Croo to Neban Point	High	Medium	Moderate
25c Neban Point to Bay of Skail	High	Medium	Moderate
29a and 29b Graemsay	Medium	Low	Minor
30d Middle Skerry to Out Taings	Medium	Low	Minor
37b St John's Head	High	Low	Minor
37c Braebuster	High	Low	Minor
LCTs			
8 Inclined Coastal Pastures	Medium	Low	Minor
13 Cliff Landscapes	High	Medium	Moderate

Moderate effects on onshore landscape character will be limited to the western edge of the Mainland, where the strong coastal influence defines the Cliff Landscapes LCT. The wild character and key views associated with this Landscape Character Type (LCT) are sensitive to changes in the seascape. Elevated views overlooking the test site are available in this area. Effects on landscape character across other parts of the study area will be minor or negligible.

8.4.2 Effects on Views

Viewpoint assessments indicate that a moderate level of effect is likely to be experienced from elevated positions along the west Mainland coast, in close proximity to the test site, as represented by Viewpoints 1 and 2. Minor effects are expected from lower elevations on the Mainland coast or from Hoy due to partial or distant views, respectively.

Table 31. Summary of the Viewpoint Assessment

Location	Sensitivity	Magnitude	Level of effect
1 Yesnaby	High	Medium	Moderate
2 Black Craig	High	Medium	Moderate
3 Outertown	High	Low	Minor
4 Warebeth Beach	High	Low	Minor
5 Cuilags	High	Low	Minor

Recreational receptors are present throughout the study area and will experience different levels of effect depending on their location. Notably, walkers along the section of Core Path WM26 between Yesnaby and Black Craig are likely to experience major effects, as a result of sequential and sustained views of devices and activities within the test site. Visitors to Yesnaby Castle and immediate surroundings are likely to experience moderate effects, as the test site would present an alternative focal point in the high value view offered from these cliffs. Moderate effects would also be experienced by visitors to this location at night time (including dusk/sunset), as a result of the lighting associated with the test site.

The level of effect on recreational receptors in other areas is deemed to be minor, mainly due to a smaller scale of effect as the devices and activities will be a small element in the wide scenic views that characterise this area.

Effects on community receptors are likely to be minor, both in the daytime and at night, as only the southern portion of the test site will be visible, from Outertown and nearby settlement, and will be in an area where offshore activity is already a feature in the view.

Effects on receptors travelling through the area by ferry will be minor, as the devices and operations within test site will be passing features in the view and are unlikely to detract from the passenger's overall experience.

8.4.3 Effects on the Special Qualities of the NSA

The SLVIA examined the implications of these predicted effects for the special qualities of the National Scenic Area designation, using a draft methodology provided by SNH for this purpose. Those special landscape qualities with reference to the sea or coast were considered in the assessment, and the majority of these are anticipated to be affected in a minor way by the devices and activities within the Project Envelope. The special quality relating to 'spectacular coastal scenery' is likely to experience a moderate effect, although this will be localised in extent as this effect will be experienced mainly by walkers on the elevated west Mainland coast. The test site will not have any unduly adverse effect on the integrity of the NSA or the qualities for which it has been designated.

8.4.4 Summary

The SLVIA has assessed the potential effects on landscape and visual receptors of the future operational activities associated with the Billia Croo test site, under the parameters of the Project Envelope. All operational impacts of the project are judged to be long-term, and are fully reversible.

9 Mitigation, Monitoring and Research

Throughout the Environmental Appraisal and Seascape, Landscape and Visual Impact Assessment, summarised in the above sections (Section 6 and 8), certain mitigation, monitoring and research measures have been identified. These are presented in the following table, Table 32. The table includes the embedded risk control measures identified during the Navigational Risk Assessment and suggested additional risk control measures that could be implemented on a project-specific basis. For certain receptors, mitigation or risk control measures have been identified, it is expected that implementation of such measures will aid in reducing the severity of the potential impact or remove the respective impact. Where monitoring measures have been suggested, such measures have been identified to either check the status of an impact and/or to increase understanding of potential impacts for the benefit of the client, regulators and industry. As a consequence of monitoring, it may be necessary to remove, introduce or modify mitigation measures applied.

Any research conducted at the site will likely be applicable at an industry level with less focus on specific devices. Research will generally be led by EMEC with the potential for clients, regulators and academic institutions to be involved.

The process that EMEC has implemented in terms of pre-appraising the potential testing activities, should allow clients to dedicate more effort to the development and delivery of their active and required mitigation, monitoring and research.

All clients are required to submit a Project-specific Environmental Monitoring Programme (PEMP) as part of their marine licence application. This is essentially a project-specific annex to the Environmental Appraisal, in which the client proposes methods for monitoring their device/component in respect of the issues of concern identified in the appraisal.

The key purposes for the PEMP are:

- Ensuring that there is compliance with conditions of consent in relation to environmental impacts;
- Structured approach to learning more about the interaction of a project/device with the environment and, more broadly, accumulating learning for the sector in general; and
- Series of required actions and standards documented contributing to good project management and cost reduction.

Clients are expected to produce robust PEMPs. The below table, Table 32, outlines the appropriate mitigation and monitoring measures for inclusion in the PEMP. Clients are expected to seek advice from EMEC and SNH regarding mitigation and monitoring activities that could be incorporated into their testing programme. The PEMP is an interactive document and should be reviewed on a regular basis to ensure consent compliance is maintained and mitigation and monitoring measures reflect best available practices at the time.

The PEMP provides an opportunity to contribute to industry solutions in terms of developing good practice and new innovative approaches to industry-wide problems. Best-practice and

innovation from clients in considering options for mitigation, monitoring and research is welcomed. It is considered that through successful delivery of the commitments within the PEMP, clients will contribute to the progression of the sector to commercial scale developments through development of a sound evidence base. It is essential that the methodologies proposed in the PEMP produce data that is statistically robust. Further advice and support regarding this and the Survey, Deploy and Monitor policy can be sought from EMEC and SNH.

Table 32. Mitigation, monitoring and research measures identified during the Environmental Appraisal, SLVIA and NRA

Impact	Receptor	Specific Receptor	Impact pathway	Mitigation, monitoring, research	Action	Task	Licence requirement / Likely condition of consent	EMEC / Client
Change to benthic communities	Benthic species and habitats	N/A	Creation of new habitat	Monitoring	Colonisation monitoring	Monitor colonisation of selected devices and infrastructure. This provide information on the species (if any) which colonise WECs and other infrastructure at the site. Information in relation to any preferences or timings and seasonality may also be identified.	No	Client
						Development of an invasive MNNS protocol or biofouling management protocol.	Possibly	Client
	Benthic species and habitats	N/A	Disturbance/loss of habitat	Mitigation	Visual inspection prior to anchoring	The use of a vessel anchor and devices anchor/mooring plans. Device and mooring plans will be informed by visual inspection of the seabed to identify and avoid any sensitive habitats/species, which may be carried out as part of maintenance activities.	No	Client
	Benthic species and habitats	N/A	Disturbance/loss of habitat	Mitigation / Monitoring	Removal of infrastructure on decommissioning and visual inspection	All infrastructure including moorings will be removed during decommissioning. This will form part of a Decommissioning Programme which is a requirement for all developers. Removal of infrastructure and moorings will allow the benthic environment to recover to pre-installation conditions which will be recorded ahead of any installation activities taking place.	Yes	Client
Benthic species and habitats	N/A	Introduction of marine non-native invasive species	Mitigation	Adopt good practice measures	It is recommended that the suggested guidelines, codes and good practice are followed to limit impacts on the benthic environment as a result of MNNS. Adopt good practice: <ul style="list-style-type: none"> • All devices moorings will be removed during decommissioning; • Marine Biosecurity Planning Guidance (SNH, 2014a); • Marine Biosecurity Planning – Identification of best practice: a review (SNH, 2014b); • Guidelines for the control and management of ships' biofouling to minimise the transfer of invasive aquatic species (IMO, 2011); • Code of practice on non-native species (Scottish Government, 2012); • Good practice for water management (IPIECA, 2010). The following wording is generally included in Marine Licences: The Licensee must ensure that the risk of transmitting MNNS to and from site is kept to a minimum, by ensuring appropriate bio-fouling management practises are implemented during any works.	Yes	Client	
Changes to hydrodynamic regime	Hydrodynamic regime	Coastal SSSI	WEC changes to hydrodynamic conditions	Research	Measurement of current speeds / wave field	Measurement of current speeds and wave field in lee of WEC, before and after installation, would quantify downstream impact of WEC on current and wave field	No	EMEC / Client
				Mitigation	Site layout	Mitigation could include giving careful thought to placement of berths, to try and avoid cumulative wake effects	No	EMEC
Changes to seabed morphology	Seabed	Local seabed	WEC installation causes new deposit on seabed	Research	Data collection regarding sediment deposition	Collecting bathymetry and side scan sonar data in the test site before, after, and e.g. one year after installation would assess the initial shape, volume and then evolution of any spoil or stirred sediment. The release of sediment and small rock fragments will likely be negligible above background levels. Unless there are any species or habitats of importance, there will be no requirement to do so.	No	EMEC / Client
				Mitigation	Foundation design	Mitigation could include using a gravity base foundation which would not require drilling into the seabed and releasing spoil	No	Client
Changes to nearby beach morphology	Beaches	Warebeth beach	WEC changes to wave and tidal regime causing downstream impacts to beach sediments	Monitoring / Research	Beach monitoring campaign	Beach monitoring campaign before and after WEC installation. Some developments which directly impact a beach may be required to undertake a beach monitoring campaign for the duration of the project, but impacts are unlikely here, and the natural site variability will be so high it would be extremely difficult to prove connectivity between the WEC and the beach, through either monitoring or modelling.	No	Client
				Mitigation	Device placement	Mitigation could include avoiding placing a WEC directly north-west of Warebeth beach, i.e. in so that Warebeth beach would not be directly leeward of a device	No	EMEC / Client
Changes to local water quality	Coastal water	Breck Ness to Noup Head coastal water body	Installation activities causing elevated suspended sediment concentration above baseline	Monitoring	Suspended sediment monitoring	Boat-based suspended sediment monitoring before, after and e.g. one year after WEC installation could attempt to quantify the impact of the WEC on water quality. The highly dispersive nature of the site and natural background variability mean it would be difficult to record any change above background levels, except during installation itself.	No	Client
				Mitigation	Foundation design	Mitigation could include using a gravity base foundation which would not require drilling into the seabed and releasing spoil	No	Client

Impact	Receptor	Specific Receptor	Impact pathway	Mitigation, monitoring, research	Action	Task	Licence requirement / Likely condition of consent	EMEC / Client
Behavioural change	Fish species	All species, of particular concern in relation to elasmobranchs	EMF	Monitoring	EMF measurements	Measurements of strength and range of EMF at the site. It would be useful for a variety of energy generation situations to be monitored i.e. various levels of occupancy etc.	No	EMEC / Client
Community composition and changes in behaviour	Fish and shellfish	Diadromous fish, marine fish and crustaceans	Habitat creation and FAD	Monitoring	Visual monitoring of infrastructure	Monitoring of all introduced infrastructure including WECs and mooring structures. Monitoring the variety of infrastructure deployed at the site would provide a useful of understanding of when and if FAD occurs and what preferences in terms of infrastructure, seasonality etc there might be.	No	EMEC / Client
Change to benthic communities	Shellfish and benthic species	Mostly low mobility shellfish and benthic species	Introduction of MNNS	Mitigation	Adopt good practice measures	It is recommended that the suggested guidelines, codes and good practice are followed to limit impacts on the benthic environment as a result of MNNS. Adopt good practice: <ul style="list-style-type: none"> • All devices moorings will be removed during decommissioning; • Marine Biosecurity Planning Guidance (SNH, 2014a); • Marine Biosecurity Planning – Identification of best practice: a review (SNH, 2014b); • Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species (IMO, 2011); • Code of practice on non-native species (Scottish Government, 2012); • Good practice for water management (IPIECA, 2010). The following wording is generally included in Marine Licences: The Licensee must ensure that the risk of transmitting MNNS to and from site is kept to a minimum, by ensuring appropriate bio-fouling management practises are implemented during any works.	Yes	Client
Injury or mortality	Basking sharks	N/A	Entanglement in mooring lines or cabling leading to injury or death	Monitoring / Research	Observational monitoring of behaviour	Continued monitoring of habitat use by basking sharks, particularly large whales. However, this monitoring measure is recommended to gain further information about the likelihood of entanglement occurring at Billia Croo. There is still uncertainty regarding the potential for basking sharks to become entangled in WEC moorings and cables. This impact pathway is considered unlikely, due to the low frequency of basking sharks utilising the test site.	No	EMEC / Client
				Mitigation	Training on SMWWC	Training of shipboard personnel on the SMWWC will enable identification of basking sharks from at-sea vantage points. In the event of entanglement, Marine Scotland and SNH will be consulted.	Possible	Client
				Mitigation	Emergency shut-down procedures	Developers are urged to develop emergency shut-down procedures for moored or cabled devices with high risk of entanglement, should an entanglement event occur. Emergency shut down procedures will enable developers to rapidly respond to any potential entanglements, with guidance from Marine Scotland and SNH	Possible	Client
				Monitoring	Basking shark licensing	it is recommended that a Basking Shark Licence be considered on a case by case basis, in consultation with Marine Scotland and SNH. Where devices and infrastructure are deemed to have a higher risk of entanglement developers should consider application for a Basking Shark Licence.	Possible	Client
Disturbance	Basking sharks	N/A	Installation, maintenance and decommissioning vessel presence, transiting and manoeuvring	Mitigation	Development of a Vessel Management Plan	A Vessel Management Plan which includes a traffic management scheme, will be included as a part of the PEMP. This mitigation measure should reduce the potential impacts of disturbance from vessel presence and activity onsite.	Yes	Client
				Mitigation	Training on SMWWC	Training of all shipboard personnel in the SMWWC will enable identification of basking sharks from all vessels on-site. Accurate identification of basking sharks will be useful in gaining an insight into basking shark usage of the area and will also allow appropriate action to be taken where basking sharks are identified.	No	Client
				Mitigation	Simultaneous operations management	Vessel movements and occupancy within the Billia Croo test site will be managed through EMEC's SOPs. The SOPs limit the number and size of vessels which can utilise the test site simultaneously.	No	EMEC
		N/A	Underwater noise from foundation/mooring installation methods leading to disturbance	Mitigation	Marine Mammal Observer	The requirement for a Marine Mammal Observer (MMO) for installation and decommissioning activities will be considered on a case by case basis. For activities included in the Project Envelope, the only likely requirement for an MMO will be for pin piling. If an MMO is required for installation activities, the EMEC MMO protocol will be utilised (SOP074). The MMO procedures will include the deployment of a dedicated MMO with protected species observation skills (as per standard MMO training) prior to and during device installation. This will include a	Yes, but likely only for pin piling	EMEC / Client

Impact	Receptor	Specific Receptor	Impact pathway	Mitigation, monitoring, research	Action	Task	Licence requirement / Likely condition of consent	EMEC / Client
						soft-start ramp up of piling noise to give animals time to move away from the noise source. For basking sharks, it is noted this may require additional time in comparison to cetaceans. The use of the EMEC MMO protocol should reduce the potential impacts of cumulative noise from installation and decommissioning activities in the test site.		
				Monitoring	Basking Shark Licensing	As there is potential to disturb basking sharks, consideration of an application for a Basking Shark Licence is recommended. This should be treated on a case by case basis and it is not considered a likely requirement apart from where particularly noisy activities are planned.	Possible	Client
Disturbance from underwater noise	Cetacean species	N/A	Installation, decommissioning and maintenance vessel(s) transiting and manoeuvring	Mitigation	Simultaneous operations management	Vessel movements and occupancy within the Billia Croo test site will be managed through EMEC's SOPs. The SOPs limit the number and size of vessels which can utilise the test site simultaneously. SOPs will be used as good practice. The SOPs limit the numbers and sizes of vessels which can utilise the test site simultaneously.	No	EMEC
				Mitigation	Development of a Vessel Management Plan	A Vessel Management Plan, which includes a traffic management scheme, will be included as a part of the PEMP. Its implementation will minimise vessel overlap and provide further mitigation against potential disturbance to cetaceans. This mitigation measure should reduce the potential impacts of cumulative noise from vessel activity onsite.	Yes	Client
			Foundation/mooring installation methods	Mitigation	Marine Mammal Observer	The requirement for an MMO for installation and decommissioning activities will be considered on a case by case basis. For the activities included in the Project Envelope, the only likely requirement for an MMO will be for pin piling. If an MMO is required for installation activities, the EMEC MMO protocol will be utilised (SOP074). The MMO procedures will include the deployment of a dedicated MMO with protected species observation skills (as per standard MMO training) prior to and during device installation. This will include a soft-start ramp up of piling noise to give animals time to move away from the noise source. The use of an MMO is considered best practice for mitigating against potential noise impacts to marine mammals from piling procedures.	Yes, but most likely only for pin piling activities.	Client
				Research	C-POD deployment	C-PODs may also be deployed at the Billia Croo test site. SNH have suggested that the use of C-POD in place or in addition to an MMO during installation could be investigated. The use of C-POD for monitoring during other phases of deployment and on a site wide basis could also be considered.		EMEC / Client
				Mitigation	Training on SMWWC	On-site monitoring of cetaceans may be extended through the training of shipboard personnel on the SMWWC. This will enable identification of cetaceans from at-sea vantage points and near the noise source.	No	Client
				Monitoring	EPS licence	Due to the frequency and occurrence of cetacean species within the test site, a licence to disturb EPS is likely to be required for noise generating activities which could disturb cetaceans. This should be reviewed on a case by basis, informed by activities associated with each deployment. EPS licensing provides an opportunity for considering device-specific mitigation measures where considered appropriate.	Likely only for noisy activities with the potential to disturb such as pin piling.	Client
			Device operation	Monitoring	EPS licence	Due to the frequency and occurrence of cetacean species within the test site, a licence to disturb EPS is likely to be required for noise generating activities which could disturb cetaceans. As knowledge increases about the noise emissions from WECs, identification of particularly noisy devices with the potential to disturb should be possible. For these devices an EPS is likely to be required.	Possible	Client
				Monitoring	Acoustic characterisation / C-POD deployment	Noise monitoring for specific devices. This may include deployment of C-PODs near the devices to monitor the occurrence of cetaceans and their behavioural responses (i.e. aversion or attraction) to WECs. Noise emissions from WECs are poorly characterised. Measurements of source levels from operational wave devices and characterisation of ambient sounds in the marine environment comprising Billia Croo will help determine the likely received levels cetaceans will experience within the test site.	No	Client
Injury from entanglement	Cetacean species	Large whales (e.g. minke whales)	Mooring lines and cabling	Monitoring	Observational monitoring of behaviour	Continued monitoring of habitat use by cetaceans, particularly large whales. On-site monitoring will enable identification of cetaceans from at-sea vantage points. In the event of entanglement, Marine Scotland and SNH will be consulted. This impact pathway is considered unlikely, due to the low frequency of large baleen utilising the test site each year. However, this monitoring measure is	No	EMEC / Client

Impact	Receptor	Specific Receptor	Impact pathway	Mitigation, monitoring, research	Action	Task	Licence requirement / Likely condition of consent	EMEC / Client
						recommended to gain further information about the likelihood of entanglement occurring at Billia Croo.		
				Mitigation	Emergency shut-down procedures	Developers are urged to develop emergency shut-down procedures for moored or cabled devices with high risk of entanglement, should an entanglement event occur. As there is still uncertainty regarding the potential for cetaceans to become entangled in moorings and cables, monitoring and emergency shut down procedures will enable developers to rapidly respond to any potential entanglements, with guidance from Marine Scotland and SNH.	Possible	Client
Disturbance from underwater noise	Grey and harbour seals	N/A	Installation, decommissioning and maintenance vessel(s) transiting and manoeuvring	Mitigation	Simultaneous operations management	Vessel movements and occupancy within the Billia Croo test site will be managed through EMEC's SOPs. The SOPs limit the number and size of vessels which can utilise the test site simultaneously. SOPs will be used as good practice. The SOPs limit the numbers and sizes of vessels which can utilise the test site simultaneously, as well as put in place a traffic management scheme to minimise vessel overlap. This mitigation measure should reduce the potential impacts of cumulative noise from vessel activity onsite.	Yes	EMEC
				Mitigation	Training on SMWWC	All shipboard personnel will be trained in the SMWWC to ensure they can recognise seals and respond accordingly any signs of distress (i.e. by moving away from the animal) to limit the potential for any harassment to seals.	Yes	Client
				Mitigation	Development of a Vessel Management Plan	A VMP, which includes a traffic management scheme, will be included as a part of the PEMP. Its implementation will minimise vessel overlap and provide further mitigation against noise impacts to seals. This includes limiting vessel speed and providing a conservative buffer zone of 500 m around designated seal haul-outs.	Yes	Client
		N/A	Foundation/ mooring installation and decommissioning methods	Mitigation	Marine Mammal Observer	The requirement for an MMO for installation and decommissioning activities will be considered on a case by case basis. For the activities presented in the Project Envelope, the only likely requirement for an MMO will be for pin piling. If an MMO is required for installation activities, the EMEC MMO protocol will be utilised (SOP074). The MMO procedures will include the deployment of a dedicated MMO with protected species observation skills (as per standard MMO training) prior to and during device installation. This will include a soft-start ramp up of piling noise to give animals time to move away from the noise source. Additionally, training of all vessel personnel in the SMWWC will enable identification of basking sharks from all vessels on-site. This is considered best practice for mitigating against potential noise impacts from installation and decommissioning activities.	Yes, but most likely only for pin piling activities.	Client
		N/A	Device operation	Monitoring	Acoustic characterisation	Noise monitoring for specific devices. To assess the occurrence of seals and their behavioural responses (i.e. aversion or attraction) to WECs and other infrastructure.	No	Client
Injury from entanglement	Grey and harbour seals	N/A	Mooring lines and cabling	Monitoring	Observational monitoring of behaviour	Continued monitoring of habitat use by seals. This impact pathway is considered unlikely, due to the low risk level entanglement in mooring lines poses to seal receptors. However, this monitoring measure is recommended to gain further information about the likelihood of entanglement occurring at Billia Croo. On-site monitoring will enable identification of seals from at-sea vantage points. In the event of entanglement, Marine Scotland and SNH should be consulted.	No	Client
				Mitigation	Emergency shut-down procedures	Developers are urged to develop emergency shut-down procedures for moored or cabled devices with high risk of entanglement, should an entanglement event occur. As there is still uncertainty regarding the potential for seals to become entangled in WEC moorings and cables, monitoring and emergency shut down procedures will enable developers to rapidly respond to any potential entanglements, with guidance from Marine Scotland and SNH.	Possible	Client
Injury/death	Birds species	N/A	Accidental release of contaminants into the marine environment.	Mitigation	Pollution prevention and reporting	Adherence to embedded mitigation in relation to pollution and reporting of incidents of leakage and contamination immediately to the regulator. The conclusion of very low risk to birds is dependent on the rigorous adherence to the project's embedded mitigation measures. These are aimed at avoiding contamination events occurring and having protocols and equipment ready to deal with any incidents should they occur. Incidents should be reported immediately to the Regulator, as appropriate, and if required, boat-based and beach surveys organised to assess if any birds are at risk or have become contaminated.	Yes	Client

Impact	Receptor	Specific Receptor	Impact pathway	Mitigation, monitoring, research	Action	Task	Licence requirement / Likely condition of consent	EMEC / Client
Disturbance and displacement	Birds species							EMEC
Disturbance and displacement/ attraction	Birds species	Auk species, seaduck species, great northern diver and European shag	Vessel activity, response to fixed marine structures	Monitoring	Observational monitoring of behaviour	The test site and an appropriate sized buffer should be monitored to determine any behavioural changes – including habituation and attraction to devices. Frequency, duration and nature of project vessel activity should be monitored to provide context. Increased knowledge on the behaviour of bird species near WECs and other infrastructure deployed at the site will serve to inform any appropriate mitigation measures and potentially future WEC designs.	No	EMEC / Client
				Mitigation	Vessel activity monitoring	Project vessel activity should avoid area used by foraging auks, sea duck and shag as far as possible. When not, possible vessels should reduce speeds to <10 knots when diving birds are present. Severity of disturbance response is reduced with vessel speed.	No	Client
Disturbance and displacement/ attraction	Birds species	Northern gannet, Northern fulmar, Manx shearwater, gull & skua species, Arctic tern	Vessel activity, response to fixed marine structures	Monitoring / Research	Roosting behaviour	The use by tern and gull species of above surface marine structures for resting should be recorded as part of monitoring of devices and components installed at the site. This kind of monitoring will provide an insight into how bird species utilise WECs and other infrastructure deployed at the test site. This may be influenced by different technologies, seasonality and species.	No	EMEC / Client
Disturbance because of lighting	Birds species	European storm petrel	Lighting	Mitigation	Device lighting	Lighting of above surface structures should be designed to provide sufficient light for purpose but avoid excessive bright lights. Flashing or coloured lights may decrease attraction and impact of any statutory lighting. All devices, equipment and infrastructure deployed at the test site will be marked and lit in accordance with marine safety standards and as specified by the Northern Lighthouse Board and Maritime and Coastguard Agency. It is anticipated that all infrastructure protruding above the water surface will be predominantly yellow in colour and, where required, be fitted with flashing lights of a similar brightness to those required on the site's cardinal buoys.	Yes	Client
Disturbance	Otters	N/A	Installation, decommissioning and maintenance vessel presence, transiting and manoeuvring	Mitigation	Simultaneous operations management	Vessel movements and occupancy within the Billia Croo test site will be managed through EMEC's SOPs. The SOPs limit the number and size of vessels which can utilise the test site simultaneously. Based on available survey data, otters are unlikely to be found onshore near Billia Croo or within the test site. As such, there is limited scope for disturbance of otters. The proposed mitigation measures will further limit the scope for vessel-related disturbance to any otters which may be near the test site.	No	EMEC
				Mitigation	Training on SMWWC	Monitoring by shipboard personnel trained on the SMWWC will enable identification of otters from at-sea vantage points.		Client
				Mitigation	Development of a Vessel Management Plan	A VMP, which includes a traffic management scheme, will be included as a part of the PEMP. Implementation of the VMP will minimise vessel overlap and provide further mitigation against potential disturbance to otters in the nearshore environment.	Yes	Client
				Monitoring	EPS licence	An EPS licence may be required where there is the potential to disturb otters. The requirement for EPS in relation to otters will be determined on a case by case basis.	Possible	Client
Damage to vessels and fishing gear	Static and mobile fishing gears	N/A	Snagging/interaction with WECs and other infrastructure	Mitigation	Marking and charting	All devices/assets should be clearly marked and charted. Through clearly marking the devices and infrastructure and through Notice to Mariners, all fishing operators should be well aware of activities within the Billia Croo test site and be able to plan accordingly	Yes	Client
				Mitigation	Notice to Mariners	Notice to Mariners will be issued to inform fishing operators of deployments at Billia Croo		Client
				Monitoring	Seabed surveying	All developers deploying at EMEC will submit pre-installation and post decommissioning seabed footage. Seabed footage will provide developers with a		Client

Impact	Receptor	Specific Receptor	Impact pathway	Mitigation, monitoring, research	Action	Task	Licence requirement / Likely condition of consent	EMEC / Client
						baseline for their project and will be used to inform the decommissioning process to ensure the seabed is returned to its condition prior to the commencing		
				Mitigation	Development of a Decommissioning Programme	All developers will develop a Decommissioning Programme which will be approved by the regulator. A Decommissioning Programme will set out the process of Decommissioning proposed for a project ensuring the seabed is left in a favourable condition as agreed with the regulator.		Client
Exclusion from fishing areas	Static and mobile fishing gears	N/A	Exclusion from areas of fishing during installation and decommissioning activities and from the test site throughout operation	Mitigation	Marking and charting	All devices/assets should be clearly marked and charted. Through clearly marking the devices and infrastructure, all fishing operators should be well aware of activities within the Billia Croo test site and be able to plan accordingly	Yes	Client
				Mitigation	Notice to Mariners	Notice to Mariners will be issued to inform fishing operators of deployments at Billia Croo. Through Notice to Mariners, all fishing operators should be well aware of activities within the Billia Croo test site and be able to plan accordingly		Client
Increased transit time	Static and mobile fishing gears	N/A	Due to extended lease area, there will be a slight increase in transit time for vessels fishing to the north of the site	Mitigation	Notice to Mariners	Notice to Mariners will be issued to inform fishing operators of deployments at Billia Croo	Yes	Client
Loss of or damage to marine historic environment assets	Potential wrecks and wreckage	N/A	Loss of or damage to marine historic environment assets	Mitigation / Monitoring	Adherence with Archaeological Discoveries SOP	The Crown Estate's 2014 <i>Protocol for Archaeological Discoveries: Offshore Renewables Projects</i> and EMEC's Archaeological Discoveries SOP (SOP128). Adherence to the protocol and SOP will ensure the potential for loss or damage to potential wrecks, wreckage and aircraft wreckage is kept to a minimum.	No	EMEC / Client
				Mitigation	Seabed survey	Seabed survey / diver inspection or drop-down camera survey prior to installation of devices or infrastructure on the seabed. Developers are required to report the condition of the seabed ahead of any installation activity. This would help to identify any potential aircraft wreckage on the seabed.	Possibly	Client
Personnel H&S	Navigation	Personnel	Personnel injured during operations or whilst at sea	Mitigation	PPE Requirement	Maintenance teams to wear suitable PPE when working on the device, including life jackets.	Yes	EMEC / Client
				Mitigation	Training of staff	Staff to be trained to the required standards for their work and have suitable local knowledge of regulations and operations in the Orkney Islands.	Yes	EMEC / Client
Promulgation of information	Navigation	N/A	Stakeholders not sufficiently informed leading to miscommunication	Mitigation	ERCoP	Emergency Response and Cooperation Plan for site to be developed and agreed with the MCA and SAR bodies to be consulted.	Yes	EMEC
				Mitigation	Layout Plan	Layout plan of the site, drawings, markings and coordinates to be issued to the MCA and Trinity House for comment.	Yes	EMEC
		N/A	Stakeholders (including fisheries) not aware of infrastructure or operations at the site	Mitigation	Notice to Mariners and Promulgation	In addition to Notice to Mariners, EMEC's Maritime Safety Information Procedure ensures that all key navigational consultees are informed prior to any works. Distribution could include HM Coastguard, Orkney Marina noticeboards (as necessary), Orkney Fisheries Association, Scottish Fisheries Federation, UKHO and linked to on OIC website. Stakeholders are targeted with information about relevant devices based on their activities and location.	Yes	EMEC / Client
				Mitigation	Liaison with local stakeholders	EMEC regularly liaises with key local stakeholders to identify any potential issues.	Yes	EMEC
				Mitigation	ERCoP	Device specific features to be incorporated into site-wide ERCoP.	Yes	EMEC / Client
		N/A	Stakeholders and other sea users aware of dangers within the site	Mitigation	Site Marking	Billia Croo is marked by five cardinal marks located on the periphery of the site boundary.	Yes	EMEC
				Mitigation	500m advisory Area to be Avoided	A 500m advisory Area to be Avoided exists around all EMEC devices.	Yes	EMEC
				Mitigation	Radar Reflectors	Use of radar reflectors to improve marking during times of poor visibility.	Possibly, dependent on device type	Client
Mitigation	AIS	Use of AtoN AIS (or virtual AIS) fitted to all surface piercing devices to improve visibility to passing vessels. AIS should be Category 3 with at least 97% up time and use Message 21, or as directed by the NLB.	Possibly, dependent on device type	Client				
Mitigation	Marking and Lighting	Device to be lit to the requirements of Northern Lighthouse Board and marked in line with IALA guidance. Appropriate statutory Sanctions must be in place to exhibit, alter or discontinue lighting.	Yes	Client				

Impact	Receptor	Specific Receptor	Impact pathway	Mitigation, monitoring, research	Action	Task	Licence requirement / Likely condition of consent	EMEC / Client
			Stakeholders and other sea users not aware of infrastructure onsite	Mitigation	Charting	Site is marked on nautical charts including a chart note.	Yes	EMEC / Client
Promulgation of information and risk identification	Navigation	N/A	Stakeholders (including fisheries) not aware of infrastructure or operations at the site	Mitigation	Liaison with local stakeholders	Consultation should be undertaken with Orkney Marine Services, the MCA and NLB prior to installation of device to confirm that adequate risk controls are in place. EMEC also conducts regular stakeholder consultation events to ensure that local marine users are aware of the pipeline of activity.	Yes	EMEC / Client
Incident monitoring and reporting	Navigation	N/A	Incidents not appropriately reported leading to repeated avoidable incidents	Monitoring	Incident monitoring and reporting	EMEC to encourage incident/near miss reporting and monitor any safety issues at the test site. If necessary, risk control to be reviewed. Risk assessments to be reviewed following any incidents.	Yes	EMEC
Navigational and safety risks	Navigation	N/A	Identification and reduction of navigation risks	Mitigation	EMEC Procedures	EMEC have a number of procedures and standard that are in place to reduce navigation risks: <ul style="list-style-type: none"> • Task Risk Assessment • Permit to Work • Permit to Access Site • Hazard Identification Reporting • Maritime Safety Information 	Yes	EMEC / Client
Site safety	Navigation	N/A	Infrastructure onsite that is disused	Mitigation	Hydrography	Responsibility for developer to return the site to the original condition post-decommissioning.	Yes	Client
Risk identification	Navigation	N/A	Active monitoring of devices and equipment	Mitigation / Monitoring	Site Monitoring	EMEC's SCADA system provides real-time status information, trends, alarms and remote control round-the-clock to facilitate a safe working environment, comprehensive assessment and safe operation of the sites.	Yes	EMEC / Client
				Monitoring	Heightened monitoring in adverse MetOcean conditions	During gale force winds, periodic monitoring of the devices is recommended to ensure excessive forces are not acting on the moorings which might cause a breakout.	Possibly	EMEC / Client
				Mitigation	Inspection and Maintenance Programme	Regular maintenance regime by developer to check the device, its fittings and any signs of wear and tear. This should identify any failings which might result in a mooring failure and therefore prevent breakout.	Yes	Client
				Mitigation	Remote shut down including feathering of blades	Devices to be fitted with ability to shut down in an emergency, such as feathering any blades or braking to allow access or prevent contact with a vessel.	Yes	Client
				Monitoring	GPS alert system for turbine moving	Remote monitoring of device to detect any major movements that might indicate a breakout for immediate response. Implement GPS excursion monitoring.	Yes	Client
			Mitigation / Monitoring	CCTV	Billia Croo test site is monitored by CCTV to satisfy operational requirements for control and monitoring of test site activities, visual checks of the test site environment, monitoring of lone worker safety, effective plant operation and substation security.	Yes	EMEC	
			Mitigation	Installation, Maintenance and Removal	All vessels undertaking activities on site should comply with EMEC procedures. Vessels should be mindful of other navigating vessels and avoiding disrupting the activities of others.	Possibly	EMEC / Client	
Contact with other vessels	Navigation	N/A	Monitoring of site activities to identify risks pre-incident	Mitigation	Guard Vessels	During major construction or maintenance activities, a guard vessel may be considered to assist in protecting the devices from contacts with passing vessel traffic. Due to the low density of traffic, this is not considered necessary unless for extraordinary circumstances. If guard vessels are to be used onsite, it is important that such vessels employed to guard the site follow appropriate guidelines, with clear instructions on when to intervene in a potential incident.	Dependent on operations.	Client
Effects on coastal and landscape character	Seascape, landscape & visual receptors	N/A	Ensure site is designed to reduce visual intrusion	Mitigation	Design of site and infrastructure size limitations	Design of scheme, such as the extent of the test site, the limits that have been placed on the size and particularly the height above sea level of devices and components.	Possibly	EMEC / Client
			Reduce to potential long-term impact on the local coastal and landscape character	Mitigation	Reversibility of installations	Complete reversibility of the installations and activities	Yes	Client

Impact	Receptor	Specific Receptor	Impact pathway	Mitigation, monitoring, research	Action	Task	Licence requirement / Likely condition of consent	EMEC / Client
			Devices and array placement and spacing designed to reduce visual intrusion	Mitigation	Placement and spacing of devices	<p>Placement and spacing between WECs:</p> <ul style="list-style-type: none"> • Devices, particularly larger ones, should ideally be placed as far offshore as possible, to reduce their visual presence in views from land; • Devices of similar form and scale should be placed together, while those of contrasting form or scale should be placed further apart, in order to retain a degree of visual coherence across the test site; • Maximum spacing should be maintained between devices, so that the test site primarily appears as an area of open sea, interspersed with occasional devices/components; • Devices should all be painted the same colour, to retain visual coherence; • Navigational marker lights should be the same colour and brightness, subject to safety requirements, to retain visual coherence; • The number of floating or surface-piercing devices should be minimised: the greater the number of with sub-surface devices among the 20 WECs, the fewer the number of visible devices; • Maintenance activities involving large vessels should be kept to a minimum, particularly if these involve night working and use of lighting; and • The number and size of floating platforms should be minimised. 	Possibly	EMEC / Client

Due to the findings and suggested monitoring and research identified during the Environmental Appraisal, EMEC is looking to resurrect the EMEC Monitoring Advisory Group. The MAG will facilitate EMEC in ensuring it is adequately addressing any concerns raised during the Environmental Appraisal process. The MAG will support industry in ensuring the facilities available at EMEC and testing campaigns conducted at EMEC are used optimally to gather information to meet existing and future monitoring needs. This will support clients testing at EMEC seize the opportunity for early research and monitoring of the potential environmental impacts associated with their device and testing activities. The MAG will oversee the production of monitoring tools and best practice techniques are employed at EMEC, whilst ensuring methods of data stewardship are compatible with the selected monitoring methodologies. As part of the remit of the MAG, an annual assessment of the environmental monitoring strategy and objectives at EMEC will be undertaken to ensure it aligns with both industry and regulatory needs. Finally, the MAG will undertake regular reviews of client’s PEMP’s and compliance reports to ensure monitoring detailed in PEMP’s is accomplished and findings reported.

10 Stakeholder Engagement

As part of the Environmental Appraisal, Seascope Landscape and Visual Impact Assessment and the Navigational Risk Assessment, consultation was undertaken on the scope and approach adopted. As part of the NRA is was necessary to undertake a consultation exercise to gather relevant information regarding how other sea users utilise the Billia Croo test site and surrounding area to complete the data acquired from AIS analysis and visual observations. Please see the NRA for a list of consultees and summary of responses.

The following tables provide an overview of the consultations undertaken regarding the SLVIA and EA. An overview of how issues raised have been considered within the appraisals and assessment is provided.

Table 33. Consultation relevant to the Seascope, Landscape and Visual Impact Assessment

Consultee	Relevant Date	Method of Consultation	Relevant Link to Appropriate Appraisal or Further Information regarding Issue / Response
Orkney Islands Council	30 November 2018	E-mail	REP663 Table 2.1 Consultation Responses
Scottish Natural Heritage	4 December 2018	E-mail	REP663 Table 2.1 Consultation Responses
Scottish Natural Heritage	15 January 2018	E-mail	REP663 Table 2.1 Consultation Responses
Scottish Natural Heritage	20 February 2019	E-mail	REP663 Table 2.1 Consultation Responses

Table 34. Consultation relevant to the Environmental Appraisal

Consultee	Date of response	Method of Consultation	Issue Raised	Response/Action Taken
Marine Scotland	7 November 2018	Conference Call	Contact report on request from EMEC.	
Scottish Natural Heritage	16 November 2018	Conference Call	Contact report on request from EMEC.	
Scottish Natural Heritage	14 March 2019	E-mail	<p>Comments on Ornithology Section Requested clarity on judgement on connectivity for likely significant effect or not and, therefore, the conclusion regarding adverse effect on site integrity. Requested standard Natura tests terminology. Recommendations on further data sources, including 4 digital aerial surveys from MS, Hoy birds, Orkney puffin numbers and information on seasonal distributions. Advised on impacts potentially arising from vessel movements to/from the site, requests consideration of frequency/duration of vessel movements. Recommendation to clarify lighting types for potential importance, and lighting characteristics in the Project Envelope. Advised on consistency in naming convention and clarification on terminologies. Adopt a consistent and transparent approach to determining and describing the importance of the test site to each species – would be good to define the terms negligible, very low, low, moderate etc in introductory text to species account. Further advised on how these descriptions could affect appraisal conclusions. Advised on missing references. Requests clarity on basis for assessment regarding connectivity with respect to individual species. Black throated diver missing from features list.</p>	<p>Clarified under 1.4.1.2 Potential for impact pathway (stage 2) and then adjusted throughout section. New section added included definitions. Added data sources to 10.1 Key data sources. Table 10.1 clarified vessel disturbance impact. Clarification on vessel lighting added to Project Envelope. Clarified WEC lighting in Table 101. Changes made throughout section for consistency in terminology, including use of 'test site' vs 'Project Envelope'. Added as section 1.3.4 Categorisation of importance – clearly defined and adjusted conclusions accordingly. Noted. Black throated diver included in Table 105.</p>
Scottish Natural Heritage	13 February 2019	E-mail	<p>Section 1 Name of the site should reflect what it is testing. Figure 1.1, there may be confusion regarding what is meant by the inshore lease area and the offshore lease area. It should be confirmed that both are within 12nm. In Section 1.2. - Requirement for EA – we recommend that this is reordered so that the reasons for applying for the Section 36 consent is clearer. Does the Guidance for Developers for Billia Croo also need revising? Rephrase text to emphasise importance of PEMP. Clarification on existence/continuation of MAG. Clarification of onshore works exclusions, within Project Envelope as well. Include SVLIA within EA. Recommendation of use of Marine Licensing Guide.</p> <p>Section 2 Table 2.1 should also cover decommissioning. Sub-bottom profiling, acoustic surveys and active acoustic devices may require additional appraisal and, therefore, should be removed from the project envelope. Clarification of maximum footprint of foundation/mooring per WEC array. Clarification of worst case scenarios of simultaneous works; define noisy activities.</p> <p>Section 3 Methodology – mentions a 4 step process but in figure 3.1 only 3 steps are shown. Section 3.6.1 – Legal requirements – we recommend including a description of SPAs and the Birds Directive in this section.</p> <p>Section 4 Would be useful to assess decommissioning in more detail. In Table 4.8, additional good practice guidance for marine non-native invasive species, including a marine biosecurity review, can be found on the SNH website.</p> <p>Section 5 We recommend the Orkney assessment undertaken for the Dynamic Coast.</p> <p>Section 6 Clarification on whether active acoustic noise is excluded from project envelope. Advice in relation to marine fish should be sought from Marine Scotland Science. We advise that diadromous fish are assessed under EIA Regulations rather than HRA. Recommendation on two further studies.</p> <p>Section 7</p>	<p>Noted. Site named Billia Croo Wave Test Site throughout document. Confirmed in 'Relevant Legislation and Policy' section of ES and Section 3.6.1 of EA. Section reordered. Guidance updated and reissued. Addressed in 'Mitigation, Monitoring and Research' section of ES. MAG excluded from EA. Clarification provided in 'Mitigation, Monitoring and Research' section of ES. Project Envelope updated to clarify exclusions. SLVIA in ES but separate document from EA for ease of reading. Noted.</p> <p>Included. Included in excluded activities. Provided in 'Intertidal and Subtidal Benthic' section. Updated Project Envelope.</p> <p>Updated Section 3.2 of EA. Section 6.3.1 of EA updated.</p> <p>Provided further detail regarding activities included in decommissioning and updated sections where necessary. Added to the list of best practice.</p> <p>Included in Section 5.3 of EA.</p> <p>This was been explicitly stated in the excluded activities of the EA. Sought during original consultation (7th Nov 2018) Both considered and included.</p>

Consultee	Date of response	Method of Consultation	Issue Raised	Response/Action Taken
			Amend Table 7.2 to reflect operation and maintenance phases. Recommendation to mention Vessel Management Plan in Table 7.5.	Updated. Included.
			Section 8 Clarification of entanglement importance difference between cetaceans and basking sharks. The text box in Table 8.6.3.4 is incomplete. Table 8.7 mentions the use of MMOs -use of CPODs may be an alternative to MMOs. The Scottish Marine Wildlife Watching Code should also be included as good practice mitigation.	Modified section. Now complete. Alternative now included. Now also included.
			Section 9 Note there are more than three SACs with seals as qualifying interests in Scotland. Note general rule for connectivity. Seal haul outs are protected from disturbance and harassment occurring at the haul out only. As such, there is no requirement to establish connectivity. Vessel traffic transiting to and from the site, and anchoring away from the site should be assessed for disturbance to seals at seal haulouts. Vessel activity should be managed through the Vessel Management Plan. Ensure consistency on entanglement across receptors. Mitigation in Table 9.8 should also include reference to the SMWWC.	Added other SACs. Removed references to connectivity. Added details regarding the potential impact caused by vessels transiting to and from site. Referenced in table as a suggested mitigation.
			Section 11 Note that as a rule of thumb otters will not necessarily be found beyond the 10m depth contour. SNH issues EPS licenses for otters and not Marine Scotland. If there are likely to be any works that will disturb otters, no consideration will be given to a licence application unless an otter survey has been carried out.	This has been included. This has been reflected in the text under Section 11.5.
			Section 14 Section 14.1 advise on rewriting text to emphasise requirements MNNS mitigation mentioned in Table 14.1 needs updating. The EMEC MMO protocol may need revising In Table 14.1, should divers be included? In Table 14.3, there is no mention of the work undertaken by CREEM looking at data gathered from the wildlife observations	Updated to emphasise requirements. Updated. Updated in 2018. Included with application. Included in ES mitigation table. Included in Wildlife Observation section of Table 14.3
			Section 15 Another purpose of the PEMP is that there should be a short summary statement indicating the application fully fits within the approved Project Envelope / or a statement indicating why it falls out with the Project Envelope and what additional works has been undertaken to inform the PEMP. It may be useful to provide definitions for mitigation and monitoring.	Included in PEMP template provided to developers. Wording updated to provide greater clarity.
			Appendix 1 Clarification in Section 1-4 to be more up-front about what is covered in document. The Project Envelope includes all activities below MHWS. This contradicts Section 1.4 page 16 of the EA which mentions excluding onshore works including intertidal. In Section 4 it mentions that the EGC agreement limits power export to 7MW. It also mentions that the EA will still be valid in a >7MW scenario providing the PE is adhered to. Is it likely that the EGC Agreement will be increased to account for a maximum of 20 WECS? In Section 5.1, more specific detail is required for those activities not covered by the Project Envelope Do the simultaneous marine works and maximum number of vessels mentioned in Section 5.4.4 fit with what would be permitted on the grounds of navigational safety? If not then a more realistic worst case scenario should be included. Table 10 is confusing as the number of vessels adds up to more than the maximum stated (12), especially when some of the operations are to occurring at more than one berth	Clarification provided. Greater clarification provided in section regarding what has been excluded from the envelope. Yes, however, this is dependent on many factors include an enhanced grid connection between Orkney and the mainland. A consent for up to 20MW generating capacity is being applied for. Greater detail provided. This has been reduced to ensure it remains realistic and in line with EMEC SOPs. This has been removed to reduce confusion.
			Additional Comments We advise that further consideration should be given to cumulative / in-combination impacts throughout the EA. There needs to be some consideration of other projects, such as aquaculture and harbour works, that could be considered to have in combination effects with this site. Marine Scotland, SEPA and Orkney Islands Council would be able to provide a list of relevant projects for an in-combination assessment.	Each receptor appraisal updated to provide greater consideration of cumulative and in-combination impacts.

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